COMBATING INFANT MORTALITY IN IBADAN NORTH LOCAL GOVERNMENT AREA, SOUTHWEST, NIGERIA: NEED FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Improve sanitation and health delivery has become an important issue because of it significant implication of quality of life in the society. This paper examines the effect of poor sanitation on infant mortality and effort of both government and individual at combating the menace. Demographic records of the Ibadan North LGA from 2006 to 2010 and perceptions of the people were obtained from Focused Group Discussions, with mothers of between 15 and 49 years at 6 purposively selected residential areas. Analysis of the demographic records shows that the study area, whose average total population was 306,795 as at 2006 national census recorded about 1431 infant deaths. The study indicates that poor sanitation attitude of the residents of the LGA were the reason of high infant mortality. The study therefore concludes that infant mortality can be reduced to the barest minimum if good sanitation is mandated for each household by the relevant local authorities.

Keywords: Infant Mortality, Improve Sanitation, Toilet Facilities, Environmental Characteristics, and Residential Area

INTRODUCTION

Infant mortality is one of the most sensitive and commonly used indicators of the socio-economic development and state of health of a particular population (Kpedekpo, 1982). It is defined as the risk for a live born child to die before its first birthday (Stroobant and Gourbin, 1995). Infant Mortality is often studied in two sub-categories according to specific age at death; neonatal mortality rate and post-natal mortality rate (Afolayan, 1989). Neo-natal mortality rate is the number of infant deaths less than four weeks (0-28 days) divided by total live birth while post natal mortality rate is the number of infant deaths from four weeks to one year divided by total live birth. Addition of the neo-natal and post-natal mortality rates is infant mortality rate (Kpedekpo, 1982; Afolayan, 1989).

Infants are in many ways the most vulnerable to adverse effects of environmental condition. They are vulnerable to adverse environmental conditions, degradation and socio-economic problems, including high morbidity, especially in situations where population increase cannot commensurate with improvement in the social, economic and technological development (Martine and Marshall, 2007; Akinbode et al, 2008; Eludoyin and Adelekan, 2013). The need to improve the conditions of the rural and urban population in Nigeria and many other developing countries has been emphasized for some time. Globally, UNEP (2002) revealed that about 250 million people lack good water for domestic use, and another 400 million live under poor sanitation condition. In Africa, it is estimated that over 70 % of the urban population lack good housing and sanitation facilities (Cairncross, 1989; Nunan and Satterthwaite, 2001; Moe and Rheingans, 2006).

This study aims at examining the influence of variation in housing and environmental factors such as liquid and solid waste disposal methods, sanitation practices, water supply and drainage system on Infant mortality in Nigeria. Specific objectives are to examine the spatial variation of cases of infant mortality at a local government area level in Nigeria, identify the main explanatory environmental factors of infant mortality and examine the perception of the local people on the relationship between environmental sanitation and infant mortality in Nigeria. The study achieves its objectives using a case study approach. Using this approach, one of the local government areas in the largest single city (Ibadan, Oyo State, Nigeria) in West Africa, was purposively selected. Ibadan North LGA is in the metropolitan Ibadan city, and it is characterized by a mixture of traditional, modern and shanty communities that may be best explained by the Hoyts' model of urban structure. Homer Hoyt believes that a big city can have more than just one CBD and may grow spirally from any of them rather than a single nucleus of growth as postulated by Burgess (Alonso, 1964). This typifies the city of Ibadan with many growth centres.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Medical studies (e.g. Kent, 1991) have attributed the immediate causes of death among young children to disease and malnutrition. However, studies based on regional development (e.g. Mutunga, 2004; Verdiell, 2003; Kalipeni, 1996; Bell, 1988; Farah and Preston, 1982) have shown that the condition of infant mortality varies with other factors, including certain socio-economic and environmental conditions. In geography, where spatial and temporal distribution of issues and phenomena are of interest, infant mortality could be seen as a factor of spatial differences of relevant environmental factors. Relevant environmental characteristics or factors as conceived here include the socioeconomic status of the people and sanitation issues which, as we shall see in this paper, may include type of house mothers live, number of occupants per room,

sources of water supply, methods of defecation and methods of solid waste disposal and how they contribute to infant mortality. These factors and their implications for infant mortality have been studied in Malawi and Kenya for instance (Mutunga, 2004; Kalipeni, 1996).

The World Bank Report on the Environment, WHO (2002) reported that leading mortality risks in high-mortality developing countries include unsafe water, sanitation and hygiene, and indoor smoke from solid fuels. In Nigeria, like most sub-Saharan African nations, significant number of infant mortality cases is rarely reported, probably due to poor education, cultural or religious miss-orientation of many of her population, poor technology or other social reasons (Gbadamosi, 2007). The poor recording system has also reflected on relatively inadequate programs and initiatives to curb infant mortality problems (WHO, 2002), as well as generally insufficient health plans and implementation by government and other policy makers. However, infant mortality in Nigeria has received a special attention from her government in the last few decades. This is because in Nigeria as well as other sub-Saharan African countries, infant mortality is still very high compared to what obtain in the first world countries. One main reason for this attention is that the knowledge of infant mortality is an essential component of population change as it is a crucial determinant of population structure and growth (Kpedekpo, 1982).

