Research Paper

Potable water supply among the physically challenged in selected homes for the disabled in Ibadan

Ifiok P. Udofia and Elizabeth O. Oloruntoba

ABSTRACT

There is paucity of information on accessibility to potable water in homes for the disabled in Nigeria. This study investigated access to potable water among physically challenged people in three homes for the disabled in Ibadan. Sixty-four physically challenged persons living at the Cheshire Home (CH), Sekinat Adekola (SAC) and Lawal Centre (LC) were surveyed. Quantity of Drinking Water (QDW) received daily was compared to the WHO minimum requirement of 2.5 litres/head/day. Drinking water samples were analysed for total coliform (TCC) and *Escherichia coli* counts (ECC). Respondents' ages were 22.4 ± 5.1 years in CH, 23.6 ± 7.4 years in SAC and 13.8 ± 5.6 years in LC. The QDW received was 5.3 ± 1.5 litres/head/day in CH, 4.5 ± 0.5 litres/head/day in SAC and 2.8 ± 0.8 litres/head/day in LC. Thirty-seven percent in CH, 55.0% in SAC and 22.0% in LC were very satisfied with QDW received. CH water had lower TCC (2.0 ± 0.6 cfu/100 mL) compared to SAC (378 ± 169.3 cfu/100 mL) and LC (357.3 ± 174.3 cfu/100 mL). Only LC water showed an ECC of 1.0 ± 0.4 cfu/100 mL. Not all individuals experienced adequate access within the homes. Water quality was poor across the homes and treatment was inadequate. Constant potable water is required for the well-being of disabled people in these homes.

Key words | access, physically challenged people, potable water

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INTRODUCTION

Disabled people are part of every community in the world; persons with disabilities make up about 15% of the world's population (WHO 2011b). Unfortunately, not all facilities in the community (schools, hospitals, public-taps and toilets) are designed in a way that is easy or possible for them to use or benefit from.

In Nigeria, in 2008, the World Health Organization estimated that 20% of the population is physically challenged, i.e. about 19 million people (Lang & Upah 2008); although there is no concrete statistical data that confirms or refutes the estimate, 20% of the current Nigerian population would be about 39 million people. A joint monitoring programme for water supply and sanitation conducted by the World Health Organization and UNICEF revealed that as of 2015, only 59% of Nigeria's total population had access to an improved water source (WHO & UNICEF 2017). Thus, in addressing the plight of 41% of Nigerians without an improved water source, the physically challenged have to be considered in water and sanitation programmes.

A study by Jones & Reed (2005) revealed that disabled people in low-income countries have the least access to potable water and sanitation services. In its Convention on the Rights of Persons with Disabilities, the United Nations called on states to 'ensure equal access by persons with disabilities' to clean water services (UN 2006).

Although studies in other countries have shown that disabled people have the least access to potable water services,

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there is a dearth of information on accessibility to potable water in homes for the disabled in Nigeria. This study was designed to investigate access to potable water supply among the physically challenged in homes for the disabled in Ibadan.

MATERIALS AND METHODS

Study area

The study was conducted in Ibadan, the capital city of Oyo State. Ibadan is located in the south-western part of Nigeria, 128 km inland north-east of Lagos (the economic hub of Nigeria) and 530 km southwest of Abuja, the Federal Capital Territory. It is a prominent transit point between the coastal region and the areas of the north. It has a total population of 3.16 million according to the Nigeria Demographic Profile (2018). It has a density of 2,140/sq mi (828/km^2) and a total area of 1,190 sq mi (3,080 km^2).

A cross-sectional study with field and laboratory components was conducted. Three homes for the disabled were used for this study (Figure 1), namely:

- Cheshire Home for the Disabled (CH), Polytechnic Road, Ibadan North LGA;
- Sekinat Olapeju Adekola Centre (SAC) for the Disabled, behind Total Gas filling station, end of Ibadan expressway, Challenge, Ibadan South-East LGA;
- W. O. Lawal Centre (LC) for the handicapped, behind Lister bus stop, ring road, Ibadan South-West LGA.

These homes were selected due to the presence of persons with mobility impairment but who are mentally able.

Oluyole Cheshire Home for the Disabled

This home was founded in 1959, by Lord Leonard Cheshire. People with different disabilities – deafness, intellectual disability, mobility impairment – live at CH. Thirty-five people with mobility impairment participated in this study. There were two female caregivers and one male caregiver residing in the compound. Friends and relatives visit the residents to spend time and assist.

