



Knowledge and Practices of the Adult Population on Diarrheal Diseases, Transmission, and Prevention in Sierra Leone: A community-based cluster survey

Bockarie Pompay Sesay^{1*}, Adel Hussein Elduma,² Jean Leonard Hakizimana², and Gebrekrstos Negash Gebru²

¹ World Health Organization, Sierra Leone, Country Office WHO; 21 A-B Riverside Drive, Off Kingharman Road, Freetown, Sierra Leone, and ² Sierra Leone Field Epidemiology Training Program, Freetown, Sierra Leone

*Corresponding author: Bockarie Pompay Sesay: Email address: bockariesesay6140@gmail.com

DOI: <https://dx.doi.org/10.4314/ajhs.v36i2.3>

Abstract

INTRODUCTION

There is limited information on the knowledge and prevention practices of diarrheal disease transmission among adults in Sierra Leone. We assessed the level of knowledge and practices of adults on diarrheal disease transmission and prevention in Sierra Leone.

METHODOLOGY

A community-based cross-sectional cluster survey was conducted in four districts of Sierra Leone. A pre-tested, structured questionnaire was used to collect demographic, knowledge and practices on water, sanitation and hygiene (WASH), diarrheal diseases transmission and prevention. On Knowledge questions, a score above 50% was categorized as adequate and below 50% was categorized as poor. We calculated frequencies, proportions and chi-square to compare knowledge and practice differences between urban and rural settings.

RESULTS

Of the total 926 study subjects, 676 (73%) were female, with a median age of 29 years (range:18 - 96 years). Almost, 75% (671/926) of study participants had adequate knowledge of the critical moments of hand washing, higher in urban (79%) compared to rural areas (66%), ($p<0.001$). Forty-one per cent (377/926) of the study participants had limited knowledge of diarrheal diseases transmission with 48% in urban and 33% in rural areas ($p<0.001$), 87% (801/926) had limited knowledge of the measures of diarrheal diseases prevention, higher in rural, 416 (92%) compared to urban, 385 (81%), ($p<0.001$).

CONCLUSION

Study participants had adequate knowledge on the importance of handwashing, and the critical times to wash hands. Study participants had limited knowledge about the transmission and prevention of diarrheal disease. The majority of the study subjects practice hand hygiene and safe water treatment method in urban as compared to rural settings. We recommend developing a WASH-related sensitization program to improve community awareness of diarrheal disease transmission and prevention.

Keywords: Hand washing, WASH, Diarrheal Disease, Household, Knowledge, Practices, Hygiene, Sierra Leone

[Afr. J. Health Sci. 2023 36 (2): 113-123]

Introduction

Access to the safe, sufficient, and continuous availability of drinking water, adequate sanitation, and practices of appropriate hygiene behaviour form the basis of human health and well-being. Safe water, sanitation and hygiene (WASH)

are crucial preconditions for the prevention of diarrheal disease transmission (1). Globally, unsafe water, poor sanitation, limited knowledge and poor hygiene practices of adults on WASH account for a significant proportion of the burden of diarrheal diseases. WASH-related illnesses, often marked by



diarrheal diseases, were the 8th largest cause of death among all ages (2). Inadequate WASH is responsible for around 7% of the global burden of diseases as measured by disability-adjusted life years (DALYs) (3).

In Sub-Saharan Africa, water and basic sanitation coverage is limited, particularly among people living in rural areas who are less likely to have access to improved water and basic sanitation facilities with limited knowledge and poor hygiene practices (4-6).

In Sierra Leone, 4.3 million (58%) people use unimproved water sources, 1.4 million (19%) practice open defecation, and 5 million (68%) practice unsafe hygiene with 95% of improved water sources reported being contaminated as a result of limited knowledge on WASH (8). Millennium Development Goal (MDG) Report 2015 on the improvement of drinking water and sanitation stated that Sierra Leone had made good progress on the drinking water target but limited progress on the sanitation target. Approximately, 50-75% of the population has improved drinking water sources, but less than 50% has access to improved sanitation. (8). In 2015, Sierra Leone agreed to participate in the program to achieve the Sustainable Development Goals (SDGs) by 2030, through improving standards of service delivery and enhancing sustainability (9). This represents an important undertaking for the country since the Millennium Development Goal (MDG) WASH targets were not achieved for 2015.

