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ORIGINAL ARTICLE

Riverine Communities and Waterborne Diseases in South Eastern Nigeria

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ABSTRAK

Penyakit bawaan air yang tercemar (waterborne diseases) adalah masalah berlarutan dan pengancam utama kesihatan ke atas penduduk di kebanyakan negara yang kurang maju disebabkan ketiadaan infrakstuktur asas terutamanya air dan kemudah-an-kemudahan kesihatan. Kajian ini melaporkan hasil penyiasatan penyakit bawaan air yang tercemar di kalangan komuniti yang tinggal di persisiran sungai di *Anambra State*, di Nigeria. Satu tinjauan dijalankan ke atas 1200 orang penghuni rumah meng-gunakan soal selidik dan 600 rekod yang diambil dari hospital. Fokus utama kajian ini adalah untuk mengenalpasti sosioekonomi dan faktor kebudayaan yang menyumbang kepada epidemiologi penyakit-penyakit ini. Hasil kajian ini menunjukkan perbezaan yang signifikan dalam kejadian penyakit bawaan air yang tercemar di kalangan komu-niti dan di antara komuniti-komuniti lain yang mana mempunyai implikasi tahap pen-didikan, ketua keluarga, pekerjaan dan sumber air yang digunakan. Kajian ini menge-syorkan supaya pendidikan kesihatan komuniti melalui pekerja kesihatan komuniti yang terlatih diberikan dan mewujudkan pusat perkhidmatan penjagaan kesihatan yang berfungsi, sebagai langkah yang utama untuk menangani penyakit yang merebak melalui penggunaan air yang tercemar.

Kata kunci: penyakit bawaan air yang tercemar, komuniti persisiran sungai, penghuni rumah, perkhidmatan penjagaan kesihatan.

ABSTRACT

Waterborne diseases (WBDs) have continued to be a major health threat to people living in many underdeveloped countries due to absence of basic infrastructure, especially water and health care facilities. In this study we report the findings of an investigation into waterborne diseases amongst the riverine communities in Anambra State, South Eastern Nigeria. A survey of 1200 heads of household using a questionnaire and 600 hospital records were reviewed. A major concern of the study was to identify socio-economic and cultural factors that drive the epidemiology

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of such diseases. Findings revealed significant differences in the prevalence of waterborne diseases within and between the communities, implicating education levels of the head of household, occupation, and source of water used. The study recommends the provision of community health education through trained community health workers and provision of functional and accessible health care services as a primary means of combating water borne diseases.

Key words: waterborne diseases, riverine communities, households, health care services

INTRODUCTION

Today, infectious diseases, which used to wreak havoc in Europe till mid 19th century, are being regarded as diseases of the underdeveloped world. In Western countries, infectious diseases and nutritional problems no longer dominate infant mortality and morbidity. However, in developing countries the reverse was the case. Mortality attributable to communicable diseases, maternal and perinatal conditions and nutritional deficiencies were reported to be more than five times as frequent in low and middle income countries as compared with high income countries (Alvarez-Dardet & Ashton 2000). Also, the World Health Organization (1998) reported that "of more than 50 million deaths worldwide in 1997, about one-third were due to infectious and parasitic diseases such as acute respiratory diseases, tuberculosis, diarrhoea, HIV/AIDS and malaria". These infectious diseases still remain leading causes of premature death among adults in the developing world (Lindgren et al. 2005).

The above facts, to some extent, underscore the importance of infectious diseases in understanding morbidity in a developing country like Nigeria. Furthermore, with the emergence of new infectious diseases which are resistant to well established antimicrobials, and the HIV/AIDS scourge for which an effective cure is yet to be found, the need for greater attention to be paid to preventive health care cannot be over stated (Huang 2004; Jones et al. 2008).

Several studies have shown that disease occurrence and distribution in a population was not a random event (Lindgren et al. 2005; Jha et al. 2002). The process of transmission of water related diseases have been found to be influenced by factors relating to the host, the individual, and the environment. Multi–level researches have been conducted in recent times to describe environmental (ecological) effects and individual level effects on transmission of diseases. Most of them have implicated "social class" or "socio–economic status" in the epidemiology of infectious diseases (Poortinga et al. 2008; Abayawardana & Hussain 2002).

