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Environmental Sanitation and Public Health Challenges in a Rapidly Growing City of the Third World: The Case of Domestic Waste and Diarrhoea Incidence in Greater Port Harcourt Metropolis, Nigeria

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Abstract: The study was instituted to identify diarrhoea risk factors in Port Harcourt, to measure their prevalence and apprehend the spatial distribution. Health problems linked to urban growth are current major concerns of developing countries. A close nexus exist between urbanization, sanitation and public Health. The conventional approach to environmental sanitation is characterised by a linear waste management system, where organic materials are often not only wasted, but also create pollution problems in receiving waters thereby posing health risks to the local populace. The cross-sectional epidemiological study that was carried out revealed a diarrheic prevalence of 14.4% (437 cases of diarrhoea on the 3,034 children examined). Also, among risk factors studied, household refuse management methods used by city dwellers were statistically associated to these diarrhoeas. Moreover, it happened that levels of diarrhoeal attacks varied consistently from one neighbourhood to another because of the discrepancy in urbanization process of the Port Harcourt metropolis.

Key words: Diarrhoea, domestic waste, health risk, handling, Port Harcourt, Public Health Sanitation

INTRODUCTION

Demographic and urban growth is one of the major challenges of the present and next decades. Historically, cities have been the driving forces in the field of economic and social development. The rapid urbanization of our planet dates back to the 19th century. In 1950, 29% of the world's population lived in the cities. This figure is currently estimated to 50% and it is projected that by 2030, this proportion will reach 61% (United Nations Population Fund, 2007). More intriguing than these global figures is the rapid and spectacular process within developing countries in general and Africa in particular.

Urbanization in Africa has been phenomenal and puzzling with a rapid shift from 15% in 1950 to about 41% urban currently. It is estimated that by 2030, the continent may attain 54% urban proportion (United Nations Population Fund, 2007). Not only are there more people living in cities but the cities themselves are becoming larger and more numerous. There are now 43 cities in Africa with populations of more than one million inhabitants, a figure that is expected to rise to almost 70 by 2015. This phenomenal growth has been qualified variously as "galloping" and "wild"(Sietchiping, 2003) to express not only the uncontrolled nature of urban growth, but also the ecological and sanitary consequences often associated with the growth and the implications they may have on human health and well-being.

Health and well-being concerns of inhabitants of developing societies are linked to or associated with the unplanned urban centres and poor sanitary habits among city dwellers. In Sub-Saharan Africa for instance, setting adequate socio-urban facilities at the disposal of all and everyone such as sanitation infrastructures is still a major a challenge to policy makers. In fact, because of slow economic growth, lack of sound development policies and an increasing number of small households, infrastructure development has been unable to cope up with the burgeoning need for shelter and services for the growing urban populations (Black and Fawcett, 2008). As a result, it has become a characteristic feature of most African cities to have an increasing number of overcrowded, informal settlements characterized by inadequate housing and poor provision of infrastructure such as water supplies, sanitation and waste management services (Mmom, 2003). Such is the case in Port Harcourt city where urbanization continues to figure as a puzzling issue in the sense that urban growth and the socio-sanitary consequences often associated are key elements of difficulties and health concerns the city currently faces. Hence, Local Government Authorities have failed to provide dwellers with infrastructure related to the

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management of domestic wastes i.e., collection, evacuation, processing, recycling or disposal of waste materials. The inability of the government to provide adequate solid waste management infrastructure has led to a disappointing situation in terms of domestic waste collection and disposal. Thus, the study was it as the objective of this study to identify diarrhoea risk factors in Port Harcourt, to measure their prevalence and apprehend the spatial distribution.

The problematic: Environmental sanitation comprises disposal and treatment of human excreta, solid waste and wastewater, control of disease vectors, and provision of washing facilities for personal and domestic hygiene. It aims at improving the quality of life of the individuals and contributing to social development. It has been defined by the Water Supply and Sanitation Collaborative Council as "Interventions to reduce people's exposure to disease by providing a clean environment in which to live, with measures to break the cycle of disease. Environmental sanitation comprises both a change in behaviour and facilities to form a hygienic environment.

