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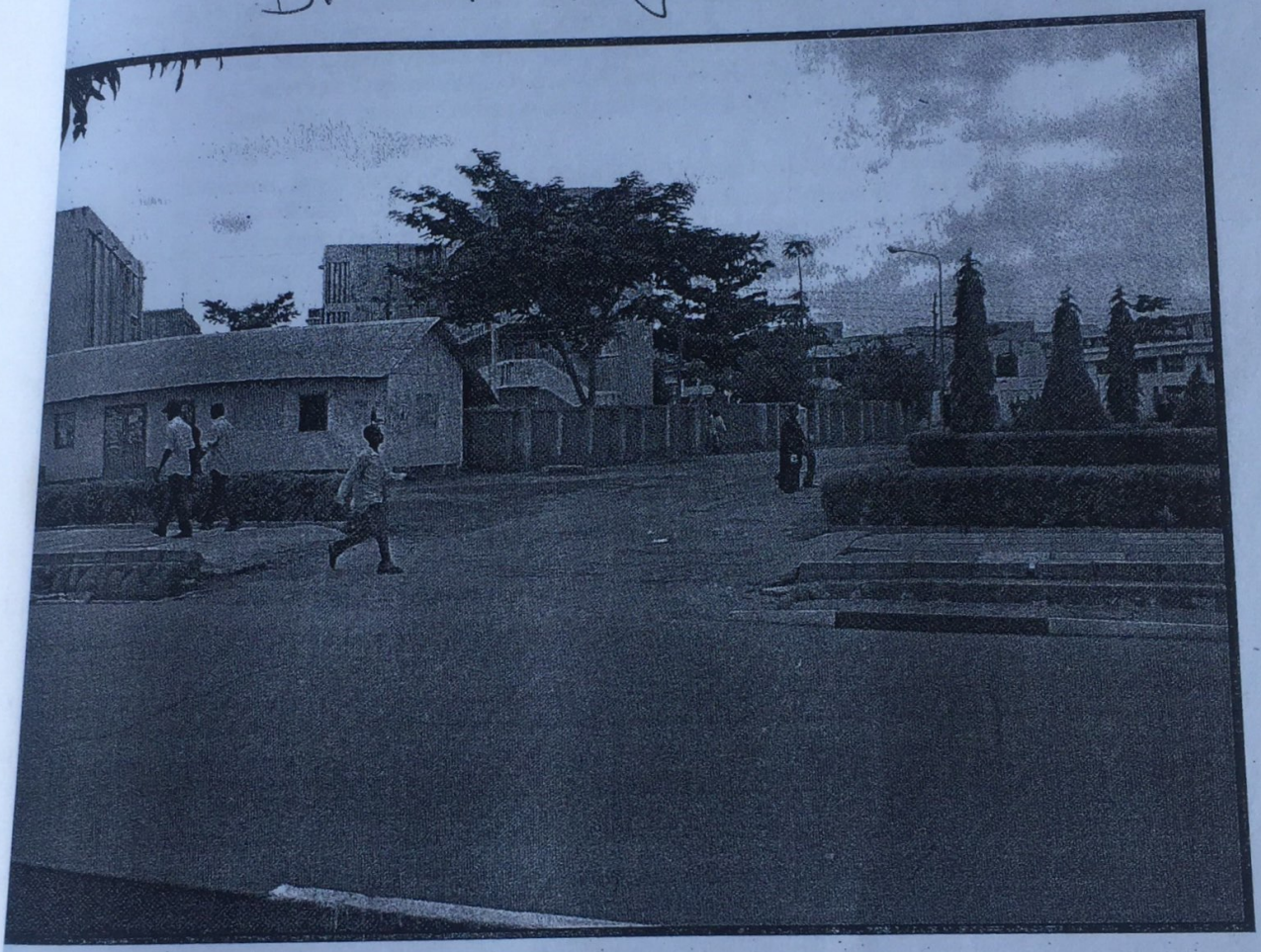

FACULTY OF ENVIRONMENTAL DESIGN
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# ANALYSIS OF SPATIAL VARIATIONS IN THE OCCURENCE OF HOUSING ENVIRONMENT- RELATED DISEASES IN MINNA, NIGERIA

BABA, J. M and JINADU, A. M.