According to Population Reference Bureau (PRB, 2013), the current rate of infant mortality for both sexes in Nigeria is 74.36 deaths per 1,000 live births. Disaggregated according to sex, it is 79.44 deaths per 1,000 live births for males and 68.97 per 1,000 live births for female. Maternal mortality is also a very big challenge in Africa as estimates still show high figures. According to the Federal Office of Statistics (Nigeria, 2006), estimates of maternal mortality ratio is between 700 and 800 maternal deaths per 100,000 mothers. Maternal mortality estimates corresponding to age group 15-19 years appear highest as is generally the case (Gbadamosi, 2006; UN 1983). Usually, children born to these women have higher mortality rate than those of older women on account of biological factors and poor socio-economic conditions in Nigeria. Nigeria averagely loses 2,300 under five year old and 145 women of child-bearing age daily (Federal Ministry of Health, 2007). This suggests the country is significantly vulnerable.

Given the large sizes of many States in Nigeria, and many tropical countries such as India and some other parts of Africa, significant spatial differences occur in the distribution of infant mortality. However, this is rarely considered in reports as reflected in many of the government's policies. On the other hand, interventions targeted at the rural people help the bottom-up approach to development. The present study is therefore aimed at assessing the factors that are associated with infant mortality in a local government area in Nigeria and effort at combating them. A local government area is the smallest organized administrative unit (consisting of a number of Wards) in Nigeria (Ajagbe, 2004). The specific roles of the LG authority with respect to health care include frequent vaccination of infants against polio, malaria and other deadly infant diseases (Gbadamosi, 2007).

CONCEPT OF SUSTAINABILITY
Sustainability is an act which relate to conservation and maintenance of environmental resources which aim at profitability for the future generations (Botic etal, 1998). This means that there is a close relationship between sustainability and resource

characteristics and resource use. Meanwhile, population pressure can be assumed to be initially less than naturally resources and later increasing at an alarming rate than natural resources. Where population and natural resources are at equilibrium, a condition of sustainability is reached. Beyond this, a condition of environmental degradation is reached.

The concept sustainability has grown out of the need to reconcile conflicts between economic development and the conservation of the environment. In their 1987 report to the United Nations General Assembly titled "our common future" the Bruntland Commission defined sustainable development as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. The report also recognized that the environment is where we live and development is what we all do in attempting to improve our lot within that abode and as a result the two are inseparable. This principle of sustainable development is related to all aspects whether ecological, natural resources, economic, socio-cultural or political environment and has been adopted in several parts of the world as a development standard.

STUDY AREA

Ibadan North Local Government, in Oyo State, Nigeria that is used in this study is a typical example of local government areas in Nigeria to which this nature of research can be replicated. Ibadan North LGA was created on 27th September, 1991, and exists between longitude $3^0 53^1$ and $3^0 56^1$ East of Greenwich Meridian and latitude $7^0 23^1$ and $7^0 29^1$ North of Equator with a total land area of about 145.58km^2. Ibadan North LGA is bounded in the north by Akinyele LGA, in the south by Ibadan South-West LG, Ibadan South-East LGA and Oluyole Ona-Ara LGA and in the west by Ibadan North-West LGA, Ido LGA, Lagelu LGA and Egbeda LGA. The population of the LGA based on the latest 2006 national census is 306,795, with an annual growth rate of about 3.2%. Figure 1 below shows the estimate population of some of the major residential areas of Ibadan North as at 2010, while Figure 2 shows the land use areas of the LGA.

Figure 1   Population Estimates of Residential Land Use at Different Communities in Ibadan North LGA for 2010

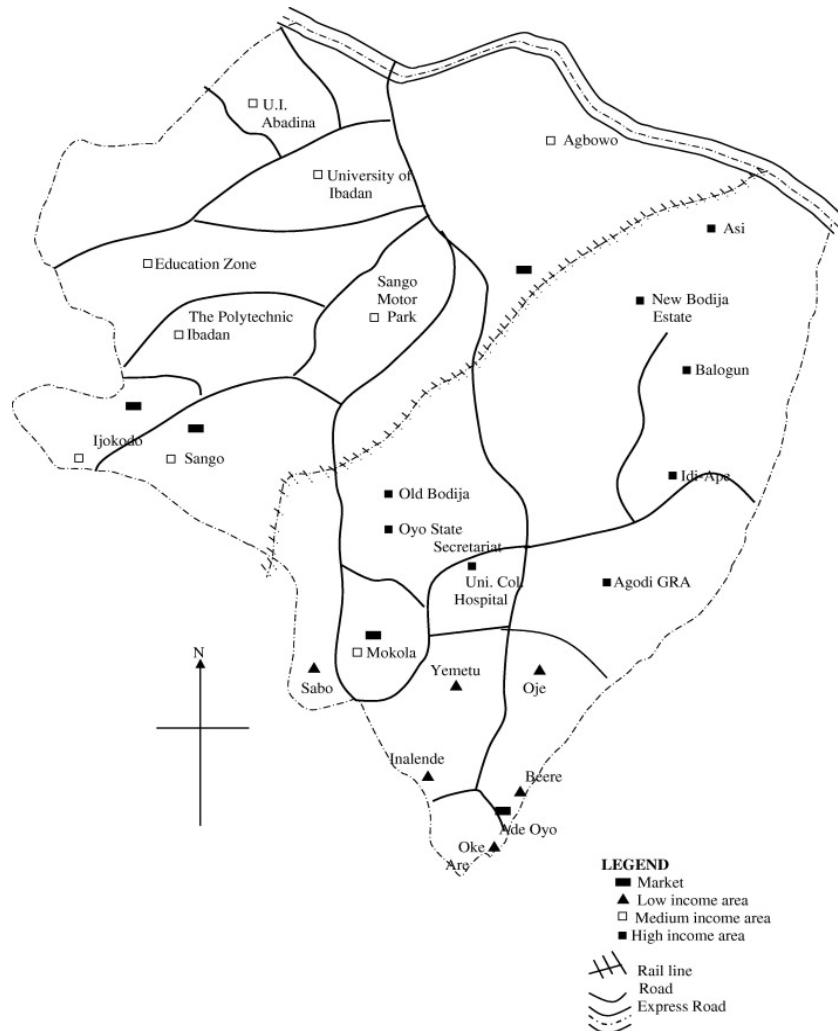Source: National Population Commission, 2011

