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WATER ASSOCIATED DISEASES AMONGST CHILDREN in IDPs CAMPS AND THEIR RELATION TO FAMILY ECONOMICS STATUS: CASE STUDY OF ABUSCHOCK IDPs CAMP, NORTH DARFUR STATE, SUDAN

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Abstract

This research discussed water-associated diseases amongst children in IDPs camps and their relation to family economic status in Abushock IDPs Camp, North Darfur State, Sudan. The main purpose of the research was to explore wither there exist a relationship between the family economic status and the rate of infection of its children with water transmitted diseases. Primary data were obtained from a total 140 of respondents who were selected using multi-stage sampling technique. Secondary data were obtained from published materials like journals, books and other relevant materials. Statistical packages for social sciences (SPSS) were used to display and interpret the data. The results revealed that water pollution in the study area is not related to the water sources, but due to the ways used to transport water, stored, and handling. Furthermore, there a declining in the rate of deaths among children related to water borne diseases due to wide spread medical services centers wither publically or privately owned, or owned by non-governmental organizations (NGOs). Chi-Square test showed that there exist a statistical significant relationship at 0.05 level between the economic status of the internally displaced family and the level of water-associated diseases prevalence among its children. It also shows that there exist a statistical significant relationship at 0.05 level between the economic status of the internally displaced family and its accessibility to potable water.

Keywords: Children; Water; Diseases; Economic Status; North Darfur; Abushok IDPs Camp.

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1. Introduction

Water-associated diseases are a significant cause of morbidity and mortality worldwide and are a barrier to sustainable development in many developing countries. Some 3.4 million people, many of them young children, die each year from water-borne diseases, such as intestinal diarrhea (cholera, typhoid fever and dysentery), caused by microbial contaminated water supplies that are linked to deficient or non-existent sanitation and sewage disposal facilities. In Africa, it has been estimated that every child has five episodes of diarrhoea per year and that 800,000 children die each year from diarrhoea and dehydration (O. Raji M. I. and E. Ibrahim Y. K, 2011).

The situation is particularly serious in many war affected areas where the war affected groups such as internally displaced persons (IDPs) and refugees mostly live in extreme conditions of poverty coupled with poor housing conditions, limited access to food and medical services, inadequate supply of safe drinking water and sanitary disposal of fecal waste, make the vulnerable groups especially women, children, older people, physically and mentally disabled people, infants and children who are already weak and sick expose to waterborne diseases like malaria, diarrhea, cholera, typhoid fever and dysentery etc[1].

However, more research is needed to deepen our understanding of the complex interactions between economic status of such vulnerable groups and the water-associated disease. In addition, an emphasis is needed on research that can inform interventions and the development of tools relevant for decision-makers.

The importance of the impact of water-associated diseases on human health has been recognized as a major threat to sustainable human development in some international forums, including the Millennium Development Goals, the World Summit on Sustainable Development (Johannesburg,26 August-4 September 2002), the 3rd World Water Forum (Kyoto, Shiga and Osaka, Japan March 2003), the Environment for Europe process and the Dushanbe International Freshwater Forum (Dushanbe, Tajikistan, 29 August-1 September 2003), among others (T. E. Funari, Herbst .Kistemann, S. and Rechenburg.A,2011).

This paper aims at exploring the association between the economic status of the internally displaced family and the prevalence of water-associated diseases among its children at Abushok IDPs camp in Northern Darfur State of Sudan.

The rest of the paper is structured as follows: Section two reviews the literature related to study theme, section three presents the methodology, specifically describing methods of data collection, the sampling of respondents, sample size and methods of data analysis. In the fourth

[1] - There are many reasons why individuals or groups are vulnerable. Some might be vulnerable because they are given less priority for limited resources, or belong to an ethnic, social, religious or political minority or have greater difficulty accessing treatment and care.

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section results analysis and interpretation will be presented. Lastly section five offers some concluding remarks.

2. Literature Review

The term water-associated diseases are reserved largely for infections that are predominantly transmitted through contact with or consumption of infected water. According to Bradley, 1974 at T. E. Funari, Herbst .Kistemann, S. and Rechenburg. A, (2011) there are five different categories of water-associated diseases, depending on the role water plays in the disease transmission process: these include: water-borne diseases, water-washed (water-hygiene) diseases, water-scarce diseases, water-based diseases, vector-borne diseases.