Sekinat Olapeju Adekola Centre for the Disabled

This centre was founded by Alhajah Sekinat Olapeju Adekola in 2009. People with different kinds of disabilities live at this centre. Eleven persons with mobility impairment participated in the study. The compound is also the location of

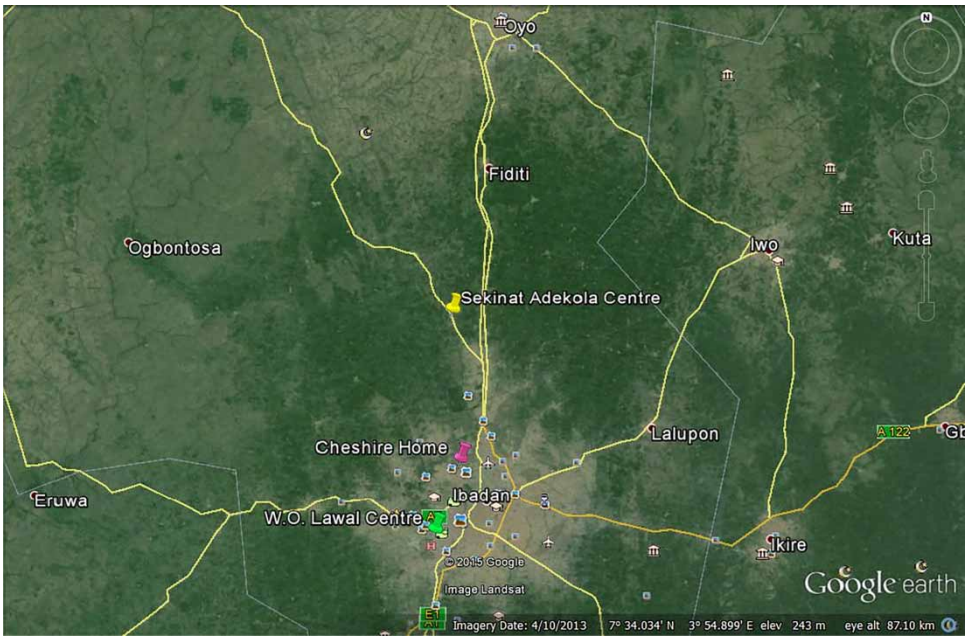

Figure 1 | Map of Ibadan showing study areas.

the Ad-din International Nursery and Primary School for children who are not physically challenged. At the hostel the males stay downstairs and the females stay upstairs. One caregiver attends to the disabled people.

W.O. Lawal Centre for the Handicapped

This centre was founded by Alhaji W. O. Lawal (of blessed memories) in 2009. Mainly two categories of disabled people were found in Lawal centre, the intellectually disabled and those with mobility impairment. Eighteen persons who have mobility impairment participated in the study. The hostel is a two-storey building, and both males and females stayed in separate rooms upstairs. There was one caregiver in the centre.

Data collection methods

Sixty-four (CH 35, SAC 11, LC 18) consenting physically challenged persons in the homes participated in the study.

A semi-structured questionnaire was used to elicit information on respondents' socio-demographic characteristics; level of satisfaction with Quantity of Drinking Water (QDW) received daily from caregivers; method used in treating water and rate at which storage containers are refilled by caregivers. The QDW received from the caregiver by the physically challenged persons was determined by dividing the capacity of the drinking water storage container in each room by the number of occupants (see Appendix I, available with the online version of this paper). Equal allocation was assumed for all occupants; this value was compared to WHO minimum requirement of 2.5 litres/head/day (Howard & Bartram 2003). This was checked by gathering information from the participants by using the questionnaire.

Information obtained from the questionnaire was supported with Focus Group Discussions (FGDs) with the physically challenged to have a better understanding of the situation in the homes. During the FGDs, the caregivers were absent, to enable the participants to feel free to respond. Key Informant Interviews (KIIs) with caregivers were conducted for a complete assessment of the situation in the homes (see Appendix II for FGD and KII guides). Ethical approval was obtained from Oyo State Ministry of Health (see Appendix III). (Appendices II and III are available online.)

Sample collection

Drinking water samples were collected from the sources (CH, borehole; SAC, protected well; LC, Gee Pee storage tank containing water supplied by Oyo State Water Corporation) and storage containers, supplying the physically challenged people, for three weeks (once per week) using standard methods. The samples were analysed in the laboratory of the Department of Environmental Health Sciences, Faculty of Public Health, University of Ibadan.

Physicochemical and bacteriological parameters analysis

The physicochemical parameters determined were pH, temperature, total dissolved solids (TDS), total suspended solids (TSS), chloride, nitrate, iron, lead, manganese and zinc, as described by APHA (2002). Also total coliform count (TCC), *Escherichia coli* count (ECC) and total heterotrophic count (THC) were determined using standard methods.

These parameters were assessed to obtain essential information about the sanitary quality of the water sources. All results were compared with WHO guidelines.