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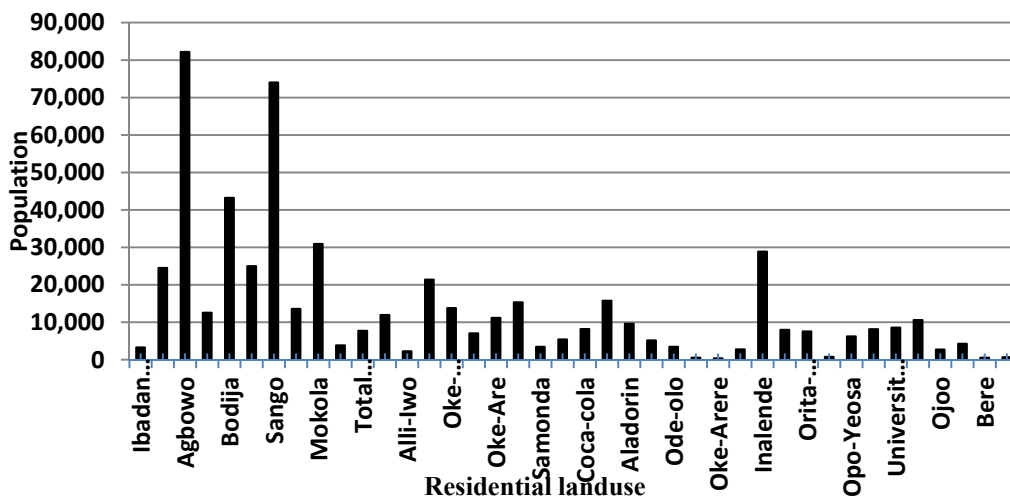
Figure 2: Land use of Ibadan North LGA showing the Residential Areas
Source: National Population Commission, 2011

MATERIALS AND METHODS

Data for this study were collected from the National Population Commission, Oyo State and Oyo State Ministry of Health. Other primary data, on the other hand, were gathered from Focused Group Discussions (FGDs) held in six different purposively selected residential areas in the Local Government-Yemetu and Oje; Agbowo and Sango; and Bodija and Ikolaba for the Low, Medium and High Class residential areas respectively as seen in Figure 3;
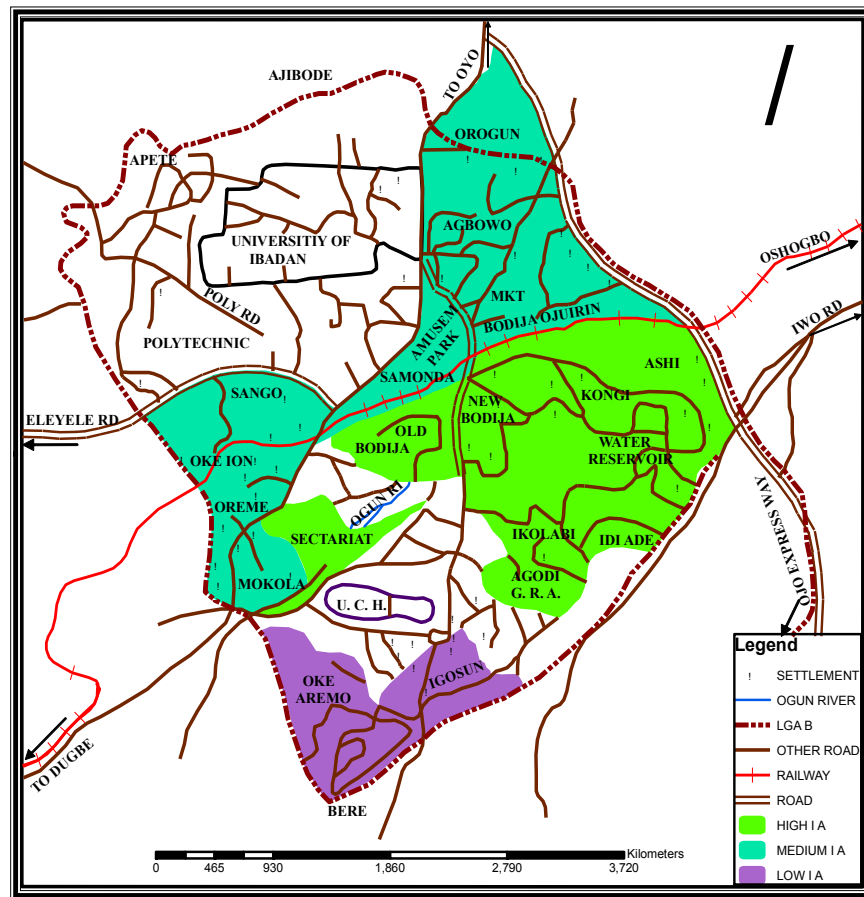
Figure 3   Categorization of Ibadan North According to Residential Characteristics

