

Knowledge and Practices Related to Water, Sanitation, and Hygiene among Household Residents in Selected Districts, Abyan Governorate

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Abstract

Introduction: Yemen is among the most water-stressed countries in the world, due to a naturally dry climate, regional drought in recent years, and falling groundwater levels due to unsustainable drilling. This work aimed to assess the current knowledge and practices on water, hygiene, and sanitation in conflict-affected communities and internally displaced people in selected districts of Abyan governorate - Yemen.

Methods: A community-based cross-sectional house-to-house survey was conducted in 2019 in three rural districts in Abyan governorate, Yemen. A total of 446 households were randomly selected and a structured interview questionnaire was used to collect data from the respondents through face-to-face interviews. Data were checked, cleaned, and entered to the SPSS version 22 for analysis.

Results: The participants had inadequate knowledge and practices on water, sanitation, and hygiene. Only less than a quarter of the participants received any related education. The surveyed households had poor socioeconomic conditions such as poverty and illiteracy. Both water quantity and quality were inadequate, open defecation still exists, and open dumping of solid waste is common.

Conclusion: This study calls for an urgent solution to address the challenges regarding inadequate quantity and quality of water in the surveyed areas. Moreover, it is of paramount importance to address the socio-economic vulnerabilities such as poverty, and illiteracy, and to maintain medium- and long-term solutions for water provision and environmental sanitation. For effective implementation of these solutions, education tailored to the context and the need of the population should be designed.

Keywords: Yemen, Water, Sanitation, Hygiene, Knowledge, Political Conflict.

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المعارف والممارسات المتعلقة بالمياه والصرف الصحي والنظافة بين القاطنين في مديريات مختارة ، محافظة أبين

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ملخص الدراسة

المقدمة: اليمن من بين أكثر البلدان التي تعاني من العوز المائي في العالم، بسبب المناخ الجاف بشكل طبيعي، والجفاف الإقليمي في السنوات الأخيرة، وانخفاض مستويات المياه الجوفية بسبب الحفر غير المستدام. يهدف هذا العمل إلى تقييم المعارف والممارسات الحالية بشأن المياه والنظافة والصرف الصحي في المجتمعات المتضررة من النزاع والنازحين داخليًا في مديريات مختارة من محافظة أبين - اليمن.

المنهجية: تم إجراء مسح مقطعي مجتمعي من منزل إلى منزل في عام 2019 في ثلاث مديريات ريفية في محافظة أبين، اليمن. تم اختيار ما مجموعه 446 أسرة بشكل عشوائي وتم استخدام استبيان مُعد مسبقاً لجمع البيانات من المستجيبين من خلال المقابلات وجهاً لوجه. تم فحص البيانات وتنقيتها وإدخالها في برنامج التحليل الإحصائي (SPSS) الإصدار 22 لتحليلها.

النتائج: كان لدى المشاركين معارف غير كافية وممارسات منقوصة بشأن المياه والصرف الصحي والنظافة. أقل من ربع المشاركين فقط تحصلوا على أي تعليم ذي صلة بموضوع الدراسة. كانت الأسر التي شملتها الدراسة تعاني من ظروف اجتماعية واقتصادية سيئة مثل الفقر والأمية وكانت كمية المياه ونوعيتها غير كافية ولا يزال التلوث في العراء موجوداً، كما أن إلقاء النفايات الصلبة في الهواء الطلق أمر شائع.

الاستنتاج: تدعو هذه الدراسة إلى حل عاجل لمواجهة التحديات المتعلقة بعدم كفاية كمية ونوعية المياه في المناطق التي تم مسحها. بالإضافة إلى أهمية التعامل مع مواطن الهشاشة الاجتماعية والاقتصادية مثل الفقر والأمية، والحفاظ على حلول متوسطة وطويلة الأجل لتوفير المياه وخدمات الإصحاح البيئي. ومن أجل التنفيذ الفعال لهذه الحلول، يتطلب تصميم خدمات تعليم موجه وفقاً لواقع واحتياجات السكان.

الكلمات المفتاحية: اليمن، المياه، الصرف الصحي، النظافة، المعارف، الصراع السياسي.