However, it is a truism that a significant number of people worldwide lack access to adequate water, sanitation, drainage, and solid waste disposal services. The latest statistics reveal that 1.1 billion people still do not have access to safe drinking water, and 2.4 billion people do not have access to adequate sanitation (WHO/UNICEF/WSSCC, 2000 as cited by Kawachi and Berkman, 2003). Furthermore, in many urban areas of developing countries, less than 50% of the municipal solid wastes are collected and only an insignificant fraction is disposed of appropriately. This not only increases the rate of diseases and mortality, but also slows down the economic progress of hundreds of millions of people in developing countries. At the same time, the world's natural supply of freshwater is subject to increasing environmental and economic pressure.

Mmom (2003) noted that urban environmental condition is deplorable in many cities of the developing world. In fact, the problems associated with providing environmental sanitation services are central to the urbanisation phenomena. Urban waste is considered one of the most serious and pressing urban environmental problems. Most cities focus on simply getting rid of their waste 'out-of-sight' and fail to recognise its potential danger when not properly disposed, treated or managed.

Indeed, the accelerated and uncontrolled development urbanisation of the city of Port Harcourt has led to a proliferation of independent household refuse collection and disposal systems in the city's various neighbourhoods where these systems have a significant impact on the health of the various populations. In this regard, these disposal methods can no longer simply be considered amenities, but rather nuisances as health risks they impose on the city dwellers are rather significantly high. Cases of infectious diarrhoeas' identified in the city and whose prevalence was linked to mismanagement of household wastes is proof of this fact.

Thus, this study reports on an epidemiological cross-sectional study of household refuse management practices in Port Harcourt. First, a presentation of the spatial and methodological framework of the research provides a background and thereafter, the city's household refuse problem is then addressed. Finally, the authors present the household refuse and the diarrheic risks assumed simultaneously.

LITERATURE REVIEW

In developing countries, waste management often emerges as a problem that endangers human health and the environment. To make matters worse, waste management usually has a low priority on the political agenda of such countries, as they are struggling with other important issues such as hunger, health problems, water shortages and unemployment. In such situations, it is easy to understand why waste problems have a tendency to grow steadily. Fast-growing population, poverty of large numbers of urban households, and persistent deterioration of living conditions are some of the challenges facing cities of the developing world (McMichael *et al*., 2000). Several researches in the past have focused on investigating the cost-benefits of providing safe and convenient living conditions to households in the developing world, especially on housing conditions, notably on the relationship between water, sanitation and disease (Cairncross, 1996; UN-HABITAT, 2006). These researches observed that water supply, sanitation and health are closely related. It is also evident that each year, poor hygiene, mismanagement of liquid or solid waste, and lack of sanitation facilities contribute to the death of millions of the world's poorest people from preventable diseases (Cairncross, 1996). Considering the nexus Cleansing/sanitation and health, empirical evidence points to their close linkages. In particular, the relationship could be outlined as follows:

- As cities continue to grow, the management of solid waste is becoming a major environmental and public health concern in urban areas of many developing countries
- Lack of sanitation, unsafe disposal or storage of waste in/around houses and streets, and in undesignated containers may provide habitats for vectors of that cause various infectious diseases including amibiasis, typhoid fever and diarrhoeas (Ogawa, 2005)
- Uncontrolled landfills are a huge danger for the surrounding environment and are a health risk to the

population, causing contamination of the drinking water and soil (Fitzpatrick and Lagory, 2000)

- More than five million people die each year from diseases related to inadequate waste disposal systems (WHO, 2007)
- More than five million people die each year from diseases related to inadequate waste disposal systems (WHO, 2007); It is estimated that 1.8 million people die worldwide every year from diarrhoeal diseases (including cholera)

Amongst them, 90% are children under 5 mostly in developing societies. An estimated 88% of this burden is attributed to unsafe drinking water supply, inadequate sanitation, and poor hygiene (Tumwine *et al*., 2002). These risk factors do not evenly threaten urban districts as slums and informal settlements are more vulnerable to communicable diseases (Kawachi and Berkman, 2003). Despite the quantity of studies carried out, relatively little is known about the key contribution of waste management in Diarrhoeal incidence. In particular, households' refuse has rarely been examined. Among the regions of the world, Sub-Saharan Africa needs to fill the research gaps in the area, especially because the region has the fastest growing urban population and the majority of city dwellers have least access to urban equipments (Stren and Rodney, 1998). Under this backdrop, this study examines health outcomes in the context of rapid urban population growth without adequate accompanying services and infrastructure.