Source: Urban and Regional Planning Board, Oyo State, 2011

The Low Class Residential Areas (LCRA) is highly congested indigenous areas with poor quality housing. These areas are typical of old Ibadan. Most of the residents of these districts are either partially literate or total illiterates and they are in the lowest strata of socio-economic status among the three categories of the residential districts. They belong to the lowest income group earners in Ibadan North. Environmental quality is also very poor in these districts, with very narrow roads, unacceptable refuse sites and poor drainages. Examples include Yemetu, Oluwo village, Oke-Aremo, Oke-Are, Igosun, Oje, Itu-Taba, Alaadorin, Beere, etc.

The Medium Class Residential Areas (MCRA) is moderately congested areas with relatively fair housing quality. Residents here are economically better, with a bit higher literacy level than the residents of the LCRA. Also, the environment is a bit finer with better drainages and organized refuse sites. Examples include Mokola, Oremeji, Oke-Itunu, Sango, Agbowo, Samonda, Idi-Ape, Total Garden, Coca-Cola, Ijokodo, Apete, Sabo, etc.

The High Class Residential Areas (HCRA) is properly planned residential estates with good quality housing. This district comprises Government Residential Areas (GRA) and estates. The inhabitants are unarguably the highest income earners in Ibadan North and are top businessmen and professionals who belong to the upper class in the society. Examples include Agodi GRA, Bodija Estate, Kongi, Ashi and Ikolaba.

Furthermore, four residential areas from each of the three categorized residential districts in Ibadan North were purposively selected for focused group discussion as presented in Table 1 below;

Table 1 Research Study Areas

FGD Theme	Residential Districts	Study Areas
Environmental Characteristics of Women in Ibadan North	Low Class Residential Areas	1. Yemetu 2. Oke-Aremo 3. Oje 4. Beere
	Medium Class Residential Areas	1. Agbowo 2.Mokola 3.Sango 4.Orogun
	High Class Residential Areas	1.Bodija 2. Agodi 3. Ikolaba 4. Ashi

How variation in housing/environmental factors (such as defecation methods, refuse or solid waste disposal methods, environmental sanitation or quality, sources of water supply and drainage system at district level) cause variation in IM and affect the survival of infants from district to district was examined. Places selected in the study area represent the prevailing environmental conditions in each of the Low, Medium and High Class Residential Areas categorized. This was followed, as seen in Table 2 below, by a systematic selection of the 1st and 3rd residential areas in each of the residential districts and study areas stated above where the Focus Group Discussions (FGDs) were actually conducted to have a general overview of some environmental information that were not available in the secondary data from the NPC. Eight women of between 15-49 years age cohorts were selected in each group with whom discussions were held. This means a total of 48 women were interviewed in all. The locations of the Focus Group Discussions and the theme are presented in Table 2 below;

Table 2: Focus Group Discussion Details

FGD Theme	Residential Districts	Residential Areas for FGD
Environmental Characteristics of Women in Ibadan North	1.Low Class Residential Areas(LCRA)	1.Yemetu 2. Oje
	2.Medium Class Residential Areas(MCRA)	1. Agbowo 2. Sango
	3.High Class Residential Areas(HCRA)	1.Bodija 2.Ikolaba

Source: Authors' Field Work, 2011.

Some of the questions discussed during the FGDs are itemized below;

1. What are the most common types of houses mothers live in this area and the most common number of occupants per room?
2. What are the most common methods of solid waste disposal in this area?
3. What are the most common types of toilet facilities mothers use in this area?
4. What is/are the commonest source(s) of water used in this area? Etc.

As shown in Table 2 above, two locations each were systematically selected from the Low, Medium and High Class Residential Areas to make the information derived from the FGDs truly representative. In addition to the available data from the NPC, other housing/environmental characteristics discussed in the FGDs for a general overview by the researcher are; type of house occupy, number of occupants per room, toilet facilities or methods of defecation, sources of water supply, refuse disposal methods and drainage system.

In addition, an In-depth Interview (IDI) with a purposively selected experienced Pediatrician at University College Hospital, Ibadan also formed part of our primary data. Information derived from the professional includes the most common types of diseases causing infant morbidity and mortality in recent times and seasonal variation in infant mortality in Ibadan North. Responses and/ or findings from these FGDs were analyze the based on the stated objective of this study, variables use include housing/environmental characteristics such as drainage system, sources of water supply, method of defecation and refuse disposal methods in these areas. Results were presented using tables, charts, graphs, illustrations and percentage.