In Sierra Leone, many studies have examined the technical and engineering aspects of WASH, such as functionality, water system breakdowns, access to high-quality latrines and sustainability of services which determine the burden of diarrheal diseases (10). However, knowledge, attitudes, and practices related to diarrheal diseases transmission, and prevention are not explored in the country (11). Health-related knowledge and practices can strongly influence the perceptions and reduction of risks, and these perceptions can be a driving motivator for the adoption of health-promoting behaviours. Despite the availability and the huge investments in WASH

interventions, the desired results of the interventions have not been achieved (12). Previous studies conducted in Sierra Leone provided limited data about the knowledge and practices of the adult population on diarrheal diseases, transmission and prevention (13–15). We, therefore, conducted this study to assess the level of knowledge and practices of the adult population on diarrheal disease transmission and prevention in Sierra Leone.

Methodology

Study design, area and population

We conducted a community-based cross-sectional survey. Sierra Leone has a tropical climate, with a diverse environment ranging from savannah to rainforests. Study participants were selected from four districts namely Kenema, Moyamba, Tonkolili, and Western Area Urban.

The study population were adult Household Heads (HH). Eligible respondents who were severely sick, mentally disabled or refuse to fill out the informed consent were excluded from the survey.

Sample size and sampling techniques

The sample size was calculated using a single proportion with the assumption that 27.5% of rural and 74% of urban populations have adequate knowledge, and access to improved water, sanitation and hygiene practices (16). We determined the required sample size by stratum for rural and urban populations. The following assumptions were considered in calculating the sample size for this population: 1,265,468 (Urban: 567,762, Rural: 697,706), expected % frequency of outcome factor in the rural population (p): 27.5%, expected % frequency of outcome factor in the urban population (p): 74%, two-sided confidence limits as % of 100 (absolute +/- %) (d): 5%, and 1.5 design effect. A total of 903 sample size (n) was calculated (459 for rural, and 444 for urban) using *epi.info* 7.2 Stat calc. found at <http://www.cdc.gov/epiinfo> (17). Considering a 10% non-response rate, the final sample size (N) of 993 (505 for rural and 488 for urban population) was required for this survey (18).



We applied a multi-stage sampling technique to reach the final required sampled study subjects. First, we selected four districts across the country, one from each region using simple random sampling. Second, we stratified each selected district into rural and urban. Then, we divided the total population of each district by the number of EAs to get the sampling interval K_{th} . From the sampling frame (EAs), we selected a total of 30 EAs using sampling intervals according to the PPS of each district. The study subjects were selected from each EAs using the PPS of each EAs.

Data collection

A pre-tested structured questionnaire adapted based on UNHCR WASH KAP survey standard questionnaire (19) was used to collect demographic data, self-reported infection in the preceding two weeks, participants' knowledge of disease transmission and prevention, WASH practices and observed handwashing practice.

The questionnaire was pretested among 51 (5% of the calculated sample size) adult population, 26 rural and 25 urban adults selected randomly were interviewed.

Data was collected by Field Epidemiology Training Program (FETP) Intermediate and Frontline participants, FETP graduates, and public health staff in the study areas. The data collectors were trained in the administration of the questionnaire. A face-to-face interview was done using the structured questionnaire which was used in an electronic format (Epi-Info7).

Variables

Knowledge: Study participants who scored 50% and above on the knowledge questions on WASH were considered to have adequate knowledge and those who scored less than 50% were considered to have limited knowledge of diarrheal diseases transmission and prevention.

Data analysis

Descriptive statistics were performed based on variables from the questionnaire using Epi-info version 7.22. Median and range for age, proportions and ratio for categorical variables such

as sex, education level, and how water is stored and treated, among many others were calculated. Measures of statistical tests using Chi-square were computed to compare proportions among rural and urban settings. For all analyses, variables were considered statistically significant at a p-value of <0.05 . Results were summarized and displayed using frequency tables and charts.

Ethical consideration

The study protocol was approved by the Sierra Leone Ethics and Scientific Review Committee. Informed consent was sought and obtained from all participants and the confidentiality and privacy of the study subjects were maintained.