Water-borne diseases are basically ―dirty-water‖ diseases; mainly attributed to water that has been contaminated by human, animals or chemical wastes (Chabalala and Mamo 2001) meanwhile the Protocol on Water and Health defines "water-related disease" to mean "any significant adverse effects on human health, such as death, disability, illness or disorders, caused directly or indirectly by the condition, or changes in the quantity or quality, of any waters". These infections are spread by waterborne agents (eg. *E.coli* O157:H7, *Vibrio cholerae* O139*),* vectors carrying viruses and parasites (eg. dengue, malaria), and water contact (eg. schistosomiasis) (Dickin. Sarah K, 2014). The onset of waterborne diseases in water is enormous and largely attributed by the fact that the World Health Organization (WHO) has estimated that 1.1 billion people globally lack basic access to drinking water resources, while 2.4 billion people have inadequate sanitation facilities, which clearly accounts for many water related acute and chronic diseases. Poverty directly associates with poor housing conditions, over crowded house, lack of access to sufficient clean water and sanitary disposal of fecal waste, and cohabitation with domestic animals that may carry human pathogens (World Bank 2006). Water-borne diseases are characterized by different transmission routes including a) ingestion of contaminants due to unsafe water, sanitation and hygiene e.g. diarrheal disease, b) contact with infected water e.g. schistosomiasis, and c) insect vectors that utilize water to propagate e.g. dengue and malaria (Dickin. Sarah K, 2014). Access to safe drinking water, basic sanitation and proper hygiene education could not only prevent diarrheal diseases by nearly 90 % (UN, 2010) but lead to improved health, poverty reduction and socio-economic development (Fewtrell L, et.al, 2005).

Globally, water-borne diseases are the second leading cause of death in children below the age of five years, while childhood mortality rates from acute respiratory infections ranks first(http://www.freedrinkingwater.com/water_health/health2/waterborne-disease-cause-human-health-problems-p).

Water-washed (water-hygiene) diseases occur due to the lack of adequate water supply for washing, bathing and cleaning. Pathogens are transmitted from person to person or by contact with contaminated surfaces. Eye and skin infections as well as diarrhoeal illnesses occur under these circumstances. Waterborne pathogens include bacteria, viruses, protozoa and helminths.

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Water-scarce diseases occur due to the lack of water available for washing, bathing and cleaning. Hence, pathogens are transmitted from person to person or from contaminated surfaces to a person and are spread by the faecal–oral route. In particular, eye (trachoma) and skin infections (scabies), as well as diarrhoeal diseases occur under those conditions.

Water-based diseases are caused by organisms, in particular by different species of worms that spend parts of their life-cycle in different habitats. They have spent one development cycle in aquatic molluscs, and another as fully grown parasites in other animal or human hosts. Because stagnating surface waters, such as reservoirs, are the preferred habitat of parasitic worms, the occurrence of water-based diseases such as dracunculiasis and schistosomiasis can be heavily influenced by anthropogenic activities.

Vector-borne diseases are caused by bites from insects that breed in water. Insect vectors such as mosquitoes transmit diseases such as malaria, Chikungunya and other diseases.

3. Materials and Methods

3.1.Area of Study

Abu Shouk IDPs Camp is located 2.5 kms Northwest of El Fasher town; the capital of North Darfur State. The camp was established in April 2004 to accommodate the massive influx of 30,000 IDPs from Jebel Si, Korma and Tawilla. After the attack on Tawilla and Korma in February 2004, there were additional influxes of 30,000 IDPs. 65% of the IDPs are from Jebel Si, 15% from Korma, 10% from Tawilla and 10% from Kutum and other areas. The camp was planned by Government of Sudan and Spanish Red Cross (SPRC) it was divided in to two parts, East part which includes 28 blocks, each block divided in to fifteen squares. The other side (West part) divided in to 11 blocks, in each block there are eight squares, in each square there are about 25 families. In the beginning of the crisis, there are 54000 individuals, but now the total number of Abushouk IDPs is approximately 42000 individuals, 70% of them are women and children (Sabbil, Sheriff and Abdulrahman, 2016).

3.2.Data Collection

Both primary and secondary data were collected. Primary data were obtained from a total 140 of respondents who were selected using multi-stage sampling technique. Primary data was collected using self-prepared questionnaire by interviewing the head of the households. The interview criterion was that the person interviewed from each household should be permanently residing in that area from past one year. In the interview, participants responded to the questionnaire that addressed the following particulars: number of family members, education, occupation, income, source of water, presence of latrines and water supply in the latrine. Any cases of waterborne diseases in the last one year period were also recorded via the questionnaire. Secondary data were obtained from published materials like journals, books and other relevant materials.

