RESIDENTIAL ENVIRONMENT AND MORTALITY IN THE LAGOS STATE OF NIGERIA

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ABSTRACT

This study examines the operational factors of the indoor and outdoor residential environments in the Lagos State of Nigeria for their impact on the mortality of residents. Using a sixteen point index of outdoor and a twenty-eight point index of indoor residential environmental pressure, the deceased were scored one point depending on the existence of the index within the proximity of the residence. It was discovered that about 71.3% of the deceased were subjected to high or very high outdoor residential environmental pressure during their lifetime whereas about 91 % of them were subjected to high or very high indoor environmental pressure. Results show that the extent of outdoor residential environmental pressure depends on the locality of the deceased (i.e. whether such individual lived in a rural or urban local government area) and that there is no significant difference between indoor residential environmental pressure and the locality (urban or rural) of the deceased.

KEY WORDS: Outdoor, Indoor, Residential, Environment, Cardiovascular.

INTRODUCTION

Engvall (2003), while discussing the indoor environment in dwellings, defined the home as an indoor environment in which the population of children and adults spend considerable time, usually between fifteen and sixteen hours per day. His work reflects a perception of the home as an important social environment in which the population keeps contact with family and friends and other important members of the social networks. Other researchers such as Malquarti and associates (2004) and Poll (1997) amongst others found close affinity between residential environment, health and well-being of people.

While raising some methodological questions on residential context of health in Geneva, Malquarti et al (2004) asked some basic questions on housing situations, among which are:

What are the housing conditions of the population and how can such conditions be evaluated in terms of both positive and negative impacts on health and well-being?

What characteristics of the lifestyle of the population have a negative impact on health and well-being?

What characteristics of the residential environment have negative impact on every-day life?

These questions, among others, enable him to conclude that though, residential environment can support or hinder promotion of health, it is difficult, in the case of Geneva, to decipher the relationship between the conditions in residential environments and ill-health.

Engvall (2003), on the other hand, opined that though, the significance of residential environment on health have been a subject of investigation in different countries, including Germany, Austria, the Netherlands, Great Britain, Japan, Russia and USA most studies conclude that amongst environmental factors ambient air pollution and noise have the largest impact on health.

To highlight the possible impact of the home and residential environment on health and other human activities, researchers such as Oinonen (1960) and McCarty et al (2004) studied the effect of these variables on children. While the work of Oinonen concluded that the residential environment does not only impact on a child's state of health but also may be responsible for poor handwriting in school, that of McCarty and associates saw them as possible factor for attention-related problems in school.

Poll (1997) in a monograph emphasizes the importance of urban residential environment. He opined that though, they assist in the development of other attributes of life, such as family work or leisure, they also serve as a source of adverse environmental conditions such as noise, malodor, air pollution, external safety risk, crowding, litter and lack of facilities.

The Fourth Ministerial Conference paper on health and environment released in Hungary observed human knowledge about the relationship between environment and health dates back to the days of the classical Greek physician, Hippocrates. However, as countries experience rapid economic growth, there are no adequate corresponding measures of safeguard of human health and his environment that could level with the prosperity derivable from such growth (WHO, 2004)

The paper notes that health does not only depend on the provision of medical care but also on priority given to the prevention of exposures to environmental and other health risks. It observes that these risks and their prevention vary from country to country because of lack of human and material resources that could lead to none-existence and inability to implement policies where they exist. It notes further that over the years, many new environmental risk factors have been suspected and later proved to be a major cause of ill- Health to human. It lists among others, pollutant in air, water, food, industrialization, urbanization, nutrition, the household, workplace, outdoor, transportation

Fernandez and Rojo (2004) attempted a definition of the components of the residential environment. Their paper explained that the components that best represents a residential environment include home and building in which it is located, residential neighborhood and neighbors.

The above examples are indications of the importance of the residential environment on the general well-being of people, including, their health and mortality. Therefore, it is the intention of the current study to evaluate the factors operational in the internal and external residential environment in Lagos state and how they impact on the mortality of the residents.

The paper is divided into five sections. The first section describes the study population, the second explains the methodology used while the third presents the result with the final second comprising the conclusion and recommendations.

