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IMPACT OF WATER AVAILABILITY ON DIARRHOEAL MORBIDITY IN TWO CONTRASTING COMMUNITIES IN CROSS RIVER STATE, SOUTH EASTERN NIGERIA.

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ABSTRACT

A case-control study of the impact of water availability on diarrhoeal morbidity was carried out in a typical rural community (Adim Community, as the study community) and the diarrhoeal morbidity compared with that of an urban settlement (Federal Housing Estate in Calabar Municipality, as the control comm...nity) all in Cross River State. Between the months of January to September 2002, a total of 1,836 households were visited in the study community and 1,500 in the control community, with 1,112 and 238 diarrhoeal cases reported respectively. Var...ble factors such as distance to water source (≥ 1000m: Odd Ratio 3.80; 95% CI : 1.98-5.21) and Amount of water used per person per day (1.4 litres: Odd Ratio 5.1:95% CI 1.86-6.84) were statistically associated with diarrhoeal morbidity in the study community. Monthly diarrhoeal incidence (per 100 (e...1000m: Odd Ratio 3.80; 95% CI : 1.98-5.21) and Amount of water used per person per day (1.4 litres: Odd Ratio 5.1:95% CI 1.86-6.84) were statistically associated with diarrhoeal morbidity in the study community. Monthly diarrhoeal incidence (per 1000 0) ranging from 5.0-18.7 and 1.5 – 4.7 were reported in the study and control communities respectively, with high values obtained during the dry period and early rains. Monthly incidence showed significant difference both in the study community (P> 0.05) and between the study and control communities (P>0.05). The two communities were observed to have great differences in the s...rces of their water supplies. Water availability was significantly associated with diarrhoeal morbidity in the study population.

KEYWORDS: Diarrhoea, morbidity, odds ratio, water.

INTRODUCTION

Water plays a major role in most human activities. In most rural communities, water supplies are frequently overused and contaminated.

Improved hygienic use of water in the home and availability of water for domestic activities depend upon an increased quantity available per capita per day (Esrey *et al.*, 1990). Gorter *et al* (1991) considered improving water availability as the main focus in the prevention of diarrhoeal diseases rather than water quality. According to USAID, the ready availability of water makes possible a hygienic environment that prevents or limits the spread of many human and animal diseases. Blum *et al* (1990) working in Imo State, Southeastern Nigeria, observed a decreasing exclusive use of borehole water for drinking as household – to – borehole distance increases. In most rural communities in the tropics, water sources are usually seasonal, drying up completely during the dry season which often leads to poor personal hygiene and sanitation (Daniels *et al.*, 1990).

Water supply and sanitation facilities have been reported to play an important role in health (Blum and Feachem, 1983; Briscoe *et al.*, 1986). Diarrhoeal morbidity in persons of all ages have frequently been considered as one of the indicators for health impact studies (Cairncross, 1990; Seas *et al.*, 1990; Huttly *et al.*, 1990; Gorter *et al.*, 1990). With the establishment of a link between water supply, sanitation and diarrhoeal diseases, increasing interest in the quantity of household water have been developed by some researchers (Kirchoff *et al.*, 1985: Han *et al.*, 1989; Synder *et al.*, 1995; Quick *et al.*, 1996; Luby *et al.*, 1998; Quick *et al.*, 1999). In 1982, the Diarrhoeal Diseases Control Programme of the World Health Organization considered improvement of water supplies and sanitation as available strategy in the control of diarrhea (WHO, 1997). Improved information on the health impact of different levels of specific water supply and sanitation activities and the combined effect of these activities are thus needed. However, available information on health impact studies in Nigeria are scanty and limited to the eastern (Huttly et al., 1987; Blum et al., 1990) and northern parts (Tomkins et al., 1975).

This situation has thus necessitated the conduct of health impact studies on risk factors of water availability in a rural community and its diarrhoeal morbidity compared with that of an urban community in Southeastern Nigeria, in order to establish a community – based strategy for the prevention and control of diarrhoeal diseases.

MATERIALS AND METHODS

STUDY AREAS

The study community (Adim) is located along the upper Cross River, about 105km North from Calabar, the Cross River State capital. With a total surface area of approx 50km2, the community has over 12,000 inhabitants living in approx, 15,000 household. A total of 1, 836 households were visited and a subject interviewed per households. The main occupation is farming, with trading and fishing carried out as subsidiary occupations involving men, women and children of all ages. Water sources available throughout the year include five springs, a borehole and a river, most of which are far away from the households. Adim has the basic characteristics of a rural settlement with poor housing, poor sanitation, poor domestic and personal hygiene, unemployment and poverty. Most inhabitants still adhere strongly to practices and beliefs common to the traditional African Society. There is a Government Health Centre, a private clinic and many patent medicine stores.

