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ORIGINAL ARTICLE

A Survey of the Community Water supply of some rural Riverine Communities in the Niger Delta Region, Nigeria: Health implications and literature search for suitable interventions.

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ABSTRACT

Background: Water is a fundamental human need. This is the basis for target 10, goal 7 of the Millennium Development Goals which sets to reduce the proportion of people without access to safe water by half by 2015. This study assessed the access to safe water supply in 22 riverine communities in the Niger delta region of Nigeria. **Materials and Method**: The study was carried out using a descriptive cross-sectional study design, with the data collected using a structured interviewer-administered questionnaire, field observations and focused group discussions. The questionnaire was administered to female heads of household, and used to collect information on the main source of drinking water, the time it took for the round trip to the main water sources, and methods used for the treatment of water of suspicious quality. An inventory of all the community water facilities in the communities was also taken, and information collected on the functionality of the facilities, and how they were constructed, operated and maintained. A sample of the water from each of the facilities was also collected in a sterile container for microbiological analysis. **Results**: A total of 456 questionnaires were administered and retrieved. The most common source of drinking water was surface water (37.9%), and most (61.2%) of the water drawers spent less than 15 minutes to complete the round trip to the water sources. There were an average of 17 community water supply facilities, but only 23.8% of the facilities were functional during the study. Most of the functional facilities were being managed by community members. More than two third (67.9%) of the samples tested were found to contain significant numbers of *Escherichia coli.* **Conclusion**: The communities had easy access to water supply, but most of the facilities were either contaminated or nonfunctional. The management of the facilities by members of the communities, and the promotion of point-of-use purification systems are hereby advocated.

Keywords: Community water supply, Millennium development goal, Niger delta, Nigeria.

INTRODUCTION

Water is needed for the maintenance of health. Its importance is not only related to the quantity, but also the quality. Access to water in the required quantity is needed to achieve good personal and domestic hygiene practices[1]; while good quality water ensures that ingested water does not constitute a health hazard, even in a life time of consumption[2]. It is however estimated that as much as 1.1 billion people do not have access to safe drinking water[3], while the drinking of contaminated water is responsible for 88% of the over four billion cases of diarrhoeal diseases that occur in the world every year, and the 1.8 million deaths that result from them. It is also indirectly responsible for the 50% of childhood malnutrition that is linked to diarrhoral diseases, and the 860, 000 deaths that result from them each year[4]

The WHO estimates that 94% of diarrhoeal diseases are preventable through modifications to the environment[4], with improved access to safe drinking water alone able to reduce diarrhea episodes by between 20% and 35%, according to two systematic reviews[5, 6]. These health benefits, and the fact that a ready access to water saves the time of water drawers for more productive activities explain why access to adequate quantity of safe water was made one of the Millennium Development Goals[7], and why it was recognized as one of the foundations of Nigeria's developmental efforts, by the National Economic Empowerment and Development Strategy (NEEDS) document[8].

Target 10, goal 7 of the millennium

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development goal sets a 2015 target to reduce the proportion of people without access to safe water by half[7]; while the 2005 National Water and Sanitation policy expects a 100% coverage by 2011[9]. These targets would however require extra effort to achieve in the rural riverine communities of the Niger delta region, considering the enormous effort required to make the huge water resources in the communities safe for drinking. According to the 2008 National Demographic and Health Survey, access to safe drinking water is still low in the rural communities of Nigeria at 43.8%, which is likely to be worse in the rural riverine communities of the Niger delta, because of the widespread use of overhung toilets in the communities, and the poor quality of groundwater, linked to saline intrusion and high concentration of iron, manganese and arsenic, as a result of the geology of the area[10].

It was not known the extent target 10, goal 7 of the MDG has been met in the communities, especially with the much publicized efforts of government and the oil companies in addressing the basic needs of the people of the Niger delta. This study assessed the situation of the community water supply in 22 rural and semi-urban riverine communities in Bayelsa and Rivers States, in the Niger delta; as part of a baseline Health Impact Assessment study conducted in the communities for a gas pipeline project. The report the findings and the recommendations of appropriate technologies that could be implemented to hasten the pace of meeting the MDG in the communities are hereby presented.

MATERIALS AND METHODS

This was a descriptive cross-sectional study using a structured interviewer-administered questionnaire, field observations and focus group discussions carried out in 21 communities, in four local government areas in south-south Nigeria. A triangulation of the qualitative research techniques were used to help gain a deeper insight into the context of the water situation in the study communities. These communities had a population of about 150, 000 people (projected with the 2006 national census). The study set to detect a 5% difference in access to safe water, with an alpha error of 5%, acceptable beta error of 20%, and a statistical power of 80%; and using the national average of access to safe water in rural communities of 43.8%[11]. Using the usual formula for sample size determination for descriptive studies[12], the minimum required sample size was thus determined to be 378.