Our focus is on infectious diarrhoeas with particular reference to household refuse handling in Port Harcourt. From the Medical Geography point of view, urban and rural areas do not experience health hazards with an equal magnitude. This study argues that incidence and prevalence rate of diarrhoeal diseases in Port Harcourt vary according to household refuse handling methods. Household refuse and diarrhoeas are key concepts in this study. Household refuse here refers to domestic rubbish such as organic trashes. Thus, hazardous industrial, commercial, hospital, construction wastes are outside scope of this study. Following clinical signs, we have considered diarrhoea as the sudden and frequent occurrence of abundant and consistently abnormal watery or mucus stools more than three times a day and more than 300 g/stool (Gascon *et al*., 2000). The stools should be mixed with a phlegm-like substance or blood, and are associated with dysentery. To indicate its acute character, the episode must last for about 14 days.

Geographical description of the study area: The City of Port Harcourt, located in the Niger Delta of Nigeria in west Africa, under tropical latitudes slightly above the equator. More specifically, the city is situated between latitudes 3º47' and 3º56′ N and 11º10′ and 11º45′ E, approximately 250 km from the Atlantic coast (Fig. 1).

The city of Port Harcourt experiences a typical classic Equatorial Guinean climate: regular and abundant precipitations (3,030 mm/year), an average annual temperature of 23ºC, existence of two seasons i.e., 'dry'' seasons and rainy seasons. Like many sub Saharan African cities, Port Harcourt is currently experiencing very rapid urbanization. The city grew from a tiny population of 5,000 in 1914 to 911,700 in 1980 to 541,115 inhabitants in 2006, with an estimated annual growth rate of 3.5%.

However, this population growth has not been checked by the city planners and policy makers. Consequently local authorities have failed to provide neighbourhoods with adequate utilities, services and infrastructure. Therefore, city dwellers are living without a waste management system as they do not have adequate solid waste collection containers and well engineered landfill sites.

METHODOLOGY

Data presented herein is taken from the Port Harcourt city metropolis and from an interdisciplinary research program conducted by the authors, a Geographer and Medical practitioner.

Data collection: Target population: In order to minimize the risk of confusion between infectious diarrhoeas and the soft stools normally observed in infants, the study only targeted children within the age bracket of 6 months to 5 years. Hence, households with no children or whose children do not meet the age criterion were excluded for sampling purposes. In households in which there were several children within this age range, a random age table allowed for the selection of one single infant. This need for only one child per household stems from the study's specificity, which wanted to focus the analysis on a smaller scale, the household or lot.

Survey frame and type: The survey covered neighbourhoods and households in Port Harcourt city used a stratified random sampling procedure based on two stages to select targeted neighbourhoods. First, 5 neighbourhoods were selected from the high density areas of the city namely: Diobu (Mile 1,2,3), Borikiri, Ogbunuabali, Bundu and Abuloma. This was necessary to derive a spatial spread and sample seize sufficient for the scientific validation of the results.

In the second stage of the survey, we selected 3,034 households. Households were elected on the basis of having a child of less than 5 years of age as they appear to be more vulnerable to infectious diseases.

The survey was conducted by a team of students of the Department of Geography and Environmental Management and Biomedical Sciences of the University of Port Harcourt, Nigeria.

