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Correlative Study on Environmental Determinants and Spread of Diseases

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Abstract Environmental characteristics, such as cleanliness of water supply, drainage system, waste management, toilet condition and dish-washing site, as well as environmental settings which encompasses population (congestion), vicinity of, dumpsite from source of water, residential premises from dumpsite, kitchen from dish-washing site and toilet from kitchen are determinants represented as more related proximately to spread of diseases. The study collected qualitative data using questionnaire and analysed respondents' perception statistically on the correlation between the set environmental variables and spread of diseases in built environment. The respondents were sampled from among the residents of the areas investigated. Spearman correlation coefficient was used to explore the primary association between these environmental determinants and spread of diseases. A step-wise regression technique was used to fit the statistical models. The result indicates that the P-values correspond to the respective environmental variables are less than the level of significance ($\alpha = 0.05$) in each case, which implies that there is positive and significant relationship between the set environmental determinants and environmental sanitary condition of the studied areas. On the other hand, the construct was statistically validated, as the instrument used found to be very satisfied since it measured what was intended for with approximately the same results on repeated times with different persons on different occasions and under different conditions ($P < 0.05$). Similarly, the reliability of the data extracted from the designed questionnaire was also statistically tested and reflected very closely the respondents' perception upon the environmental qualities of the studied areas ascertained by Cronbarch's Alpha far greater than 50%.

Keywords: *environment, health, sanitation, urban, planning and disease*

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1. Introduction

Countries in Africa, Asia and Latin America are diverse in many fields, but one problem they have in common is lack of basic sanitary conditions for the generality of their populace in urban cities and thus, are far from meeting united nations (UN) sustainable development goals (SDGs) for sanitation. As part of its general assembly resolutions, UN declared that one of the major international crises is the dilapidation of public health, particularly in the developing countries, which solemnly associated with environmental problems [1,2]. This emanated from disconnection between urban planning and public health. Even though urban planning and public health moved concurrently with a common objective to prevent urban outbreaks and widespread of infectious diseases. However, there is little or no linkage between the fields in environmental planning and coordination. The unrecognition of harmonisation of the fields has resulted in all efforts abortive in addressing the health problems of urban population and a general failure to identify the links between built environment and health disparities facing disorganised urban-ward populations.

Poor environmental sanitation is a major cause of disease spread worldwide while improving sanitation (Hygiene) is known to have significant impact on public health both in household and across the community. Sanitary measures are aiming to decrease spreading diseases by adequate wastewater, excreta and other waste management, proper handling of food waste and by restricting disease breeding ground such as indiscriminate street wastewater discharge and domicile waste stabilisation ponds. In an unplanned environment, particularly in developing countries, that has not been the case in the urban core and inner ring suburbs typically occupied by low-income earners and urban poor, as such environs are characterise by poor housing pattern and conditions, improper waste handling, inadequate sanitation and ventilation and thus, helped cause devastating outbreaks and widespread of cholera and typhoid [1,3]. However, wealthier households often reside on the suburban periphery where land use planning and public health are explicitly linked and regularly affiliated and therefore, one result of this 'connect' is coordinated approach to eliminating the glaring health problem facing the urban core and inner ring suburbs predominantly occupied by urban poor and low-income earners, respectively.

In Nigeria, it was found that poor sanitation conditions and domestic waste are the major causes of hand-dug