The data were collected by the author and trained assistants and analysed for the type, operation, maintenance and functionality of water facilities, and the microbiological status of the water, using the membrane filtration technique, with *Escherichia coli* as the indicator organism[14].

The data were analyzed according to the standard method[12], and the results were considered to be significantly contaminated if they were found to be beyond the World Health Organisation (WHO) minimum acceptable values[15].

RESULTS

A total of 456 questionnaires were administered and retrieved. The respondents had an average age of 29.20 +/ 5.2 years; most (89.69%) had a secondary school education or less, and had spouses that were mostly engaged in fishing and farming (40.13%) (Table I).

Table 2 shows the water and sanitation facilities of the respondents. The most common source of drinking water was surface water (37.9%), with bottled/sachet water serving the needs of up to 19% of the households.

Table 1: The socio-demographic characteristics of study participants

Variable	No. (N= 456)	Percentage (%)
Age		
14 - 19 years	82	17.98
20 - 29 years	171	37.50
30 - 39 years	126	27.63
40 - 49 years	77	16.89
Educational status of respondents		
No formal education	53	11.62
Primary	189	41.45
Secondary	167	36.62
Tertiary	47	10.31
Occupation of respondents' spouse		
Fishing/ Farming	183	40.13
Self employed	89	19.52
Civil servant	55	12.06
Employed in private sector	47	10.31
Student	24	5.26
Unemployed	58	12.72

Most (61.2%) of the drawers of water for the households spent less than 15 minutes to complete the round trip to the water sources, while most (60.8%) of the households stored their drinking water in jerry cans.

Table 2: Household water and sanitation facilities

Variable	No. (N= 456)	Percentage (%)
1. Sources of drinking water Improved water Source	155	33.99
Piped household supply	23	5.04
Public tap/standpipe	104	22.81
Borehole fitted with hand pump (Monopump)	19	4.17
Protected hand-dug well	9	1.97
Non-improved water source	301	66.01
Unprotected hand-dug well	41	8.99
Surface water	173	37.94
Bottled/sachet water	87	19.08
2. Time spent to fetch water from the main source of drinking water		
Piped household supply	23	5.04
Less than 15 minutes	279	61.18
15 - 30 minutes	113	24.78
More than 30 minutes	41	8.99
3. Household treatment of suspicious water for drinking		
No treatment	219	48.03
Boiling	77	16.89
Alum	119	26.10
Coagulant/chlorine mixture	27	5.92
Cloth filtration	14	3.07
4. Storage container for drinking water		
Piped supply	23	5.04
Jerry can	277	60.75
Covered basin/drum	109	23.90
Earthen pot	47	10.31
5. Types of toilet facilities used by household		
Improved sanitation facility	58	12.72
Flush toilet with septic tank	49	10.75
Pit latrine	9	1.97
Non-improved sanitation facility	398	87.28
Flush toilet flushed into the river	67	14.69
Jetty (overhung) toilet	233	51.10
Public toilet with flush facility	41	8.99
No facility/bush	57	12.50
6. Two weeks Period Prevalence of diarrhea	123	26.97

A lot (48%) of the drinking water used by the households were not treated, even as only 12.72% of them used an improved sanitation facility, and the two-week period prevalence of diarrhea amongst them was 27%.

The number and type of water supply facilities in the 22 study communities are shown in Table 3. There were a total of 374 community water supply facilities in the communities, an average of 17 per community, but only 89 (23.80%) were functional as at the time of the study; an average of 4.4 per community. Only 46 (12.3%) of the water facilities provided piped supply, though with very few household connections, with only 17 (36.96%) of them functional as at the time of the study.

Table 4 shows how the water facilities in the communities were provided. Most (64.7%) of the facilities were provided by government and its agencies like the Niger Delta Development Commission, but this included the protected hand-dug well constructed during the colonial and immediate post-colonial periods, and the hand-pumped well provided by several ad-hoc government water supply programmes.

Table 3: The number and types of community water supply facilities in the study communities

Facility	Functional	Nonfunctional	Total
1. Piped community supply	17	29	46
2. Protected hand-dug well	7	34	41
3. Hand pumped well	26	141	167
4. Machine pumped well	39	81	120
TOTAL	89	285	374

Table 4: The sources of the community water facilities in the study communities

Facility	Govt and its agencies	Oil companies / NGOs	Community effort	Total
1. Community piped supply	13	33	0	46
2. Protected hand-dug well	32	0	9	41
3. Hand pumped well	148	19	0	167
4. Machine pumped well	49	71	0	120
TOTAL	242	123	9	374

The water facilities provided by the oil companies were either provided as part of their social responsibility to the communities, or as part of the remediation for an oil spill. Those provided as part of the company's social responsibility were mostly functional, mainly because they had functional committee for the maintenance of the facilities, though with most of the maintenance costs borne by the oil company.