THE STUDY POPULATION

Lagos State, which was created on May 27, 1967, lies approximately between longitudes 2°42'East and 3°42'East and latitudes 6°22'North and 6°52'North.It is bounded in the South by the Guinea coast of the 180km Atlantic Coastline, in the West by the Republic of Benin and in the North and East by Ogun State (Odumosu et al,1999, p.1).

It has a total area of 3,577 square kilometers about 22 per cent of which is water (Okesola et al, 2000). Despite its position as the smallest State in the Federation in terms of land mass, occupying only 0.4 per cent of the area of Nigeria, it has gone through series of administrative transformations to metamorphosed into a frontline position amongst the thirty-six states making up the federation of modern day Nigeria Lagos State which has a current population of over 13 million is the most urbanized state in Nigeria. (WHO, 2004) Over 50 per cent of industries in Nigeria are located in the state, contributing 70% of the national gross industrial output (Oke et al, 2001). The state accommodates about 6.2 per cent of the total population of Nigeria and its annual population growth rate is over 9 per cent. About 34 persons are added to the population of Lagos State every hour of the day. This translates to about 833 persons per day. The Average population density for Nigeria is 85 persons per square kilometer while that of Lagos State is 1,308 persons per square kilometer and in some cases density is over 20,000 people per square kilometer.

The share of Lagos State in international trade in Nigeria is above 70 per cent and it is responsible for 50 per cent of total value added by the manufacturing sector in the country. The State employs 40 per cent of the skilled human resource in Nigeria. Lagos State harbors the leading Nigerian ports and it is a center of Nigerian Intellectual and cultural life. This includes the University of Lagos (established in 1962), Yaba College of Technology (established in 1948), Lagos State University (established in

1977), National Museum (established in 1957), National Library of Nigeria (Established in 1964), National Theatre (established in 1976) and many other institutions (Travel In Lagos-Nigeria, 2004)

Lagos State, which had five administrative divisions in 1967, was later divided into eight Local government areas in 1976, and increased to twenty three in 1983. In 1984, the state reverted to eight local governments which was later increased to twelve in 1989, fifteen in 1991 and twenty in 1996. In 2003, attempts by the Lagos State House of Assembly to create fifty-seven local government administrative areas from the twenty existing units became a subject of intense political and constitutional dispute between the Federal Government of Nigeria and the State. Onibokun and Kumuyi (2003) while reviewing urbanization process in Africa claimed that the growth rates of Lagos have increased more than six folds within four decades.

The existing twenty local government areas include: Surulere, Agege, Lagos Island, Lagos Mainland, Ojo, Awori-Ajeromi, Ajeromi- Ifelodun, Mushin, Alimosho, Badagry, Epe, Ikorodu, Shomolu, Kosofe, Ifako-Ijaiye, Eti-Osa, Ibeju-Lekki, Ikeja ,Isolo and Surulere.

In this study, three local government areas, Lagos Mainland, Epe and Badagry were selected through probability sampling processes.

Lagos Mainland Local Government

Lagos mainland local government which is a fully urbanized Local Government areas (LGA) located between Latitude 6^0 9' and 6^0 15' North and Longitude 4^0 30' East. It is bounded in the West and South by the Lagos Lagoon, in the East by Surulere and the North by the Shomolu. The Local Government is connected to its neighbouring LGA by three main bridges: the Carter Bridge, which connects it to Lagos Island and the Babangida and Eko Bridges.

The Lagos Mainland Local Government houses one of the best commercial centers in the country. It has the Iddo Railway Terminus, Leventis Group of Companies , headquarters of the Nigerian Railways, Oyingbo Market and branches of banks, which include the First Bank, Union Bank, United Bank for Africa and Insurance Companies like The Elmac Insurance Plc and Crusader (Nig) Plc.

It is the headquarters of the Nigerian Representative of the World Health Organisation (WHO), Nigerian Medical Laboratory, Yaba Psychiatric Hospital, Yaba College of Technology, which is the oldest tertiary institution in Nigeria, University of Lagos, Queens College and Methodist Girls High School, which is one of the oldest Girls Secondary schools in Nigeria. The LGA is a close neighbor of the Apapa Port, Tin Can Island and Roro Port, which are the three largest ports in Nigeria.

