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Environmental conditions in displaced communities of Khartoum State, Sudan

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Inadequate environmental sanitation has been recognized as a public health hazard worldwide. Nearly one quarter of all deaths and of the total disease burden and slightly more than one-third for children can be attributed to the changes and degradation of the environment. This study examined the environmental conditions of the displaced communities in Khartoum State, Sudan. A community-based descriptive, cross-sectional survey design was used for a population of 726,989 inhabitants of the Displaced communities in Khartoum State. Multi-stage cluster sampling was used in selecting 662 households in these communities and a structured questionnaire was used for data collection. Data were analyzed using frequencies, percentages, Chi-square test and multiple logistic regressions. Results showed that protected dug wells and tap water were the major sources of water supply in the study area, usually transferred to the house by cart and almost all was not treated. The major source of toilet facilities was traditional pit latrine and more than one-fifth of the populations share common latrines. More than one-third of the families had animals inside their housing. Almost half of the families were disposing their rubbish in collection areas far from housing followed by burning of rubbish, which had been used by more than one-third of them. More than one-fifth of the households' preschool children (21.3%) had diarrhea. A result of multiple logistic regressions showed that, time of hand washing (when to wash hand) was independently predictive for diarrhea among the households' preschool children (B = 0.005, Wald test = 6.758, p=0.009). It can therefore, be concluded that the environmental conditions including access to improved sources of water and hygienic latrines in these communities were accepted, although there were still some negative environmental practices, which can affect the safety of water and promote diseases spread. Bad hygienic practice was prevalent and led to high rates of diarrhea among the households' children. Therefore, to improve the environmental conditions in these communities, authorities should establish and enforce a more healthy environmental conditions approach and health promotion activities to improve the hygienic practice.

Key words: Displaced communities, Khartoum State, environmental conditions, hygienic practice and diarrhea.

INTRODUCTION

The environment is defined as: "All that which is external to the human". The environment can be divided into physical, biological, social, cultural, etc., any or all of which can influence health status of populations" (Prüss-

Üstün, 2006).

According to this definition, the environment would include anything that is not genetic, although it could be argued that even genes are influenced by the environment in the short or long-term (Prüss-Üstün, 2006).

The aim of this study was to examine the environmental conditions that affect the well-being of people, which include clean and safe water supply, efficient and safe human waste disposal and clean and safe housing and surroundings, of displaced communities and hygiene practice in Khartoum State, Sudan. By understanding the situation in these IDPs, this will help the government to develop specific plans to solve the targeted problems of environmental conditions and to create an evidence-based intervention program in order to improve the health situation of the population in the displaced communities of Khartoum State.

In 2012, 89% of the world's population had some form of improved water supply; while 64% had access to basic sanitation facilities (World Health Organization (WHO)/Global Health Observatory (GHO), 2015). An improved drinking-water source is defined as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with fecal matter (WHO/UNICEF Joint Monitoring Programme, 2006). According to the WHO/GHO, improved drinking-water sources include piped water to the house or yard, public taps or standpipes, boreholes, protected dug wells, protected springs and rainwater collection (terms, WHO/UNICEF Joint Monitoring Report, 2012). An improved sanitation facility is defined as one that hygienically separates human excreta from human contact (WHO/UNICEF Joint Monitoring Programme, 2006). According to the WHO GHO, improved sanitation facilities include flush or pour-flush toilets connected to a piped sewer system, septic tanks or pit latrines, and composting toilets.

The environment influences our health in many ways; through exposures to the environmental risk factors and through related changes in our behavior in response to these factors (Prüss-Üstün, 2006). The evidence shows that environmental risk factors play a role in more than 80% of the diseases regularly reported by the WHO (Prüss-Üstün, 2006). Globally, nearly one quarter of all deaths and of the total disease burden and slightly more than one-third for children, can be attributed to the changes and degradation of the environment (Prüss-Üstün, 2006). Inadequate sanitation, hygiene or access to water increases the incidence of diarrheal diseases (World Health Organization (WHO)/Global Health Observatory (GHO), 2015). The highest proportion of deaths and Disability Adjusted Life Years (DALYs), as well as the highest absolute numbers, occur in countries with high mortality patterns, such as Africa and parts of South-East Asia (WHO/UNICEF Joint Monitoring Programme, 2006). “Most diarrheal deaths in the world (88%) were caused by unsafe water, sanitation or hygiene” as stated by WHO GHO (2015). “In addition to diarrhea, an important share of the following diseases could be prevented if adequate water quality and quantity, sanitation facilities, hygiene practices, as well as water resource management interventions were implemented: malnutrition, intestinal nematode infections, Lymphatic filariasis, Trachoma, Schistosomiasis, Malaria and other infectious diseases” as stated by WHO GHO (2015). Altogether, improvements related to drinking water, sanitation, hygiene, and water resource management could result in the reduction of almost 10% of the total burden of disease worldwide (Prüss-Üstün et al., 2008).

