



Availability of Improved Water Sources in Public Places of Four Health Districts with Cholera History in Cameroon

Ketina Hirma TCHIO-NIGHIE ^{*1,2}, Eugene Joel BAYIHA ¹, Landry BEYALA ¹, Jerome ATEUDJIEU ^{1,2,3}

¹Department of Health Research, M.A. SANTE (Meilleur Accès aux Soins de Santé (M.A. SANTE), Yaounde Cameroon.

²Department of Public Health, Faculty of Medicine and Pharmaceutical Sciences University of Dschang, Dschang, Cameroon.

³Division of Health Operations Research, Cameroon Ministry of Public Health, Yaoundé, Cameroon.

*Corresponding author: Ketina Hirma TCHIO-NIGHIE, ktchio@masante-cam.org

Received 15 January 2023;

Accepted 03 February 2023;

Published 06 February 2023

Abstract

In public places as well as in homes, water is necessary for consumption, compliance with hygiene rules, sanitation and environmental cleanliness. This study describes in 2017, access to improved water sources in public places of health districts frequently affected by cholera outbreak in Cameroon. This was a cross-sectional descriptive study targeting public places in four health districts of the Littoral and Far North regions of Cameroon. Using an observational grid, data were collected on the availability of improved water sources in public places accommodating at least 100 persons daily. Public places were selected by stratified random sampling process. All 432 identified public places were included. Schools, mosques and bars were the most represented with 169 (39.1%), 74 (17.1%) and 68 (15.7%) surveyed respectively. Out of the 432 public places, 262 [60.7% (55.9-65.3)] had an improved water source. This varied with respect to types of public places and health districts. Improved water sources were available in 99 [58.6 (50.8-66.1) %] schools, 41 [55.4 (33.1-69.9) %] mosques and 46 [67.7 (55.2-78.5) %] bars. About two out of five public places were not covered by at least one point of improved water sources in 2017. Health districts more frequently affected by previous Cameroon cholera outbreak had lower coverage and schools accommodating at daily base a large number of vulnerable people need intervention.

Keywords: *water sources, public places, cameroon, availability of water, access to water.*

Introduction

The definition of access to water varies from one author to another and typically considers the coverage of the population, the type and availability of water source, the quantity and quality, the cost in time, money and distance to reach water source [1-3]. This definition is limited as it does not give specification in access or availability to water in public places which are known to contribute in occurrence and propagation of outbreaks of waterborne diseases [4,5].

Public places have been described as one of the main catalyzers for the spread of diarrheal and other diseases [6-10]. At home as well as in public places, water is necessary for consumption, compliance with hygiene rules, sanitation and environmental cleanliness. The availability of improved water sources in public places such as schools, markets, restaurants may determine the occurrence, attack and case fatality rates of waterborne diseases.

The Cameroon Ministry of Energy and Water is in charge of the development and implementation of policies and directives on water supply and sanitation [11]. Water supply in each locality is under the responsibility of local councils and the national company in charge of water supply [12]. Studies have been conducted on access to water in Cameroon but none have covered the issue in public places to the best of our knowledge [13-16]. Such studies could have provided data to generate information that will serve as evidence to

guide decision makers in improving regulation, planning and monitoring of access to improved water sources in public places. This study is proposed to map the distribution of the availability of improved water sources in public places of Deido, Nylon, Kousseri and Mada health districts which are health districts of Cameroon frequently affected by cholera outbreaks [17].

Material and Methods

Study design

This was a cross-sectional descriptive study that targeted public places selected by stratified random sampling in four health districts in the Far North and Littoral regions of Cameroon. Using an observation grid, trained surveyors evaluated the access to water sources in public places in the health districts of Deido, Nylon, Kousseri and Mada in 2017.

Study setting and period

This study was conducted in July 2017 in Deido, Nylon, Kousseri and Mada health districts in Cameroon. These health districts were among the most affected during the previous cholera outbreak [17]. Deido and Nylon health districts are located in the city of Douala which is the greatest urban city of the Littoral region. Kousseri and Mada health districts are located in the Far North region near Lake

Chad. Figure 1 presents the location of the included health districts in Cameroun. Kousseri health district is mostly rural but hosts a town that is described as urban while Mada health district is entirely rural.