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Introduction

Yemen is among the most water-stressed countries in the world, due to a naturally dry climate, regional drought in recent years, and falling groundwater levels due to unsustainable drilling[1]. However, the country faced years of poverty, under-development, environmental degradation, intermittent conflict, weak rule of law, and chronic vulnerabilities even before March 2015, when the conflict escalated. The escalating conflict continues to inflict civilian casualties and cause extensive damage to public and private infrastructure, and today, half of the Yemeni population lives in areas directly affected by conflict[2].

Universal, affordable and sustainable access to water, sanitation, and hygiene (WASH) is a key public health issue within international development and is the focus of Sustainable Development Goal 6 [3, 4]. Access to WASH includes safe water, adequate sanitation, and hygiene education can significantly reduce illness, death, and reduce poverty and lead to improving socio-economic development [5]. Several international development agencies assert that attention to WASH can also improve health, life expectancy, student learning, gender equality, and other important issues of international development [6]. In 2019, the United Nations (UN) estimated that some 2.2 billion people around the world do not have safely managed drinking water, while 4.2 billion go without safe sanitation services and three billion lack basic handwashing facilities, according to a new report from the United Nations Children's Fund

(UNICEF) and the World Health Organization (WHO) [7].

In Yemen, in 2019, The Humanitarian Needs Overview estimated that 17.8 million people will require support to access clean water, basic sanitation, and hygiene -related assistance, with 12.6 million of those in acute need of support [8,9]. At the same time, it should be noted that there has been a significant shift from people in moderate need to acute need [10]. More accurate information gathered on WASH needs for Internally Displaced People (IDPs) also reveals an increase in the severity of the situation, especially in the context of a continued large-scale displacement situation in which many WASH needs for IDPs, returnees, and host communities remain unmet. This leaves no other option than using drinking water from unprotected water sources or spontaneous settlements, people living in areas with poor WASH conditions are at high risk of cholera and WASH-related diseases such as malaria and dengue[11]. Unfortunately, by January 2019, almost 1.5 million Cholera cases and 2906 associated deaths were reported almost in all governorates of Yemen.[12,13]

Water, sanitation, and hygiene interventions are needed in nearly all emergency contexts, particularly in conflict zones and those with frequent disease outbreaks such as in Yemen [14]. However, it is important to understand the community awareness and the need to design community-tailored educational WASH messages and interventions. Therefore, this study aims at assessing the baseline knowledge and practices related to WASH in 3 districts in Abyan governorate, Yemen.

Methods

Study design and setting

Community-based cross-sectional house-to-house survey was conducted in January 2019 in the selected areas (villages) within the three districts (Lawdar, Khanfar, and Rusud) from Abyan governorate in Yemen.

Target population

The target population (respondents) includes household members aged 18 years and above residing in households for at least one year in the selected areas at the time of data collection.

Sampling

The sample size was calculated using a single population proportion formula [15]. Based on the assumption of an unknown proportion of any component of WASH utilization in Yemen, 50% was used to attain a maximum sample size. The design effect of 1.2 was used as a multistage sampling technique. The following assumptions were made to determine the required sample size:

(i) WASH utilization of 50%, $p = 0.50$; (ii) Two-sided standard Z-score $Z_{\alpha/2} = 1.96$; corresponding to a 95%

confidence level; (iii) Margin of error/relative precision $d = 0.05$ (5%); and (iv) Design effect $D = 1.2$, and contingency for nonresponse rate = 10%

The sample size $n = [Z^2 \alpha^2 p (1 - p) / d^2] \times D = [(1.96)^2 \times (0.50 \times 0.50) / (0.05)^2] \times 1.2 = [3.8416 \times 0.25 / 0.0025] \times 1.2 = 384 \times 1.2 = 460$

A required sample size after adding the 10% for the nonresponse rate was 506 households.

In the 1st stage of sampling, according to the final list received from the International Organization of Migration (IOM) that includes the total number of individuals and households in each area within the involved three districts in Abyan governorate (IOM working areas and districts), the percentage and the required number of households in each area were identified. Based on Table 1, the calculated sample was allocated to each selected area and district using probability proportional to size (PPS). In the 2nd stage, a modified Expanded Program on Immunization (EPI) procedure was used to select the required numbers of households in each area within the involved three districts.