Sudan has been virtually in a state of civil war since its independence in 1956. The conflict has generated the largest internal displacement crisis in the world, and over two million people have died as a direct result of war. More than four million people are internally displaced, about half of whom have fled to the north and mostly settled around the capital Khartoum. Quantifying IDP populations in Sudan is complicated by traditional nomadic migration patterns as well as by people moving to access emergency assistance. The country is also prone to natural and man-made disasters, and famines have killed tens of thousands of Sudanese during the past 15-years (Norwegian Refugee Council/Global IDP Project, 2004). In Khartoum State, the government is implementing the process of permanent re-planning of some camps and IDPs must move to new settlements. According to the report of the international agencies, including International Non-Governmental Organizations (INGOs), Donors, and the UN, who have been following the situation of the IDPs in Khartoum State for the past years, there are complaints by IDPs on water shortages and a lack of access to sanitary facilities. INGOs operational in the area have observed that IDPs use open fields for defecation. In Wad el Bashier and Omdurman es Salaam IDPs, only five out of nine water yards are operating which has reduced access to water and raised costs, according to the Wad el Bashier Development Association, some areas have increased their water costs by as much as 50% (International Agencies in Sudan, 2004). The aim of any Water Sanitation Hygiene (WASH) programme is to promote

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good personal and environmental hygiene in order to protect health (UK Department for International Development, 2013). Ensuring the optimal use of all water supply and sanitation facilities and practicing safe hygiene will result in the greatest impact on public health. Hygiene promotion is vital to a successful WASH intervention. The focus on hygiene promotion is general and specific. In general terms, hygiene promotion is integral to all of the sections and is reflected in the indicators for water supply, excreta disposal, vector control, solid waste management, and drainage (UK Department for International Development, 2013).

MATERIALS AND METHODS

This study was conducted in the displaced communities of Khartoum State, Sudan. There are six displaced communities in Khartoum State; all are included in this study, which have 726989 people residing there. These communities comprise six displaced communities sites, namely, Wad Albashir–Omdurman, Alsalam-Omdurman, Jabel Awlia (Banteyou and Dar-Alsalam), Mayo (Angola and Mandela), Soba Alaradi, and Albaraka Al-Haj Yousif. A cross-sectional design was adopted in this study. The Khartoum State's six IDP communities were considered as the main sampling domains. A multistage sampling technique was used for this survey. The sample size was calculated using OpenEpi, entitled "OpenEpi for a Proportion for Cluster Surveys Version 04.06.08". Single proportion formula was at 95% confidence interval (CI) level Z = 1.96, Population size (N) = 131919, 14 households, an expected prevalence of 50% "the prevalence rate of the key indicator (when selecting P = 0.5, this will yield the maximum sample size, since the overall prevalence rate (P) of diarrhea was not known for the study area)" (WHO, 2006), 0.1 marginal error, and the design effect (for cluster surveys-DEFF) was = 1.5. The sample size was 575 households and the total sample size was completed to 662 households included in this study. Then, the sample size was divided into 30 clusters (Lot Quality Assurance Sampling (LQAS) Community Survey) and so the number of households per cluster was 22.