RESULTS

Environmental Determinants of Infant Mortality in Ibadan North

This section examines the environmental/housing characteristics of mothers of age cohort 15-49 years in Ibadan North, Nigeria with respect to the incidence of Infant Mortality. Environmental/housing characteristics such as type of house occupy and number of occupants per room, sources of water, defecation methods (toilet facilities) and refuse/solid waste disposal

methods were discussed. Other variable of interest discussed in this paper is the spatio-temporal variation of IM in the study area. Figures 4 and 5 below show the trends of total live births and registered infant deaths in Ibadan North LGA, Nigeria, from 2006-2010.

Figure 4: **Total Live Births in Ibadan North (2006-2010)**
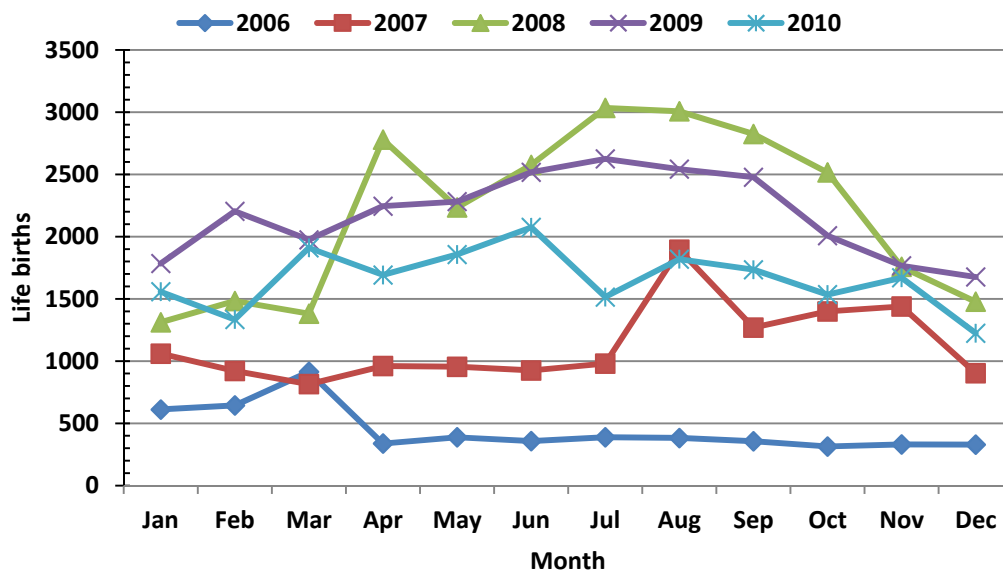
Source: NPC, Oyo State, 2011

Figure 5: Registered Deaths in Ibadan North (2006-2010)
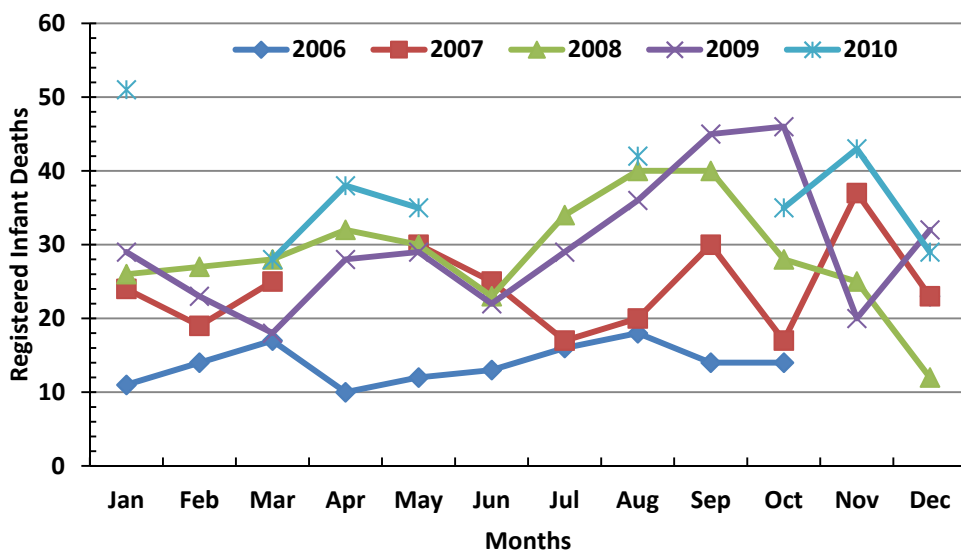
Source: NPC, Oyo State, 2011

Altogether, there were 90,491 live births and 1,431 registered infant deaths in Ibadan North from 2006 to 2010. The implication here is that there is at least an approximate 16 infant deaths per 1000 live births in this Local Government. Note that this varies from one district to the other as we shall see later. Besides, this may be the least one can come by in any part of the study area within the specified period (2006-2010) as it is usually far higher than this. Reluctance of mothers to report and record infant death(s) in this part of the world is perhaps the greatest limitation to this study.