**Abstract**

*The problem of ill health arising from poor housing environment is a source of global concern. In Nigeria and many other developing countries, environmental health problems occur against the background of limited access to health facilities and dwindling governmental health expenditures. Against this backdrop, this study examined the relationships between the quality of urban housing environment and disease occurrence. The study uses over 4,000 clinical cases collected from eleven hospitals in Minna and 600 questionnaires, which collected information on the socio-economic characteristics of residents and 19 quality variables. Analysis of data shows a positive correlation housing quality and the rate of disease occurrence in the 12 residential neighbourhoods used. The study therefore concluded with recommendations on such community based strategies as environmental education, sanitation and housing improvement programmes to enhance the health status of the residents.*

## Introduction

Urbanization, an inevitable global phenomenon, has brought about both negative and positive outcomes. As a blessing, it created, for man, the city- a melting pot of cultures that offers a lot of opportunities and serves as an engine of growth. As a problem, however, it bequeathed onto the same city, an array of problems. Today, the global community is faced with the reality of such problems of urbanization as the mushrooming and growth of slums and squatter settlements which are characterized by poverty, insecurity, accumulated waste, lack of basic sanitary facilities, overcrowding, general poor condition of living and poor health.

Amongst others, the problem of ill health arising from poor housing environment is a major source of global concern. According to UNEP (1982) environmental factors play a major role in the transmission of communicable diseases, which accounted for a large proportion of illness and death in developing countries. Statistics from different parts of the world express the magnitude of the problem. The account of UNEP, for instance, reveals that six environment-related diseases accounted for the death of some five million children in developing countries in the 1972-1982 decade. In specific terms, the UNFPA (1996) recognizes that malaria is the fifth most common cause of ill health in the world, causing an estimated 2 million deaths per year while respiratory infections take the lives of 4-5 million infants and children per year. The highest incidence of these diseases is said to be in the poorest, most crowded areas. Thus an estimated 10,000 people die every day as a result of accidents or diseases caused by inadequate shelter or lack of access to such basic services as clean water and sanitary excreta disposal (WHO, 1987).

Environmental health problems in Nigeria and most other developing countries occur against the background of limited access to health facilities and dwindling government health expenditures. According to the 1994 World Bank's review of social sector strategy pin Nigeria, only 35% of the population had access to modern health services even though there had been increased investment in health facilities and personnel. The FOS (1996) also noted that, except for 1990, the share of the Federal Government's health expenditures has, since 1987, been lower than that of 1986. For instance, the expenditure fell from 2.4 million Naira

in 1986 to 1.8 million Naira in 1989 and to 1.1 million Naira in 1992. Consequently, the health status of the citizens is poor and improvement in health care in Nigeria is adjudged to occur at considerably slower pace relative to other developing countries (World Bank, 1994).

The problems of limited access and dwindling health expenditures have been compounded by the greater emphasis placed on curative medicine by successive governments. Given the observed low performance of the health sector, there is the need for a shift of emphasis to a more cost saving and sustainable preventive healthcare strategy. To achieve this will require not only the understanding of the health-environment relationships, but also the institution of a sustainable environmental health policy and strategies which are supportive of the wellbeing of the entire citizenry. This study therefore examines the health-environment relationships in Minna with a view to understanding the underlying environmental factors and to propose housing/environment improvement strategies so as to reduce the level of environment-induced diseases in the area.

**Issues on Health - Environment Relationship**

The health status of man is influenced by a complex set of relationships as understood within the context of the disease ecological concept. Basically, studies of disease etiology have identified four major causes of disease to include genetic, environmental, attitudinal and life -style factors. Hence any person's state of health is the result of interactions between their human biology (including their genetic inheritance), lifestyle, the health care system and the environment (UNCHS, 1996).

Although the major factors identified interact and are important in the production of diseases, the environment had always played a major role and it has been of particular interest to medical geographers and environmental health planners. The importance of environmental factors in the consideration of urban health is therefore well emphasized by Fiona Nunan and David Satterthwaite (1999) who asserted that; "infectious and parasitic diseases are 'environmental' because they are transmitted through the environmental media - air, water, soil, food - or through insect or animal vectors."

Studies carried out in different parts of the world have established the basic fact that the quality of the living environment determines, to a large extent, the health status of the residents. In Nigeria, studies that considered the health implications of poor environment include that of Fashuyi (1988) who in his study of school children in urban slum of Lagos, found that 94 % of the children were infected with helminthes ova compared with the infection prevalence of 51.8% in pupils in a rural school. The author associated the difference with population concentration in slum, low level of hygiene, poor drainage and absence of facilities. Also, Jinadu (2000) in his study of the health implications of students' housing condition at the Federal Polytechnic, Bida, found a significant relationship between the hostel condition and the rate of disease occurrence as the rate decreases with hostel expansion and improvement in the school.