Table 1. Procedure of Selection in Each Area and District in Abyan Governorate

District (% household)	Area	Total No. of households	% of households	Required No. of households in each area	Surveyed households in each area
Lawder (64.3)	Almagel	1,386	34.6	175	152
	Shwhat	429	10.7	54	45
	Addarb	297	7.5	38	36
	Alkhyalah	322	8.0	41	36
	Almehrab	174	4.3	22	18
Khanfar (5.4)	Mogan	217	5.4	27	24
Roused (30.3)	Alsfaah	857	21.4	108	99
	Khiran	325	8.1	41	36
	Alwattahi				
Total	-	4007	100.0	506	446

Data collection

Training of data collectors

Ten WASH community volunteers were chosen from the survey areas and from those having experience in questionnaire administration and conducting fieldwork in communities similar to that of the current survey. However, they were also subjected to two days training.

Fieldwork

Once an eligible household was identified, a household member aged 18 years and above residing in households for at least one year was recruited and invited to participate in the interview. Under the supervision of the field work supervisor, the modified EPI procedure in each area was used until all necessary households in each area (as identified in table 1) were visited by the field work team. In each eligible household, aim of the study was explained, consent of respondents was obtained to indicate their willingness to be interviewed and to participate in the study, and confidentiality of responses was assured.

Study instruments

A structured interview questionnaire was used. The questionnaire items were retrieved from previously published relevant reports. The questionnaire covered the following three sections: General information; WASH knowledge; and WASH practices.

Statistical analysis

Data were checked on quality control and cleaning immediately and then entered and analyzed in the Statistical Package for Social Sciences software version 22 (SPSS Incorporation, Chicago, IL, USA). Descriptive

statistics were computed to obtain frequencies and percentages. Each knowledge and practice on WASH and related questions were presented using frequencies and percentages in tables.

Ethical approval and consent

All procedures performed in this study were in accordance with the international ethical standards. All participants were briefed on the conduct of the study and an informed consent was obtained from the participants declaring their permission on using the data for the purpose of the research. Ethical clearance and approval were obtained from the Faculty of Medicine and Health Sciences, University of Aden, Yemen. Oral informed consent was obtained from each study participant.

Results

Background characteristics of the study population

A total 446 surveyed household (HH) in eight villages distributed in three districts of Abyan governorate (with response rate of 88.1% (446/506 of the sample size). The highest percentage was in Lawdar (64.3%) followed by Roused (30.3%) and finally, Khanfar (5.4%). Table 2. shows that internally displaced population (IDP) and returnees make up 9.5% of the population with a mean family size of 7.5 (SD±3.16) persons and a mean age of 43.5 (SD±13.02) years. Most of the respondents were males (59.0%), illiterates (35.2%), employers in public sector (41.9%) and very poor economic level (lives with 60,000 YR per month, which is less than one US \$ per day).

Table 2: Socioeconomic Characteristics of the Respondents (n=466)

Characteristic	No.	%
Situation of the household		
<i>Settled</i>	408	91.5
<i>IDP</i>	20	4.5
<i>Returnee</i>	18	4.0
Respondent Sex		
<i>Male</i>	263	59.0
<i>Female</i>	183	41.0
Head of the family		
<i>Adult male</i>	380	85.2
<i>Adult female</i>	62	13.9
<i>Teenage</i>	4	0.9
Educational level		
<i>Illiterate</i>	157	35.2
<i>Read & write</i>	67	15.0
<i>Basic school</i>	111	24.9
<i>Secondary school</i>	81	18.2
<i>Post-secondary</i>	30	6.7
Job		
<i>Employee</i>	187	41.9
<i>Housewife</i>	151	33.9
<i>Casual labour</i>	29	6.5
<i>Private sector</i>	46	10.3
<i>Unemployed</i>	30	6.7
<i>Student</i>	3	0.7
Age Mean (SD) [Min.-Max]	43.53(13.02)	[18 – 99]
Family size: Mean (SD) [Min.-Max]	7.49(3.16)	[2-20]
Monthly Income per capita (YR): Median (Q1-Q3)	60,000	(30,000-80,000)

Knowledge of the respondents***General hygiene – related knowledge***

Only 24.0% received education sessions about hygiene. Importance of personal hygiene and washing hands were the most frequent topic mentioned by the respondent (77.6% and 53.3% respectively) as being educated about, while only 7.5% of

the participants were educated about water treatment. Most of the participants have been participated in group sessions of education (78.1%). On the other hand, community leaders had negligible role in education (0.7%) as shown in Table 3.