Sanitary inspection of water sources and storage containers

Sanitary inspection of the water sources was carried out by the use of Sanitary Inspection Forms designed by WHO (2004) (see Appendix V, available online). These were used to evaluate the water sources in the homes as well as storage containers. The forms contained ten questions about the water sources, asked such that if the answer is YES, it indicates a risk of contamination, thus 1 mark. If the answer is NO, there is no risk of contamination, thus no (0) mark. At the end of the exercise, risk scores were added and rated as shown:

Sanitary risk score	Assessment of risk
≥ 9	Very high
6, 7, 8	High
3, 4, 5	Moderate
0, 1, 2	Low

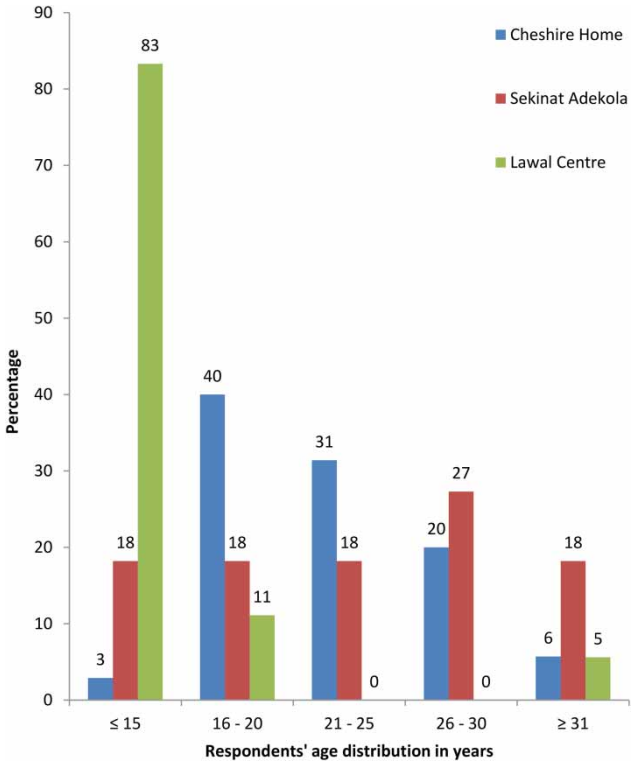

Figure 2 | Age distribution of participants. Overall mean ± SD = 20.2 ± 6.9 years; Min = 8 years, Max = 38 years.

RESULTS

Figure 2 shows the age distribution of the respondents. In CH, the mean age was 22.4 years, in SAC, mean age was 23.6 years and in LC, mean age was 13.8 years. Table 1 and Figure 3 show other socio-demographic characteristics of the study population.

Access to potable water

The main source of potable water for respondents in CH was a borehole, for those in SAC, a protected well, and for those in LC, water from Oyo State Water Corporation, Ibadan. Table 2 shows the mean QDW received from the caregivers per (physically challenged) person per day in the homes was 5.3 litres; 4.5 litres and 2.8 litres in CH, SAC and LC respectively. Eleven percent of the respondents from CH, 9% from SAC and 50% from LC were very unsatisfied with the QDW they received from their caregivers daily.

Observation revealed that the proximity of the water facility to the hostels in the three homes exceeded the recommended range of 5–10 m (Jones & Reed 2003). In CH,

Table 1 | Socio-demographic characteristics

	Home			
Socio-demographic feature	**Cheshire Home no. (%)**	**Sekinat Adekola no. (%)**	**Lawal Centre no. (%)**	**Total no. (%)**
Sex				
Male	18 (51)	6 (55)	12 (67)	36 (56)
Female	17 (49)	5 (46)	6 (33)	28 (44)
Marital status				
Married	1 (3)	2 (18)	1 (6)	4 (6)
Single	34 (97)	9 (82)	17 (94)	60 (94)
Ethnicity				
Yoruba	27 (77)	11 (100)	14 (78)	52 (81)
Hausa	2 (6)	0 (0)	3 (17)	5 (8)
Igbo	4 (11)	0 (0)	1 (6)	5 (8)
Edo	1 (3)	0 (0)	0 (0)	1 (1.6)
Fulani	1 (3)	0 (0)	0 (0)	1 (1.6)
Religion				
Christianity	28 (80.0)	6 (54.5)	7 (38.9)	41 (64.1)
Islam	7 (20.0)	5 (45.5)	11 (61.1)	23 (35.9)
Total	**35 (100)**	**11 (100)**	**18 (100)**	**64 (100)**

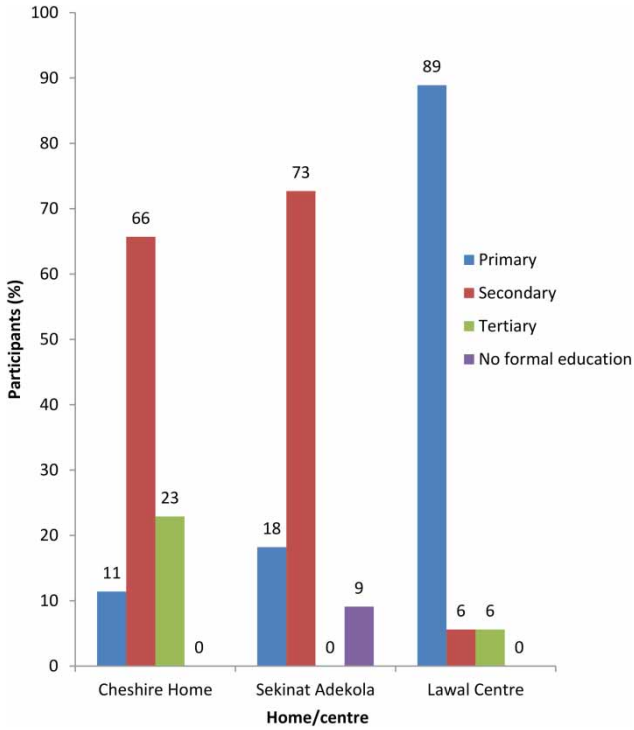

Figure 3 | Participants' highest level of education.