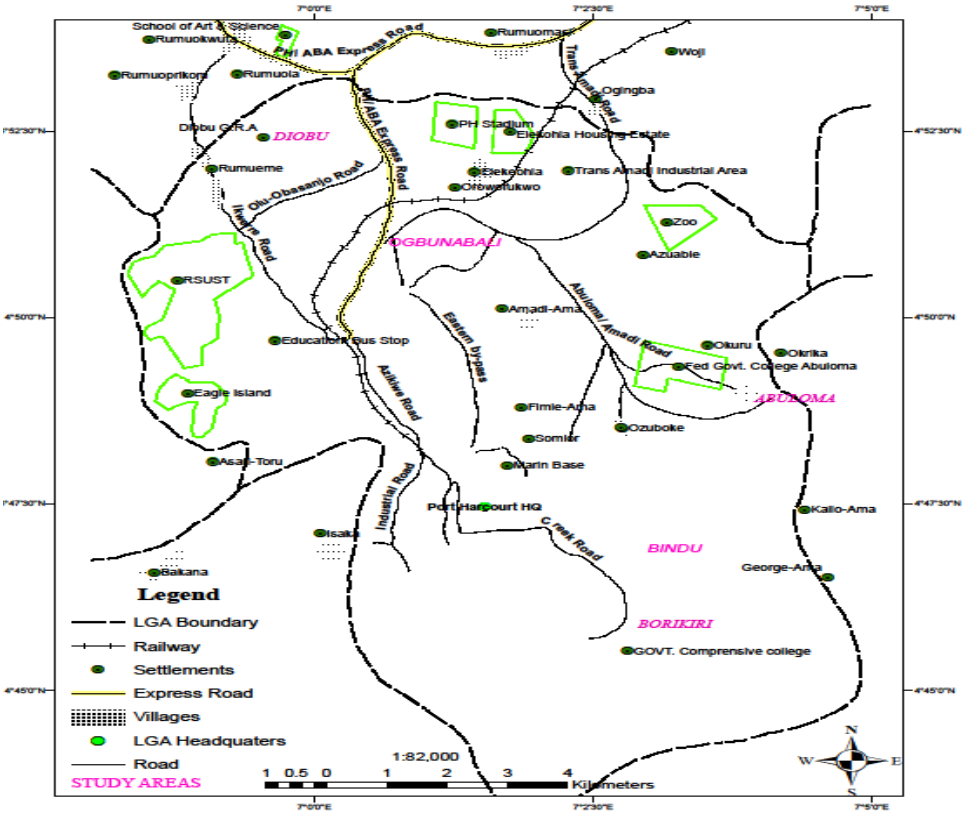

Fig. 1: Map of Greater Port Harcourt showing study area

The team visited the selected households to collect data using (i) direct participatory observation technique and (ii) structured questionnaires drawn up to respond to the two dimensions of this study, namely: The socio-demographic and environmental dimension: Covered by 63 questions and items, this aimed at (i) examining how refuse is handled, and (ii) at characterizing living conditions of households within the selected districts. The targeted children of less than five years in the sampled households were aimed to detect cases of diarrhoea in children within the selected households. Thus, when a case of diarrhoea was reported, a stool sample was taken and dispatched to the bacteriological, virological and parasitological laboratories of the University of Port Harcourt Teaching Hospital within the accepted requirements, for confirmation and identification of the causal germs. Each positive sample was linked with the household's socio-environmental data. These data files were spatially analyzed using the Geographical Information System method. Bivariate statistical analyses and tests of significance were carried out to verify level of association between the two variables i.e. diarrhoeas and household refuse management method(s).

Data collection period: One of the goals of this study was to pinpoint, if necessary, diarrhoeas seasonality within the city and thus evaluate its incidence. This is why two visits were planned: one during the rainy season and the other during the dry season. That said, budgetary cuts forced us to limit ourselves to only one visit. This visit was made during the months of April, May or June, which correspond to the city's rainy season.

Level of analysis: Several factors are involved in diarrhoeal prevalence in Port Harcourt. However, our objective is far from drawing a hierarchy of those factors. Rather, we intend to assess household refuse management practices on the city dweller's health. Thus, analysis hereby done is merely contextual i.e., 'household refuse management method' variable is analyzed without any consideration for the other variables, obviously linked as well but not part of the selected analysis theme. This attitude is set by problems linked to geographical explanations and by the diversity of scientific reasoning that geographers must nowadays take into account2. Indeed, given expansion of geography field, it is important within an explanation and demonstration process to isolate each risk factor so as to open out into a

Table 1: Waste storage methods used by Port Harcourt households and diarrhoeas

Storage method	Households distribution	%	Diarrhoea
No storage	108	3.59	15
In a closed container	295	9.77	55
Open container	2484	82.34	363
On the ground behind the house	130	4.3	17
Variable cover			
99.43 (3,017)			

$p \leq 0.005$

Table 2: Household refuse disposal methods in Port Harcourt and diarrhoeas

Method	Frequency	%	Diarrhoea incidence
House to house collection by private enterprise	879	29.03	133
In waste receptacles /collection centre	1,047	34.58	136
In the nearby bush /roadside	1,091	36.39	167
Variable cover			
99.4 (3,017)			

$p \leq 0.005$

system through the multivariate analysis. Hence, statistical measure used to assess the association level between variables (refuse collection/disposal methods and diarrhoeas) is the bi-variate analysis. It has been reinforced through the signification tests.