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TABLE 1: Distribution of Diarrhoeal Cases and Controls by exposures to water availability Risk factors in study community.

Risk factor	*Cases* N= 1112(%)	*Controls* N= 724(%)	*Case-control OD*	*95%CI*
a. Distance to water sources (m)				
< 100	202 (18.2)	394(53.0)	0.34	(0.29-1.33)
100-499	182 (16.4)	198 (27.3)	0.60	(0.37-1.03)
500-999	480 (43.2)	100 (13.8)	3.12	(0.59-4.75)
≥1000	248 (22.2)	42(5.9)	3.80	(1.89-5.21)
b. Amount of water used per person/ day (L)				
< 1-5	614 (55.2)	78(103.8)	5.1	(1.86-6.84)
5-9	202 (18.2)	164 (22.7)	0.80	(0. 17-2.24)
10-14	212 (19.1)	306 (42.3)	0.45	(0.39-2.43)
≥15	84 (7.5)	176 (24.2)	0.31	(0.07-1.96)
c. Duration of water storage				
< 1 day	440 (39.6)	64(8.8)	4.50	(2.96-6.01)
1 day	258 (23.2)	206(28.5)	0.81	(0.15-2.17)
2 days	58 (5.2)	127 (17.7)	0.29	(0.09-1.92)
3 days	76 (6.8)	120 (6.6)	0.41	(0.21-1.93)
≥ 4 days	280 (25.2)	207(28.5)	0.88	(0.17-2.34)
d. Average Number of persons per Household				
1-4	295 (26.6)	312(43.1)	0.62	(0.33-1.54)
5-8	394 (35.5)	262 (36.2)	0.98	(0. 60-1..85)
≥9	423 (38.0)	150(20.7)	1.84	(1.19-3.13)

CI- Confidence Interval

The control community (Federal Housing Estate in Calabar Municipality) is an Urban settlement located along the lower Cross River. It has over 9,000 inhabitants living in approx 2,000 households largely separated from each other. Most of the inhabitants are civil servants with most of their wards attending academic institutions. A total of 1,500 households were visited the during the study period. There are two Government Health Centres, four private clinics and a hospital. Water sources available are mainly boreholes and pipe-borne water. Housing and sanitation are averagely good.

Research Methodology

The design of this research work was based on the case –control study as reported by Cairncross (1990) and recommended by UNICEF (1990) and WHO (1997). Analyses were carried out twice a month between January and April 2002 (part of dry season) and from May to September 2002 (part of wet season). Analyses in both communities were done on subsequent days within the same week.

Two groups were mapped out in the study community: the case and control groups. The case population was considered to be individuals with reported diarrhoeal cases (defined as four or more liquid motions per day with or without mucus, fever or blood) while the control population were individuals selected randomly from households with no reported case of diarrhoeal for at least six months before the sampling period (Seas *et al.*, 1999). The case and control populations were matched using water availability risk factors such as distance to water source, average amount of water used per person per day, duration of water storage and average number of persons per household.

The distance to water sources was measured directly using a calibrated string (Gorter et al., 1991) either from household to water source or from household to designated points with known distances to the various water sources. The average amount of water used per person per day was obtained by evaluation of the ratio of the volume available in each household to its storage duration and to the number of persons in the household (Assuming that adults consume equal amounts of water and equivalent to that consumed by paired infants).

Amount of water used per person per day =

$$\frac{\text{Water Volume}}{\text{Stored duration}} \times \frac{1}{\text{No of adult persons and paired infants}}$$

The other factors were obtained by questionnaires issued to each subject. In situations where the subject is illiterate, the questions were asked through an interpreter. Questions on infant subjects were answered by their parents/guardians while