Table 3: General Hygiene - Related Knowledge (n=466)

Knowledge item	No.	%
Exposed to education about hygiene (n=466)	107	24.0
Topics respondents received education about (n=107)		
<i>Importance of personal hygiene</i>	83	77.6
<i>Importance of handwashing using soap during key times</i>	57	53.3
<i>Diseases caused by poor WASH practices</i>	29	27.1
<i>Importance of excreta disposal</i>	14	13.1
<i>How to keep water safe</i>	21	19.6
<i>Household water treatment</i>	8	7.5
Type of awareness session (n =96)		
<i>Group session</i>	75	78.1
<i>Home visitation</i>	6	6.3
<i>Social media app (What's App, Facebook, etc....)</i>	10	10.4
<i>Media (TV, radio, newspapers, magazine.)</i>	5	5.2
Last time of awareness session (n= 28)		
<i>This week</i>	4	14.3
<i>Before two weeks</i>	0	00.0
<i>Before month</i>	24	85.7
Source awareness session /message (n= 142)		
<i>Community educators</i>	56	39.4
<i>Camping</i>	42	29.6
<i>Students or schoolteachers</i>	35	24.6
<i>Social media app (What's App, Facebook, etc....)</i>	19	13.4
<i>Media (TV, radio, newspapers, magazine.)</i>	14	9.9
<i>Neighbours</i>	8	5.6
<i>Community leaders</i>	1	0.7

Diarrhea-related knowledge

Respondents' knowledge about diarrhea causes and prevention were poor (Table 4). Respondent showed that contaminated food and water as a cause of diarrhea (61.2% and 56.3%, respectively). Washing hand with

soap was the top preventive action mentioned by the respondents (83.9%). The most mentioned key time for washing hand was "before eating" (90.1%), while only (32.7%) reported washing their hands "after using latrine/after defecation".

Table 4: Diarrhea - Related Knowledge (n=446)

Knowledge item	No.	%
Causes of Diarrhea (n=446)		
<i>Eating contaminated food</i>	273	61.2
<i>Drinking contaminated water</i>	251	56.3
<i>Unwashed fruits/vegetables</i>	142	31.8
<i>Flies/insects</i>	119	26.7
<i>Poor personal hygiene/not washing hands</i>	103	23.1
<i>Poor environmental sanitation</i>	101	22.6
<i>Person to person contact</i>	42	9.4
<i>Don't know</i>	15	3.4
Diarrhea prevention (n=436)		
<i>Wash hands with soap and water</i>	374	83.9
<i>Wash vegetables/fruits</i>	149	33.1
<i>Cook food thoroughly</i>	107	24.0
<i>Cover food to keep away from flies</i>	72	16.1
<i>Clean cooking utensils/vessels</i>	50	11.5
<i>Personal and domestic hygiene</i>	81	18.2
<i>Dispose of human waste properly</i>	33	7.4
<i>Boil water</i>	40	9.0
<i>Avoid street vendor</i>	22	4.9
<i>Treat water with chlorine products</i>	16	3.6
<i>Don't know</i>	19	4.3
<i>Cannot be prevented</i>	3	0.3
Reasons of hand washing (n=432)		
<i>To prevent disease transmission/kill germs</i>	297	66.6
<i>To keep clean</i>	224	50.2
<i>To be free from bad smell</i>	44	9.9
<i>I was told do so</i>	7	1.6
<i>Don't know the reason</i>	11	2.5
Important times for hand washing (n=437)		
<i>Before eating</i>	402	90.1
<i>After using latrine/after defecation</i>	146	32.7
<i>Before preparing food</i>	86	19.3
<i>When hands are dirty</i>	123	27.6
<i>After touching animals</i>	63	14.1
<i>After disposal of animal faeces</i>	34	7.6
<i>Before feeding the child</i>	38	8.5
<i>After cleaning the home</i>	37	8.3
<i>After cleaning the child</i>	62	13.9

Practice of the respondents**Water sources, delivery, storage, and management**

Table 5. shows that near half of the respondents were using piped water as the main water source for drinking (49.8%) and for washing and cooking (54.7%). In addition, tanker truck

water was the second used either for drinking (24.2%) or for washing and cooking (17%). Only 29.8% believe that water they are using is not safe, but it is the only choice they have (59.6%).