Results

Demographic characteristics

A total of 926 (451 in Rural, and 475 in Urban) study subjects were interviewed. The median age of the study subjects was 29 years (range: 18 - 96 years). Female participants represented 676 (73%) of the study subjects. Of the total study subjects, 389 (42%) did not attend school. The majority of the study subjects, 385 (74%), were Muslims; Temne and Mende accounted for 306 (33%).

The main source of income was farming, 437 (44%), followed by small businesses representing 221 (22%). Four hundred and ninety-seven (54%) of the total study subjects earned below the national minimum wage per month (national minimum wage per month= 500,000 Leones) (20). The median monthly income was 400,000 Leones (Range: 100,000-15,000,000 Leones). Of the total surveyed households, 242 (32%) had one to five household members and 229 (31%) had more than 10 members.

The prevalence of self-reported diarrheal disease during the two weeks before the interview date was 17% (15% in rural and 12% in urban). Of 287 study subjects who got diarrheal disease, 156 (54%) seek medical care, and 270 (94%) took medicine (Table 1).



Knowledge of diarrheal disease transmission and prevention

Of the total 926 study subjects, 671 (75 %) had adequate knowledge of the critical moments of hand washing with the high proportion found in urban compared to rural areas (79% versus 66% respectively, ($p < 0.001$). A total of 377 (41%) study subjects had limited knowledge of the ways diarrheal disease can be transmitted (48% in urban vs 33% in rural, $p < 0.001$). Of the total 926 study subjects interviewed, 801 (87%) had limited knowledge of the measures of diarrheal diseases prevention with a higher proportion in rural compared to urban settings 416 (92%) versus 385 (81%) respectively, ($p < 0.001$) see (Table 2).

WASH practices and risk perceptions of the study subjects

Of the 926 study subjects, 917(99%) reported that hand washing is important. Of those 917 study subjects who reported handwashing is important, 444 (48%) were from rural and 473 (52%) from urban settings. Regarding hand washing practices, 288 (64%) in rural and 366 (77%) study subjects reported that they always wash their hands before eating ($p < 0.001$). Also, 158 (35%) in rural and 108 (23%) in urban reported that they sometimes wash their hands, and 5 (1%) in rural and 1 (0.2%) in urban reported they never wash their hand ($p < 0.001$).

Table 1:
Demographic characteristics of respondents, Sierra Leone, 2019

Variable	Total		Urban		Rural	
	n	%	n	%	n	%
Location of the household	926	100.0	475	51.3	451	48.7
Gender of respondents						
Female	676	73.0	344	37.2	332	35.9
Male	250	27.0	313	14.2	119	12.9
Number of people in the household						
<=5 people	242	32.2	212	43.4	166	32.3
6-7 people	109	14.5	100	20.49	124	24.1
8-10 people	171	22.8	80	16.4	91	17.7
>10 people	229	30.5	96	19.7	133	25.9
Highest level of education of respondents						
Junior Secondary	135	14.6	80	8.6	55	5.5
None	385	41.6	99	10.7	286	30.9
Primary	90	9.7	34	3.7	56	6.0
Senior Secondary	225	24.3	178	19.2	47	5.1
Tertiary	54	5.8	50	5.4	4	0.4
University	37	4.0	34	3.7	3	0.3
Religion of respondents						
Christian	237	25.6	157	17	80	8.6
Muslim	685	74.0	316	34.1	369	39.8
Others	4	0.4	2	0.2	2	0.2
Monthly income (Leones)						
Households earning below the minimum wage	497	54.2	162	36.5	350	74.0
Households earning the minimum wage and above	420	45.8	282	63.5	123	26.0
Source of household income	926					
Farming	355	38.4	17	3.6	338	74.9
Small business	153	16.5	120	25.3	33	7.3
Employed/Salaried	40	4.3	36	7.6	4	0.9
Trading	54	5.8	42	8.8	12	2.7
Fishing	7	0.8	1	0.2	6	1.3
Others	317	34.2	259	54.5	58	12.9



Table 2:

Knowledge about clinical moments of handwashing, transmission, and prevention of diarrheal disease, Sierra Leone 2019