Table 5 shows the results of the microbiological analysis of the water sample collected from various water sources in the communities. Members of four of the communities had during the field study complained of the quality of water from their facilities, and some members had refused to drink from the facilities.

Table 5: The results of the microbiological analysis of the water sample collected from the various facilities in the communities

Facility	Number tested	Number positive (%)
1. Community piped supply	17	11
2. Protected hand-dug well	2	2
3. Hand pumped well	2	0
4. Machine pumped well	13	3
5. Surface water	22	22
Total	56	38

More than two third (67.9%) of the samples tested were found to contain significant numbers of *Escherichia coli;* especially the samples collected from surface *wat*er from which members of the communities routinely drank from.

DISCUSSION

The study showed that the study communities were served by an average of 4.4 functional community water supply facilities, and that most of the inhabitants spent less than fifteen minutes to draw water from the facilities. This is consistent with the WHO recommendation of less than 15 minutes to and fro journey to the drinking water source, that ensures the provision of adequate quantity of water required to satisfy the drinking water and sanitation needs[13, 16]. The situation in the study communities was also better than the figures obtained during the 2008 National Demographic and Health Survey[11]. According to the survey, only 71.9 % of Nigerians residing in the rural areas had access to water within 30 minutes, compared to the 91% obtained in the study. The situation in the study communities was helped by the efforts of the oil companies operating in the communities who provided more than 30% of the community water facilities in the communities.

However, as much as 76.2% of the community water facilities in the study communities were not functional as at the time of the study (Table III). This has also been noted in other communities in Nigeria[17]; and blamed on factors that include amongst others, the absence of a responsible body for the operation and maintenance of the facilities, and poor workmanship by dubious contractors[17]. These factors were also noted in the study communities as most of the non-functional facilities were those provided by government and its agencies, without any arrangement for their maintenance and operation. On the other hand, facilities provided as part of an oil company's social responsibility were found to be mostly functional, because they had functional committees constituted and funded for the operation and maintenance of the facilities.

The non-functional water facilities forced 66% of the households into drawing their water from non-improved sources. This is worse than the national average for rural areas of 53.4%[11] and very unhealthy considering that as high as 67.9% of the water facilities were found to have *e.coli* count higher than the WHO recommended level[15]. It is also not surprising that the two week period prevalence in the communities was 26.97%, much higher than the 8.9% average for rural areas in Nigeria. The quality of water in the communities can be improved not only by ensuring the functionality of the water facilities, but most importantly by encouraging the use of point-of-use water purification systems. The use of point-of-use water purification systems would fully tap the huge surface water resources in the communities, and particularly discourage the use of the expensive, but dubious bottle/sachet water that was used by19.08% of the households to satisfy their drinking water needs. Point-of-use water purification systems have been found to deliver as much health benefits as an improved water source[5, 6], and among the most cost-effective approaches in preventing diarrhoeal diseases[18].

Promoting the use of the point-of-use purification systems require a deliberate effort, especially because 48.03% of the households did not see the need to purify water of suspicious quality before drinking; while up to 29% use alum and cloth filtration that are not particularly effective in disinfecting the water in the communities. Even boiling that is often recommended has been found to fail under conditions of heavy faecal contamination as found in the study communities; because of the ease with which household utensils are recontaminated[19]. More social marketing activities would therefore be needed in the communities to specifically promote the use of the coagulant/chlorine combination that was used by just 5.92% of the households, but have been found to be very effective[5, 20].

Members of four of the study communities had complained of the quality of water from their facilities. This is probably related to the high iron and manganese content of the water, as

indicated by a previous study in the Niger delta[10]. Also, the fact that most of the water facilities in the communities had elaborate water treatment facilities points to the enormity of the problem posed by the high inorganic content of the ground water. The type of technology used to deal with the poor quality ground water is probably inappropriate, and responsible for the high level of non-functionality of the water facilities. The sustainable use of the water facilities therefore lies in adopting an appropriate technology that can address the need, yet simple enough to be operated and repaired by readily available expertise[21]. There are already several low-cost and rugged technologies that can be applied at household and community levels in the communities for the treatment of water with high inorganic content[22, 23]; such technologies should as a matter of urgency be adopted and promoted in the communities.

Conclusion: The communities had easy access to water supply, but most of the facilities were either contaminated or nonfunctional. The operation and management of the facilities by members of the communities, and the promotion of point-of-use purification systems are hereby advocated.

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CONFLICT OF INTEREST: The study was part of a baseline study for a health impact assessment study, for an oil and gas pipeline project.

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