wells contamination, which mostly occur due to close proximity to refuse dump, latrines, toilets, domicile dish-washing areas, and drainage among others [4]. These environmental characteristics that are common in unplanned built environments are responsible for the glaring health inequalities and environmental injustice facing the urban poor and low-income earners. The public health disparities between urban poor populations and wealthier households have not narrowed over time, are getting worse, and are increasingly linked to the physical and social environmental settings that fall under the traditional domain of environmental planning, such as housing pattern, streetscapes, and community or social capacity on waste management. Public health scientists have made assertion that emergence and re-emergence of infectious diseases has an origin in environmental change [5,6]. These environmental changes include social processes such as urbanisation branded by public health disparities, as well as ecological processes such as differential land and water pattern utilisation between urban poor communities and wealthier households. With this urban stratification, within cities outbreak and widespread of diseases seem not always equitably manifested rather predominantly befall in urban core and inner ring largely dominated by urban poor populations. It is therefore evident that while public health is increasingly concentrating on biomedical factors that might contribute to different morbidity and mortality rates between the well-off and least well-off, the field is just beginning to seriously investigate the role of land use decisions and patterns, as well as how the built environment influences inhabitants' health. At the same time, in an injustice environment, urban planning practice shows signs of failure of public system in addressing the health of the least well-off [7,8]. Hence, the disconnect between environmental planning and public health has not gone unnoticed. For instance, in urban poor localities, as population grows concurrently with waste accumulation, progress in sanitation and improved wellbeing have not been greatly improved and thus, left many people still with no adequate means of disposing their waste and resulting dumping on streets indiscriminately. Consequently, there will be growing nuisance for heavily urban poor populations, carrying the risk of infectious diseases, particularly to vulnerable group such as children, aged people and people live with low disease immunity. Corburn [9] revealed that the nature of environment that is unplanned and densely inhabited can serve as a spreading agent of diseases, but may be effectively lessened in the case of well-planned and sparsely occupied areas. Commonly, poorly controlled wastes in residential areas also mean daily exposure to an unpleasant environment. However, in some instances, provision of merely good built environment does not in itself translate free of sanitary related diseases. Therefore, correlative relationship between environmental determinants and spread of diseases is imperatively needed.

2. Methodology

2.1. Study Area

The study was carried-out in Bauchi Metropolis, Bauchi Local Government, Bauchi State of Nigeria. Bauchi Metropolis is a residential area in the Eastern part of Nigeria. It is the capital of Bauchi State; it is located at the North edge of Jos Plateau at an elevation of 616m (Anonymous). The study area represents the part of the topographic map of Bauchi North-East sheet 149 as produced by Federal Survey of Nigeria and it falls within N-E part of the map basement complex [10]. It is located on the coordinate $10^{o}.15 - 10^{o}.22$ N and $9^{o}.45 - 9^{o}.55$ E [11].

Bauchi Metropolis was selected for this study because of the ease to access developed sets of environmental databases and again it is mainly an urban area being stratified into urban core and inner ring suburbs typically occupied by urban poor and low-income earners, while the wealthier households often reside on the suburban periphery of the study area characterised as high density, medium density and low density residential areas, respectively. Besides, the three chosen sampling sites are of different physical environmental characteristics and settings.

2.2. Sampling Sites and Sample Sizes

The sampling sites and sizes were determined based on the information accessed from Bauchi State Water Board demographic data. The household population sizes Nassarawa-Jahun with a household population of 1912, followed by Federal Low-cost comprised of 636 and then New GRA considered with 229; of which are classified as high density, medium density and low density residential areas, respectively.

Frankfort Nachmias model for determining sample size was used for each of the household population and presented as follows-

$$n = \frac{Z^2\, pqN}{e^2\,(N-1) + Z^2\, pq} \quad (1)$$

Where n =sample size; N = population Size; p = sample population estimated to have characteristic of being measured (in this study, 95% confidence level of the target population) or probability of success; q = probability of failure (1-p); e = acceptable error at + or – 5%; z = 1.96 (the standard normal deviation at 95% confidence level [12]. Consequently, sample sizes of 250, 198 and 127 were determined for high, medium and low density residential areas, respectively and totally amounting to 575 samples required for the study. Hence, a total of 575 questionnaires were distributed, however, only 500 were successfully returned.

2.3. Data Collection

The data for the study were generated through the use of structured questionnaire and reconnaissance survey with the help of sanitary inspectors from Bauchi State Environmental Protection Agency (BASEPA). The data were collected from 500 individuals, 260 from Nasarawa Jahun (high density residential area), 240 from Federal Low-cost (medium residential area) while 100 from new Government Reserved Area (New GRA- Low density residential area). The historical records of occurrence of diseases such as malaria, cholera, diarrhea, and typhoid in the study area was taken from Bauchi Specialist Hospital.