Type of House, Number of Occupants per Room and Infant Mortality

There are clear variations to type and quality of houses mothers reside in Ibadan North and number of occupants per room also varies from one residential district to the other. **The Low Class Residential Areas (LCRA)** such as Yemetu and Oje are predominantly dominated by face to face traditional buildings which are tightly packed together with extremely poor ventilation, drainage and environmental sanitation. Also, there is an average of three persons per room in these areas based on the discussions held. **The Medium Class Residential Areas (MCRA)** such as Agbowo and Sango comprise a mixture of flats and face to face traditional buildings. Ventilation, drainage and environmental sanitation are averagely fair in these places and an average of two persons occupies a room here. The case of the **High Class Residential Areas (HCRA)**, especially Ikolaba is totally different as it comprises mixtures of modern blocks of flats, detached bungalows, mansions and duplexes with extremely aesthetic environment, good ventilation and very good drainage system. Also, an average of one person occupies a room here. Research has revealed that ventilation, drainage, environmental sanitation, type of house and number of occupants per room bring about variation in infant mortality from place to place. It is not amazing therefore while infant mortality is common in the Low Class Residential Areas of Ibadan North such as Oje and Yemetu and scarce in the High Class Residential Areas based on the discussions held. This means that with regard to these points of discussion, more infant deaths from figure 5 above came from the **LCRA** such as Oje, Yemetu, Oke-Aremo and Oke-Are.

Sources of Water Supply and Infant Mortality

Sources of water supply have been seen as an important determinant of IM. Though Ibadan North is largely urban but access to quality water supply varies from one residential district to the other. The quality differs as wells in the Low Class Residential Areas are not as treated as the ones in the Medium and High Class Residential Areas, while there are very few boreholes there. The Medium Class Residential Areas such as Sango and Agbowo also contain a mixture of wells and few boreholes owned by the few rich, but in the High Class Residential Areas such as Ikolaba, almost all households have a borehole. Besides, private water tankers do supply interested households with treated pipe-borne water. So, there is variation to the quality of water used in Ibadan North which partially explains why there is variation in infant mortality. Based on water supply therefore, more of infant deaths recorded in figure 5 above is likely to occur in the Low Class Residential Areas such as Oje, Yemetu, and Beere which are exposed to all kinds of various bad and untreated water bringing about diseases such as diarrhea and all kinds of malaria.

Methods of Defecation and Infant Mortality

This variable is also used as a proxy for environmental/housing characteristics. Findings reveal that this is one of the most problematic areas, not only in Ibadan North LG but in the entire Oyo State, Nigeria. Table 3 below shows the poor state of defecation methods and facilities in Oyo State.

Table 3   Methods of wastewater and solid waste treatment in Oyo State in 2006

Type of wastes	Treatment types	Facilities	Percentages
Wastewaters	Water Closet(WC)	236,376	18.9
	Pit Latrine	418,807	38.1
	Bucket/ Pan	28,505	2.3
	Shared Toilet Between Households	13,074	1
	Public Toilet	71,606	5.7
	Short Put	475,009	33.6
	Other	4,728	0.4
	Total	**1,248,15**	**100**
Solid wastes	Collected	126,955	10
	Buried	46883	4
	Approved Dumpsite	169,926	13
	Unapproved Dumpsite	538,871	44
	Burning	335,739	27
	Other	29,731	2
	Total	**1248105**	**100**

Source: Ministry of Health, Oyo State, 2006.

*Note: **'Short put'** as conceived in Table 3 means defecating in a rough sheet of paper or nylon after which it is thrown away, mostly in unwanted places, while **'Others'** may mean passing feaces along drainages or making use of dunghills which are highly unhygienic to infant health. This is very common in Oje, Beere and Yemetu.*

Table 3 above shows that two of the most unacceptable, archaic and unhygienic methods of defecation (short put and pit latrine) carry the largest percentages in Oyo State. Of the 1,248,105 households sampled for toilet facility in the State, unbelievably, 475,009 households (38.1%) and 418,807 households (33.6%) used pit latrines and short put respectively. Unfortunately, only 236,376 households (18.9%) and 71,606 households (5.7%) make use of water closet and public toilets which are modern toilet facilities. This means that about 71.7 per cent of households in Oyo State do not have good toilet facilities, leaving only 24.6 per cent with good toilet facilities.

Moreover, responses from the FGDs show that more than half of the buildings in the Low Class Residential Areas of Ibadan North such as Oje and Yemetu make use of pit toilets. It is a mixture of both pit toilets and water closet in the Medium Class Residential Areas such as Sango, while in the High Class Residential Areas, especially Ikolaba, no single house uses pit toilet. All residential and even commercial buildings in Ikolaba use functioning water closet. Based on this point therefore, the largest percentage of the infant deaths from figure 5 above would be from the Low Class Residential Areas such as Yemetu, Oje, Oke-Aremo and Beere.