the water facility was 24 m from the male hostel and 15 m from the female hostel. In SAC, the water facility was 70 m from the hostel. In LC, the water facility was 22 m from the hostel. Other observations (across the homes) were high well walls and inadequate space for a wheelchair user around the water facility.

During the FGDs, respondents in Lawal and SACs complained about inconsistency on the part of the caregivers in fetching water for them.

'They fetch it for us but sometimes we fetch it ourselves and it takes a long time to get the water to our abode. Our legs and hands begin to ache when we do this. If the caregiver was consistent, we would not have felt pains' (FGD with males in Lawal Centre).

'The caregivers and our friends (non-physically challenged) fetch it for us. We send students when the school is in session, when they are on holiday and the caregiver is not around, we fetch it ourselves. The caregivers are not constantly available, this means we have to find a way to fetch it ourselves' (FGD with males in SAC).

'The caregivers fetch for us but we don't stay together, thus it is difficult to get water when they are not around. Chest pain results from fetching with wheelchair and we stay upstairs, getting the water up there proves very difficult' (FGD with females in SAC).

During the KIIs with caregivers (across the homes), they stated that water was always provided whenever the physically challenged people needed it.

Table 2 | Accessibility to potable water for the physically challenged

		Cheshire Home no. (%)	Sekinat Adekola no. (%)	Lawal Centre no. (%)	Total no. (%)
Main source of potable water					
Borehole with pump		35 (100)	0	0	35 (100)
Protected well		0	11 (100)	0	11 (100)
Water from water corporation		0	0	18 (100)	18 (100)
Total		35 (100)	11 (100)	18 (100)	64 (100)
Person who fetches the water (from the main source)					
I fetch it myself	Yes	6 (17)	4 (36)	5 (28)	15 (23)
	No	29 (83)	7 (64)	13 (72)	49 (77)
The caregiver	Yes	20 (57)	4 (36)	13 (72)	37 (58)
	No	15 (43)	7 (64)	5(28)	27 (42)
A NPCF	Yes	17 (49)	9 (82)	5 (28)	31 (48)
	No	18 (51)	2 (18)	13 (72)	33 (52)

(*continued*)

Table 2 | continued

	Cheshire Home no. (%)	Sekinat Adekola no. (%)	Lawal Centre no. (%)	Total no. (%)
Challenges faced when fetching water themselves				
Back pain	2 (6)	2 (18)	3 (17)	7 (11)
Chest pain	1 (3)	2 (18)	0	3 (5)
Pain in hands and legs	3 (9)	0	2 (11)	5 (8)
Not applicable	29 (83)	7 (64)	13 (72)	49 (77)
Best description of usage of facility				
Impossible	2 (6)	1 (9)	0	3 (5)
Difficult	4 (11)	4 (36)	2 (11)	10 (16)
Manageable	2 (6)	0	2 (11)	4 (6)
Convenient	0	0	1 (6)	1 (2)
Not applicable	27 (77)	6 (55)	13 (72)	46 (72)
Total	35 (100)	11 (100)	18 (100)	64 (100)
Quantity of water respondents can fetch themselves from water source per day (due to their condition)				
5 litres	5 (14)	3 (27)	4 (22)	12 (19)
10 litres	1 (3)	1 (9)	1 (6)	3 (5)
Not applicable	29 (83)	7 (64)	13 (72)	49 (77)
Total	35 (100)	11 (100)	18(100)	64 (100)
Level of satisfaction with quantity of water respondents can fetch themselves from water source per day				
Very unsatisfied	2 (6)	3 (27)	4 (22)	9 (14)
Mildly satisfied	3 (9)	1 (9)	1 (6)	5 (8)
Very satisfied	1 (3)	1 (9)	0	2 (3)
Not applicable	29 (83)	6 (55)	13 (72)	48 (75)
Total	35 (100)	11 (100)	18(100)	64 (100)
Quantity of drinking water received from caregiver (or friend) everyday				
About 2–3 litres	3 (9)	0	17 (94)	20 (31)
About 4–6 litres	26 (74)	11 (100)	1 (6)	38 (60)
About 7 litres	6 (17)	0	0	6 (9)
Total	35 (100)	11 (100)	18 (100)	64 (100)
Mean QDW (litres/head/day)	5.3 ± 1.5	4.5 ± 0.5	2.8 ± 0.8	4.2 ± 1.5
Level of satisfaction with quantity of water received from caregiver (or friend) every day				
Very unsatisfied	4 (11)	1 (9)	9 (50)	14 (22)
Mildly satisfied	18 (51)	4 (36)	5 (28)	27 (42)
Very satisfied	13 (37)	6 (55)	4 (22)	23 (36)
Total	35 (100)	11 (100)	18(100)	64 (100)
Rate at which storage containers are refilled in the rooms				
Once a day	27 (77.2)	8 (72.7)	10 (55.6)	45 (70.3)
Thrice a day	0	0	5 (27.8)	5 (7.8)
Whenever container is empty	4 (11.4)	3 (27.3)	3 (16.7)	10 (15.6)
Once in two days	4 (11.4)	0 (0)	0 (0)	4 (6.3)
Total	35 (100)	11 (100)	18(100)	64 (100)