The environmental determinant variables were categorised into environmental characteristics and settings Table 1 and Table 2. The environmental characteristics variables were ranked as very good, good, poor and very poor with numerical values as 1, 2, 3, and 4, respectively. However, for the environmental settings, the variables were keyed as very far, far, close, and very close specified in a numerically ordered series as 5, 6, 7, and 8, respectively. The data generation procedure adopted for the feedback of the targeted respondents is presented below.

Table 1. Environmental Characteristics

S/N	Environmental characteristics	1	2	3	4	Total no of respondents
1	Cleanliness of water supply	xxx	xxx	xxx	xxx	xxx
2	Waste management	xxx	xxx	xxx	xxx	xxx
3	Drainage system	xxx	xxx	xxx	xxx	xxx
4	Kitchen condition	xxx	xxx	xxx	xxx	xxx
5	Dish-washing site	xxx	xxx	xxx	xxx	xxx
6	Toilet condition	xxx	xxx	xxx	xxx	xxx

Keys: Very good =1, Good = 2, poor = 3, Very poor = 4.

Table 2. Environmental Settings

S/N	Environmental settings	5	6	7	8	Total no of respondents
1	Dumpsite from source of water	xxx	xxx	xxx	xxx	xxx
2	Dumpsite from residential premises	xxx	xxx	xxx	xxx	xxx
3	Kitchen from dish-washing site	xxx	xxx	xxx	xxx	xxx
4	Toilet from kitchen	xxx	xxx	xxx	xxx	xxx

Key: Very far = 5, far = 6, close = 7, very close = 8.

2.4. Data Analysis

Data analyses were performed with SPSS statistical software system version 21.0. The coefficient of correlation between environmental study variables and spread of diseases was calculated by Spearman correlations test. After the selection of the final model, all possible interactions between variables were assessed and retained when statistically significant ($P < 0.05$). The construct was statistically tested to measure what is intended for and satisfy its validity with P values. Similarly, the reliability of the data extracted from the respondents' response was statistically ascertained using Cronbarch's Alpha test.

3. Results

The environmental characteristics studied in all the selected areas were primarily cleanliness of water supply, waste management, drainage system, kitchen condition, dish washing area and toilet condition. For easy quality evaluation, these characteristics were ranked very good, good, poor and very poor with integer values of 1, 2, 3 and 4, respectively. The intuitive reasoning of the respondents reached in all of the study areas was quite adequate, as most of the respondents 428 (85.6%) are male with the knowledge of happenings in their surroundings. The field survey also revealed that 442 (88.4%) of the respondents are between the ages of 21 and 40 years, which are generally the active age group full of reasoning aptness. In terms of their educational background, 459 (91.8%) attained at least secondary education. Table 3, Table 4 and Table 5 show the response frequencies of the residents of high, medium and low densely populated areas, which are designated as Nassarawa-Jahun, Federal low-cost and New GRA residential areas, respectively. Of all the residential areas studied, response frequencies for cleanliness of water supply was rated good (2) with highest frequency recorded at Nassarawa-Jahun (107), followed by Federal low-cost (72) and then New GRA (40). All the responses obtained from the two residential areas namely- Nassarawa-Jahun and Federal low-cost rated waste management, drainage system, kitchen condition, dish-washing site and toilet condition in the areas as poor (3) and/or very poor (4). In these two areas, dish-washing site, toilet condition and drainage system were recorded highest with response frequencies higher than 150, but waste management and kitchen condition got $\leq$ 150 appraisals at Nassarawa-Jahun (Table 3), while in Federal low-cost drainage system and waste management were the highest with 84 and 77 responses, respectively and the remaining environmental characteristic indices stood in the range between 31 and 56 response frequencies (Table 4). However, in GRA all the remaining environmental characteristics appraisal was also rated good (2), as it received the highest response frequency corresponding to more than half (50%) of the reached residents in the area (Table 5).

Table 3. Environmental Characteristics in Nassarawa-Jahun.

S/N	Environmental characteristics	1	2	3	4	Total
1	Cleanliness of water supply	5	107	97	51	260
2	Waste management	9	68	133	50	260
3	Drainage system	5	19	153	83	260
4	Kitchen condition	14	41	150	55	260
5	Dish-washing site	17	38	159	46	260
6	Toilet condition	4	35	155	66	260

Keys: Very good = 1, Good = 2, poor = 3, Very poor = 4.