Methods of Solid Waste Disposal and Infant Mortality

For sewage or solid waste disposal on the other hand, table 3 above shows the pitiable level of unacceptable methods of refuse disposal in Oyo State. 538,871 households (44%) of the 1,248,105 households sampled make use of unapproved dumpsite in Oyo State. This represents the largest of all methods of refuse dumping in the State. Adding insult to injury is the fact that 27 per cent (the second largest) of the households burn their solid waste products which is also unhygienic. Apart from the danger to mothers and infant health through inhaling carbon monoxide and blocking of visibility, it is also dangerous to the atmosphere as it contributes to the depletion of the ozone layer and subsequently global warming. Unfortunately, only 27 per cent of solid wastes(collected, burried and approved dumpsite) generated in 2006 were properly disposed, while over 71 per cent of these were not. As earlier stated, 'Others' from the table above may also mean dumping refuses in the drainages or on unapproved dunghills. Dumping in gutters, roads and other unapproved locations are the order of the day at Oje and Yemetu. But in Bodija, refuse is collected in designated points for the local government authority and other waste management agencies to move to where they will either be buried or recycled. This may be the reason why malaria incidences are very common at Oje and Yemetu because these drainages and other points where refuse is unacceptably thrown serve as breeding habitats for insect vectors, especially mosquitoes. Infant mortality from figure 5 above is therefore bound to be very common here as revealed from the discussions held with mothers.

Generally in Ibadan North Nigeria, there are variations in housing/environmental characteristics of residential districts as shown in table 4 below based on responses from the FGDs with mothers in Ibadan North. Please note that these responses are based on aggregate responses from mothers at all the venues of the FGDs.

Table 4 Variations in Housing/Environmental Characteristics of Residential Districts In Ibadan North

Residential Districts	Residential Areas	Defecation Methods	Sources of Water	Solid Waste Disposal Methods	Drainage	Sanitation
1.Low Class Residential Areas	1.Yemetu 2. Oje	Pit toilet Pit toilet	Well Well	Dumping/Burning Dumping/Burning	Very bad Very bad	Not neat Not neat
1. 2. Medium Class Residential Areas.	1.Agbowo 2. Sango	Water closet/pit toilet Water Closet/Pit toilet	Well/borehole Well	Dumping/collected Dumping/burning	Fair Fair	Fair Fair
3.High Class Residential Areas	1. Bodija 2.Ikolaba	Water Closet Water Closet	Pipe-borne/bore-hole Pipe-borne/bore-hole	Collected Collected	Very good Very good	Very neat Very neat

Source: Field Survey, 2011

Note: *'Dumping'* in table 4 above means dropping solid wastes in unapproved places, while *'Collected'* means packing them at designated points for onward movement to where they will either be recycled or buried.

Spatial Variation of Infant Mortality Ibadan North

IM varies in Ibadan North over space and time. Three words: *"very common", "common" and "not common"* were used to capture the level of the prevalence of infant mortality in the Low Class, Medium Class and High Class Residential Areas. Mothers in the Low Class Residential Areas of Ibadan North such as Oje and Yemetu confessed that infant mortality was **very common** in these areas. Mothers in the Medium Class Residential Areas said it was **common,** but those in the High Class Residential Areas such as Bodija and Ikolaba said it was **not common** in their areas. This means that a larger percentage of infant deaths from figure 5 above came from the Low Class and Medium Class Residential Areas. This variation could be due to different environmental/housing qualities such as methods of waste disposal and defecation methods.

Moreover, an experienced purposively selected Pediatrician from the University College Hospital (UCH) was asked whether there were variations in IM at different seasons of the year. The response shows that infant deaths are more common in Ibadan North during the rainy season than in the dry season. This reflected in figure 5 above as there were more infant deaths usually between July and December than other months throughout the period under review. No spectacular reason was given for this except the incessant rainfall which usually characterizes the rainy season leading to water-logging which served as breeding habitats for malaria-induced mosquitoes. This agrees with what Oketoki (2001) discovered a decade ago in Ilorin, North-central Nigeria. In addition, the Pediatrician explained that there were variations to diseases bringing about infant morbidity and mortality at different seasons of the year. Malaria and pneumonia are said to be the main infant killers in the rainy season. Multiplicity of mosquitoes as a result of various stagnant waters was offered as the reason for this. Mosquitoes reproduce faster in the rainy season because of the stagnant waters which usually serve as buffers. Measles, diarrhea and malnutrition on the other hand are said to be the main infant killers in Ibadan North in the dry season. Reasons given by this

experienced Paediatrician are heat and scarcity of foods usually characterizing this season. Mothers, especially those from low income homes do resort to eating junks and unbalanced diets in this period and are at times forced to feed their infants with them which they may not be old or mature enough to eat. This exactly typifies what Adewumi and Feyisetan (1984) found out in their empirical study of correlates of infant mortality in Ile Ife, Southwestern Nigeria about three decades ago.