3.3.Sampling Procedure and Sample Size

Multi- stage sampling technique was used to select the sample size. The first stage involves a random selection of 28 blocks out of 48 blocks constituting the total IDPs Camps blocks; the second stage involves a random selection of 60 squires out of 240 squires constituting the total

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squires in the camp; and the third stage involves the random selection of 450 household out of 47500 household.

The sample size (n) is determined according to the following formula:

$$n = \frac{Z_{\alpha}^{2} P(1-P)\,deff}{d^{2}}$$

Where: n = the required sample size, Z= the value of the standard distribution at the 0.95 confidence level (Z=1.96), p= the study population (=the numbers of IDPs households in the study area), q = 1-p = 0.5%, and d = the margin of error = 5% (= 0.5). Setting Zα = 1.96, P = 0.5, and d = 0.5, and substituting into the above formula, we obtain a sample size of approximately 450 IDP households which will randomly been selected from Abu Shock IDP camp.

3.4.Methods of Data Analysis

Statistical Package for Social Sciences (SPSS), mainly frequency distribution, and chi-square tests were applied to manipulate the data of the study. In view of the inaccuracies and limitations of data, a combination of both qualitative and quantitative analysis was conducted.

4. Results and Discussion

Part one Frequency Distribution and Percentages of the Respondents:
Socio - Demographic Profile

Table 1: Frequency Distribution and Percentages of Respondents by ***Sex***

Sex	Frequency	Percent	Cumulative %
Male	213	47.3	47.3
Female	237	52.7	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that 47.3% of the IDPs households were headed by male, while 52.7% were female headed. In IDPs camp it is a common feature to see female headed households.

Table 2: Frequency Distribution and Percentages of Respondents by Marital Status

Marital Status	Frequency	Percent	Cumulative %
Single	78	17.3	17.3
Married	302	67.1	84.4
Divorced	30	6.7	91.1
Widowed	43	7.6	98.7
Others No reply	2	0.4	100.0
Total	140	100.0	

Source: Field Survey, 2016.

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Marital status is an important aspect of the value system upon which individuals, married, single, separated, or widowed are revered. Marital status is deemed to be the pillar of family life and a driver of societal values. Care for the sick, and ability to tackle community problems are all viewed in the context of the marital status of an individual. The above result shows that the majority of the respondents were married (67.1 %). Notably though, the percentage of the single, divorced and widowed were relatively high (31.6 %). Such a result shows that the family system among the study group is still strong and intact.

Table 3: Frequency Distribution and Percentages of Respondents by Level of Education

Level of Education	Frequency	Percent	Cumulative %
Illiterate	95	21.1	21.1
Non formal education	94	20.9	42.0
Basic level	129	27.8	70.7
Secondary	62	13.8	84.5
University	69	15.3	99.8
No reply	1	0.2	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that only % 41.6 had formal education and 10.3% were high school graduates. From this information, one can therefore deduce that knowledge deficit is really a serious problem faced by the community in the prevention of water borne diseases. This is due to the fact that, the majority of the population with only basic education non formal education cannot really understand what water borne diseases are as well as measures geared at preventing them. Additionally, lower the number of years in school lower will be the knowledge regarding personal hygiene and cleanliness. Maintaining personal hygiene and cleanliness comes with an increase in level of education which eventually helps in preventing waterborne diseases.

Table 4: Frequency Distribution and Percentages of Respondents by Water Source

Water Source	Frequency	Percent	Cumulative %
Communal taps	435	96.7	96.7
Other sources	10	2.2	98.9
No reply	5	1.1	100.0
Total	140	100.0	

Source: Field Survey, 2016.

The above result shows that the most common source of water for the study participants was communal taps (% 96.7) suggesting that the risk of public health exposure was high. The remainder (%2.2) got their water from various other sources.

Table 5: Frequency Distribution and Percentages of Respondents by Type of Water Storage

Type of water storage	Frequency	Percent	Cumulative %
Closed containers	13	2.9	2.9

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Open containers	430	95.6	98.5
Others	2	0.4	98.9
No reply	5	1.1	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that 95.6 % of respondents stored their water in open containers. Storage of water was common among the IDPs camps due to lack of direct supply of water in their homes. Water stored at home is vulnerable to contamination (primarily from handling) regardless of how clean or uncontaminated. Even with improved, uncontaminated sources for drinking water, human behaviors may contaminate the household drinking water and promote pathogen transmission. Additionally, insufficient hand washing procedures, unsafe disposal of waste water, uncovered household drinking water containers, lack of water treatment prior to consumption, and use of inappropriate toilets by small children were, etc. were responsible for the contamination of water after collection from the point of source.