Table 4. Environmental Characteristics in Federal Low Cost

S/N	Environmental characteristics	1	2	3	4	Total
1	Cleanliness of water supply	3	72	31	34	140
2	Waste management	3	26	77	34	140
3	Drainage system	3	22	84	31	140
4	Kitchen condition	5	30	53	52	140
5	Dish-washing site	16	33	56	35	140
6	Toilet condition	14	34	44	48	140

Table 5. Environmental Characteristics in New GRA

S/N	Environmental characteristics	1	2	3	4	Total
1	Cleanliness of water supply	36	40	18	6	100
2	Waste management	25	58	15	2	100
3	Drainage system	20	53	23	4	100
4	Kitchen condition	20	54	22	4	100
5	Dish-washing site	22	55	16	7	100
6	Toilet condition	15	63	20	2	100

Table 6, Table 7 and Table 8 show the response frequencies on environmental setting variables, which are dumpsite from source of water, dumpsite from residential premises, kitchen from dish-washing site and toilet from kitchen. Similarly, the environmental setting variables were ranked very far, far, close and very close with integer values of 5, 6, 7 and 8, respectively. The highest counts of 152 and 74 respondents were recorded for closeness of residential areas to dumpsite in both Nassarawa-Jahun and Federal low-cost, respectively. The response frequency of closeness of kitchen from dish-washing site and of toilet from kitchen in Nassarawa-Jahun and Federal low-cost were the second highest with 145 and 70 counts, respectively. These were followed by the closeness of kitchen from toilet (136) and then water source from dumpsite (120) in the sequence trend of environmental settings of Nassarawa-Jahun, while water source from dumpsite (69) followed and then kitchen from dish-washing site (64) in Federal low-cost. However, the environmental setting of New GRA is in disparate with the other residential areas studied. Because of aesthetic nature of its surroundings, water sources and residential premises are believed to be very far from dumpsite, as 53 and 64 counts of respondents out of 100 returned questionnaires were assigned to these environmental setting indices, respectively. Based on the nature of housing system in the area, closeness of kitchen from dish-washing site and from toilet are thought to be very close, as their counts stood at 68 and 65, respectively.

Table 6. Environmental Setting in Nassarawa-Jahun

S/N	Environmental Setting	5	6	7	8	Total
1	Dumpsite from source of water	31	40	120	69	260
2	Dumpsite from residential premises	10	28	152	70	260
3	Kitchen from dish-washing site	19	31	145	65	260
4	Toilet from kitchen	3	42	136	79	260

Key: Very far = 5, far = 6, close = 7, very close = 8.

Table 7. Environmental Setting in Federal Low-cost

S/N	Environmental Setting	5	6	7	8	Total
1	Dumpsite from source of water	16	24	69	31	140
2	Dumpsite from residential premises	16	11	74	39	140
3	Kitchen from dish-washing site	22	18	64	36	140
4	Toilet from kitchen	3	27	70	40	140

Table 8. Environmental Setting in New GRA

S/N	Environmental Setting	5	6	7	8	Total
1	Dumpsite from source of water	53	26	14	7	100
2	Dumpsite from residential premises	64	25	9	2	100
3	Kitchen from dish-washing site	2	13	17	68	100
4	Toilet from kitchen	4	11	20	65	100