Furthermore, a structured questionnaire was used for data collection by well-trained data collectors (Annex 1). This questionnaire comprised demographics aspects of the respondents' families and assessed the environmental conditions of the study area. To enhance the validity of this instrument, all items of the questionnaire were framed in simplified language that was easy to understand. After the displaced communities' heads granted permission, the researcher with the help of community representatives from these communities administered the questionnaire. The sampled population covered the women at the households and their families including children younger than 6 years. The women were chosen as respondents, because of their availability at households most of the day in comparison to men. On the other hand, the women were more capable of answering the questions related to the households' environmental conditions, and answering other questions of the survey especially when asking about diarrhea among their children. The resulting data were entered into the Statistical Package for Social Sciences (SPSS) Version 15 for data analysis. Frequencies and percentages were computed for all variables, univariate associations between categorical variables were examined using chi-square test and multivariate analysis association was examined using multiple logistic regressions. A multivariate logistic regression analysis was run to study the independent association of variables (types of toilet facilities, use of toilet for defecation, regularity of hand washing and time of hand washing (when to wash hand)) with diarrhea among children. Statistical significance was tested at the 0.05 level of significance.

RESULTS

All households' respondents (662 households) agreed to administer the questionnaire. Table 1 shows the distribution of demographic characteristic of the respondents. More than half (428) women (64.7%) fall in the age group 26 to 45 years and few of them fall in the marginal age groups. Most of the respondents' ethnic groups fall under "others" tribe group, which include different small ethnic groups, almost one-third (203) of them were Nuba (30.7%) and few of them (31) were Arab (4.7%). Almost three-quarters of the households' families (489) fall in the family size group of 5 to 10 persons per family (73.9%) and nearly equal percentages was distributed between other two groups >10 persons per family (13.6%) and <5 persons per family (12.5%). More than half of the households' families (357) fall in the income group of 500 to <1000 Sudanese Bounds per month (53.9%) and only few of them (25) had an income more than 1500 Sudanese Bounds per month (3.8%). There was high percentage of illiteracy or no formal education among women (278) and men (272) in the households (42 and 41.1%, respectively) and few of them had university education (2.6 and 6.5%, respectively). More than three-quarters of the men in the households (551) were unskilled workers (83.2%) and only 4.7% of them were professional workers. More than three-quarters of the women in the households (543) were housewives or unemployed (82%) and 1.5% of them were professional workers.

The results in Table 2 show that almost half of the households (327) were recipients from piped water supply network (49.4%) and the other half (332) received water from protected dug well (50.2%). Most of the households' families transfer water to the house by cart (79%). Almost all families (657) were not purifying water before use (99.2%). A negligible percentage of them used boiling and filtration for purifying treatment (0.8 and 0.2%, respectively). Most of the households (469) had traditional pit latrine (usually consist of a single pit covered by a slab with a drop hole and a superstructure) inside their housing (70.8%) and 21% of them share latrine with other families. About two third of the families (446) were cooking in the kitchen (67.4%), the remaining had no kitchen and were cooking either inside their living room or at yard (14.8 and 14.7%, respectively). More than one-third (256) of the families had animals inside their houses (38.7%), 14.2% of them, had chickens and/or pigeons in their houses.

The results in Table 3 show that more than three-quarters of the pre-school children (539) had been

Table 1. Shows frequency and percentage distribution of the respondents by their sociodemographic characteristics in Khartoum State displaced communities, 2013. (N = 662).

Sociodemographic characteristics	Frequency	Percent
Women age		
< 15 years	1	0.2
15 - 25 years	223	33.7
26-45 years	428	64.7
> 45 years	10	1.5
Total	662	100.0
Ethnic group		
Arab	31	4.7
Fallata	31	4.7
Fur	109	16.5
Nuba	203	30.7
Others	288	43.5
Total	662	100.0
Family size		
< 5	83	12.5
>10	90	13.6
5-10	489	73.9
Total	662	100.0
Family income		
>1500 SDG	25	3.8
1000-1500 SDG	65	9.8
<500 SDG	215	32.5
500- < 1000 SDG	357	53.9
Total	662	100.0
Husband' education		
University	43	6.5
Secondary	101	15.3
Primary	246	37.2
No formal education or illiterate	272	41.1
Total	662	100.0
Women education		
University	17	2.6
Secondary	92	13.9
Primary	275	41.5
No formal education or illiterate	278	42.0
Total	662	100.0
Husband' occupation		
Unemployed	21	3.2
Professional	31	4.7
Skilled worker	59	8.9
Unskilled worker	551	83.2
Total	662	100.0

Table 1. Contd.