Table 5: Water Source Related Practices (n=446)

Practices	No.	%
Water Source related practices		
The main source of drinking water for the household		
<i>Piped water in house</i>	222	49.8
<i>Tanker truck water</i>	108	24.2
<i>Open water sources (Unprotected well /Stream)</i>	62	13.9
<i>Stored rainwater collection</i>	39	8.7
<i>Protected well</i>	15	3.4
The main source of water for hand washing and cooking		
<i>Piped water in house</i>	244	54.7
<i>Tanker truck water</i>	76	17.0
<i>Open water sources (Unprotected well /Stream)</i>	68	15.2
<i>Stored rainwater collection</i>	37	8.3
<i>Protected well/tanker truck water</i>	21	4.7
Reasons to having water from the mentioned source		
<i>It is the only choice I have</i>	266	59.6
<i>It is safe to drink</i>	133	29.8
<i>It is near to my home</i>	44	9.9
<i>It has no disease in it</i>	3	0.7

Regarding water delivery, storage, and management. Table 6. shows that 45.3% of the participants need less than 30 minutes to reach water resources and only 21.1% and 24.9% believes that the condition of the water carrying tool and water container is good respectively. Moreover, only 34.8% reported

having enough water and 31.6% satisfied with the quality of drinking water. Mothers (54.1%) and girls (21.1%) were the most commonly HH members who collect water. In addition, it is clear from Table 6. That 15.0% of the participants use any procedures to make the water safe.

Table 6: Water Delivery and Management Related Practices (n=446)

Practice	No.	%
How long do you walk to reach your nearest water point? (n=446)		
<i>Less than 30 min.</i>	202	45.3
<i>Between 30 - 60 min.</i>	99	22.2
<i>More than 60 min.</i>	30	6.7
<i>Do not know</i>	115	25.8
Condition of water carrying tools (n=446)		
<i>Good</i>	94	21.1
<i>Average</i>	192	43.0
<i>Bad</i>	102	22.9
<i>Don't know</i>	58	13.0
Members of HH who usually collect water (n=194)		
<i>Mother</i>	105	54.1
<i>Girl</i>	41	21.1
<i>Father</i>	26	13.4
<i>Boy</i>	2	1.1
<i>Hired vendor/ labour</i>	20	10.3
Condition of water containers (n=446)		
<i>Good</i>	111	24.9
<i>Average (not bad)</i>	216	48.4
<i>Bad</i>	70	15.7
<i>Don't know</i>	49	11.0
Having enough collected water (drinking, cooking, bathing/cloth washing (n=446)		
<i>No</i>	281	63.0
<i>Yes</i>	155	34.8
<i>Don't know</i>	10	2.2
Satisfied with the quality of drinking water. If no, what are the reasons =446)		
<i>Yes</i>	141	31.6
<i>No, it tastes bad</i>	48	10.8
<i>No, it has suspended particles</i>	97	21.7
<i>No, it smells bad</i>	172	38.6
<i>No, it has bad color</i>	20	4.5
Using any procedure to make water safer to drink (n=446)	67	15.0

Hand Washing Related Practices

In Table 7, 70.6% of respondents claimed that they have regular hand washing habit and 60.6% of them

using water and soap for hand washing.

Table 7: Hand Washing Related Practices (n=446)

Practices item	No.	%
Have a regular hand washing habit (n=446)	315	70.6
The usually used material for hand washing (n=444)		
<i>Water and soap</i>	269	60.6
<i>Water only</i>	175	39.4

Sanitation practices

Respondents mentioned HH latrines as the main place for defecation of

adult males and females (89.7% each), while only 8.1% of the adult females and 8.3% of males mentioned

open fields as the place for defecation. Additionally, children use latrines less frequently than adult (74.7%) and

uses open fields more frequently (25.9%) as illustrated in Table 8.