While the work of Iyun (1983) identified the low income, deteriorated core areas of Ibadan, Nigeria as a source of clinical cases, Ejioku (1994), in her study of intra-urban health differentials in the same city, discovered variations in health condition as measured by disease type and frequency. Analysis of both questionnaires and clinical data shows that low-income households in high-density residential areas were prone to diseases like diarrhoea, cholera, tuberculosis and typhoid while those in low-density areas complained mostly of malaria. In line with the health differentials found in Ibadan by the earlier authors, Obabiyi (1995) confirmed that high incidences of diseases are experienced by residents of substandard housing most especially those without planning approval and proved the hypothesis that housing condition and health status of residents in three different districts- high, medium and

ow, differ. Amongst others, the factors responsible for poor health status of residents of low quality areas were recognized by Osoko (2000) to include; non regular cleaning of drains and efuse, exposure to disease vectors, poor hygiene behaviour, contaminated water and overgrown bushes.

The health burden associated with poor housing quality and lack of basic services is immense. Governments across the world are becoming aware of the cost implications of this and few studies have attempted to estimate the monetary losses thereof. For instance, a case study of low-income, poor quality settlement in Khulna, Bangladesh, documented the loss of income and nutritional problems in households where the main income earner was too sick to work (Pryer Jane, 1993). The study found that low-income households not only lost more work days to illness or injury and more income than the richer households, but also a much higher proportion of their income. Also, the cholera epidemic in Peru which affected over 320,000 persons and caused 2,600 deaths was estimated to result in $1 billion losses from reduced agricultural and fisheries export as well as tourism, an amount less than the capital needed to radically improve water and sanitation in Peru's settlement (UNCHS, 1996).

The foregoing review of literature reveals that a causal relationship exists between environmental quality and health of residents. Although the health burden of poor environment is severe and its cost implications are immense, both international and local efforts meant to address the issues have not yielded significant results. It is on this basis that this study examines the nature of the relationships between environmental quality and health in Minna, with a view to proposing a more decentralized, neighbourhood-based environmental management action plan, which will focus on developing local capacities to improve the health of the residents.

**Research Tool and Methods**

The study utilizes both secondary clinical data and primary information collected from a household survey. The clinical data (7,471 cases) were collected from the records of eleven out of the sixteen selected health establishments located in different parts of Minna. The primary data were collected with the aid of a structured questionnaire which was used to collect data on socio-economic characteristics of households, housing/neighborhood quality, disease types and causal factors as well as the residents' perception on the relationships between housing environment quality and disease occurrence.

The administration of questionnaire followed a stratified sampling method. First, the major residential districts were categorized into twelve zones consisting of low, medium and high-density areas (table 1). Line sampling (of roads) was carried out in each zone to select some streets along which houses were systematically sampled. 1.5% of the 41, 203 estimated households were sampled for the study. Thus, a total of 618 questionnaires were distributed in the twelve zones out of which 600 questionnaires were properly completed and returned for analysis.

**able 1: Residential Zones Used in the Study**

| Zones | Description | Density Class |
|---|---|---|
| Zone 1: Bosso I | This consists of areas stretching, from Tudun Fulani to Niger Livestock/ Vertinary Clinic- including Anguwan Biri, Area Court, Jikpan and Mypa areas. | High |
| Zone 2: Bosso II | This include Bosso estate, Bosso Low cost estate areas east of Okada road in Dutsen Kura Hausa | Medium |
| Zone 3: GRA | Areas west of the central road Stretching from Bahogo roundabout to Government Secondary Schoo in including GRA and Zarumai quarters. | Low |
| Zone 4: Minna East Central | Areas east of the central road from Government Secondary School to Mobil Roundabout. This includes Sabon Gari, Emirs Palace, Kuta Road, Angwan Daji/ Doko Pharmacy area. | High |
| Zone 5: Minna West Central | Areas left of the central road from Government Secondary School to Mobil roundabout including Limawa, Keteren Gwari, Kwangila, Old airport road areas. | High |
| Zone 6: Tunga I | Areas east of the main road from Shiroro roundabout to Abdul Salami Park including Tunga market and Top Medical areas. | Medium |
| Zone 7: Tunga II | Areas west of main road from Shiroro roundabout including Shiroro, Bay Clinic and NITECO roads, Kolawole area, Tunga Low cost up to western by-pass. | Medium |
| Zone 8: Minna Southwest Peripheral | This includes Kpakungu, Barikin Sale and Sauka Kahuta. | High |
| Zone 9: Minna Northwest Peripheral | This includes Dutsen Kura Hausa, Dutsen Kura Gwari and Gbaiko. | High |
| Zone 10: Maitunbi | This includes Sayako, Paida and Maitunbi. | High |
| Zone 11: F-Layout | Areas east of the main road from Bahago to Government Secondary School including Farin Doki, F- Layout and Mustapha junction area. | Medium |
| Zone 12: 123 Quarters | This includes 123 quarters and Oduoye quarters. | Medium |

Source: Fieldwork, November, 2004.