The Far-North region has a dry tropical climate and semi-arid with low rainfall while the Littoral region has an equatorial climate with heavy rainfall.

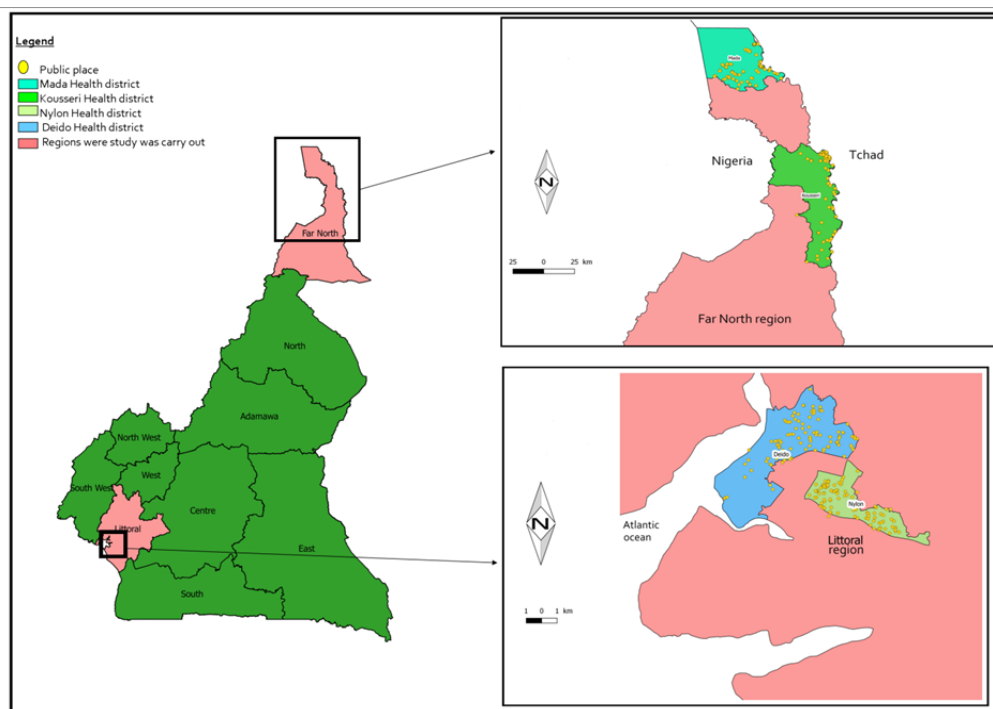


Figure 1: Map of Cameroon illustrating targeted regions and surveyed points

Participants

The study targeted public places operationally defined as a known place frequently accommodating at least 100 persons per day. All public places identified by the competent health district authorities were eligible. They included markets, schools, universities, recreation areas, churches, mosques, bars, restaurants, travel agencies, train stations and administrative offices. All those randomly selected were included and visited for data collection.

We identified, listed and categorized all eligible public places in each targeted health district with the help of community volunteers. This served as sampling frame for each health districts. The public places were selected by stratified random sampling with respect to the category of public places. In public places, the head was informed on objectives and procedures of the study and had to give his verbal approval before the place was included.

Variables and data collection

For each public place, all listed water sources were visited to collect data on the type of source, its protection against contamination and functionality. Was considered improved water source as a type of water source that, by nature of its construction or through active intervention, was protected from contamination by outside substances or foreign materials.

The observational grid included the following key variables: the availability of water sources in public places and the type of water source used in the public places. Data were collected in each selected public place by trained surveyors.

Sample size

The minimum size was estimated at 108 public places per health district assuming a precision of 10% and 95% confidence interval

[18], and a 76% coverage of public places with improved water sources (based on results of a previous unpublished study conducted in Douala in 2016).

Data management and analysis

Data were collected using a paper observation grid, entered in a database and cleaned using Epi Info software version 7.2.1.0. It was analyzed using the same software by estimating with a 95% confidence interval frequencies per health districts of types of public places, public places with an improved water sources and of public place with at least one improved water source. We considered improved water sources as water from drillings, and water supplied by the national company in charge of water supply.