Women occupation		
Skilled worker	9	1.4
Professional	10	1.5
Unskilled worker	100	15.1
Housewife or unemployed	543	82.0
Total	662	100.0

Table 2. Frequency and percentage distribution of the respondents by housing characteristics in Khartoum State displaced communities, 2013. (N = 662).

Housing characteristics	Frequency	Percent
Water supply source		
Water supply network	327	49.4
Protected dug well	332	50.2
Others	3	0.5
Total	662	100.0
Method of water transfer		
Piped network	108	16.3
From the pump	22	3.3
Cart	523	79.0
Others	9	1.5
Total	662	100.0
Water purification		
Yes	5	0.8
No	657	99.2
Total	662	100.0
Method of water purification		
Poiling	4	0.6
Filtration	1	0.2
Not applicable	657	99.2
Total	662	100.0
Type toilet facilities		
Traditional split latrine	469	70.8
Share latrine	139	21.0
General latrine	27	4.1
Improve latrine with cement slab	15	2.3
Open defecation	11	1.7
Not applicable	1	0.2
Total	662	100.0
Place of cooking		
Kitchen	446	67.4
At room	98	14.8
At yard	97	14.7
Other	21	3.2

Table 2. Contd.

Total	662	100.0
Animals at the home		
Yes	256	38.7
No	406	61.3
Total	662	100.0
Type of domestic animals		
Chickens/pigeons	117	17.7
Goats/Sheep	53	8
Donkeys/Horses	18	2.7
Others	72	10.9
Not applicable	402	60.7
Total	662	100.0

Table 3. Frequency and percentage distribution of the respondents by practice of personal hygiene and life style factors in Khartoum State displaced communities, 2013 (N = 662).

Personal hygiene and life style factors	Frequency	Percent
Rubbish disposal method		
Garbage collection car	55	8.3
Burning	241	36.4
Collections areas far from home	322	48.6
Burning and in the collection area far from home	33	5.0
Others	11	1.7
Total	662	100.0
Use of toilet for defecation by the preschool children		
Yes	312	47.1
No	350	52.9
Total	662	100.0
Practice of hand washing by the preschool children		
Regular	539	81.4
Irregular	104	15.7
No hand wash	19	2.9
Total	662	100.0
Time of hand washing used by the preschool children (when do they wash hands?)		
Before eating	19	2.9
After eating	10	1.5
After toilet use	18	2.7
After waste disposal	4	0.6
Not applicable	35	5.3
Before and after eating	229	34.6
Before and after eating and after use of toilet	347	52.4
Total	662	100.0
What the preschool children use for hand washing		
Only water	263	39.7
Soap and water	366	55.3

Table 3. Contd.

Water and ramad	3	0.5
Others	1	0.2
Not applicable	29	4.4
Total	662	100.0
The practice of walking barefoot by the preschool children		
Yes	479	72.4
No	183	27.6
Total	662	100.0
Vegetable washing and cleaning (peeling) before eating		
Yes	639	96.5
No	23	3.5
Total	662	100.0

washing their hands regularly (81.4%) and only 2.9% of them were not washing hands at all. More than half of the pre-school children (347) used to wash their hands before and after eating and after using the toilet (52.4%). More than half of the pre-school children (366) were using water and soap for hand washing (55.3%) followed by 39.7% of them who were using only water to wash their hands. Almost three-quarters (479) of the pre-school children were walking barefoot (72%), which was a bad hygienic practice. Almost half of the families (322) were disposing of their wastes in collection areas far from their home (48.6%) followed by burning of rubbish method, which had been used by 36.4% of them. More than half of the preschool children (350) were not using toilets (52.9%) and were practicing open defecation. Almost all of the families (639) were washing and cleaning (peeling) the vegetables before eating them (96.5%).