Analysis of data was done using the SPSS package. First, the total cases (diseases) recorded were grouped into infectious diseases, non-infectious diseases and symptoms. The non-infectious diseases are those that have no relationship with the residents' housing environmental condition while the symptoms are the non-specific cases or mere symptoms of un-diagnosed diseases. These categories of cases were discarded and the analysis focused on the infectious diseases, which have relationship with the condition of residents' housing environment. The infectious diseases were further categorized into vector (those spread by vectors), feaco-oral (those associated with poor hygiene and poor water supply), droplet (those spread through the respiratory tract as port of entry) and contact (those contacted through sexual and skin-to-skin contact) for ease of analysis (see table 2).

ble 2: Categories of Infectious Diseases

| ntact | Droplet | Feaco-oral | Vector |
|---|---|---|---|
| tanus<br>ngworm<br>hicken pox<br>abies<br>rinary Tract Infection<br>enital Tract Infection<br>andidiasis<br>lumps<br>yphilis<br>histosomiasis<br>HIV Infection<br>Tinea Cipitis<br>Candidal Dematitis<br>Epidycho Orchitis<br>Cellutite | Whooping Cough<br>Measles<br>Tuberculosis<br>Respiratory(Non Specific)<br>Tract Infection<br>Otitis Media<br>Pneumonia<br>C. S Meningitis<br>Pharyngitis | Acute Diarrhea<br>Typhoid Fever<br>Amoebic Dysentery<br>Helminthiasis/Worm<br>Cholera<br>Gastroenteritis<br>Guinea worm | Malaria<br>Yellow Fever<br>Rabies<br>Typanosomiasis |

Source: Fieldwork, November; 2004.

The spatial variation in quality level was achieved through the rating of 23 quality variables, which fall into the general categories of building condition, level and quality of facilities, accessibility and general neighbourhood environmental condition. These variables were scored (e.g. 0 = no score and 5 = highest score) and the scores were summed up to derive the mean quality rating per zone. The overall average and standard deviation of the zonal means were further used to categorize the residential districts into three quality classes. Finally, the frequency of disease occurrence (using the clinical data) and the quality scores for the zones were used in the regression analysis to establish the relationship between the quality of housing environment and the rate of disease occurrence.

Two research hypotheses are set up to verify the relationship between housing quality and disease occurrence. The first hypothesis ($H_o$) states that there is no significant variation in the rate of occurrence of housing environment-related diseases across the different neighbourhoods in Minna. The second $H_o$ states that there is no significant relationship between the quality of housing environment and the rate of disease occurrence.

**Data Analysis and Findings**

This analysis uses information from the 600 copies of the questionnaire administered and 4,607 infectious clinical cases which were recorded in the study area between 1999 and the year 2000. The analysis is divided into three sections consisting of urban quality rating, spatial pattern of diseases as well as the analysis of disease-environment relationships.

**Analysis of Spatial Pattern of Urban Quality**

The spatial pattern of urban quality was determined using the mean scores of housing quality rating as described under research methods in section four of this report. Analysis of the scores for the 23 quality variables used revealed inter-zonal differences in urban quality. As shown in table 3, Bosso II, GRA and 123/ Oduoye residential districts score above seventy; Tunga I& II and F-layout scored slightly below seventy while Bosso I, Minna East Central, Minna West Central, Minna S/W peripheral, Minna N/W Peripheral and Maitumbi scored below sixty. The overall mean and standard deviation calculated for the mean scores in

able 3 are 64.26 and 9.51 respectively. These figures were used in demarcating the oundaries of the three quality classes viz:

(i) below 64.26 = low quality.
(ii) 64.26 - 73.77 = medium quality
(iii) above 73.77 = high quality.

Thus, Bosso I, Minna Central and peripheral areas and Maitumbi (See table 1 for description of zones) that scored below the mean (64.26) are classified as low quality zones. In the same vein, Tunga I & II and F- Layout zones which fall within the class of 9.51 standard deviation above the mean (64.26 - 73.77) are classified as medium quality zones while Bosso II, GRA and 123/Oduoye qualify as high quality zones (table 3).