Variables	Rural (%)	Urban (%)	P value
What are the most important times (critical moments)when to wash hands(among respondents			
Before eating (n=926, Rural 451, Urban 475)			
Yes	405 (89.8)	429 (90.3)	0.821
No	46 (10.2)	46 (9.7)	
After defecation (n=926, Rural 451, Urban 475)			
Yes	391 (86.7)	443 (93.3)	0.001
No	60 (13.3)	32 (6.7)	
Before cooking a meal (n=926, Rural 451, Urban 475)			
Yes	212 (47.0)	321 (67.6)	<0.001
No	239 (53.0)	154 (32.4)	
Before breastfeeding (n=926, Rural 451, Urban 475)			
Yes	43 (9.5)	79 (16.6)	0.001
No	408 (90.5)	396 (83.4)	
Before feeding children (n=926, Rural 451, Urban 475)			
Yes	51 (11.3)	80 (16.8)	0.018
No	400 (88.7)	395 (83.2)	
After handling a child's stool/changing a nappy/cleaning a child's bottom (n=926, Rural 451, Urban 475)			
Yes	89 (19.7)	74 (15.6)	0.101
No	362 (80.3)	401 (84.4)	
Level of knowledge on critical moments of handwashing among respondents			
Adequate	297 (65.8)	374 (78.7)	<0.001
Limited	154 (34.2)	101 (21.3)	
Knowledge of ways of diarrheal disease transmission			
Through contaminated water (n=926, Rural 451, Urban 475)			
Yes	319 (70.7)	336 (71.8)	0.010
No	139 (30.3)	132 (28.2)	
From flies (n=926, Rural 451, Urban 475)			
Yes	247 (54.8)	284 (59.8)	<0.001
No	204 (45.2)	191 (40.2)	
Through contaminated or undercooked food (n=926, Rural 451, Urban 475)			
Yes	196 (43.5)	297 (62.5)	<0.001
No	255 (56.5)	178 (37.5)	
From contact with someone sick with diarrheal disease or someone who died from diarrheal disease			
Yes	42 (9.3)	73 (13.4)	0.005
No	409 (90.7)	402 (84.6)	
From unpleasant odours (n=926, Rural 451, Urban 475)			
Yes	41 (9.1)	42 (8.8)	0.908
No	410 (90.9)	433 (91.2)	
From swimming/bathing in surface water (n=926, Rural 451, Urban 475)			
Yes	15 (3.3)	5 (1.0)	0.022
No	436 (96.7)	470 (99.0)	
Level of knowledge on ways of transmission among respondents			
Adequate	149 (33.0)	228 (48.0)	<0.001
Limited	302 (77.0)	247 (52.0)	
Knowledge of ways of preventing diarrheal disease among respondents			
Cover food (n=926, Rural 451, Urban 475)			
Yes	236 (52.3)	284 (59.8)	0.024
No	215 (47.7)	191 (40.2)	



A total of 499 (54%) reported that they wash their hand with soap and water and the proportion was slightly higher in urban 272 (57%) compared to rural settings 227 (50%), ($p=0.035$). The data collection revealed also that 394 (43%) of participants washed their hands with water only at a point in time, 249 (52%) in urban versus 142 (32%) in rural, $p<0.001$). A total of 471 (51 %) reported that they have ever run out of soap.

Of the 471 who ever run out of soap, 152 (48%) were from rural and 49 (32%) from urban

cannot afford soap, 138 (44%) were from rural, and 71 (47%) from urban run out of soap or used it, and 22 (7%) from rural and 25 (17%) from urban setting cannot find soap. The majority of the study subjects, 457 (49%) reported the main reason for not having soap as they cannot afford it or they run out of soap (Table 3). Those who did not use a toilet/latrine or practice open defecation were 821 (89%), in rural were 411 (50%) and in urban were 410 (50%).