Analysis of storage method of waste in the study area as shown in Table 1 reveals storage of household wastes in open containers is the major and most popular storage method in the city of Port Harcourt. Data in Table 1 shows that 82.34% of the sampled households store their wastes in open containers similarly, there were about 363 cases of Diarrhoea recorded in these households. Whereas only 9.77% of the sampled households store their wastes in closed containers. Given the proximity of humans, contamination may occur especially given the fact that this waste remains inside the houses several days before being taken out for disposal. This is a permanent situation in numerous developing cities. The exposure of these wastes to bacteria actions would have led to the high incidence of diarrhoea in the sampled zones as the disease vectors infest food and drinking water of the people leading to diarrhoea incidence. This analysis corroborates with the findings of Mmom (2003) that most urban dwellers in developing countries do not have adequate storage facilities for their household wastes. Government has made several attempts at providing the neighbourhoods with waste storage containers at a minimum cost, but this effort was not sustained.

Analysis of Table 2 on disposal method of wastes in the households shows no sharp contrast among the identified disposal methods. However, a common practice in most neighbourhoods is the disposal by the roadside (36.39%) which constitutes not just visual chaos, but health risk as made manifest by the high incidence of diarrhoea in these neighbourhoods. Similarly, about 4.58% of the households dispose their wastes in waste receptacles closer to them. It was also discovered that some of the households engage the services of private waste collectors whom they pay on a monthly basis and this constitute 29% of the sampled households. However, there are still high cases of diarrhoea recorded in this neighbourhood. The findings of is in agreement the study by Nguendo *et al*. (2008) on Yaounde-Cameroun, where over 35% of the city's residents dispose their wastes along the road. Similarly, just as in the case of Greater Port Harcourt metropolis, many neighbourhoods have resulted to paying private waste collectors, but high cases of diarrhoea was equally recorded in Yaounde-Cameroun and this could be accounted for by the non-frequent collection or disposal of wastes in the areas.

Table 3: Frequency of disposal of waste

Frequency	No.	%
Daily	383	12.69
Twice/ week	1,606	53.23
Weekly	1,028	34.07

Table 3 shows on the analysis of frequency of disposal of waste shows 53.2% of the sampled households dispose of their waste twice per week, 34% dispose their wastes once per week, while 12.69% dispose theirs daily. This findings account for the prevalence of diarrhoea in the area as these wastes are exposed longer before they are disposed during which many microbial activities would have decomposed these wastes with diseases vectors carrying the pathogens around. In effect, a combined effect of exposure of wastes and infrequent disposal would have accounted for high incidence of diarrhoea as recorded and observed in the area. In effect, heaps of wastes is a common site in the study area despite the efforts combat these wastes. To that extent, it could be deduced that the growing urbanisation of the city is overpowering the carrying capacity of the existing waste management infrastructure.

CONCLUSION

Based on the analyses data from the study, it was established that a close nexus exist between sanitation and incidence of diarrhoea in the area. Similarly, household waste management is a major challenge in the cities of

developing countries. The rapid growth in the cities, rapid urbanization has made more complex the management of these wastes as the per capita waste generation has become higher than the available infrastructure. In other words, the unplanned urban growth in the area has over powered the carrying capacity of the existing waste management infrastructure in the city. Thus, most of the city's residents have resorted to engagement of private waste collectors, who are still unable to cope with the growing household waste. The resultant effect of this is the proliferation of heaps of wastes in the area which disease vectors feed on. The incidence of diarrhoea in the area was compounded by the humid nature of the environment which makes the wastes moist and conducive for breeding of disease vectors carrying pathogens.

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