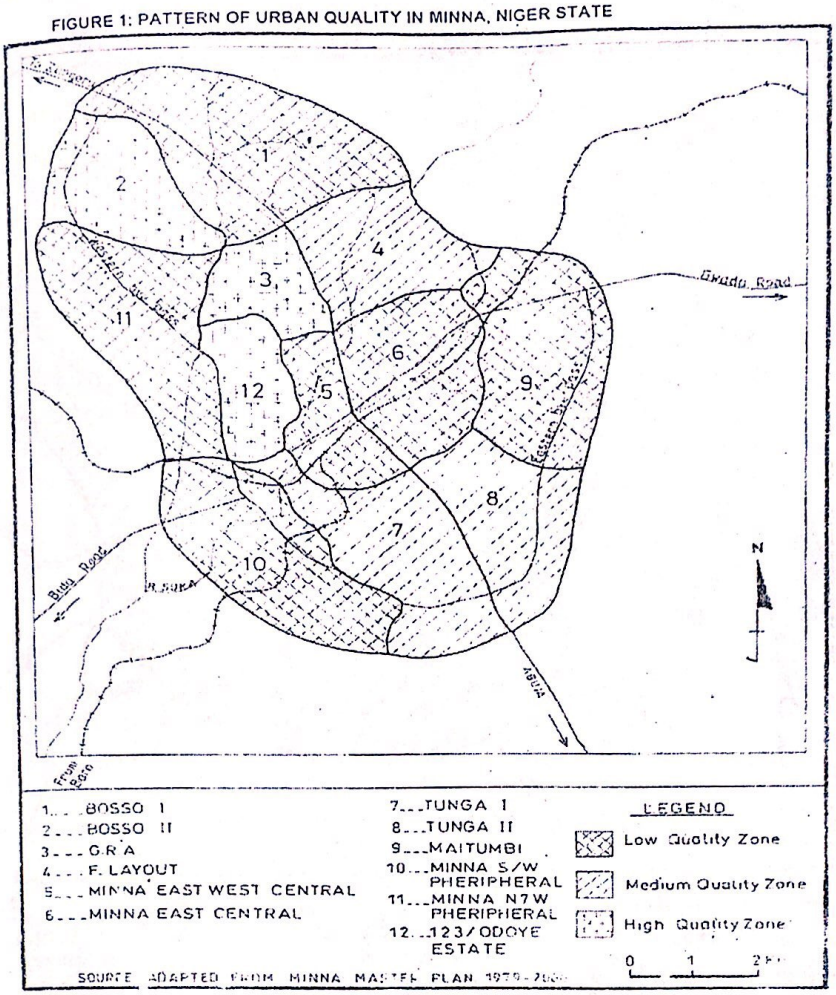
**Table 3: Residential Quality Score and Classification in Minna**

| Residential Zone | Density class | Mean Score | % of houses above mean score | Quality class and description |
|---|---|---|---|---|
| Bosso I | *High* | *56.37* | *34.7* | *Low: deteriorated housing environment.* |
| Bosso II | *Medium* | *77.34* | *89.4* | *High: good housing environment.* |
| GRA | *Low* | *74.67* | *82.5* | *High: good housing environment.* |
| Minna East Central | *High* | *57.35* | *31.7* | *Low: deteriorated housing environment.* |
| Minna West Central | *High* | *57.55* | *38.7* | *Low: deteriorated housing environment.* |
| Tunga I | *Medium* | *69.21* | *62.8* | *Medium: fair housing environment.* |
| Tunga II | *Medium* | *69.60* | *62.3* | *Medium: fair housing environment.* |
| Minna S/W Peripheral | *High* | *51.67* | *15.2* | *Low: deteriorated housing environment.* |
| Minna N/W Peripheral | *High* | *52.88* | *32.7* | *Low: deteriorated housing environment.* |
| Maitumbi | *High* | *58.29* | *38.8* | *Low: deteriorated housing environment.* |
| F- Layout | *Medium* | *69.46* | *72.9* | *Medium: fair housing environment.* |
| 123/ Oduoye Quarters | *Medium* | *76.75* | *91.7* | *High: good housing environment.* |

Source: Authors' Fieldwork, 2004.

Generally, the high quality zones are characterized by good housing environment and better facilities, the medium quality areas have appreciable number of good housing and average level of facilities while the low quality zones are characterized by deteriorating and deteriorated housing, poor facilities and low environmental sanitation. However, survey findings show that the percentage of houses above the mean score (houses which could be regarded as good) varies according to zonal quality. This is an indication that there are elements of the good and the bad houses in each of the zones as no zone has 100% good housing or bad housing (See table 3). It is thus the overall quality scores that qualify individual zones for the class they are found. The spatial pattern of urban quality in the entire city is shown in figure 1.