Egboka et al. (1989) observed that in Nigeria, "outbreak of water-borne diseases such as cholera, yellow fever, dysentery, diarrhoea, and guinea worm occur periodically resulting in fatality". Guinea worm is reported to be widespread in many rural districts throughout central and southern Nigeria. An estimated 650,000 Nigerians suffered from guinea worm infections every year (Kinley 1989; Egboka 1989). Though considerable progress has been made since, but the problem still persists, albeit at a much lower level (Brieger et al. 1997).

In Anambra State, South–Eastern Nigeria, majority of the riverine communities lived in poverty and illiteracy, with their

beliefs and social practices steeped in their traditional cultural belief system. Also notable was the conspicuous absence of basic infrastructure and social amenities, especially water, roads, electricity and health facilities. The socio-economic and cultural environment exposed these communities to greater risk of infectious diseases.

The environment has been implicated as an important factor contributing to morbidity. There was a widespread belief that environmental quality was a major determinant of health and well–being (Fenwick 2006; Osuafor 1997; Cairncross & Feachem, 1983). The relationship between polluted drinking water and spread of cholera was established by John Snow in his study of the epidemiology of cholera in London, from 1848 to 1854 (Park 1997).

Water related diseases have been traditionally presented in four categories: (1) Waterborne, are faeco-orally transmitted through contaminated water or food. Examples are cholera, typhoid, diarrhoeas, poliomyelitis etc. (2) Water–washed, are due to insufficient quantity of water used e.g. trachoma, scabies etc. (3) Water-based, the pathogen spends a part of its life cycle in a water snail or other aquatic animals, e.g. schistosomiasis and guinea worm. Lastly, (4) water-related insect vector, spread by insects which either breed in water or bit near water. e.g. malaria and onchocerciasis (Park 1997; Mera 1997).

Numerous studies have shown the relationship between certain diseases and water pollution and contamination (Fenwick 2006). Other significant variables linked to morbidity include socio-economic factors as measured in terms of per capita income, education, housing, employment (Obermeyer 1993; Trinder et al. 2000); lifestyle (Evans et. al. 2000; Bitton & Mckea, 2000); increased human intrusion into tropical forest for purpose of mining, farming, settlement, and tourism (Demany 1996); foreign trade and expanded markets for imported foods, which occasionally contain bacterial or viral contamination (Demeny 1996; Mera 1997). Ethnicity is believed to be related to epidemiology of a number of diseases. This was due to the fact that ethnic background implied group homogeneity of diet, hygiene, education, religious and other customs that influence human health (Vallin & Behm 1980). Age, sex and stress are also known to influence morbidity differentials (Ramalingaswani 1994; Miles 1991). Several studies have also associated certain diseases with seasonal and climatic changes (Miles 1991; Kendall 1991).

There are a range of theories such as epidemiological transition, multi-factorial causation theory, socio–economic deprivation theory, epidemiological triad, Ajzen's theory of planned behaviour, health belief model, political economy of morbidity etc. that could be useful in explaining the character and pattern of morbidity in a community. The theories of multi-factorial causation, political economy and economic deprivation were considered most appropriate for explanation of morbidity differentials in this study. The multi-factorial causation recognizes that disease predisposition is influenced by a number of factors, which were linked to socio–economic status, cultural, genetic and environmental variables. Most of these factors are linked to man's life-style and behaviour patterns. The Economic Deprivation theory is applied here to look at morbidity from the point of view of participants' socio-economic status, which is mostly determined by societal forces. In Nigerian society, the social structure plays a primary role in social placement. Those at the lower social strata are likely to experience greater health problems. The position adopted in this study is that the morbidity differential is produced by the social system which creates social

inequality and socio-economic deprivation.

From the political economy perspective, people's beliefs and actions may play an important role on their health status. However, the socio-political economy plays a more primary and deterministic role. The theory suggests that "the possible range of health statuses and health behaviours of individuals is limited by their location in the social and economic system. As a result, a significant change in the health behaviour of any group of individuals is seen to require altering the social and economic context within which they live" (Minkler et al. 1995).

In this study, the focus was on water-related diseases generally, but with specific emphasis on those that were transmitted through oral consumption of contaminated water. Specifically, this study tried to identify the frequency of water–borne diseases such as typhoid, cholera, diarrhoeal illnesses, dysentery, infectious hepatitis and poliomyelitis as a result of exposure to untreated or contaminated water in the communities studied. It also explored those socio-economic factors as well as cultural beliefs and practices that influence the susceptibility of the people to water borne diseases. It sought to identify differences within and between the communities studied in relation to the occurrence of the water borne diseases.