Ethical considerations

As none of data sources was from human participants, this study did not require ethical approval as defined by the national regulation [19]. However, the permission of the head of the selected public places was asked prior to data collection and data were collected anonymously.

Results

A total of 432 public places were assessed in the present study including 108 public places in each health district. Table 1 presents the distribution of public places in terms of types, districts and regions. It is noted that the most prevailing public places in both regions were schools (40.7% and 37.5% in the Littoral and Far North regions respectively).

Table 1: Distribution of public places per health districts, regions and types

	Littoral Region						Far North Region						Total	
	Deido		Nylon		Total		Kousseri		Mada		Total		n	%
	n	%	n	%	n	%	n	%	n	%	n	%		
Travel agencies/stations	3	2.8	5	4.6	8	3.7	1	0.9	1	0.9	2	0.9	10	2.3
Bars	33	30.6	26	24.1	59	27.3	9	8.3	0	0.0	9	4.2	68	15.7

Administrative offices	7	6.5	1	0.9	8	3.7	2	1.9	3	2.8	5	2.3	13	3.0
Nursery, primary and secondary schools	34	31.5	55	50.9	88	40.7	40	37.0	41	38.0	81	37.5	170	39.4
Churches	16	14.8	13	12.0	29	13.4	12	11.1	9	8.3	21	9.7	50	11.6
Markets	3	2.8	2	1.9	5	2.3	10	9.3	16	14.8	26	12.0	31	7.2
Mosques	2	1.9	3	2.8	5	2.3	31	28.7	38	35.2	69	31.9	74	17.1
Restaurants	10	9.3	2	1.9	12	5.6	0	0.0	0	0.0	0	0.0	12	2.8
Universities/ training centers	1	0.9	1	0.9	2	0.9	2	1.9	0	0.0	2	0.9	4	0.9

Types and distribution of water sources identified

Table 2 presents the types of water sources observed and their distribution per type of public places. Boreholes (32.6%) and pipes from the national distribution network (NDN) (30.6%) were the

most frequent. Boreholes were more frequent in mosques (52.7%) and water from the NDN was more frequent in restaurants (66.7%) and administrative offices (64.3%).

Table 2: Types and distribution of water sources per type of public places

	Boreholes		NDN		Wells		Springs	
	n	%	n	%	n	%	n	%
Travel agencies / stations	0	0.0	5	50.0	0	0.0	0	0.0
Bars	9	13.2	37	54.4	2	2.9	0	0.0
Administrative offices	2	14.3	9	64.3	0	0.0	0	0.0
Nursery, primary and secondary schools	54	31.8	49	28.8	22	12.9	1	0.6
Churches	17	34.0	17	34.0	4	8.0	0	0.0
Markets	15	50.0	0	0.0	0	0.0	1	3.3
Mosques	39	52.7	5	6.8	3	4.1	1	1.4
Restaurants	3	25.0	8	66.7	0	0.0	0	0.0
Universities/ training centers	2	50.0	2	50.0	1	25.0	0	0.0
Total	141	32.6	132	30.6	32	7.4	3	0.7

*NDN: National Distribution Network

Availability of water sources in health districts

Table 3 presents the types of water sources distributed per health district and region. Springs were the sparest water sources in Deido (0.0%), Nylon (0.9%) and Kousseri (0.9%) health districts but water from the NDN was the sparest in the Mada health district (0.0%).

Table 4 presents in each health district the proportion of public places with at least one water source and at least one improved water source. The proportion of improved water sources was significantly higher ($X^2 = 17.93$; p -value < 0.00) in Littoral health districts (70.8%) than in Far North Health districts (50.5%).