Epe Local Government

Epe Local Government is made up of towns and cities such as Epe town, Agbowa, Eredo , Ejirin, Odomola, Orimedu, Ilara, Igboye, Ibowon, Igbonla and Itoikin, among others. Like most parts of Lagos State, Epe is known for fishing but in addition are the tree and root crops productions such as palm oil, kola nut, cassava and gari, maize and vegetables.

Many local communities in Epe have access to pipe borne and portable water supply and there are electricity and telephone lines connected to almost all the communities in the LGA. There are many primary and secondary schools dotting the nook and crannies of the LGA and also the Faculty of Engineering of the Lagos State University is located in Epe town.

Health facilities include many maternity homes, primary health centers, Welfare Centers, clinics and a General Hospital. The Local Government is connected to other parts of the state through the Lagos-Lekki Peninsular Expressway and the Ikorodu-Itoikin-Epe Expressway.

Badagry Local Government

The Badagry Local Government is located between the boundaries of Ogun State in the North, Atlantic Ocean in the South and Olorunda Local Government in the East. The Headquarters is in Badagry Town.

Badagry is located on Latitude 6.4167 and Longitude 2.8833 at an Altitude of 118 feet. It is about 27nmE from the Murtala Mohammed Airport and 29nmW from Cotonou. Towns around Badagry include Ago Hausa 2.2nm west

RESEARCH METHODOLOGY

This section defines the population of study and the sampling methodology used; it explains the methods used in data collection, and the analytical techniques employed.

Population of study and Sampling Methodology

Lagos State was selected for this study because it is the most urbanized State in Nigeria and being a former Federal Capital territory, it houses one tenth of the Nigerian population.

This study involved an examination of the effects of the indoor and outdoor residential environment on mortality. Data on those who died in the selected local governments were recorded, but with emphasis on three causes of death: cardiovascular, cerebrovascular and, infectious and parasitic diseases. The interest in these three

causes of death is due to the UNDP (1999) statistics which claims that over eighty per cent of those dying in the developing countries of the world die as a result of cardiovascular, cerebrovascular and infectious and parasitic diseases.

A follow up study on the cohort in the secondary data was conducted by following their cases to their residential environment. Here, relations of the deceased were used as dummy to extract information on the lifestyle of the deceased. However, due to constraint of resources, the study was limited to only three out of the twenty local government areas. For this purpose, the State was divided into twenty clusters, each cluster representing a Local Government Area (LGA). Three clusters, namely; Lagos Mainland, Epe and Badagry were selected using the simple random sampling technique. The choice of cluster sampling was premised on the fact that the elements of the population under study are geographically scattered (Van Matre and Gilbreath ,1980)

Type of Data

Both primary and secondary sources of data collection were used. For the secondary data, causes of death, locality, occupation and age at death were recorded for those individuals who died in the three clusters during the period 1991 to 2000. Although the sample elements belong to several cohorts belonging to different years and seasons, these individuals were treated as if they belong to the same cohort. The data were obtained from the records of events in the Register of the Lagos Mainland, Epe and Badagry Local Governments. For the primary source, two hundred questionnaires, making 34.48 per cent of the number of elements in the secondary data were distributed to respondents in both rural and urban areas of the state.

Method of Analysis

Hypotheses

The following two hypotheses was be tested in this study;

H_{01}: Effect of outdoor residential environments does not depend on urban or rural locality.

H_{02} Effect of indoor residential environments does not depend on urban or rural locality.

Data Analyses

The data analysis was divided into two broad categories:

a) Analysis of the secondary data
b) Analysis of the primary data

Records of two thousand, three hundred and fifty eight (2358) individuals who died was extracted from the death register of the three local government areas. Since the interest here is to examine the effect of the indoor and outdoor residential environments to which the deceased were subjected during their lifetime on mortality, the analysis at this stage did not go beyond simple descriptive measures.