Table 8: Sanitation Practices Related to Household Latrine

Practices	No.	%
Place of defecation of the family males' members (n=446)		
Household Latrine	400	89.7
Open field far from house	28	6.3
Open field close to house	9	2.0
Shared household Latrine	9	2.0
Place of defecation of the family females' members (n=446)		
Household Latrine	400	89.7
Open field far from house	24	5.4
Open field close to house	12	2.7
Shared household Latrine	8	1.8
Dig small hole and cover	2	0.4
Where do the children of your family defecate? (n=446)		
Household Latrine	333	74.7
Open field close to house	86	19.3
Open field far from house	15	6.6
Shared household Latrine	12	3.4
Dig small hole and cover	0	0.0

With regards to disposal of solid waste, Table 9 shows that burning (50.7%) and throwing away in open field outside the house (42.4%) were the most frequently reported disposal methods. It is also clear from table 9

that washing soap (powder detergent) as a cleaning and hygiene materials available in 85.2% of houses and only 21.5% of houses had female disposable pads.

Table 9: Sanitation Practices Related to Disposal of Solid Wastes and Cleanliness

Disposal of solid wastes/rubbish (n=446)	No.	%
Burning	226	50.7
Throw away in open field outside the house	189	42.4
In waste pit of the household	21	4.7
In the garbage, near to the house	10	2.2
Cleaning and hygiene materials available at home (n=446)		
Washing soap (powder detergent)	380	85.2
Soap	221	49.6
Brush and toothpaste	75	16.8
Female disposable pads	96	21.5
Cleaning and hygiene materials, they want to be always available at home (n=446)		
Washing soap (powder detergent)	375	84.1
Soap	288	64.6
Brush and toothpaste	208	46.6
Female disposable pads	197	44.2

Discussion

This study was conducted to assess the adequacy level of water availability, sanitation, and hand washing practices among rural areas in Abyan governorate, Yemen. The study was part of the comprehensive project implemented by the IOM under the title “Provision of Life-Saving WASH Assistance to IDPs and Conflict-Affected Communities in Yemen”. It was also targeted to contribute to addressing the critical needs of IDPs and Conflict-Affected Communities with life-saving WASH interventions. Although safe drinking water and sanitation are basic human rights, almost 2 billion people depend on health care facilities without basic water services [16,17].

The study revealed the inadequate level of knowledge of the participants on hygiene and sanitation as well as on how to prevent attributable causes of diseases. For example, when asked about causes of Diarrheal diseases, only around half of them (56.3%) reported the contaminated water, less than third (31.8%) reported unwashed food and vegetable, and less than quarter (23.1%) stated the poor personal hygiene/not washing hands. Moreover, one quarter of the participants (24.0%) have exposed to education about sanitation and hygiene. This percentage is much less compared to residents in Aden governorate, in which 83.6% of the respondents has been exposed to education [18].

On the other hand, the level of practice on sanitation and hygiene was also insufficient and found as among the main challenges to improve their

practices due to the limited availability of the drinking water in quantity as well as in quality. Most of the participants in this study, claimed they do not have enough water (63.0%). Moreover, less than third of them (31.6%) satisfied with water quality. There is a sharp imbalance between demand and supply of water in Yemen as in some low-income countries, despite the increase in coverage of drinking water facility decade by decade in many countries, and despite the call of the sustainable development goals it is expected to increase in the future [4]. Poverty probably was another factor affecting the availability of the basic requirement of the people in the study area for improving their practice in preventing diseases such as diarrheal diseases as they were living in rural areas with very limited economic resources. A previous study in Aden, has shown that the socioeconomic and WASH characteristics were the major determinants of cholera morbidity and mortality regardless of participant’s knowledge [18]. During the protracted crisis, people will have to prioritize water and food availability over their quality regardless their knowledge [19].