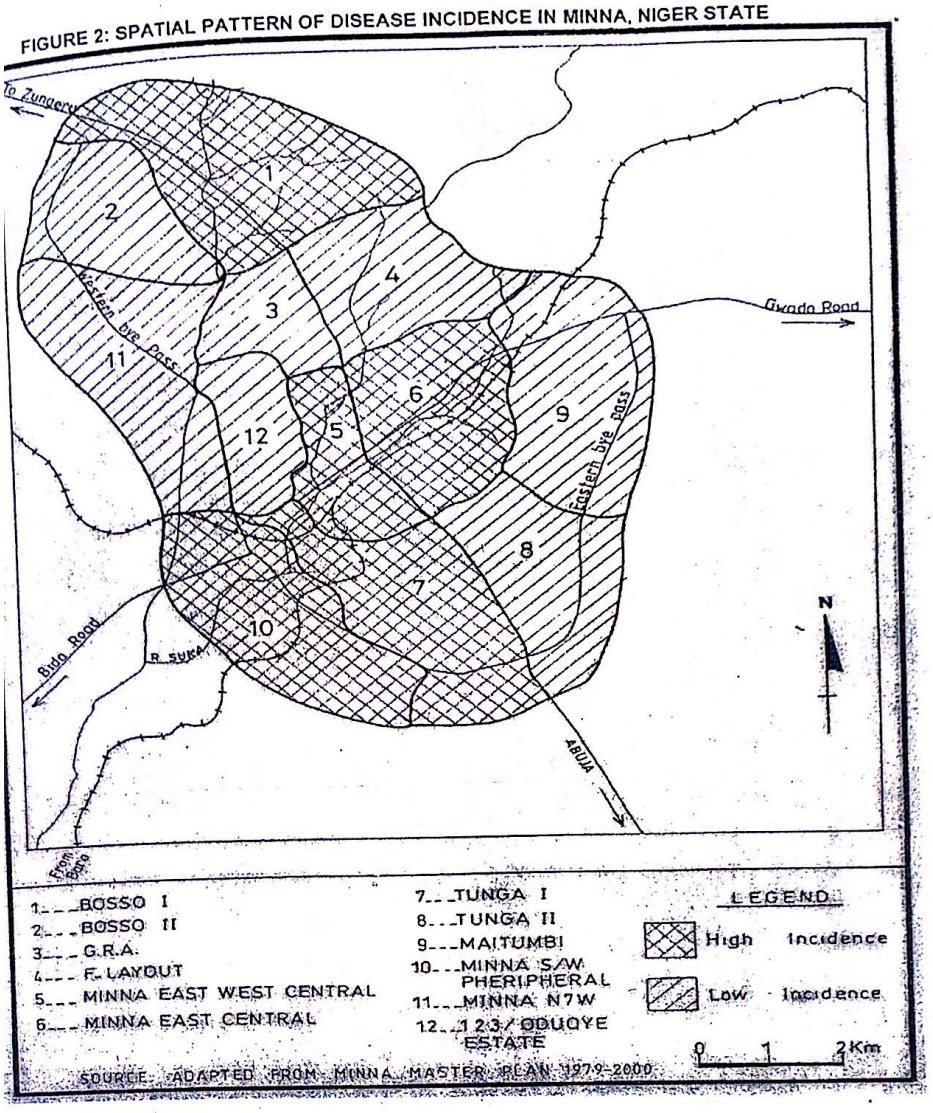
FIGURE 1: PATTERN OF URBAN QUALITY IN MINNA, NIGER STATE




**patial Distribution of Diseases in Minna**

Analysis of the spatial pattern of incidences of the diseases shows that the high-ensity areas such as Bosso I (712), Minna central (1,311), and Minna southwest peripheral 992) recorded relatively high incidence of diseases. On the other hand the low and medium lensity areas such as GRA (180), Bosso II (258), Tunga II (211), F-layout (65) and 23/Oduoye quarters (30) recorded relatively lower incidence of diseases (Table 4). This hows that the low quality zones have higher incidence of diseases while the medium and high quality areas recorded lower incidence of diseases. Thus the emerging pattern suggests a relationship between environmental quality and the rate of lisease occurrence. Figure 2 shows the pattern of disease occurrence across the zones.

FIGURE 2: SPATIAL PATTERN OF DISEASE INCIDENCE IN MINNA, NIGER STATE




The suggested relationship is more vividly brought out by the cross tabulation of feaco - oral diseases by their location (Table 5). With reference to feaco - oral diseases (those arising from food and water contamination due to dirty environment), it is observed that Bosso I (106), Minna central areas (203) and the peripheral areas (185) such as Kpakungu, Barkin Sale and Sauka Kahuta recorded relatively higher cases of acute diarrhoea, typhoid fever and amoebic dysentery than the GRA (35) and F –layout (7) which are high and medium quality zones respectively. Also, helminthiasis, which is associated with poor sanitation and contact with fecal matter, is much higher in Minna central (51.3% of the total cases). This trend is also noticeable for some droplet diseases such as measles, whooping cough and respiratory tract infection, which occur more in Minna central and the peripheral zones which are noticeable for their high rate of congestion and poor ventilation.