3.1. Discussion

In the aspect of environmental characteristics, outbreaks of diseases have been associated with unwholesome environment that generally characterised by water supply and sanitation [3,13], which comprised of the quality or cleanliness of water supply, waste management, drainage system, kitchen condition, dish-washing area and toilet conditions. The manifestation of good or poor grade of such environmental characteristics is an index of quality of livable environment, which translates the fitness or inaptness for human habitation. Except for cleanliness of water supply, of all the responses obtained on environmental characteristics from the study areas of Nassarawa-Jahun and Federal low-cost were rated poor and/or very poor, while all that of the New GRA were graded as good. The cleanliness of water supply in the former areas can be attributed to availability of boreholes constructed in recent years by political representatives of the areas complemented by the intermittent pipe-bone water supply by state water board. It is common to observe such disparity between the two other areas and New GRA, as their built environment are dominated by poor blended with least well-off and well-off residents, respectively. The P–values corresponding to the respective environmental variables are less than the level of significant ($\alpha = 0.05$) in each case of Nassarawa-Jahun, Federal low-cost and New GRA. This implies that there is positive and significant relationship between the environmental characteristics and the quality of environment of the studied areas. However, the coefficients of multiple correlation revealed that Nassarawa-Jahun had significantly highest value of $R^2 = 0.857$, followed by Federal low-cost with $R^2 = 0.799$ and then the least was for the New GRA with a value of $R^2 = 0.532$. This shows that 85.7%, 79.9% and 53.2% of the total variation is explained by the changes in the independent variables. Meaning that the environmental characteristics labelled as cleanliness of water, waste management, drainage system, kitchen condition, dish-washing and toilet condition explained poor environmental hygiene with 85.7%, 79.9% and 53.2% for Nassarawa-Jahun, Federal low-cost and New GRA, respectively. This is clearly indicating that hygienic environmental condition of New GRA was far better than the two other studied areas and therefore further supports the responses got from the each of the studied areas. Therefore, the very poor and poor environmental hygiene observed in Nassarawa-Jahun and Federal low-cost, respectively could considerably create breeding ground for mosquitoes, flies, cockroaches and rodents for the spread of diseases. However, if these vectors exist in an unwholesome built environment, they can be proliferated with the influence of temperature, rainfall and humidity and perpetrate spread of diseases such as malaria, diarrhoea, cholera, typhoid, etc. The prevalence of such diseases has been reoccurrence in hot seasons downstream to rainy period, of which cholera, diarrhea, and malaria remained the most reported cases and kept rising unavoidably (Figure 1, Figure 2, and Figure 3, respectively). This further hypothesises the existence of links between environment and human health, and the incidence of diseases in the environment can serve is an important indicator of anthropo-ecological disparity in the studied areas, more especially Nassarawa-Jahun and Federal low-cost. It also reflects that poor habitat quality is in harmonious dynamic interaction with diseases. A multiple regression analysis was carried out to assess the combine influence of these environmental variables on environmental hygiene of the areas. The R^2 values of the analysis are 82.9%, 72.5% and

46.3% for Nassarawa-Jahun, Federal low-cost and New GRA, respectively. This shows that these variables are part of the contributing factors that impact poor environmental hygiene in Nassarawa-Jahun and Federal low-cost and thus the inhabitants are more susceptible than those in New GRA to the risks of diseases. The simultaneous regression analysis further ascertained the combine effect of these variables. All the predictors (cleanliness of water, waste management, drainage system, kitchen condition, dish washing and toilet condition) yielded significant beta weights (β_x) with their varied t – values all statistically significant ($P < 0.05$) in each case. Overall, the results of the statistical analyses of possible relationships between the environmental characteristics and hygienic condition of the studied areas using Spearman's correlation test disclosed positive correlation particularly between poor environmental hygiene and each of waste management ($r = 0.705$; $P = 0.000$), drainage system ($r = 0.476$; $P = 0.000$), toilet condition ($r = 0.603$; $P = 0.000$) for Nassarawa-Jahun; waste management ($r = 0.618$; $P = 0.000$), drainage system ($r = 0.719$; $P = 0.000$), toilet condition ($r = 0.464$; $P = 0.000$) for Federal low-cost and waste management ($r = 0.630$; $P = 0.003$), drainage system ($r = 0.620$; $P = 0.000$), toilet condition ($r = 0.337$; $P = 0.001$) for New GRA, respectively. Therefore, high quality of environmental characteristics reflects hygienic practices and can interrupt the spread of enteric pathogens more especially through poor waste management, drainage system and toilet condition predominantly in Nassarawa-Jahun and Federal low-cost.