DISCUSSION AND POLICY IMPLICATIONS

Findings from the variables analyzed above reveal that there are variations in IM in Ibadan North, Nigeria. For example, the revealed variation in the type of houses occupied and number of occupants per room in the districts brought about variation in IM. In the LCRAs with very poor ventilation, drainage, environmental sanitation, poor toilet facilities and poor attitude to waste management, IM is very common and vice versa. Variation in the quality of water available for the districts also causes variation in IM. The HCRAs with good portable water has less of the incidences of diarrhea, malaria and other water borne diseases than in the LCRAs with poor wells and unclean streams. This is very similar to what Mutunga **(2004)** discovered for urban Kenya, Nairobi to be specific, as variation in the quality of drinking water brings about variation of IM at district level. The available toilet facilities also differ in quality among the districts. The commonest methods of defecation in the LCRAs for instance are pit latrines, using of dunghills and short put (defecating in a rough sheet of paper or nylon after which it is thrown away, mostly in unwanted places). These old, archaic and rural ways of passing feces are totally unacceptable in this 21st century as they are highly unhygienic. This partly explains why IM is very common in this place, unlike the HCRA where there are modern toilet facilities in all houses. IM therefore varies at district level based on the method of defecation available to a particular district. More so, 44 per cent of wastes generated in Ibadan North are not properly disposed. Throwing solid wastes in dunghills, drainages and other unwanted places are still the order of the day in the LCRAs of Ibadan North for instance. These refuses create buffers for insect pests and other disease-causing micro-organisms that affect the survival chances of infants. This is why IM is very common in the LCRAs such Oje and Yemetu. This agrees with what Kalipeni **(1996)** finds out in Malawi as the northern part of the country with better environmental quality and infrastructural facilities records lower IM compare to the southern part with relatively poorer environmental facilities and quality.

One of the ways Nigerian Government can achieve vision 20:2020 (one of the top 20 leading economies by year 2020) is to pay a serious attention to her health system, especially the ones directed at her infants and their mothers. Nigeria's intervention in public health should give priority to maternal and infant health in order to reduce morbidity and mortality. The National Health Insurance Scheme (NHIS) should be made truly national by making all Nigerians of all social strata-literate or illiterate and of any level or cadre at work to be beneficiaries. More women and infants will have more access to quality health care when this is fully operational. This will invariably reduce infant mortality in the country, especially in Oyo State where cost is the main determinant of access to health care. Achieving this means the government has to give free medical treatments to expectant mothers and infant mothers. Although this is very effective in Lagos State, Ondo State, the FCT and most recently Imo State for instance. But this has to be extended to Oyo State if there will be any meaningful achievement at reducing IM in the State. This is because access to healthcare in Ibadan is cost-determined and as such, mothers in the Low Class Residential Areas have limited access because most of them are poor being predominantly farmers and petty traders. This perhaps may be the reason for high mortality in these areas as confessed by mothers living there.

Moreover, various lectures and seminars should be organized from time to time by the Oyo State Government to teach infant mothers and expectant mothers on environmental sanitation, personal hygiene and other factors that can improve their health and secure their infant survival chances. Also, different NGOs, other stakeholders and Private individuals should organize such seminars. For instance, the annual Late Professor Olutoye Ransome Kuti's (Nigeria's ex-Minster of Health) Memorial Lecture in Lagos has always centered on Maternal and Infant mortality and it is usually widely attended. Such lectures if organized in Oyo State from time to time will go a long way to inform infant mothers of safety precautions that will both help them to live more healthy lives and enhance the surviving chances of their infants. This will also be a good road-map towards achieving goal 5 of the Millennium Development Goals (MDGs) which centres on reducing maternal mortality by 75 per cent globally by 2015.

Lastly but most seriously, the government of Oyo State, Nigeria should give a keen attention to providing modern toilet facilities, good water supply and modern waste disposal facilities as these will help to reduce morbidity which invariably will reduce IM. This is so sure because areas with better provision of the aforementioned have lower IM than other areas with poor housing/environmental qualities. The government of Oyo State should try to make modern toilet facilities cheaper and affordable for a common man to have. The predominant use of pit latrine, dunghill and short put, especially in the Low Class Residential Areas of Ibadan North should be discouraged because of its unhygienic nature. Moreover, people should be discouraged from throwing solid wastes in the drainages as these serve as breeding places for mosquitoes and block the free flow of water and waste products. Serious laws should be enacted in the State against improper refuse disposal. The government should also make the use of modern toilet facilities compulsory for each household in Ibadan North while the use of pit latrine and dunghill should be totally prohibited as serious laws should be enacted where offenders against this law will be prosecuted and seriously dealt with if found guilty.

SUMMARY AND CONCLUSION

Through the use of FGDs with which results were analyzed the data from NPC and OSMH, this study has attempted to explain the spatial variation of IM in Ibadan North, Nigeria at district level and efforts at combating it. The results indicate that IM is strongly associated with a number of housing/environmental variables. Sources of water supply, methods of defecation, solid waste disposal methods, sources of water supply, type of house and number of occupants per room are among the most significant housing/environmental variables examined. For example, districts with high or better housing/environmental qualities such as the High Class Residential Areas have lower rates of IM and vice versa. As a result, there are distinct regional variations in IM due to uneven level of the quality of environmental sanitation, source of water, methods of defecation, solid waste disposal, type of house and number of occupants per room. Spatio-temporal variations in infant mortality incidence in Ibadan North were also examined. Infant mortality incidence was revealed to be very common in the Low Class Residential Areas such as Oje and Yemetu and not common in the High Class Residential Areas such as Bodija and Ikolaba. Generally however, poor methods of defecation and sewage disposal were found to be very significant factors contributing to infant mortality in Ibadan North, Nigeria.

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