**ble 4: Distribution of Cases by Location**

| idential Districts | Frequency | Percentage | Cum. Percentage |
|---|---|---|---|
| so I | 712 | 15.5 | 15.5 |
| so II | 258 | 5.6 | 21.1 |
| A | 180 | 3.9 | 25.0 |
| nna East Central | 628 | 13.6 | 38.6 |
| nna West Central | 622 | 14.6 | 53.2 |
| nga I | 422 | 9.2 | 62.4 |
| nga II | 211 | 4.6 | 66.9 |
| inna S/W Peripheral | 992 | 21.5 | 88.5 |
| inna N/W Peripheral | 227 | 4.9 | 93.4 |
| aitumbi | 209 | 4.5 | 97.9 |
| Layout | 65 | 1.4 | 99.3 |
| 23/ Oduoye Quarters | 30 | 0.7 | 100 |
| Total | 4,607 | 100 | - |

ource: Authors' Fieldwork, 2004

The observed differences in the rate of disease occurrence are further confirmed by a Chi-square test computed for the zonal frequency of diseases in table 4. The test yielded a Chi-square value of 2,582.65 (at 0.0000 level of significance) to show that variations across the zones are statically highly significant. This result refutes the first hypothesis, which states that there is no significant variation in the rate of occurrence of housing environment-related diseases across the different neighborhoods and renders acceptable the alternative hypothesis that there is significant variation in the rate of disease occurrence across the different neighborhoods in Minna. The extent to which this variation could be ascribed to environmental quality is considered in section 4.3 of the analysis.

**Table 5: Cross Tabulation of Feaco-oral Diseases by Location**

| Location | Acute diarrhoea | Typhoid fever | Cholera | Amoebic Dysent. | Helminthiasia | Gastroenteritis |
|---|---|---|---|---|---|---|
| Bosso I | 8<br>6.3 | 51<br>15.5 | 23<br>24.2 | 22<br>15.6 | 2<br>5.1 | 1<br>20.0 |
| Bosso II | 10<br>7.9 | 22<br>6.7 | 10<br>10.5 | 10<br>7.1 | 1<br>2.6 | 1<br>20.0 |
| GRA | 8<br>6.3 | 11<br>3.4 | 7<br>7.4 | 8<br>5.7 | 1<br>2.6 | - |
| Minna East Central | 12<br>9.4 | 41<br>12.5 | 14<br>14.7 | 21<br>14.9 | 11<br>28.2 | - |
| Minna West Central | 19<br>15.0 | 46<br>14.0 | 11<br>11.6 | 19<br>13.5 | 9<br>23.1 | - |
| Tunga I | 5<br>3.9 | 35<br>10.7 | 7<br>7.4 | 10<br>7.1 | 1<br>2.6 | - |
| Tunga II | 2<br>1.6 | 21<br>6.4 | 3<br>3.2 | 12<br>8.5 | 3<br>7.7 | - |
| Minna S/W Peripheral | 49<br>38.6 | 66<br>20.1 | 14<br>14.7 | 10<br>7.1 | 6<br>15.4 | 2<br>40.0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Minna N/W Peripheral | 6<br>4.7 | 19<br>5.8 | 4<br>4.2 | 8<br>5.7 | 1<br>2.6 | - | |
| Maitumbi | 7<br>5.5 | 13<br>4.0 | 2<br>2.1 | 12<br>8.5 | 4<br>10.3 | - | |
| -Layout | 1<br>0.8 | 2<br>0.6 | -<br>- | 3<br>2.1 | - | 1<br>20.0 | |
| 123/Oduoye | -<br>- | 1<br>3.0 | -<br>- | 6<br>4.3 | - | - | |
| Column Total<br>column Percentage | 127<br>17.3 | 328<br>44.6 | 95<br>12.9 | 141<br>19.2 | 39<br>5.3 | 5 =<br>0.7<br>= | 735<br>100.<br>0 |

Source: Authors' Fieldwork, 2004

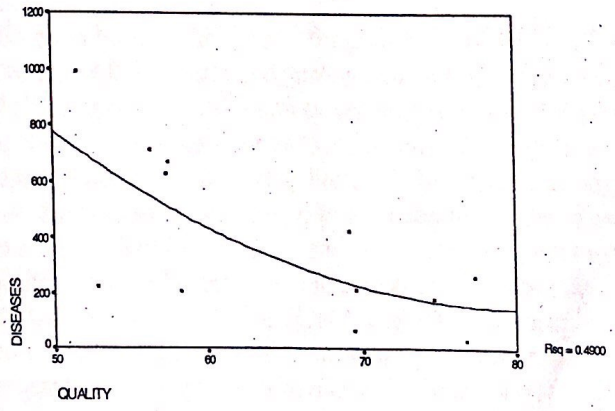
**Relationship between Housing- Environment Quality and Disease Occurrence**

A simple linear regression test was performed to examine the relationship between the quality of housing environment and the rate of disease occurrence. The result yielded a regression (r) value of 0.688559 (approximately 0.69) to show that there is a strong association between the two variables. Hence, 69% of disease occurrence in Minna is explained by housing environment quality.