The questionnaire used in this study contains questions that enable us to measure two major indices, namely; Index of indoor environment" and "Index of the outdoor environment. It is expected that these two will jointly explain those residential environmental factors to which the dead in our secondary data were subjected to during their lifetime

It is important to explain that,since the secondary data are grossly inadequate to show us these factors, it was decided that Indices of indoor and outdoor residential environment taken from the living could be used as dummy measures of the experience of the dead during their lifetime

Measures Residential Environment

The Index of outdoor residential environment was taken on a scale of 1- 16 as follows:

- Migration
- Occupation
- Income *
- Frequent Change of Job
- Cost of monthly accommodation*
- Possession of Vehicle**
- Educational Attainment
- Proximity to place of work and School for Children
- Mode of transportation to and from work
- Type of building
- Proximity of household to factory**
- Proximity of household to Record Shop/Store**
- Proximity of household to Market**
- Quality of Road leading to house
- Exposure to car exhaust'
- Traffic hold-up

On each questionnaire, the respondent was scored one point depending on the existence of the index of outdoor residential environment. Each respondent could score a maximum of 16 points.

Similarly, the following were taken as indices of indoor residential environment on a scale of 1 – 28:

- Marital Status
- Employment Status
- Income**
- Contribution to income by members of the family
- Dependants
- Ownership of House
- Cost of monthly Accommodation or Monthly Rent*
- Number of people in household
- Possession of electronic gadgets
- Possession of vehicle**
- Possession of Telephone
- Number of rooms occupied
- Number of people earning income within the household
- Educational Qualification of spouse
- Mode of transportation of members of household
- Time the head of household wakes up in the morning
- Time the head of household leaves home for work
- Time the head of household returns from work
- Other sources of income
- Proximity of house to record store**
- Proximity of house to place of worship**
- Proximity of house to waste dump site**
- Proximity of house to Mills**
- Proximity of house to factory**
- Quality of roads leading to house
- Time the head of household goes to bed
- Loss of relation
- Loss of neighbors

** Outdoor problems having indoor effect.

Here, proximity means a distance of about 1km from the household of the deceased.

On each questionnaire, the respondent was scored one point depending on the presence or absence of the Index of indoor residential environment, as shown in Section 3.13 2. Each respondent could score a maximum of 28 points.

Scaling

The following scaling was done, to measure the extent of outdoor residential impact on the people. On a Scale of 16:

0 - 3	-	low outdoor impact
4 - 7	-	moderate outdoor impact.
8 - 10	-	high outdoor impact.
More than 10	-	very high outdoor impacts.

Similarly, the following scaling was done, to measure the extent of indoor residential impact on the people On a scale of 28:

0 - 3	-	low indoor impact.
4 - 6	-	moderate indoor impact
7 – 10	-	high indoor impact
More than 10	-	very high indoor impacts.

Simple frequency analysis of responses was undertaken and 2x2 contingency tables associating Index of outdoor residential environment and Index indoor residential environment with other variables of interest were constructed. The three hypotheses in namely, H_{01} and H_{02} were tested at 0.05 level of significance (i.e. $\alpha = 0.05$) using the χ^2.

RESULTS AND ANALYSIS OF THE STUDY

Table 1 shows the distribution of deaths by cause in the Lagos Mainland, Epe and Badagry Local Government Areas.

Table 1: Distribution of deaths by cause

CAUSE	NUMBER OF DEATHS RECORDED	PERCENTAGES (%)
Respiration	218	9.2%
Maternal	28	1.2%
Cerebrovascular	506	21.3%
Infection	265	11.1%
Metabolic Disorder	56	2.4%
Hepatic Failure	45	1.9%
Cancer	33	1.4%
Malnutrition	2	0.1%
Old Age	83	3.5%
Homicide	8	0.3%
Cardiovascular	534	22.4%
Others	580	24.3%

SOURCE: Death Registry of Lagos Mainland, Epe and Badagry Local Government Area

The highest number of deaths was caused by cardiovascular disease (22.4%). This is closely followed by cerebrovascular disease (21.3%), while infection takes the third position with 11.1% of the recorded cases. Only 0.1% of the people were killed by malnutrition being the lowest cause of death in the three localities combined.

Table 2 is the records of deaths by occupation. The most affected group are traders and this accounts for 18% of the recorded death. This is closely followed by Housewives with 14.9% while workers in the private sector are third with 13.3%.