The obtained results based on the women and men educational qualification show significant association between the men education and the practice of water treatment (p=0.015). The results showed that there was no significant association between the family income (p=0.088), the women education (p=0.748), men occupation (p=0.798) and women occupation (p=0.776) with the practiced of water treatment. On the other hand, the results showed significant association between the men education (p=0.001), the women education (p=0.011) and men occupation (p<0.001) with the type of toilet facilities in the house. There was no significant association between the women occupation (p=0.508) with the sanitation and type of toilet facilities. Moreover, the results showed significant association between the men and women education (p=0.001 and p<0.001, respectively) and women occupation (p<0.001) with the waste disposal method. Results showed that there was no significant association between the men occupation (p=0.755) with the waste disposal method. Results showed significant association between the men and women occupation (p=0.043 and p<0.001, respectively) with the regularity of hand washing. Results showed that there was no significant association between the men education (p=0.198), the women education (p=0.062), and women occupation (p=0.776) with the regularity of hand washing.

Considerable percentages of the households' preschool children (21.3%) had been complaining from diarrhea (stated by their mothers) in the last week prior to the data elevation as shown in Figure 1. Variables assessed for association with outcome variable during the univariate analysis were further re-entered into final multivariate model using logistic regression analysis. In the multivariate analysis, time of hand washing (when to wash hand) was independently predictive for diarrhea among the preschool children of the respondents (B = 0.005, Wald test = 6.758, p=0.009) (Table 4).

DISCUSSION

This study assessed the environmental conditions in displaced communities of Khartoum State, Sudan and found that most of the Displaced population had one of two main source of water supply. The first source of water supply was piped water supply network (50.2%) and the second one was protected dug wells (49.4%). These two sources of water were considered as improved sources of drinking water according to the WHO, which define an improved drinking water source as a source that, by nature of its construction, adequately protects the water from outside contamination, in particular from fecal matter (WHO/UNICEF Joint Monitoring Report, 2012). Despite of the high percentage

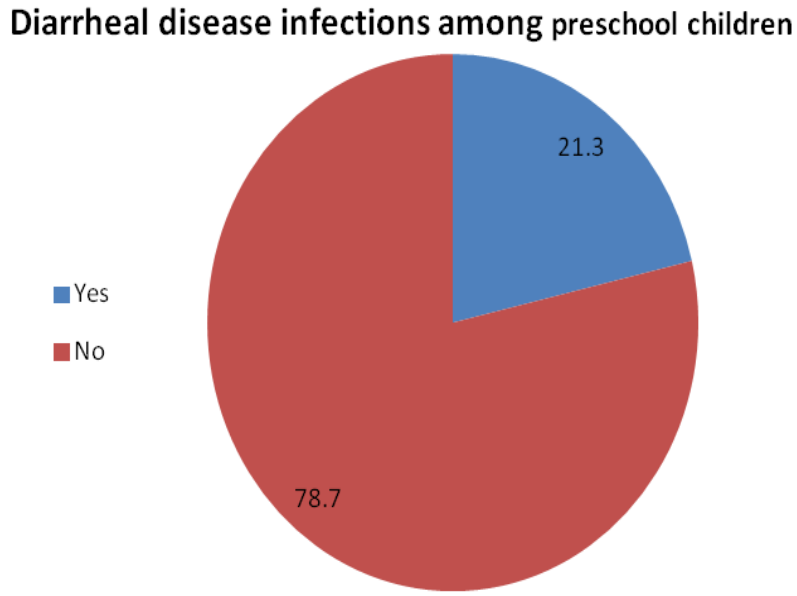

Figure 1. Percentage distribution of diarrheal diseases among respondents' preschool children (1-5 years) in the last week in Khartoum State Displaced communities, 2013.

Table 4. Multiple logistic regression results of the association between housing characteristics and practice of personal hygiene with diarrhea among the respondents' preschool children.

Variable	B	SE	Wald statistic	df	Sig.	Exp (B)
Types of toilet facilities	-0.174	0.102	2.922	1	0.087	0.840
Use of toilet for defecation	-0.266	0.202	1.733	1	0.188	0.767
Regularity of hand washing	-0.184	0.204	0.809	1	0.368	0.832
Time of hand washing	0.005	0.002	6.758	1	0.009*	1.005
Constant	1.891	0.446	17.988	1	0.000	6.629

*Significant at 0.05.