Table 2: Continued

Variables	Rural (%)	Urban (%)	P value
Boil or treat your water/drink clean water (n=926, Rural 451, Urban 475)			
Yes	199 (44.1)	266 (56.0)	0.0002
No	252 (55.9)	209 (44.0)	
Cook food well (n=926, Rural 451, Urban 475)			
Yes	181 (40.1)	256 (53.9)	<0.001
No	270 (59.9)	219 (46.1)	
Wash fruits and vegetables (n=926, Rural 451, Urban 475)			
Yes	129 (28.8)	187 (39.4)	0.0005
No	322 (71.4)	288 (60.6)	
Cleaning cooking utensils (n=926, Rural 451, Urban 475)			
Yes	69 (15.3)	121 (24.5)	0.0001
No	382 (84.7)	354 (74.5)	
Store water safely (n=926, Rural 451, Urban 475)			
Yes	40 (8.9)	73 (15.4)	0.002
No	441 (91.2)	402 (84.6)	
Use toilet/latrine facility to defecate (n=926, Rural 451, Urban 475)			
Yes	40 (8.9)	65 (13.7)	0.020
No	441 (91.1)	410 (86.3)	
Clean your home with bleach (n=926, Rural 451, Urban 475)			
Yes	31 (6.9)	49 (10.3)	0.062
No	420 (93.1)	426 (89.7)	
Dispose of children's faeces in toilet/latrine (n=926, Rural 451, Urban 475)			
Yes	32 (7.1)	29 (6.1)	0.543
No	419 (92.9)	446 (93.9)	
Bury faeces (n=926, Rural 451, Urban 475)			
Yes	25 (5.5)	29 (6.1)	0.715
No	426 (94.5)	446 (93.9)	
Receive a vaccine			
Yes	11 (2.4)	14 (2.9)	0.633
No	440 (97.6)	461 (97.1)	
Breastfeeding babies (n=926, Rural 451, Urban 475)			
Yes	0	5 (1.1)	0.062
No	451 (100.0)	470 (98.1)	
Level of knowledge on ways of diarrheal disease prevention among respondents			
Adequate	35 (7.8)	90 (18.9)	<0.001
Limited	416 (92.2)	385 (81.1)	



Discussion

This study assessed the knowledge and practices related to diarrheal disease among adult populations in rural and urban settings of Sierra Leone. The main finding of this study revealed that the majority of the study subjects had low socio-economic status, and more than half of them earned below the minimum wage. Farming was the main source of income and about half of study subjects

didn't attend school. This will contribute to the study subjects' limited knowledge and practices for preventing the spread of diarrheal illnesses.

The study found that self-reported diarrheal disease in the two weeks before the study was 17% (15% in rural and 12% in urban). This finding was similar to a study conducted in South Africa where the prevalence of self-reported diarrheal diseases was 20% (7).

Table 3:

Hand washing practices on diarrheal disease transmission and prevention, Sierra Leone, 2019

Variables	Rural (%)	Urban (%)	P value
Is handwashing is important (n=926, Rural 451, Urban 475)			
Yes	444 (98.5)	473 (99.6)	0.212
No	4 (0.9)	1 (0.4)	
How often do you wash your hand (n=926, Rural 451, Urban 475)			
Always	288 (63.9)	366 (77.1)	<0.001
Never	5 (1.1)	1 (0.2)	
Sometimes	158 (35.0)	108 (22.7)	
What adults wash hands with (n=926, Rural 451, Urban 475)			
Soap and water			
Yes	227 (50.3)	272 (57.3)	0.035
No	224 (49.7)	203 (42.7)	
Water only			
Yes	145 (32.2)	249 (52.4)	<0.001
No	306 (67.8)	226 (47.6)	
Ash			
Yes	43 (9.5)	408 (90.5)	<0.001
No	7 (1.5)	468 (98.5)	
Mud			
Yes	5 (1.1)	0	0.027
No	446 (98.9)	475 (100)	
Others			
Yes	68 (15.1)	103 (21.7)	0.010
No	383 (84.9)	372 (78.3)	
Have respondents ever run out of soap? (n=926, Rural 451, Urban 475)			
Yes	316 (70.1)	133 (32.6)	<0.001
No	130 (28.8)	319 (67.2)	
Taking care of animals (n=926, Rural 451, Urban 475)			
Yes	223 (49.5)	87 (18.3)	<0.001
No	225 (50.0)	388 (81.7)	
The main reason for running out of soap (n=926, Rural 451, Urban 475)			
Cannot afford soap			
Cannot afford soap	152 (48.3)	49 (32.4)	
Don't know	2 (0.6)	0	
Don't like soap	1 (0.3)	0	
Other	0	5 (3.3)	
Ran out of soap/Used it	138 (43.8)	71 (46.7)	
Soap is unavailable/cannot find soap	22 (7)	25 (16.5)	
Soap is unnecessary	0	2 (1.3)	



This prevalence was lower than what was observed in Ethiopia, which was 33% (21). This pattern was seen across all age groups of the adult population, which was similar to the findings of a study conducted in India (22).