MATERIALS AND METHODS

This was a retrospective, cross sectional survey on water-borne disease experiences of riverine communities in three Local Government Areas (LGA) of Ogbaru, Anambra East and Anambra West in Anambra State, South-Eastern Nigeria. In this study morbidity was investigated from a multi-factorial causation perspective, with emphasis on the social, cultural and economic background of the people. Six communities were sampled from the three LGAs studied. The combined population of the six communities were projected by Nigerian Population Commision (NPC 2000) at 87,636. A total sample of 1200 respondents representing 600 households was drawn from the six communities. The data collection process focused on heads of the households, using a set of structured questionnaire. In addition, 600 cases were reviewed from hospital records in the communities studied.

To ensure representativeness of the communities and households, a combination of the following sampling techniques was adopted – quota, cluster, systematic random and simple random. Method of data analysis included frequency distribution tables, percentages, and analysis of variance.

Ethics approval was sought and obtained from the University of Nigeria ethics committee.

RESULTS

Table 1 shows that 51.5% are females, while 48.5% are males. Over sixty percent (67.6%) of the respondents were engaged in either farming or fishing. Only 11.4% were civil servants or professionals. This is a typical characteristic of rural communities. The respondents were predominantly Christians (61.5%), while 38.5% belonged to the African Traditional Religion. A greater percentage of the respondents, i.e. 49.8% had no formal education. This is followed by 34% with primary level education. The population can best be described as predominantly rural, illiterate and agricultural in nature. These facts influence their economic status, lifestyle and possibly their health status.

Typhoid and intestinal worms comprise 25.4% and 19.3% respectively. Prevalence of dysentery was also quite significant (15.4%). Poliomyelitis had the least percentage frequency of 0.9% (Table 2).

Table 1 : Demographic Characteristics of Respondents

Variables	Respondent (%)
Sex	
Male	582 (48.5)
Female	618 (51.5)
Occupational Categories	
Farming	572 (47.7)
Fishing	239 (19.9)
Trading	168 (14)
Civil Servants/private company employees	121 (10.1)
Unskilled labourers	84 (7)
Professionals (Doctors, Lawyers etc.)	16 (1.3)
Religious Affiliation	
Traditional Religion	462 (38.5)
Christianity	738 (61.5)
Islam	-
Level of Education	
No Formal Education	598 (49.8)
Primary Education	408 (34)
Secondary Education	140 (11.7)
Tertiary Education	54 (4.5)

Review of 100 cases randomly collected from hospitals and/or health centres located within the six communities is presented in Table 3. Most of the health facilities were health centres and as such were not equipped to deal with serious health problems like infectious hepatitis, cholera, typhoid and so on. Most of such suspected cases were either referred out or were taken to hospitals outside the LGAs. The result generally reveals that water related diseases rank higher than other diseases. For instance, malaria, which is a water-related insect vector disease, ranked highest among all diseases found in all the communities with over 50% occurrence. The next high ranking diseases were gastroenteritis and diarrhoea.

The analysis of variance was used to test the significance of difference observed in the occurrence of WBDs in relation to a range of variables. It was hypothesised that prevalence of WBDs decreases as the level of education of household heads increases. A two-way ANOVA was used to test this hypothesis. The result gave an F value of 10.81 and 12.26 for prevalence and education respectively, which were significant at a p value of <0.001, indicating that there was a significant difference in the prevalence of WBDs in relation to level of education. The conclusion here was that prevalence of WBDs tends to reduce with increased level of education of the household heads.

It was hypothesized that some occupational groups experience higher prevalence of WBDs than others. This hypothesis was tested using a two-way ANOVA, which gave F values of 7.00 for prevalence and 9.70 for occupation, with significance at P value < 0.001. An observation of the disease distribution showed that the greatest disease burden was borne by those in farming/fishing occupation, with 49.2%, followed by unskilled labours with 19.3%. The lowest burden of WBDs was found amongst those in the professional category with 1.8%.