of the improved source of drinking water in the study area, this study revealed that most of the populations were transferring water to their houses by cart (79%) and almost all of them were not purifying water before use for drinking (99.2%). These factors might affect the safety of drinking water in the study area. These results were better than the previous interagency assessment report findings, which were studied by different NGOs in the same IDPs in 2004. Their assessment showed that the water was sourced either directly at water points or purchased from donkey carts (84%). The assessment also reported that the children were the ones primarily responsible for fetching water, and that there was often conflict at the water sources (International Agencies in Sudan, 2004). Our findings also showed better situation when compared with the two household surveys carried out to assess the water and sanitation situation in refugee camps, one in West Africa (Ghana) in 2005 and one in East Africa (Kenya) in 2006, showed that only 6% of the estimated water needs had been covered (Cronin et al., 2008).

Most of the displaced populations (70.8%) have a traditional pit latrine type of toilet. A considerable percentage (21%) shared latrine with other families, 4.1% have been using public latrines, 1.7% having none and defecate openly, and only 2.3% of the populations having improved latrine with cement slab inside their houses as shown in Table 2. Our survey showed better results than the NGOs interagency assessment report in 2004, which found that there were few latrines available; the people either defecated in open areas, in neighbors' latrines, or in public latrines and the latrine coverage was concerning

with 30% of households in all areas reporting no access (to either their own latrine, neighbors' or public) (International Agencies in Sudan, 2004). Our findings showed better situation when compared with the two household surveys carried out in refugee camps in Ghana and Kenya, which showed that only 2% of the estimated sanitation needs had been provided (Cronin et al., 2008). A comparatively good situation in our study area was gotten compared to the aforementioned studies, but more attention is needed for the 26.8% of the populations who share the latrine with other families, who use public latrines and those who have no latrines. The effect of improved water sources and sanitation will be reflected positively in health and nutritional status of the population, this was found in a study in Bangladesh (World Vision, 2011) and many other studies conducted in the developing countries. On the other hand, unsafe water may additionally affect the nutritional status of the population through diarrheal diseases (World Vision, 2011). More than one-third (38.7%) of the populations in our study had animals inside their houses, 45.7% of them have chickens and/or pigeons type of animals. Although this can help to improve the economic situation of the families, it can affect the hygiene and cleanness of the houses, attracting flies and might carry pathogens. What are houseflies attracted to? (http://animals.mom.me/houseflies-attracted-to-5559.html). Almost half of the displaced populations (48.6%) had been getting rid of their waste in the waste collections areas far from their housing, followed by the burning of rubbish method, which had been used by 36.4% of them. Only a small percent of the households (8.3%) used a garbage car collection method. It becomes obvious that the IDPs settlements in Khartoum State need more capacity to improve garbage and waste collection, collected in a healthy-respected way; it will improve the environment situation and the health status of the community. More than three-quarters of the households' preschool children (81.4%) were washing their hands regularly in these communities and a few of them (2.9%) were not washing their hands at all. This was surprising to us because of the high percentage of illiteracy among women and men in these communities. More than half of the preschool children (55.3%) were using water and soap for hands washing followed by 39.7% of them who were using only water to wash hands. In addition to that, this study found that almost all of the households with preschool children (96.5%) were washing and cleaning (peeling) their vegetables before eating them. Despite the low education percentages and high poverty rates among the displaced populations, still good results were observed concerning personal hygiene practice and life style factors. This could be due to spread of mass media and availability of NGOs health services in these settlements, which concentrate more on these issues.

Concerning the associations between the water supply, sanitation facilities and practicing safe hygiene among the families based on some of their sociodemographic characteristics (educational qualifications and occupations of the women and men), it was noticed that the men education significantly affected the practice of water treatment rather than the women education. On the other hand, it was noticed that the men and women education also positively affected the sanitation and type of toilet facilities in their house and the waste disposal method. The men occupation significantly affected the sanitation form and type of toilet facilities in the house rather than the women occupation. On the other hand, the women occupation significantly affected the method of waste disposal rather than men occupation. Moreover, the men and women occupation positively affected the regularity of hand washing of their preschool children. There was high percent of diarrhea among children in the study area, which might be affected by the environmental conditions. However, in this study, it was found out that the time of hand washing (when to wash hand) was independently predictive for diarrhea among the preschool children of the respondents.