NPCF, Non-physically challenged friend.

'*We fetch for them as the need arises. It is difficult at times but we make sure we provide them with the water they need*' (KII with female caregiver in CH).

'*There are no challenges as I and disabled persons that can walk fetch for those with mobility impairment every now and then as the need arises*' (KII with caregiver in LC).

'*We fetch for them regularly, we also get the disabled ones that can walk to fetch for them so there is always water for them to use*' (KII with male caregiver in SAC).

There were mixed reactions from the physically challenged persons concerning how satisfied they were with the quantity of water received from caregivers. Extracts from the FGDs are shown below:

'*Yes we are satisfied with the quantity of water we receive*' (FGDs, Cheshire Home, males and females).

'*Not all the time; sometimes we are satisfied, sometimes we are not*' (FGD Lawal Centre, males).

'*Sometimes we are satisfied and sometimes we are not, especially when our day's activities require more water and the caregiver is not available to fetch more water for us. Only one caregiver is officially employed to attend to us but she does not stay here with us and is not available all the time*' (FGDs, SAC males and females).

Sanitary inspection of water sources and storage containers

Table 3 shows the sanitary status of the water sources as well as storage containers across the homes. Some risk factors identified around the water sources were: protected well – presence of a latrine within 10 m of the well, poor drainage causing stagnation within 2 m of the well, lid not covering the well properly; borehole – female toilet situated uphill of the borehole, drainage channel clogged with sand and grasses causing stagnation around the borehole, diameter of the apron less than 2 m; Gee Pee tank – visible sign of contamination (leaves from nearby tree, faecal particles from birds, lizards) on roof close to the tank.

Table 3 | Sanitary risk associated with water sources and storage containers across the homes

Site assessed	CH risk score (LR)	SAC risk score (LR)	LC risk score (LR)
Source	4.0 ± 0.0 (MR)	6.0 ± 0.0 (MR)	5.0 ± 0.0 (MR)
Boys' storage container	4.3 ± 0.87 (MR)	6.0 ± 0.0 (HR)	6.0 ± 0.0 (HR)
Girls' storage container	3.3 ± 0.50 (MR)	1.0 ± 0.0 (LR)	5.0 ± 0.0 (MR)

For explanation of scores, see Materials and Methods. VHR: Very High Risk; HR: High Risk; MR: Moderate Risk; LR: Low Risk.

Across the homes, the girls' storage container at SAC had a mean sanitary risk score of 1.0. The boys' storage containers at LC and SAC had risk scores of 6.0 each. Some risk factors observed in the hostels were: storage container placed near chalkboard; respondents drinking from the same cup they dipped into the storage container; storage container (keg) without cover; storage container with the collecting utensil (i.e. a bowl) facing up.

Method of treating drinking water

Table 4 shows the treatment methods reported. During the KIIs, across the homes, caregivers said they only treated the water when they felt it was necessary.

Suggestions from participants on how to improve access to water and sanitation facilities

Participants suggested what should be done to improve access to potable water and sanitation. Figure 4 shows that

Table 4 | Number of participants reporting each method of treating drinking water

Method of treating drinking water	Cheshire Home no. (%)	Sekinat Adekola no. (%)	Lawal Centre no. (%)	Total no. (%)
Boiling	10 (29)	6 (55)	0 (0)	16 (25)
Filtration	1 (3)	1 (9)	1 (6)	3 (5)
Sedimentation	1 (3)	0 (0)	3 (17)	4 (6)
Not applicable	23 (66)	4 (36)	14 (78)	41 (64)
Total	35 (100)	11 (100)	18 (100)	64 (100)