Table 6: Frequency Distribution and Percentages of Respondents by Water satisfaction

Water satisfaction	Frequency	Percent	Cumulative %
Satisfied	42	9.3	9.3
Not Satisfied	402	89.6	98.9
No reply	20	1.1	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that 98.9% of respondents do not have enough water for different consumption purposes. This situation leads many households to resort on unsafe sources such as hand- dug shallow wells for obtaining water. Water from such sources is often contaminated with fecal material and domestic wastes which will result in an increased public health risk of waterborne diseases.

Table 7: Frequency Distribution and Percentages of Respondents by Feces Disposal Practices At Home

Feces disposal practices at home	Frequency	Percent	Cumulative %
Improved latrine	123	27.3	27.3
Ordinary(temporary) latrine	28 7.1		89.7
Open fields	1	62.4	96.8
No reply	32	3.2	100.0
	14		
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that about 89.7 % of respondents use latrines for defecation, whereas % 7.1 use open fields, as they did not have any toilet facility in their own houses. Ibrahim Kasirye from the Economic Policy Research Centre, Uganda (2010) found that the incidence of diarrhea

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is highest among households without any established toilet structure. He also showed that access to a private covered pit latrine brings about the greatest reduction in the incidence of diarrhea amongst children. However, even though presence of latrines, the lack of water supply in these latrines were considered to be the major risk factor to increase the instances of waterborne diseases. Little or no access to water and sanitation, poor hygiene and feces disposal practices at home are major risk factors for waterborne diseases.

Table 8: Frequency Distribution and Percentages of Respondents by Kind of Illness

Kind of Illness	Frequency	Percent	Cumulative %
Malaria	302	67.1	67.1
Acute diarrhea (dysentery)	51	11.3	78.4
Giardia	19	4.2	82.6
Abdominal illness (typhoid fever)	4.0	0.9	83.5
Acute dehydrating diarrhea (cholera)	46	10.2	93.7
No reply	28	6.2	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that Malaria is the most common illness children suffering from it (%67.1). Malaria is water-related insect vector caused by poor drainage and uncovered water tanks which is a common feature in the study area (see Table 4.5), furthermore, mostly prevalent in rainy season (autumn) and summer (see Table 4.9 below). Next to it was acute diarrhea (dysentery), having a prevalence rate of %11.3 and then acute dehydrating diarrhea with a prevalence rate of %10.2. Few children that is, %4.2 and %0.9 suffered from Giardia and abdominal illness (typhoid fever), respectively. Findings of this study is partially in conformity with the report of Esrey et al. (1990, 1991) who carried out 142 studies on 6 of the major water-borne diseases and estimated that in developing countries (excluding China), there were 875 million cases of diarrhea and 4.6 million deaths annually in the mid-1980s.

Table 9: Frequency Distribution and Percentages of Respondents by Season of Water-borne Diseases

Season of water-associated diseases	Frequency	Percent	Cumulative %
Summer	88	19.6	19.6
Autumn	280	62.2	81.8
Winter	15	3.3	85.1
The whole year	41.0	9.1	94.2
No reply	26	5.8	100.0
Total	450	100.0	100.0

Source: Field Survey, 2016.

The above result shows the prevalence of water- associated diseases fluctuates across seasons. The information obtained in this context revealed a very clear picture, as shown in table (4.9) that water- associated diseases among children were mostly prevalent in rainy season (autumn)

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and summer, showing a percentage of 62.2 and %19.6, respectively. Seasonality is another critical factor influencing water- associated disease trends in Africa as well as elsewhere in the developing world. In many areas of Africa it is widely acknowledged that the transmission of gastro-enteritis peaks during the rainy season (Orlandi et al., 2001; Tomkins et al., 1989 in Williams, 2009) because rainfall facilitates an increase of fecal contamination to water sources (Findley et al., 2005; Vaahtera et al., 2000; Musa et al., 1999; Brewster and Greenwood, 1993; Tomkins 1981 in Williams, 2009). Conversely, additional research in West Africa (Molbak, et al., 2000 in Williams, 2009) and sub-Saharan Africa (Vargas et al., 2004; Steele et al., 2003; Georges et al., 1984 in Williams, 2009) has shown that the peak in diarrheal dieses is during the dry season when water scarcity affects hygienic conditions and favors transmission via fecal-oral route (Weisberg, 2007 in Williams, 2009).