Table 3: Distribution of types of water sources per health district

Region	District	Boreholes		NDN		Wells		Springs	
		n	%	n	%	n	%	n	%
Littoral	Deido	14	13.0	78	72.2	3	2.8	0	0.0
	Nylon	24	22.2	41	38.0	17	15.7	1	0.9
Far North	Kousseri	58	53.7	13	12.0	6	5.6	1	0.9
	Mada	45	41.7	0	0.0	6	5.6	1	0.9

Table 4: Distribution of the availability of water sources and improved water sources per health district

Regions	Districts	Water sources			Improved water sources		
		n	%	95% CI	n	%	95% CI
Littoral	Deido	94	87.0	[79.2;92.7]	91	84.3	[76.0;90.6]
	Nylon	76	70.4	[60.8;78.8]	63	58.3	[48.5;67.7]
	Total	170	78.7	[72.6;84.0]	154	71.3	[64.8;77.2]
Far North	Kousseri	73	67.6	[57.9;76.3]	69	63.9	[54.1;72.9]
	Mada	50	46.3	[36.7;56.2]	45	41.7	[32.3;51.5]
	Total	123	56.9	[50.1;63.6]	114	52.9	[45.9;59.6]
Total (N=432)		293	67.8	[63.3;76.1]	268	62.0	[57.4;66.5]

Distribution of water sources by type of public place

Table 5 shows the proportion of public places with at least one water source and one improved water source for each type of public place

targeted. It is noted that the availability of improved water sources was limited in schools, mosques, markets and travel agencies.

Table 5: Distribution of water sources by type of public place

Types of public places	Water source			Improved water sources		
	n	%	95% CI	n	%	95% CI
Travel agencies / stations	5	50.0	[18.7;81.3]	5	50.0	[18.7;81.3]
Bars	46	67.6	[55.2;78.5]	46	67.6	[55.2;78.5]
Administrative offices	11	78.6	[49.2;95.3]	11	78.6	[49.2;95.3]
Nursery, primary and secondary schools	121	71.2	[63.7;77.9]	102	83.3	[51.6;97.9]
Churches	35	70.0	[55.4;82.1]	33	66.0	[51.2;78.8]

Markets	15	50.0	[31.3;68.7]	15	50.0	[31.3;68.7]
Mosques	46	62.2	[50.1;73.2]	43	58.1	[46.1;69.5]
Restaurants	10	83.3	[51.6;97.9]	10	83.3	[51.6;97.9]
Universities/ training centers	4	100.0	[39.8;100.0]	3	75.0	[19.4;99.4]

Discussion

This study assessed the availability of improved water sources in public places in the health districts of Deido, Nylon, Kousseri and Mada in 2017. Access to water sources varied between regions where it was higher in the Littoral region compared to the Far North and per type of public places varying from 50.0% in travel agencies to 75.0% in universities/training centers. Availability of improved water sources varied between health districts in the two regions.

Public places are those expected to be visited and/or accommodating by a multitude of people at daily basis. Each of these places is expected to provide access to basic services such as water. In this study, neither regions, health districts nor types of public places had a 100% coverage of public places in terms of availability of improved water sources. To the best of our knowledge, none of published studies has assessed this indicator. These results question actual policies and guidelines on standards regarding availability of water sources in public places or the implementation of these guidelines. Actual existing policies attribute responsibilities regarding water supply system in general but there are no guidelines specifying standards applicable to public places including the obligation to have access to water supply or indicating process of monitoring the existence of water sources. There is need to advocate decision makers in charge to develop from actual policies, standards in terms of water sources in public places and monitoring processes of these sources.

National policy in terms of water supply management is centralized and should be the same in all the regions and public places of Cameroon. Thus the observed differences in this study regarding the availability of water sources between the regions or districts of the same regions and between types of public places is not expected. These discrepancies may be explained by the fact that the level of development in the targeted regions differ, Littoral being an urban area with relatively good access to water, Kousseri being a semi urban district and Mada an urban district. This seems to be plausible as from the most recent demographic and health surveys, where access to water at household level is higher in urban areas compared to rural areas [15,20]. If these results are confirmed in other studies, it should be recommended to partners involved in water supply to prioritize public places of urban health districts compared to urban districts during their planification.

The distribution of water sources between types of public places is heterogeneous underlining the lack of policies and standardizing guidelines. This study did not collect data on the reasons for the unavailability of water sources in public places. This can nevertheless be explained by the absence or inadequacy of regulations on the issue, the fact that some of these public places do not have access to the national water distribution network and the lack of resources to build water sources such as boreholes or the ignorance of heads on the importance of the availability of water sources.