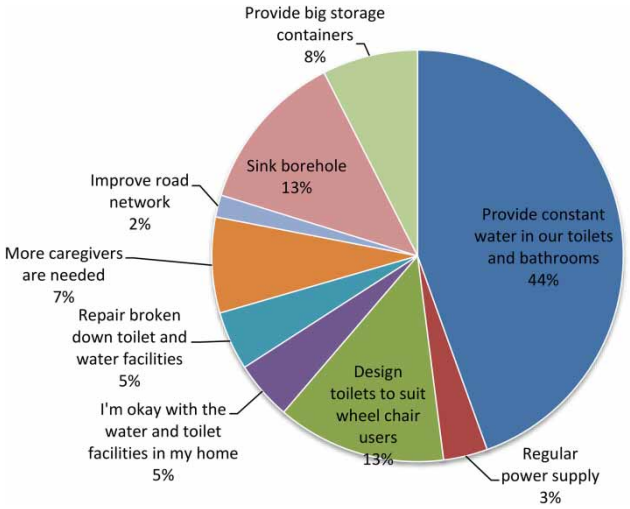

Figure 4 | Suggestions from participants on how to improve access to water and sanitation facilities.

the majority of the participants (44%) wanted constant water supply in their toilets and bathrooms. Other suggestions are shown in the chart.

Physico-chemical and bacteriological quality of source and stored water samples from the homes

Table 5 shows the results of water analysis from the three homes for the disabled studied. In CH, with the exception of pH of water from the source, all physico-chemical parameters were within WHO standards. The TCC (most probable number index/100 mL) in the samples from the source, boys' and girls' storage containers were 2.00/100 mL, 20.67/100 mL and 640.00/100 mL, respectively.

In SAC, all physico-chemical parameters were within WHO standards. The THC in samples from the source, boys' and girls' storage containers were 24.30 cfu/100 mL, 57.6 cfu/100 mL and 33.0 cfu/100 mL, respectively. The TCC were 378.00/100 mL, 670.00/100 mL and 176.00/100 mL, respectively.

In LC, all physico-chemical parameters were within permissible limits. The THC in samples from the source, boys' and girls' storage containers were 39.30 cfu/mL, 52.00 cfu/mL and 78.00 cfu/mL, respectively. The ECC were 1.00 cfu/mL, 0.67 cfu/mL and 1.33 cfu/mL, respectively, while the TCC were 357.3/100 mL, 1,166.7/100 mL and 606.7/100 mL, respectively.

Table 5 | Physico-chemical and bacteriological parameters of water samples across the homes

	Cheshire Home			Sekinat Adekola Centre			Lawal Centre			WHO
Parameter	**Source**	**Boys' SC**	**Girls' SC**	**Source**	**Boys' SC**	**Girls' SC**	**Source**	**Boys' SC**	**Girls' SC**	**standards**
pH	6.3 ± 0.3	6.5 ± 0.2	6.7 ± 0.3	6.7 ± 0.2	7.2 ± 0.3	7.2 ± 0.2	7.6 ± 0.5	7.5 ± 0.5	7.5 ± 0.6	**6.5–8.5**
TDS (mg/L)	154.3 ± 9.0	153.7 ± 6.7	149.5 ± 0.8	258.5 ± 7.9	196.7 ± 88.1	208.7 ± 78.3	100.6 ± 10.2	133.5 ± 60.8	144.9 ± 79.1	**500**
TSS (mg/L)	ND	ND	0.4 ± 0.9	0.7 ± 1.0	0.3 ± 0.5	ND	ND	3.0 ± 3.9	1.3 ± 1.5	
Chloride (mg/L)	16.0 ± 6.6	13.3 ± 8.3	18.3 ± 4.4	14.3 ± 3.7	10.7 ± 3.3	15.0 ± 4.2	5.3 ± 3.5	5.7 ± 4.3	5.0 ± 2.8	**250**
Nitrates (mg/L)	2.5 ± 1.3	4.7 ± 1.4	4.7 ± 1.4	5.9 ± 1.3	4.0 ± 1.0	3.8 ± 1.0	0.1 ± 0.1	5.7 ± 1.6	5.9 ± 1.8	**50**
Manganese (mg/L)	0.01 ± 0.01			0.01 ± 0.0			0.01 ± 0.0			**0.1**
Iron (mg/L)	0.01 ± 0.00			0.01 ± 0.0			0.01 ± 0.0			**0.3**
Zinc (mg/L)	0.02 ± 0.01			0.01 ± 0.0			0.01 ± 0.0			**5.0**
Lead (mg/L)	ND			0.01 ± 0.01			ND			**0.01**
THC	1.7 ± 0.6	37.6 ± 5.6	54.0 ± 12.4	24.3 ± 11.8	57.6 ± 25.4	33.0 ± 14.4	39.3 ± 16.1	52.0 ± 21.5	78.0 ± 32.2	
ECC	ND	ND	ND	ND	ND	ND	1.0 ± 0.4	0.7 ± 0.3	1.3 ± 0.6	**0**
TCC (MPN)	2.0 ± 0.6	20.7 ± 7.5	640.0 ± 241.1	378.0 ± 169.3	670.0 ± 296.1	176.0 ± 55.1	357.3 ± 174.3	1166.7 ± 274.1	606.7 ± 314.3	**0**

SC, storage container; ND, not detected; TDS, total dissolved solids; TSS, total soluble solids; THC, total heterotrophic counts; ECC, *E. coli* counts; TCC (MPN), total coliform count (most probable number).