Even though the majority of the study subjects had adequate knowledge of the critical moments of handwashing, half of them had limited knowledge of how diarrheal diseases are transmitted. A significant proportion of study subjects had limited knowledge of diarrheal disease prevention measures. This implies that the WASH interventions by the Sierra Leone Ministry of Health and Sanitation (MOHS) and its developmental partners need to focus on improving the hand-washing knowledge of the population (23). Also, more efforts are needed to strengthen diarrheal disease transmission and prevention measures. A study conducted in South Africa showed that knowledge about water-related diseases and their prevention was poor, where 78% of study participants reported that they did not know anything about water-related diseases (24).

This study also examined risk perceptions and WASH-related practices including diarrheal disease risk factors such as demographic, water, sanitation, hygiene, knowledge, and practices. Various studies have revealed that water, sanitation, demographic, and behavioural factors significantly predict diarrheal disease occurrence (14,25,26). Nearly all of the study subjects emphasized the importance of hand washing, suggesting that the MOHS's WASH-related intervention was effective. (27). The study revealed that the majority (93%) of the study subjects wash their hand with soap and water. Also, the majority of the study subjects washed their hands after defecation and before eating which can contribute to breaking the transmission of diarrhoea diseases. These findings are different from a study conducted in Ethiopia(28). Also, this finding was slightly higher than the findings of another study, which showed that handwashing with soap in low and middle-income countries was 13% and 17% in rural and urban respectively (29). This high proportion of hand washing in this study may be

attributed to WASH interventions implemented across the country to meet the SDGs targets.

This study showed that 99% of the study subjects agreed that handwashing was important, and this finding was similar to that observed in a study conducted in South Africa (30). Also, 10% of study subjects perform handwashing after handling a child's stool, 11% before feeding babies and 45% before cooking meals. These findings are dissimilar to a study conducted in Bangladesh, where 30% of respondents wash their hands after handling a child's stool, 3% after feeding babies and 9% before cooking meals (24). Socio-cultural practices might be the reasons for the differences observed in those studies. Further analysis revealed that the most prevalent method of water treatment was letting water stand and settle. This measure is not a good practice to improve water quality for drinking in households. Study subjects who used this treatment method were more likely to experience diarrheal diseases and this finding was similar to what was found in a study conducted in Indonesia (14,31). This finding may also be explained that water can be contaminated during the process of treatment or storage after treatment (32). Open defecation was found higher in this study than what was found in other studies, where it was 23% in sub-Saharan Africa compared to 34% in Asia (33,34). The high proportion of Open defecation in this study may be explained by the low socio-economic status of the respondents in a rural setting where their monthly income is far less than the minimum wage.

Study limitations

The occurrence of diarrheal diseases may vary with seasons and our findings might have been affected by these factors. The findings might have been also affected by social desirability factors.

Conclusion

The level of knowledge of the study subjects about the importance of handwashing, and the critical times to wash hands was adequate. However, the level of knowledge on diarrheal disease transmission and prevention was limited. The majority of the study subjects knew the importance of hand hygiene and study participants

in the urban setting practice safe water treatment methods compared to rural settings.

We recommend developing WASH-related sensitization programs aimed at increasing community awareness of diarrheal disease transmission and prevention. We recommend WASH-related interventions related to poor quality of drinking water and hand hygiene. Since half of the respondents had no education, community sensitization programs should focus on the use of local leaders, role plays, skits, and talk shows rather than print media.

Disclosure

The author reports no conflicts of interest in this work.