Table 2: Distribution of deaths by occupation

Occupation	NUMBER OF DEATHS RECORDED	PERCENTAGES (%)
Workers in private Sector	275	13.3%
Businessmen	83	4.0%
Professionals	116	5.6%
Traders	370	18.0%
Housewives	308	14.9%
Students	258	12.5%
Civil Servant	181	8.8%
Pensioners	171	8.3%
Clergymen	24	1.2%
Others	274	13.2%

SOURCE: Death Registry of Lagos Mainland, Epe and Badagry Local Government Areas

The most salient feature of **Table 3** is that majority of deaths occurring in each occupational group are caused by cardiovascular disease, cerebrovascular diseases and infection in that order. Cerebrovascular and cardiovascular accidents are jointly responsible for 49.03% of the deaths among workers in the private sector, while 12.45% is due to infection, with cerebrovascular accident being their highest killer (24.9%). Among the Businessmen, the two diseases are responsible for 47.5% while infection killed 13.75%. In this group, cardiovascular problems caused 27.5% being the highest killer.

It is interesting to note that the professionals are the highest victim of cardiovascular and cerebrovascular accidents in our population with 59.59% of them dying as a result of the two diseases while infection is responsible for 17.02%. This is closely fol-

lowed by students with 57.59 % of them being killed by both cardiovascular and cerebrovascular problems. Infection is responsible for 16.23 % of the deaths in this group.

Table 3: Distribution of Deaths by Cause and Occupation

Cause of Death	Occupation									
	Worker	Business	Prof.	Trading	Student	House-wife	Civil Servant	Pen-sioner	Clergy	Other
Respiration	24	8	7	37	30	27	23	12	3	14
Maternal	1	1	2	2	3	-	6	3	-	9
Cerbrovascular	64	16	27	90	50	73	42	32	3	41
Infection	32	11	16	42	31	35	17	21	3	26
Metabolic Disorder	12	1	4	6	5	9	2	4	-	4
AIDS	-	-	-	3	3	-	4	2	-	3
Hepatic Fail-ure	6	-	2	11	6	2	4	1	1	2
Cancer	-	3	3	3	2	4	2	1	-	2
Malnutrition	1	-	-	-	-	-	-	1	-	-
Old Age	-	3	4	8	-	8	-	9	-	21
Homicide	-	1	-	1	1	-	2	-	1	-
Cadiovascular	62	22	29	84	60	74	46	45	8	48
Others	55	14	14	62	44	52	28	30	4	23

Table 4 shows the distribution of death by locality. It is important to note that whereas the population elements in the Lagos Mainland have clearly defined occupation, the same is not true of Epe and Badagry where substantial number of people do not have identifiable occupation. However, cardiovascular disease is responsible for 25.51% of the deaths in the Lagos Mainland Local Government, followed by cerebrovascular problems which accounts for 24.44% of the deaths and 13.06% caused by infectious and parasitic diseases. It is noteworthy that 63.01% of the deaths recorded in the Lagos mainland were caused by the three diseases.

Table 4: Distribution of Deaths by Cause and Locality

Cause of Death	Urban Rural		
	Lagos Mainland	Badagry	Epe
Respiration	209	3	6
Maternal	27	-	1
Cerebrovascular	483	7	16
Infection	258	2	5
Metabolic Disorder	54	-	2
AIDS	16	4	2
Hepatic Failure	40	1	4
Cancer	19	2	12
Malnutrition	2	-	2
Old Age	57	13	13
Homicide	6	-	2
Cadiovascular	504	16	14
Others	301	154	125

The distribution of deaths for cardiovascular diseases, cerebrovascular diseases and infection in the rural areas of the state as shown by records in Badagry and Epe Local Government may not be too far from those observed in the urban area (Lagos Mainland), but old age seems to gain prominence in these two areas with 6.43% and 6.40% for Badagry and Epe respectively.

Analyzing data on indoor and outdoor residential environment

Table 5 shows that 71.3% of the respondents are subjected to high or very outdoor residential environmental pressure, while only 3.6% are under low pressure. In fact, 93.1% of the respondents are victims of one form of serious outdoor residential environmental pressure or another.