Table 2 : Reported Cases of Water-Borne Diseases (WBDs) by Household Heads

Categories of WBDs	Number of Cases (%)
Typhoid	84 (25.4)
Dysentery	51 (15.4)
Infectious Hepatitis	12 (3.6)
Cholera	7 (2.1)
Gastroenteritis/Diarrhoea	110 (33.2)
Intestinal Worms	64 (19.3)
Poliomyelitis	3 (0.9)
Total	331 (100)

Table 4 shows considerable variation in the distribution of WBDs amongst the communities. The highest morbidity burden of 22.1% was found in Nzam, the headquarters of Anambra West Local Government Area. This is followed closely by Ogbakuba with 18.7%. On the other hand, Otuocha has the lowest burden of 12.1%. The variation was mainly due to the source of water used, with rivers and ponds being the major contributors.

The Latin Square Design (a three-way ANOVA) was used to determine the level and significance of interaction between community, prevalence and water source available to the communities (Table 5). Result of the analysis shows significant difference in the prevalence of water-borne diseases at P=0.001 level of significance in the general distribution of these diseases and also, with regard to the sources of water used. When interaction between different variables is measured, the result shows that there is a significant difference between communities and the water they use as well as between prevalence of the different water-borne diseases and the water source available to the communities. The essence of this Latin Square Design was to

Table 3 : Hospital Data: Morbidity Data from Six Communities in the 3 LGAs

Types Of Diseases	Atani	Ogbakuba	Nzam	Oroma Etiti	Neyi Umuleri	Otuocha
Malaria	52	54	53	58	56	55
Typhoid	7	5	NA	NA	NA	9
Anemia /Sickle Cell	3	2	1	1	Nil	2
Respiratory tract infection	6	7	4	5	6	5
Hepatitis	Nil	1	NA	NA	NA	1
Pneumonia	2	1	3	2	2	Nil
Gastroenteritis/Diarrhea	14	16	17	16	14	12
RTA/Fractures, Burns etc.	2	Nil	2	1	3	5
Arthritis (Rheumatism, Joint pains etc)	1	2	1	Nil	4	1
Measles	2	1	2	Nil	Nil	Nil
Skin Diseases	1	3	6	9	8	2
Urinary tract infection	1	Nil	NA	NA	NA	Nil
Hypertension	1	Nil	NA	NA	NA	2
Appendicitis	2	Nil	NA	NA	NA	1
Intestinal worms	2	4	4	3	5	Nil
Cholera	Nil	Nil	1	Nil	Nil	Nil
Dysentery	2	2	4	4	2	3
Ear infections	1	Nil	1	Nil	Nil	Nil
Eye infections	Nil	Nil	NIL	1	Nil	1
Dental problems	1	Nil	1	Nil	Nil	Nil
Diabetes	Nil	1	NA	NA	NA	1
Total	100	100	100	100	100	100

*NA is used to refer to cases not being treated in the health facility and as such not available.
*Nil means that the disease being referred to was not found in the hundred cases selected.

establish the points of interaction and the significance of such interactions between different variables.

DISCUSSION

This study specifically relates toinfectious diseases that resulted from domestic use of contaminated water. Water-borne diseases were quite prevalent in Nigeria (Rooy 1987; Egboka 1989; Kinley 1989). Although the riverine people have more water in their environment than other communities living in the upland, most of the water available to them were pond, river, and stagnant lakes, which were

Table 4 : Prevalence of water-borne diseases among different communities using different sources of water

	Communities	Atani	Ogbakuba	Oroma Etiti	Nzam	Otuocha	Nneyi Umuleri	TOTAL
Amoebic Dysentery	Tanker water	-	1	-	-	2	2	51
	Borehole	1	-	1	2	1	1	
	Pump water	-	-	-	1	-	-	
	Rain water	1	2	2	1	1	1	
	Rivers/ponds	5	7	8	6	2	-	
	Spring water	-	-	-	-	-	3	
Poliomyelitis	Tanker water	-	-	-	-	-	-	3
	Borehole	-	-	-	-	-	-	
	Pump water	-	-	-	-	-	-	
	Rain water	-	-	-	-	-	-	
	Rivers/ponds	-	-	2	-	-	-	
	Spring water	-	-	-	-	-	1	
Hepatitis B	Tanker water	-	-	-	-	-	-	12
	Borehole	-	-	-	1	-	-	
	Pump water	-	-	-	-	-	-	
	Rain water	-	-	-	-	-	-	
	Rivers/ponds	2	3	2	3	1	-	
	Spring water	-	-	-	-	-	-	
Diarrhoea	Tanker water	1	2	-	-	2	4	110
	Borehole	-	-	6	6	1	3	
	Pump water	-	-	-	-	-	-	
	Rain water	4	3	4	7	2	6	
	Rivers/ponds	11	15	18	13	7	-	
	Spring water	-	-	-	-	-	5	
Cholera	Tanker water	-	-	-	-	-	-	7
	Borehole	-	-	-	-	-	-	
	Pump water	-	-	-	-	-	-	
	Rain water	-	-	1	-	-	-	
	Rivers/ponds	-	2	3	1	-	-	
	Spring water	-	-	-	-	-	-	
Typhoid	Tanker water	1	-	-	-	2	3	84
	Borehole	1	-	-	3	2	1	
	Pump water	-	-	-	-	-	-	
	Rain water	2	3	2	1	1	2	
	Rivers/ponds	6	11	8	12	7	-	
	Spring water	-	-	-	-	-	8	