DISCUSSION

Access to potable water

Across the homes, participants relied on either caregivers or friends (who are not physically challenged) for the delivery of potable water. In CH, relatives and friends of the residents also assisted in fetching water. It was only in rare cases that the participants had to go fetch water on their own, and whenever this happened, they experienced pain due to their condition. Most of them were satisfied with the QDW received from their caregivers daily. However during the FGDs, it was discovered that the mild satisfaction for some was because most of them shared (or used) water from the same storage container for cooking, drinking and washing plates; thus there was enough to drink for most of them but not enough for other activities that required more water.

In SAC, there was one caregiver available for the residents. With more hands (to fetch water), access would improve; also the fact that the caregiver did not live in the compound meant there were times the participants needed more water but could not get it. With more storage containers in the rooms, the caregiver would have more work to do but access would improve.

In LC, the participants cited inconsistency on the part of the caregivers as a factor contributing to their limited access. Another limiting factor was the capacity of storage containers in the rooms (5 L and 10 L) and the number of occupants that drank from the containers (5 in one room, 6 in another). Here, the physically challenged and intellectually disabled stay together, so when the caregiver is unavailable, the non-physically challenged friend (NPCF) assists. However, the intellectually disabled may exhibit poor hygiene practices like not rinsing the storage container before fetching water.

On the other hand, caregivers in the respective homes stated the residents always had potable water to drink. In a situation whereby three or more people drink from one storage container, the water in that container will go down faster than if consumed by one person; thus caregivers need to refill the storage containers more often.

A major factor in the accessibility of water is proximity. This means the water collection point should either be in the house or at most 5 to 10 metres from the house (Jones & Reed 2003). Across the homes, the distance of the water sources from the hostels exceeded the recommended range. Thus in the absence of a caregiver, physically challenged people would have to cover beyond 10 metres to fetch water. Also, the sources of water in the respective homes were not disabled-friendly, thus limiting accessibility to water when caregivers are unavailable.

Quantity of drinking water received from caregivers

Across the homes, the mean QDW the participants had access to (based on what the caregivers fetched for them) exceeded WHO minimum requirement. Though they seemed to have enough to drink, FGDs revealed some of them were not satisfied with the efforts of the caregivers. In LC, the small size of the drinking water storage containers, the number of occupants in the rooms and inconsistency on the part of the caregiver could be responsible for this (even though the minimum requirement for a 13-year-old child is not expected to be the same as that of 22- and 23-year-old adults – mean ages in CH and SAC, respectively).

In SAC, the caregivers did not live in the compound (this could be caused by high financial demand), thus getting water when the caregiver and NPCF were not around could reduce the QDW received daily.

Sanitary inspection of water sources and storage containers

On a scale of 1 to 10, the scores were at the midpoint indicating a medium risk of contamination of the water.

In CH (borehole), the risk factors observed could increase the likelihood of contamination of the water from the source, so the management needs to ensure drainage channels are free from sand and weeds. Caregivers have to wash storage containers often to reduce sanitary risks. Most of the storage containers for the females were buckets. This implied the collecting utensil would have to be dipped into the bucket to collect water. With unclean hands and collecting utensils (which is possible), there is an increased risk of contamination of the water in the bucket. Cairncross *et al.* (1996) reported that children could introduce contaminants into potable water stored in the house through the use of faecally contaminated

hands or utensils; this could explain the high TCC in the girls' storage container in CH.

In SAC (protected well), it was noticed that the well was close (within 10 m) to the toilets. The sanitary inspection form indicated that a latrine should not be that close to a well as this could increase the likelihood of contamination of the well water. The well lid did not cover the well properly, increasing the likelihood of contaminants entering the well; the cement platform of the well was less than 2 metres in diameter, resulting in stagnant water collecting around the well.

In LC (water from Oyo State Water Corporation collected in a Gee Pee tank), some risk factors around the tank were: leaves from nearby tree and faecal matter from birds and lizards on a roof close to the tank. A study on assessment of the quality of water of Eleyele Dam reported that Oyo State Water Corporation gets its water (supplied to LC) from Eleyele dam which is in Ido Local Government Area (Ojelabi *et al.* 2018). The drinking water storage container of the males was without a cover at times and that of the females did not look clean; some of the physically challenged people used their hands for support while crawling on the floor, thus increasing the risk of contamination of the water. On observation, they did not make a conscious effort to wash their hands before handling the storage container. In a study conducted by Oloruntoba (2005), which assessed households' drinking water quality in Ibadan, it was concluded that the unhygienic handling of storage containers could lead to contamination of the water.

Across the homes, sanitary inspection of the storage containers indicated that the water in the boys' storage containers had a higher risk of contamination than that of the girls'. This could be because the boys were more playful and carefree.