References

1. **Fewtrell L, Colford JM.** Water, sanitation and hygiene in developing countries: Interventions and diarrhoea-a review. *Water Science and Technology.* 2005;52(8):133–42.
2. Diarrhoeal disease [Internet]. [cited 2022 Apr 6]. Available from: <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>
3. **Prüss-Ustün A, Bartram J, Clasen T, Colford JM, Cumming O, Curtis V, et al.** Burden of disease from inadequate water, sanitation and hygiene in low- and middle-income settings: A retrospective analysis of data from 145 countries. *Tropical Medicine and International Health.* 2014;19(8):894–905.
4. Association between water, sanitation, and hygiene access and the prevalence of soil-transmitted helminth and schistosome infections in Wolayita, Ethiopia | Parasites & Vectors | Full Text [Internet]. [cited 2023 Feb 15]. Available from: <https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-022-05465-7>
5. **Tshuma M, Belle JA, Ncube A.** An Analysis of Factors Influencing Household Water, Sanitation, and Hygiene (WASH) Experiences during Flood Hazards in Tsholotsho District Using a Seemingly Unrelated Regression (SUR) Model. *Water.* 2023 Jan;15(2):371.
6. **Eméline Angoua, E. L., Dongo, K., Templeton, M. R., Zinsstag, J., & Bonfoh, B.** Barriers to access improved water and sanitation in poor peri-urban settlements of Abidjan, Côte d'Ivoire. *PLoS ONE* [Internet]. 20018;13(8). Available from: <https://doi.org/10.1371/journal.pone.0202928>
7. **Kapwata T, Mathee A, le Roux WJ, Wright CY.** Diarrhoeal Disease in Relation to Possible Household Risk Factors in South African Villages. *Int J Environ Res Public Health.* 2018 Aug;15(8):1665.
8. Statistics Sierra Leone. Sierra Leone Multiple Indicator Cluster Survey 2017: Survey findings report. 2017;
9. Sierra Leone .:. Sustainable Development Knowledge Platform [Internet]. [cited 2022 Mar 3]. Available from: <https://sustainabledevelopment.un.org/membestates/sierraleone>
10. Statistics Sierra Leone and Ministry of Water Resources. WASH Baseline Survey and Water Point Mapping 2016. 2016.
11. **Kelly E, Shields KF, Cronk R, Lee K, Behnke N, Klug T, et al.** Seasonality, water use and community management of water systems in rural settings: Qualitative evidence from Ghana, Kenya, and Zambia. *Science of The Total Environment.* 2018 Jul 1;628–629:715–21.
12. **Vivas A, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA.** Knowledge, Attitudes, and Practices (KAP) of Hygiene among School Children in Angolela, Ethiopia. *J Prev Med Hyg.* 2010 Jun;51(2):73–9.
13. ASPR-2017-final-draft-5aug2018-1.pdf [Internet]. [cited 2022 Mar 3]. Available from: <https://wash-alliance.org/wp-content/uploads/sites/43/2019/01/ASPR-2017-final-draft-5aug2018-1.pdf>
14. **Bah D, Gebru G, Hakizimana JL, Ogbonna U, Sesay B, Bah B, et al.** Prevalence and risk factors of diarrheal diseases in Sierra Leone, 2019: a cross-sectional study. *Pan Afr Med J.* 2022 Jan 3;41:3.
15. **Sesay BP, Hakizimana JL, Elduma AH, Gebru GN.** Assessment of Water, Sanitation and Hygiene Practices Among Households, 2019 – Sierra Leone: A Community-based