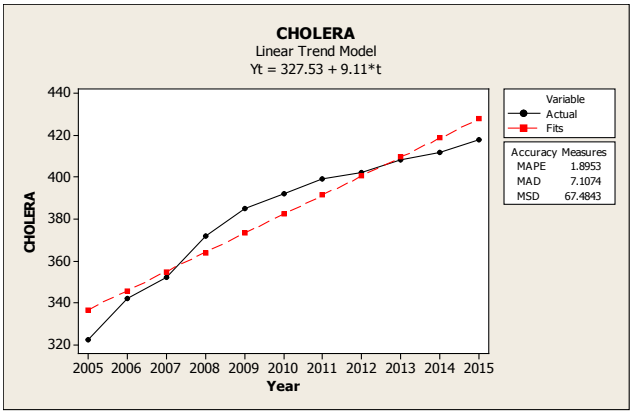

Figure 1. Trend analysis of cases of cholera between 2005 and 2015

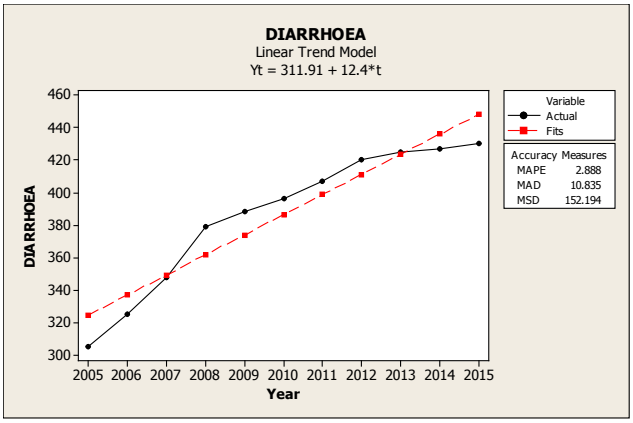

Figure 2. Trend analysis of cases of diarrhoea between 2005 and 2015

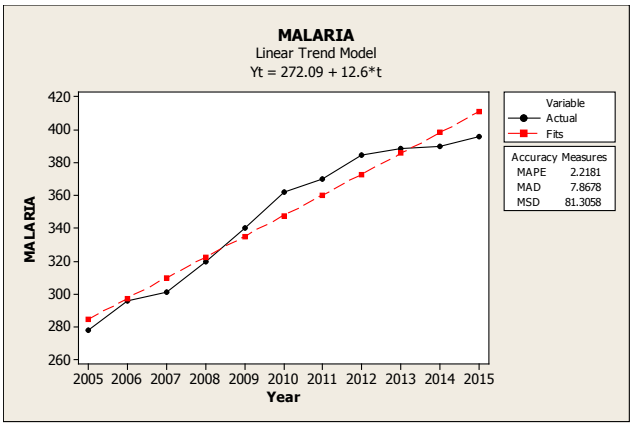

Figure 3. Trend analysis of cases of malaria between 2005 and 2015

To gain more understanding on the issue of discussion, the link between environmental setting variables namely-dumpsite from source of water, dumpsite from residential premises, kitchen from dish-washing site, toilet from kitchen and risk of prevalence of diseases was also studied. This was targeted to establish whether environmental setting variables significantly influence spread of diseases in built environment of different planning. In this respect, closeness of residential areas to dumpsite in both Nassarawa-Jahun and Federal low-cost had the highest counts, followed by closeness of kitchen from dish-washing site and of toilet from kitchen and then water source from dumpsite. In contrast, the environmental setting of New GRA is in dissimilar with the other residential areas. Because of aesthetic nature of its surroundings, water sources and residential premises showed to be very far from dumpsite. Although the disparate of the physical environmental set-ups and standards of the studied areas can conspicuously reveal unpleasant environment and prone to spread of diseases, but the inclination might not hold undoubtedly. The statistical based evidence demonstrates that there is significant and positive relationship between environmental arrangement and the risks of disease contamination ($P < 0.05$), particularly with respect to residential areas of Nassarawa-Jahun and Federal low-cost. The correlation test revealed positive correlations between respondents' population (congestion) and dump site from water source ($r = 0.874$; $P = 0.000$), dump site from residential premises ($r = 0.877$; $P = 0.000$) and toilet from kitchen ($r = 0.805$; $P = 0.000$) for Nassarawa-Jahun; dump site from water source ($r = 0.803$; $P = 0.000$), dump site from residential premises ($r = 0.798$; $P = 0.000$) and toilet from kitchen ($r = 0.809$; $P = 0.000$) for Federal low-cost and dump site from water source ($r = 0.304$; $P = 0.000$), dump site from residential premises ($r = 0.251$; $P = 0.000$) and toilet from kitchen ($r = 0.274$; $P = 0.000$) for New GRA, respectively. The positive relationship specifies that improper environmental set-ups and rowdy population in Nassarawa-Jahun and Federal low-cost is responsible to closeness of the dumping site to the water source and residential premises as well as closeness of toilets from kitchen and therefore susceptible to high risk of spread of diseases. However, in a well-planned and isolated built environment such as New GRA their dumping sites from their water sources and residential premises as well as toilets from kitchen