Conclusion

This study examined the environmental conditions in a Sudanese community and found that most of the residents in this community, which comprised six displaced communities sites, had access to improved sources of water and sanitation, in addition to a high standards of personal hygiene practice and life style factors, despite low education percentages and a high poverty rates among the displaced population. It can therefore be concluded that the environmental conditions in these communities were accepted, although there were still some negative environmental practices such as use of carts to transfer water to the houses and not purifying water before use for drinking, breeding animals inside the houses, dumping of waste openly and sharing of latrine with other families and the public.

Based on the findings, the following recommendations were made in order to enhance the environmental conditions in the study area and even in the Khartoum State and the country at large: The government at all levels should continually review and revise existing policies with respect to urban planning, developing healthy standards, infrastructure and environmental regulations in order to make them more attainable and compatible with local conditions. Legislations should be enforced concerning indiscriminate getting rid of waste and burning in the study area. The local authorities should endeavor to provide more rubbish containers and place them at strategic positions and the defaulters should be made to face the full wrath of the law. Health

promotion should be increased by the local authority on the need to avoid open defecation and to build hygienic latrine inside the houses, purifying drinking water and breeding animals inside the houses. Health education should be carried out according to the needs of the inhabitants to adopt the habit of regular hand washing after using toilets and for food preparation or taking meals.

Conflict of Interests

The author have not declared any conflict of interests.

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ANNEXES

Annex 1. Questionnaire.

S/N	Parameter	Coding
	Region name Data collector team No (a, b) Cluster No Questionnaire date: Data collector name: Respondent name (Optional): Serial Number:	Camp name.....Squire No... Day...Month... Year.....
1	Women age	1=Less than 15 years 2=15-25 years 3=26-45 years 4=Greater than 45 years
2	Ethnicity	1=Arabs 2=Four 3=Nuba 4=Fallatah 5=Other (specify.....)
3	No of family members:	.....Individuals
4	Household's monthly income (in Sudanese pound):	..... Sudanese pound
5	Educational level of the Women	1=Illiterate/ None formal education 2=Primary/Basic 3=Secondary 4=University/Postgraduate
6	Educational level of the Husband	1=Illiterate/None formal education 2=Primary/Basic 3=Secondary 4=University/Postgraduate
7	Women occupation	1=Housewife 2=Unskilled worker 3=Skilled labor 4=Professional worker
8	Father's occupation	1=Unemployed 2=Unskilled worker 3=Skilled labor 4=Professional worker
9	Source of drinking water	1=River or canals 2=Water supply network 3=Protected Well 4=Other (specify).....
10	If the answer is a water supply network or well what are the means of water transport?	1=Pipes network. 2=Directly from the pump

Annex 1. Questionnaire. Contd.

		3=From the cart. 4=Other (specify)..... 9=Not applicable
11	Water Purification	1=Yes 2=No
12	If the answer is yes, what are the means of water Purification?	1=Poiling 2=Filtration 3=Other (specify)..... 9=Not applicable
13	Type of toilet facilities	1=Split latrine 2=Share latrine with other families 3=Public latrine 4=Improve latrine with cement slab 5=Open defecation 6= Not applicable
14	Place of cooking	1=At the Kitchen 2=At room 3=At yard 4=Other (specify)...
15	Do you have animals at the home?	1=Yes 2=No
16	Type of domestic animals	1=Chickens/pigeons 2=Goats/Sheep 3=Donkeys/Horses 4=Other (specify)... 5=Not applicable
17	Rubbish disposal method	1=Garbage collection car 2=Burning 3=Collections areas far from home 4=Burning and in the collection area far from home 5=Others specify.....
18	Use of toilet for defecation by the preschool children	1= Yes 2= No
19	Practice of hand washing by the preschool children	1=Regular 2=Irregular 3=No hand wash
20	At what time you wash your child's hands?	.....
21	What used for hands washing?	.....
22	Walking barefoot habit most of time per day	1= Yes 2= No
23	Vegetable washing and cleaning (peeling) before eating	1= Yes 2= No
24	Did your preschool children (1-5 years) suffer from diarrhea in the last week	1= Yes 2= No

At the end of the questionnaire thank the women and take her/her husband telephone number to return back for any inquiry: Telephone number.....