Table 5 : Latin Square Design (A Three-Way ANOVA)

Source Of Variation	Degree of Freedom	S.S	M.S	V.r	F pr.
Community	5	17.356	3.471	1.77	0.123
Prevalence	5	303.301	60.660	31.02	<.001
Water	5	435.301	87.060	44.52	<.001
Comm. Prevalence	25	26.171	1.047	0.54	.964
Comm. Water	25	253.171	10.127	5.18	<.001
Prevalence. Water	25	330.227	13.209	6.75	<.001
Residual	125	244.468	1.956	-	-
TOTAL	**215**	**1609.995**	**-**	**-**	**-**

subject to contamination and as such are not suitable for consumption. The streams were used for household chores, including bathing (especially in the river), washing of plates, clothes and also served as sources of drinking water. The result of this was that it led to frequent outbreaks of water-borne diseases, often reaching epidemic levels.

Results of this study showed significant differences in the prevalence of water borne diseases. This was found to vary with the level of education of the household heads, being higher among those with lower education level. There was also a significant variation in the prevalence with regard to the sources of water used in the households. There were also differences in the prevalence of WBDs observed between the communities due to source of water available to them (Table 4).

The higher prevalence of WBDs amongst those in farming and fishing households could be explained by their poor living conditions and lifestyle. Farming and fishing tend to be done as a collective household activity, exposing them to the same risk conditions. The epidemiology is driven by the fact that they drink from the same source, using shared utensils. Moreover, the type of water commonly available to them in the farm was pond, river or streams, which were most often unfit for consumption.

The study indicated some social and economic factors that influence the prevalence of WBDs. In the riverine areas the people are predominantly farmers and fishermen. A good number engaged in petty trading on agricultural produce. They lived in typical rural settings, with very poor road networks most of which became impassable during rainy seasons. Also, the health facilities were inadequate, and most boreholes were broken down, with the few functional ones producing murky and undrinkable water. Due to widespread poverty, most of the people could not afford sanitary facilities, and this predisposed them to high risk of disease.

Due to low level of education and poor awareness of water related health issues, prevalence of WBDs were high. However, above and beyond all these internal factors, it is important to recognise that these communities are located and operate within a wider socio-economic and political system which they have no influence over, but which determines their living condition. Explaining the morbidity among the people require wider understanding of the social-economic and political forces. This is primarily why this study is predicated on Multifactoral Causation theory, Economic Deprivation theory, and Theory of Political Economy, all of which calls for a broader consideration of factors beyond the cultural beliefs and practices of the people to avoid 'blaming the victim' that characterises many socio-psychological theories such as the Health Belief Model. As Minkler et al. (1995)

noted, “the possible range of health statuses and health behaviours of individuals is limited by their location in the social and economic system. As a result, a significant change in the health behaviour of any group of individuals is seen to require altering the social and economic context within which they live”.

The problems of social inequality and marginalisation with all its ramifications were quite glaring in these communities. If the sanitary conditions in the communities are allowed to continue as they were, the occurrence of serious outbreaks of cholera and increased prevalence of typhoid, diarrhoea, dysentery, intestinal worms and other water related diseases would be inevitable.

In view of the above discussions, it could be argued that the political economy plays a primary role in the determination of the health status of the people. The differences in the prevalence of water borne diseases between groups within the communities, and between the communities are a function of the type of water available to them. While some of the communities had access to safe portable water, some did not. Our data revealed that the prevalence of WBDs was higher among households and communities with unsafe water source, compared with those that relied on safe portable water.

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