- Cluster Survey. *Environ Health Insights*. 2022 Jan 1;16:11786302221125042.
16. Sierra Leone Multiple Indicator Cluster Survey 2017 [Internet]. [cited 2021 Nov 11]. Available from: <https://www.unicef.org/sierraleone/reports/sierraleone-multiple-indicator-cluster-survey-2017>
 17. **Epi Info™** | CDC [Internet]. 2021 [cited 2022 Mar 4]. Available from: <https://www.cdc.gov/epiinfo/index.html> [sl_2015_phc_thematic_report_on_population_projections.pdf](https://www.cdc.gov/epiinfo/index.html) [Internet]. [cited 2022 Mar 3]. Available from: https://www.statistics.sl/images/StatisticsSL/Documents/Census/2015/sl_2015_phc_thematic_report_on_population_projections.pdf
 19. WASH KAP Survey in Refugee Sites Standardized Questionnaire [Internet]. UNHCR.; 2018 Apr. Available from: file:///C:/Users/SLFETP/Downloads/UNHCR_UGA_2018_KAP_PALORINYA_questionnaire.pdf
 20. Sierra Leone Minimum Wage - World Minimum Wage Rates 2022 [Internet]. [cited 2022 Apr 20]. Available from: <https://www.minimum-wage.org/international/sierra-leone>
 21. Progress on Drinking Water, Sanitation and Hygiene: 2017 update and SDG baselines [Internet]. UNICEF DATA. 2017 [cited 2022 Mar 3]. Available from: <https://data.unicef.org/resources/progress-drinking-water-sanitation-hygiene-2017-update-sdg-baselines/>
 22. **Kattula D, Francis MR, Kulinkina A, Sarkar R, Mohan VR, Babji S, et al.** Environmental predictors of diarrhoeal infection for rural and urban communities in south India in children and adults. *Epidemiol Infect*. 2015 Oct;143(14):3036–47.
 23. Sierra Leone Multiple Indicator Cluster Survey 2017 [Internet]. 2018 [cited 2023 Feb 15]. Available from: <https://www.unicef.org/sierraleone/reports/sierraleone-multiple-indicator-cluster-survey-2017>
 24. **Rabbi SE, Dey NC.** Exploring the gap between hand washing knowledge and practices in Bangladesh: a cross-sectional comparative study. *BMC Public Health*. 2013 Jan 30;13:89.
 25. **Gavhi F, Kuonza L, Musekiwa A, Motaze NV.** Factors associated with mortality in children under five years old hospitalized for Severe Acute Malnutrition in Limpopo province, South Africa, 2014-2018: A cross-sectional analytic study. *PLoS One*. 2020 May 8;15(5):e0232838.
 26. **Mebrahtom S, Worku A, Gage DJ.** The risk of water, sanitation and hygiene on diarrhea-related infant mortality in eastern Ethiopia: a population-based nested case-control. *BMC Public Health*. 2022 Feb 18;22(1):343.
 27. **Khan S, Ashraf H, Iftikhar S, Baig-Ansari N.** Impact of hand hygiene intervention on hand washing ability of school-aged children. *J Family Med Prim Care*. 2021 Feb;10(2):642–7.
 28. **Belachew A.B., Abrha M.B., Gebrezgi Z.A., Tekle D.Y.** Availability and utilization of sanitation facilities in Enderta district, Tigray, Ethiopia. *J Prev Med Hyg*. 2018 Sep 28;59(3):E219–25.
 29. **Freeman MC, Stocks ME, Cumming O, Jeandron A, Higgins JPT, Wolf J, et al.** Systematic review: Hygiene and health: systematic review of handwashing practices worldwide and update of health effects. *Tropical Medicine & International Health*. 2014;19(8):906–16.
 30. **Sibiya JE, Gumbo JR.** Knowledge, Attitude and Practices (KAP) Survey on Water, Sanitation and Hygiene in Selected Schools in Vhembe District, Limpopo, South Africa. *Int J Environ Res Public Health*. 2013 Jun;10(6):2282–95.
 31. **Komarulzaman A, Smits J, de Jong E.** Clean water, sanitation and diarrhoea in Indonesia: Effects of household and community factors. *Global Public Health*. 2017 Sep 2;12(9):1141–55.
 32. **Sima LC, Desai MM, McCarty KM, Elimelech M.** Relationship between Use of Water from Community-Scale Water



Treatment Refill Kiosks and Childhood Diarrhea in Jakarta. *Am J Trop Med Hyg.* 2012 Dec 5;87(6):979–84.

Hygiene. *Int J Environ Res Public Health.* 2016 Jun;13(6):536.

33. **Ohwo O, Agusomu TD.** Assessment of Water, Sanitation and Hygiene Services in Sub-Saharan Africa. *European Scientific Journal, ESJ.* 2018 Dec 31;14(35):308–308.
34. **Hutton G, Chase C.** The Knowledge Base for Achieving the Sustainable Development Goal Targets on Water Supply, Sanitation and