Yemen suffered from water scarcity and poor sanitation management even before 2015 and only 55% of total population used to have access to improved water [20]. The disruption of water and sanitation services has deteriorated thereafter as consequences of the violent conflict. As a result, even in areas where the water network presents, about half of the respondents had to carry water

from other water point sources. Open water sources for drinking and domestic use were also common among 13.9% and 15.2% of the respondents, which needs special attention of its quality and management. Moreover, less than quarter of the respondents described the water carrying tools (21.1%) and containers (24.9%) as good. All these factors should be counted when used to measure of the quality of water as well as the leading causes of diarrheal diseases. Therefore, it is important to explore wider promotion of water safety planning which, through a better management of contamination risks, would be expected to improved water quality in Abyan Governorate. Although men were predominantly the head of the households (85.2%), but not the responsible to carry water from source point. So, the burden of carry water falls upon women (54.1%) and girls (21.1%) which may take more than hour in some areas, and though, increasing their exposure to sexual harassment, or physical injuries due carrying heavy water containers from open water resources as reported in some studies elsewhere [21], and may affect the girls school enrolment as well.

The hygiene knowledge and practices reported by the participants were also inadequate. Only 70.6% reported that they wash their hand regularly. Although most participants reported they should wash their hands before eating (83.9%), few reported washing hands after using latrine (32.7%), preparing food (19.3%) and less other times. Moreover, about two third of the participants reported the use water and soap for washing hands (60.6%), and 39.4% of the participants uses water only. Similarly, multiple systematic review after compiling 42

studies all over the world showed that handwashing practice with soap was still challenging for universal practice with a prevalence of handwashing with soap was estimated nearly of 19% [22-24]. Some intervention studies hygiene education component conducted elsewhere, reported that hygiene education would have had the effect of encouraging more frequent handwashing and suggest a highest reduction for gastrointestinal illness [25,26]. However, the poor knowledge and practice of the participants in this study may be due the limited health education on water, sanitation, and hygiene was incompatible with their local contextual character and environment.

The majority of the respondents reported the use of latrines site for defecation; however, open field defecation was also reported by some participants, particularly, common for children (19.3%). According to the WHO global estimation of people practicing open defecation in the year 2020 with around 7%, and about 15% in rural area of Yemen [27]. The lack of safety and privacy is challenging with open defecation, especially for women and children. Moreover, systematic review studies suggested some health impacts linked to open defecation such as increased risk of sexual exploitation, threat to women's privacy and dignity and psychosocial stressors, which clearly present a serious situation of poor sanitation in rural communities of lower-middle income countries [28].

For the solid waste disposal methods, half of the respondents using to burn their waste (50.7%), while others using an open dump (42.4%). All these behaviors are carrying the risk of polluting open and deep-water sources

as well as create a fertile environment for communicable diseases transmission. The World Bank estimates that inadequate sanitation costs lower-middle income countries (LMICs) billions of dollars each year in lost GDP [29].

Limitations

Some limitations need to be reported in this study. The quantitative survey had methodological limitations, as it was designed for self-reported behaviour, thus recall bias could be among the limitations that could be associated with this type of design. Other limitation was that the study did not explore impacts on health outcomes, or gather perspectives from government officials, which could have strengthened the study's inferences. Finally, although the study site was limited to rural districts of Abyan governorate which limit the representativeness of the study to be generalized for Abyan Governorate, though the findings can be relevant to similar settings and will provide a baseline data needed for behavioural and WASH interventions in other areas of the country.

Conclusion

The study revealed poor knowledge of the participants regarding aspect related to water management, sanitation, and hygiene which also has been reflected in respondents' practices. Water availability and quality and socioeconomic vulnerabilities such as extreme poverty and illiteracy are the underlying factors for their poor hygiene knowledge and practices. Therefore, there is an extreme need for medium- and long-term sustainable solutions especially for

the water provision and education, rather than immediate and short-term solutions. Raising the proportion of households that have regular access to safe water through sustainable solutions is the most important intervention to be considered for changing the sanitation and hygiene practices. Understanding the causes of poor water quality, where water is available but not potable is important element for implementing some interventions aimed to improve the quality of water.

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Abbreviations/acronyms

IDPs: Internally Displaced Peoples
IOM: International Organization of Migration
SPSS: Statistical Package for Social Sciences
UNDP: United Nations Development Programme
UNICEF: United Nations Children's Fund
UKAIDS: United Kingdom Agency for International Development
USAID: United states Agency for International Development
WASH: Water and Sanitation Hygiene
WHO: World Health Organization
YR: Yemeni Rial

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