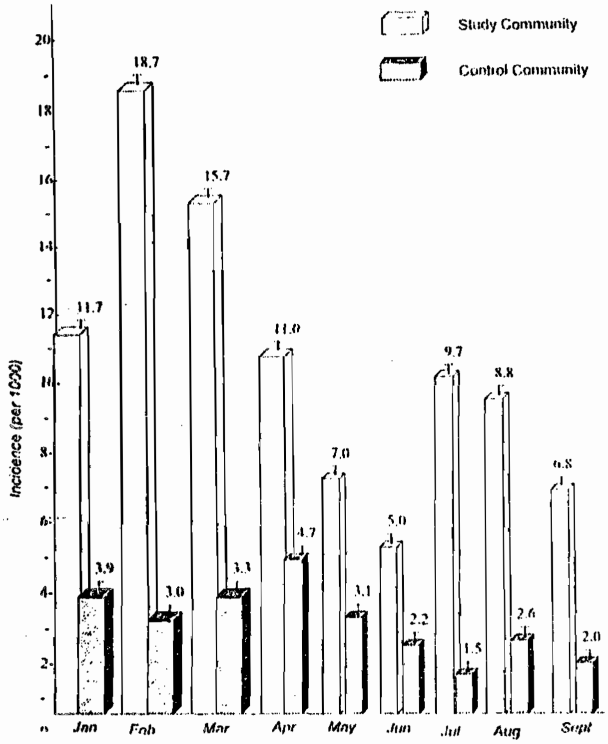

Fig. 1: *Monthly incidence (per 1000) of diarrhoeal cases in study and control communities*

households of hospitalized subjects (in-patients) were also visited. The monthly incidence of diarrhoeal cases in the two communities were evaluated by considering reported cases per 1,000 in the populations. Monthly incidence from both populations were compared and values obtained were statistically analysed using the student't' test.

RESULTS

One thousand one hundred and twelve cases and 724 controls were analysed in the study community. Risk factors evaluated showed highest risks at water source distance above 1000m (OR =3. 80; 95% CI = 1.89-5.21) and amount of water used per person per day between 1-5 litres (OR = 5.1; 95% CI = 1.86 – 6.84).

The distribution of diarrhoeal cases and controls by exposure to water availability risk factors in the study community is shown in table 1. The distance from household to water source showed large increases in the case - control odds ratios as the distance range increased with maximum value (OR = 3.80) recorded at 1000m. Similar trend was observed as the average number of persons per household increased (≥ 9: OR = 1.84). However, the amount of water used per person per day obtained the highest odd ratio (5.1) at < 1-5 litres and the values were observed to decrease significantly as the amount of water consumed increased. These risk factors were therefore considered to highly influence diarrhoeal morbidity in the study community.

The monthly incidence (per 1000) of diarrhoeal cases in the study and control communities is shown in Fig. 1. High monthly incidence of 18.7 and 15.7 were recorded in the study community during February and March respectively. Monthly incidence were significantly lower in the control community throughout the study period. Comparison of monthly incidence in the two communities showed significant difference at P> 0.05. Monthly incidence within the study community also differed significantly (P>0.05), while that of the control community showed no significant difference at P < 0.05.

DISCUSSION

Water availability has been reported as an important factor that influences diarrhoeal morbidity in many rural communities (Blum and Feachem, 1983; Daniels et al., 1990; Huttly et al., 1990; Gorter et al., 1991). In most rural communities in the tropics, water sources are usually seasonal, drying up completely during the dry season. Perennial shortage of water in such communities during the dry months often leads to poor personal hygiene and sanitation (Daniels et al., 1990). In the geographical area where the study community is located, the people usually depend on surface water sources which are usually located at very far distances from the settlement. These prevailing conditions therefore suggest the possibility of water being of relative importance in most rural communities in the area. Risk factors associated with water availability were therefore used to asses their impact on diarrhoeal cases and the diarrhoeal prevalence was compared with that of an urban community.

The amount of water consumed per person day was seen to directly affect diarrhoeal morbidity in the study community with the quantity range of <1-5 litres (OR = 5.10) having highest risk. This was also the case with increasing distance to water sources, with the highest risk (OR = 3.80) observed at a distance range ≥ 1000m. Similarly, Cairncross (1990) working in Imo State, Nigeria, observed that children aged 0-4 from houses more than 250m from a borehole were 23% more likely to have diarrhoea than those living in closer households. This may be explained by the fact that the presence of insufficient water in the study community promotes unhygienic behaviours, which may have contributed to the high incidence of diarrhoea in the control community. The limited water sources in the study community could not provide sufficient water to serve the large number of persons in most households as was commonly observed.

Monthly, incidence (per 1000) of diarrhoea in the study community were relatively higher during the dry months and differed significantly (P>0.05) throughout the study period. Gorter et al. (1991) working in a rural settlement in Nicaragua, also reported high diarrhoeal incidence during the dry seasons. However, he reported better quality of water from wells and other traditional sources during periods of low rainfall. This suggests that high diarrhoeal incidence during the dry season may be due to lack of sufficient water supply rather than its quality, which may result to unhygienic practices. This explains the significant difference (P>0.05) observed in the monthly incidence of the two communities compared though no significant difference (P<0.05) was observed in the monthly variation in the control community. The presence of household pipe – borne water and bore holes at proximal distances to households enables constant availability of sufficient water in the control community. The availability of water in rural communities should therefore be considered a priority for an effective control of diarrhoeal diseases.

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