Table 5: Frequency distribution of index of outdoor environment.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	1	.5	.5	.5
	2.00	1	.5	.5	1.1
	3.00	5	2.6	2.7	3.8
	4.00	2	1.0	1.1	4.8
	5.00	7	3.6	3.8	8.6
	6.00	19	9.9	10.2	18.8
	7.00	14	7.3	7.5	26.3
	8.00	29	15.1	15.6	41.9
	9.00	20	10.4	10.8	52.7
	10.00	24	12.5	12.9	65.6
	11.00	21	10.9	11.3	76.9
	12.00	14	7.3	7.5	84.4
	13.00	14	7.3	7.5	91.9
	14.00	12	6.3	6.5	98.4
	15.00	1	.5	.5	98.9
	16.00	2	1.0	1.1	100.0
	Total	186	96.9	100.0	
Missing	System	6	3.1		
Total		192	100.0		

Table 7 on the other hand shows that 91% of the respondents are subjected to high or very high indoor residential environmental pressure, while only 3.1% are subjected to moderate pressure and only 0.5% are subjected to low indoor residential environmental pressure.

TABLE 7: Frequency Distribution of index of Indoor Environment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	.5	.5	.5
	5.00	5	2.6	2.7	3.3
	6.00	1	.5	.5	3.8
	7.00	7	3.6	3.8	7.7
	8.00	2	1.0	1.1	8.8
	9.00	16	8.3	8.8	17.6
	10.00	21	10.9	11.5	29.1
	11.00	27	14.1	14.8	44.0
	12.00	26	13.5	14.3	58.2
	13.00	21	10.9	11.5	69.8
	14.00	22	11.5	12.1	81.9
	15.00	8	4.2	4.4	86.3
	16.00	12	6.3	6.6	92.9
	17.00	6	3.1	3.3	96.2
	18.00	5	2.6	2.7	98.9
	19.00	1	.5	.5	99.5
	20.00	1	.5	.5	100.0
	Total	182	94.8	100.0	
Missing	System	10	5.2		
Total		192	100.0		

Hypothesis One : H_{01}

Table 6 shows that the calculated value of χ^2 is 25.516, which is significant at 5% level of significance. Therefore, it seems that outdoor residential environmental impacts have something to do with the locality of the deceased.

TABLE 6

Computer output on the test of independence between index of outdoor environment and locality (rural vs urban)

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	25.516	15	.043	
Likelihood Ratio	29.159	15	.015	
Linear-by-Linear Association	13.332	1	.000	
McNemar Test				
N of Valid Cases	157			

a 23 cells (71.9%) have expected count less than 5. The minimum expected count is .18.

b Computed only for a PxP table, where P must be greater than 1.

Hypothesis Two: H_{02}

Table 8 shows that the calculated value of χ^2 is 23.546 which is not significant at 5% level of significance. Therefore, we conclude that there is no relationship between indoor residential environment and the respondent's locality. That is, the indoor residential environment to which a person is subjected does not necessarily depend on his choice of abode.

TABLE 8: Computer output on the test of independence between index of indoor environment and locality (urban vs rural)

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	23.546	15	.073	
Likelihood Ratio	28.425	15	.019	
Linear-by-Linear Association	.753	1	.386	
McNemar Test				
N of Valid Cases	155			

a 25 cells (78.1%) have expected count less than 5. The minimum expected count is .19.

B Computed only for a PxP table, where P must be greater than 1.

CONCLUSION AND RECOMMENDATION

The primary data reveals that majority of the respondents are subjected to very high outdoor residential environmental pressure and indoor pressure which may be responsible for the high death rate due to cardiovascular and cerebrovascular problems observed in secondary data. As expected, it shows further that there is a difference between the intensity of this pressure in the urban areas, such as the Lagos Mainland Local Government and the rural areas like Badagry and Epe.

Lagos, is a mega-city and with the surrounding industrial estates such as Ikeja, Apapa, Ota, Ilupeju and so on, residents of Lagos are exposed to pollutants released from industrial pollutants and piles of municipal wastes, which not only impair human health, but also shortens life, hence, the high cardiovascular deaths.

Over 11% of these population elements have died or may be killed by infectious and parasitic diseases and over half of that generation will be killed by cardiovascular and cerebrovascular accidents. These two great killers are byproducts of the environment we live in.

The study indicates that environment has a role to play in the rate of mortality. In this study it is established the existence of environmental impact such as indoor and outdoor residential environmental impact, are both contributors to mortality patterns in Lagos State. The study shows that mortality could be considerably reduced if the environment is improved.

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