Despite the fact there is no great difference between the types of public places, sensitive areas such travel agencies/stations which serve as transport mean for the majority of people, and schools where children spend much time should benefit a particular attention. Travel agencies/stations permit population displacement and can contribute to rapid propagation of epidemic prone diseases and water related diseases when water sources are limited. The availability of water in schools is also very relevant because of the prolonged time that students spend in these places and the intense promiscuity that prevails there. WHO recommends that in schools a drinking water point be accessible at all times to all students and staff

[21]. In this study, it was noted that only 58.6% of schools surveyed had an improved water source. These results are slightly higher than the results obtained by the Ministry of Basic Education in 2012 in Cameroon, which estimated that 42.3% of primary and nursery schools in Cameroon had potable water [22]. We can conclude that schools in Cameroon are particularly conducive to the spread of epidemics.

The main limitation of this study is that we did not collect data to explain why water sources were unavailable in public places. These data could be collected from heads of public places.

Conclusion

Access to improved water sources was limited in almost all types of public places and in all surveyed health districts although disparities exist between districts. The situation was particularly critical in the districts of the Far North region. It was particularly preoccupying in markets, schools, restaurants, travel agencies/stations and bars who hosts a great number of people. It should be included in policies the construction and monitoring of water sources in public places and the obligation to take into account water sources when setting up public places. Partners involved in water supply management should prioritize the supply of public places of urban health districts compared to urban districts during their planification. Further studies should be conducted to explore the reasons of unavailability of water sources in public places. Heads of public places should also be advocated on the importance of water sources in public places.

Declarations

Data availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Funding

This study was funded by IMC (International Medical Corps) under the REMMOCC (Reducing the Morbidity and Mortality of Cholera in Cameroon) project. The funding body was not involved in the design of the study and was not involved in the implementation and the exploitation of the results.

Conflict of interest

The authors declare no conflict of interest

Authors contributions

KHTN led the writing of the manuscript and contributed in data analysis, EJB contributed to the writing of the manuscript and data analysis, LB contributed to the writing of the manuscript, JA conceived and designed the study, and contributed to the writing of the manuscript.

Acknowledgements

Our gratitude goes to all the local health authorities in the Deido, Nylon, Kousseri and Mada health districts and to all the heads of public places surveyed.