Results for the sanitary inspection of the water sources indicated that SAC and LC had higher values. In line with this, results of the bacteriological analysis of samples from the sources indicated higher THC and TCC, respectively, compared to the values in the samples from CH.

Treatment of drinking water

Across the homes, two factors could have been responsible for the attitude of the participants towards water treatment; first, some of them had no doubts about the quality of water from their water sources. Secondly, their condition as physically challenged people did not give much room for them to worry about water treatment as they just consumed what their caregivers gave them.

Interviews with caregivers across the homes revealed the water fetched for the physically challenged was treated where they felt it was necessary. In CH, the presence of total coliforms in samples from the borehole indicated that treatment was either inadequate or not done. In a study on lead and coliform contaminants in potable groundwater sources in Ibadan, Olusegun (2010) reported that Ibadan residents drinking untreated borehole water are potentially exposed to water-borne diseases such as typhoid fever, dysentery or diarrhoea. The same applied to LC that relied on Oyo State Water Corporation for their drinking water; Ojelabi *et al.* (2018) stated that water supplied from dams (as is done by Oyo State Water Corporation) has a likelihood of being contaminated with microbes. In SAC, the water source was a protected well and the management of the centre chlorinated the water periodically. However this is not reflected in the THC and TCC values in the water samples. Treatment could have been inadequate.

Suggestions from participants on how to improve access

Most of them stated that a constant supply of water is needed. Others were more specific by indicating a borehole facility should be installed. This would ensure a constant supply of water in the homes, but the onus would still be on the management of these homes to make the water as close as possible to the participants. Also more caregivers in the homes would improve accessibility.

Assessment of physico-chemical and bacteriological parameters in the water samples

The pH from the water source (borehole) in CH is lower than the WHO recommendation. In a comparative analysis of borehole water supply sources in Akwa Ibom State, Ukpong & Okon (2013) reported that the quality of water from a particular area depends on human activities and the natural physicochemical characteristics of the area.

The TDS values across the homes were below WHO limit of 500 mg/L and were in line with findings from the study conducted by Soyingbe *et al.* (2014) on borehole water samples in Ogun State (which shares the same border with Oyo State, southwards) College of Health Technology where TDS values ranged from 105.2 mg/L to 231.4 mg/L.

Microbiological examination of the water samples revealed that water quality was poor in samples from the sources. In a study on coliform contaminants in potable water sources in Ibadan, Olusegun (2010) reported that most of the boreholes sampled had coliform bacteria. Soyingbe *et al.* (2014) reported that high coliform counts seemed to be a characteristic feature of rural ground water quality in Nigeria, and this is not acceptable by WHO quality standards; its presence indicates inadequate water treatment (WHO 2011a). Across the homes, TCC was higher in most storage containers compared to the sources, implying that the drinking water of the participants was not or inadequately treated; secondly, participants had poor water handling practices like dipping cups into storage containers and drinking from the same cups, leaving storage containers in unclean places and collecting water for drinking with dirty hands. Deb *et al.* (1982) reported that people generally took stored water from buckets by dipping, resulting in the possible contamination of otherwise safe water by their likely infected hands. Only samples (source and storage containers) from LC had an *E. coli* count that exceeded the WHO permissible limit of 0 cfu/100 mL. *E. coli* is a major indicator of water pollution.

In SAC, there was a significant reduction in TCC in the girls' storage container. This centre had the largest proportion of respondents who said their water was boiled. Even though the TCC in the girls' storage container was not within WHO recommended values, the counts indicated that the water consumed by the girls was subjected to some treatment. Also the low sanitary risk score could as well reduce the likelihood of contamination of the water.

CONCLUSION

In a home for physically challenged people, access to water depends on the availability of a constant water supply as well as the availability and efficiency of caregivers. Also water facilities should be close to the hostel and accessible to the physically challenged people by means of wheel chair ramps (where necessary), and disabled friendly facilities.

Across the homes, access to potable water was not good enough; even though the quantity of drinking water the residents had access to exceeded WHO minimum requirement, some of the residents were very unsatisfied with the QDW they received from their caregivers daily. More caregivers were needed to respond to the needs of the physically challenged people. Also, some of the indicator organisms assessed exceeded the WHO recommended limit implying that the drinking water was not potable. The management of the homes needed to do more in terms of water treatment.

Recommendation

Government should establish minimum requirements for the opening of a home for physically challenged people: a constant supply of potable water in the compound (preferably a borehole facility which supplies water throughout the year); at least two male and two female caregivers should be employed; the buildings should be bungalows with wheelchair ramps at strategic locations.

Challenges during the study

1. *Scarcity of participants:* There are not many physically challenged people living in homes for the handicapped who only have mobility impairment. Finding them took time and reduced the study population.
2. *Co-operation of participants:* Getting the physically challenged people to trust and co-operate with the researcher was not easy as they saw some information they divulged as confidential.

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