Table 10: Frequency Distribution and Percentages of Respondents by Place of Illness Treatment

Place of Illness Treatment	Frequency	Percent	Cumulative %
Public hospitals	333	74.0	74.0
Private hospitals	104	23.1	97.1
Others	13	2.9	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that %74.0 of respondents took their children to public hospitals for medical treatment, whereas % 23.1 took them to private hospitals and %.2.9 reported others (could be to those owned by NGOs which is a common feature in IDPs camps)

Table 11: Frequency Distribution and Percentages of Respondents by Child death due to Infection with one of the Water- related Diseases

Child death due to infection with one of the water- related diseases	Frequency	Percent	Cumulative %
Yes	51	11.3	11.3
No	388	86.2	97.5
No reply	11	2.5	100.0
Total	450	100.0	

Source: Field Survey, 2016.

The above result shows that % 86.2 of the respondents do not have any child death due to infection with one of the water- related diseases. Such a result could be attributed to the wide spread medical services centers wither publically or privately owned, or owned by non-governmental organizations (NGOs).

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Part Two Chi-Square Test

Table 12: Chi-Square Test for the Association between the economic status of the internally displaced family and the level of waterborne diseases prevalence among its children at 0.5 level.

	Value	df	Significance Level
Chi-Square	85.749	12	0.000
Likelihood Ratio	79.639	12	0.000
Linear-by-Linear Association	24.839	1	0.000
N of Valid Cases	434		

Source: Own calculation based on sample data.

The Chi-Square results in table (11) indicates a strong relationship between the economic status of the internally displaced family and the level of waterborne diseases prevalence among its children size ($\chi 2$ = 85.749, n= 434, P= 0.000). i.e. there exists strong statistical relationship between the two variables at (0.05) significance level. This result involves the rejection of the null hypothesis which states that there is no relationship between the economic status of the internally displaced family and the level of waterborne diseases prevalence among its children. Such a result could also be explained by the fact that people having better life economic condition were more acceptability to pay for water services which is eventually reduces the chance of getting waterborne disease. With better economic conditions households may able to adopt better hygienic practices and will be able to buy appropriate commodities such as soaps for managing hygiene, therefore reducing the prevalence of waterborne disease.

Table 12: Chi-Square Test for the Association between the economic status of the internally displaced family and its accessibility to potable water at 0.5 level.

	Value	df	Significance Level
Chi-Square	19.998	9	0.018
Likelihood Ratio	12.820	9	0.171
Linear-by-Linear Association	0.036	1	0.849
N of Valid Cases	433		

Source: Own calculation based on sample data.

Table (12) indicates a strong relationship between the economic status of the internally displaced family and its accessibility to potable water ($\chi 2$ = 19.998, n= 433, P= 0.018). This result involves the rejection of the null hypothesis which states that there is no relationship between the economic status of the internally displaced family and its accessibility to potable water. I.e. there exists strong statistical relationship between the two variables at (0.05) significance level. Simply, the two variables are related to each other.

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5. Concluding Remarks

This paper discussed water-associated diseases among Internally Displaced Family's Children and their Relation to its Economic Status, Case Study Abushock IDPs Camp- North Darfur State- Sudan. The results achieved revealed that water pollution in the study area in not related to the water sources, but due to the ways used to transport water, stored, and handling. Furthermore, there a declining in the rate of deaths related to water borne diseases due to wide spread medical services centers wither publically or privately owned, or owned by non-governmental organizations (NGOs). Chi-Square test showed that there exist a statistical significant relationship at 0.05 level between the economic status of the internally displaced family and the level of water-associated diseases prevalence among its children. It also shows that there exist a statistical significant relationship at 0.05 level between the economic status of the internally displaced family and its accessibility to potable water.

Based on the above mentioned results the research offered the following recommendations:

1) To reduce waterborne diseases in rural areas water, sanitation and hygiene intervention provide a substantial role. By providing the alternative water source or sufficient supply of safe water, the incidences of disease can be reduced.
2) In light of these findings, it recommends that health information campaigns and local government ordinances should be designed to improve sanitation, as these represent the most effective ways of reducing diarrhea in the country.
3) Children are mostly affected by water borne diseases and it can be due to the fact that knowledge on child healthcare is inadequate among the IDPs households. So hygiene education is needed.
4) In the baseline survey it was found that very few people have the access to proper medical facilities. By giving the medical and health care facilities, cases of diseases can be reduced. Under this circumstance under-5 children need the urgency to get these medical conditions irrespective of economic status.
5) Educational interventions regarding personal hygiene, cleanliness and sanitary programs should be organized.
6) Quality assessment of the water source should be conducted time to time to assure that safe drinking water of national quality standards is available to everyone.

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