References

- [1] World Health Organization. Guidelines for drinking-water quality, 2nd ed. - Volume 3: Surveillance and control of community supplies. <https://www.who.int/publications-detail-redirect/9241545038>. Accessed 25 October 2021.
- [2] Aiga H, Umenai T. Standardisation of the definition of access to safe water. *The Lancet*. 2003;361. doi:10.1016/S0140-6736(03)13703-8.
- [3] World Health Organization, WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade. 2006. World Health Organization <https://apps.who.int/iris/handle/10665/43488>. Accessed 25 October 2021.
- [4] Cairncross S, Blumenthal U, Kolsky P, Moraes L, Tayeh A. The public and domestic domains in the transmission of disease. *Trop Med Int Health TM IH*. 1996;1(1):27–34.
- [5] Török TJ, Tauxe RV, Wise RP, Livengood JR, Sokolow R, Mauvais S, et al. A large community outbreak of salmonellosis caused by intentional contamination of restaurant salad bars. *JAMA*. 1997;278(5):389–395.
- [6] Cairncross S, Blumenthal U, Kolsky P, Moraes L, Tayeh A. The public and domestic domains in the transmission of disease. *Trop Med Int Health TM IH*. 1996;1(1):27–34.
- [7] Török TJ, Tauxe RV, Wise RP, Livengood JR, Sokolow R, Mauvais S, et al. A Large Community Outbreak of Salmonellosis Caused by Intentional Contamination of Restaurant Salad Bars. *JAMA*. 1997;278(5):389–395.
- [8] Quick R, Paugh K, Addiss D, Kobayashi J, Baron R. Restaurant-Associated Outbreak of Giardiasis. *J Infect Dis*. 1992;166(3):673–676.
- [9] Daniels NA, Mackinnon L, Rowe SM, Bean NH, Griffin PM, Mead PS. Foodborne disease outbreaks in United States schools. *Pediatr Infect Dis J*. 2002;21(7):623–628.
- [10] Evans HS, Maguire H. Outbreaks of infectious intestinal disease in schools and nurseries in England and Wales 1992 to 1994. *Commun Dis Rep CDR Rev*. 1996;6(7):R103-8.
- [11] Président de la République. Décret n° 2005/087 du 29 mars 2005 portant organisation du Ministère de l’Energie et de l’Eau | Services du Premier Ministre. 2005. <https://www.spm.gov.cm/site/?q=fr/content/d%C3%A9cret-n%C2%B0-2005087-du-29-mars-2005-portant-organisation-du-minist%C3%A8re-de-energie-et-de-leau>. Accessed 12 November 2021.
- [12] Services du Premier Ministre. Décret N° 2005/494 du 31 décembre 2005 portant création de la Cameroon Water Utilities Corporation | Services du Premier Ministre. 2005. <https://www.spm.gov.cm/site/?q=fr/content/d%C3%A9cret-n%C2%B0-2005494-du-31-d%C3%A9cembre-2005-portant-cr%C3%A9ation-de-la-cameroon-water-utilities>. Accessed 25 October 2021.
- [13] Institut National de la Statistique, Ministère de la Santé Publique Cameroun, ICF International. Enquête démographique Et de santé et à indicateurs multiples (EDS-MICS) 2011. 2012. <https://dhsprogram.com/pubs/pdf/fr260/fr260.pdf>.
- [14] Institut National de la Statistique., Ministère de la Santé Publique Cameroun. Enquête par grappes à indicateurs multiples (MICS5), 2014, Rapport de résultats clés. Yaoundé, Cameroun. 2015. https://mics-surveys-prod.s3.amazonaws.com/MICS5/West%20and%20Central%20Africa/Cameroon/2014/Key%20findings/Cameroon%202014%20MICS%20KFR_French.pdf.
- [15] Institut National de la Statistique, Ministère de l’Économie de la Planification et de l’Aménagement du Territoire, Ministère de la Santé Publique du Cameroun. Enquête Démographique Et De Santé Et À Indicateurs Multiples (Eds-Mics) 2011. 2011. <https://dhsprogram.com/pubs/pdf/fr260/fr260.pdf>. Accessed 24 May 2021.
- [16] Institut National de Statistiques (INS), IFC. Enquête Démographique et de Santé 2018. <https://www.dhsprogram.com/pubs/pdf/FR360/FR360.pdf>. Accessed 23 August 2021.
- [17] Ngwa MC, Liang S, Kracalik IT, Morris L, Blackburn JK, Mbam LM, et al. Cholera in Cameroon, 2000-2012: Spatial and Temporal Analysis at the Operational (Health District) and Sub Climate Levels. *PLoS Negl Trop Dis*. 2016;10(11): e0005105.
- [18] Lwanga SK, Lemeshow S, Organization WH. *Sample size determination in health studies: a practical manual*. 1991. Geneva: World Health Organization <https://apps.who.int/iris/handle/10665/40062>. Accessed 21 March 2019.
- [19] Ministère de la santé publique du Cameroun. Arrêté No 0977/A/MINSANTE/SESP/SG/DROS/ Du 18 Avril 2012 Portant Création, Organisation Et Fonctionnement Des Comités D’éthique De La Recherche En Santé Humaine. 2012.
- [20] Institut National de la Statistique, Ministère de la Santé Publique Cameroun, The DHS Program. Enquête Démographiques et de Santé 2018. 2018. <https://www.dhsprogram.com/pubs/pdf/FR360/FR360.pdf>. Accessed 24 May 2021.
- [21] Adams J, Bartram J, Chartier Y, Sims J. *Water, sanitation and hygiene standards for schools in low-cost settings*. WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland. 2009. John Adams, Jamie Bartram, Yves Chartier, Jackie Sims.
- [22] Statistical Yearbook 2013. 2013. National Institute of Statistics <http://www.statistics-cameroon.org/news.php?id=259>.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third-party material in this article are included in the article’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2023