A linear graph plotted for the regression equation (Figure 3) further explained the direction of the relationship. The graph shows an inverse relationship between disease occurrence and environmental quality. That is, as environmental quality increases, the number of diseases recorded falls. However, the coefficient of determination ($r^2$) value of 0.490 reveals that only 49% of the total variation in disease occurrence is accounted for by housing quality. This means that the residual part of the equation is explained by other variables such as attitude to hygiene, nutritional level, among others.

Analysis of variance (ANOVA) was computed to verify the second hypothesis, which states that there is no significant relationship between the quality of housing environment and the rate of disease occurrence. The test also yielded a statistically highly significant F value of 9.01683 at 1 degree of freedom and 0.0133 level of significance. Hence the hypothesis is refuted to confirm our $H_1$, which states that there is a significant relationship between environment quality and rate of disease occurrence.

**Figure 3: Linear Relationship between Housing Quality and Disease Occurrence**




Source: Authors' Fieldwork, 2004

**Summary of Findings**

This study examined the spatial variation in the occurrence of housing environment-related diseases and the relationship between the rate of disease occurrence and housing quality in Minna. Amongst others, it was found out that a range of contact, droplet, vector and feaco-oral diseases affects the residents. The disease occurrence varies significantly across the 12 zones used in the study. The spatial variation corresponds with the quality levels across the zones. Thus the low quality zones such as Bosso I, Minna central and the peripheral areas of Barkin Sale, Sauka Kahuta, Kpakungu and Mautumbi were found to record relatively higher frequency of diseases than the high and medium quality zones such as GRA, Bosso II and F-Layout.

The study showed that there is a strong association between the quality of housing environment and the rate of disease occurrence as 69% of occurrences are explained by environmental quality. However, only 49% of the total variation is determined or predicted by environmental quality. This shows that other variables such as accessibility to and affordability of basic health care, personal hygiene behavior, among others, help to explain spatial variation in the occurrence of environment-related diseases in Minna.

**Recommendations**

The established relationship between housing environment quality and disease occurrence necessitates actions to improve the quality of living environment in Minna so as to reduce the level of morbidity arising from poor environment. In this regard, concerted efforts are desirable at a general (policy) and more localized levels to achieve the desired result. Action necessary at the policy level should include the review of the State's health policy to focus m e on environmental health and preventive care. The policy should facilitate the people's capacity to maintain and manage a clean environment through decentralized functions.

A neighborhood-based community environmental education should also be put in place. This recommendation is made against the background of the fact that 72.0% of the respondents confirmed that enlightenment campaigns have not taken place in their neighborhood. Actors here will include Niger State Ministry of Health and Niger State Urban Development Board (NUDB), CBOs, NGOs and the community leaders. The State Government is to provide funding to facilitate the campaign. The technical staff of the State's agencies shall prepare and give relevant lectures, while the CBOs, NGOs and the community leaders shall assist in sensitizing and organizing the people as well as providing campaign venues in each locality. The campaign should be directed towards "hygiene behavior-change" among the residents.

A neighborhood-based sanitation programme, which will involve the entire community, and which will be facilitated through sanitation committees need be instituted. The committee shall comprise two community workers (one medical personnel and one town planner) from the State's ministries, community leaders (*Mai Angwas*), CBO leaders as well as youth and women leaders in each neighborhood. In each neighborhood, the committee shall bring cases of threat to the environment to the attention of the relevant State agencies. It shall also designate refuse deports, organize and supervise communal works and take custody of all working implements. The activities of the sanitation committees are to be facilitated and monitored by the State's Ministry of Health and NUDB, which shall provide necessary logistics to ensure the success of the sanitation project. In addition to this, housing improvement programme through the provision of basic services such as roads, proper drainage, adequate water supply, refuse depots and public toilets should be put in place in the low quality neighborhoods.

**Conclusion**

This study provided empirical information and background to the spatial variation in the occurrence of housing environment-related diseases and showed the extent to which disease occurrence could be ascribed to the level of environmental quality. Since poor environmental quality is found to impact negatively on the people's health, governments and other stakeholders should expedite actions on the three action areas recommended to reduce the level of environmentally induced morbidity generally in the towns and cities of the developing world. To reiterate, the three action areas are: (i) policy review; (ii) environmental education and (iii) neighborhood-based sanitation programme.

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