have least influence to cause out-break of diseases in the area. In addition, multiple regression analysis was carried out to assess the combine influence of environmental setting variables on the quality of the assessed areas. The R^2 values of 95.2 and 92.8 for Nassarawa-Jahun and Federal low-cost, respectively, indicate deterioration circumstances in these areas influenced by the environmental settings. Nevertheless, low R^2 of 48.6 for New GRA unfolds that environmental setting in area was commendable and therefore risk of disease out-break was at lowest heap. All such was further significantly confirmed by ANOVA results ($P = 0.000 < 0.05$). In a summary, environmental sanitary and planning variables dictate quality of environment, as this mirrored clearly in this study that rowdy setting is unhealthy environment while well planned and isolated environment truncates risk of disease propagation.

The construct was statistically validated and showed that the test was actually measured the intended attributes of the areas studied as well as respondents' behaviour. It consistently discriminates individuals at one time or over a course of time. It showed the extent to which measurements were repeatable with different persons answered the designed questionnaire on different occasions and under different conditions. The consistency of measurement as well as temporal stability of the test from one valuation to another over a variety of conditions was very satisfied since instrument used measured what was intended for, in which virtually the same results was obtained as all their correlation values were strong and significant for the reason that all P – values are all less than 0.05 or 0.1 (5% and 10% level of significance, respectively), hence the construct was valid and accepted as it adequately defined the environmental characteristics and settings of the areas investigated.

The Cronbarch's Alpha was found to be 0.852, 0.916 and 0.938 for environmental characteristic, setting and the overall environmental variables, respectively. This showed that 85.2%, 91.6% and 93.8% of the meaningful components of the environmental characteristics, settings and the overall variables of the questionnaire measured the behaviours, attitudes and beliefs of the respondents. Therefore, the test signifies that the data extracted from the respondents' response reflected very closely the respondents' perception upon the environmental qualities of the areas investigated. Although the respondents' opinion can never be with complete certainty, but the Cronbarch's Alpha values ascertain the reliability of the data extracted from the respondents' opinions.

4. Conclusion

Environmental characteristics and settings that reflect possessions and vulnerabilities, respectively, can help predict the possible end results of health problems and risk for certain diseases or of public health emergencies and associated risks. The environmental determinants can also show how diseases can be developed and spread over time and from one place to another. Our unhygienic practices and adequate environmental mechanism of ensuring its sustainability is what need to be reversed.

This research has revealed the current interrelationship between environmental hygiene and spread of disease. The results presented have shown that there are risks of disease contamination and disease spread under consistent and predictable environmental circumstances. The environmental quality of the areas investigated was significantly related and influenced by the environmental characteristics and setting (($P < 0.05$). The increase number of population or when the residential area is clustered or congested, the chance of spread of diseases is at high hike. On the other hand, when the residential area is well-planned, sparse and/or isolated, their chance of spread of diseases is at low climb. Though, the negative slope in the regression analysis (−0.965 and −1.019) for environmental characteristics and settings, respectively) demonstrates that the tendency of spread diseases and risk of infection was influenced not only by the selected physical environmental determinants, but also enthused by other environmental factors. The construct is statistically valid, as the instrument used found to be very satisfied since it measured what was intended for with approximately the same results on repeated times with different persons on different occasions and under different conditions ($P < 0.05$). Similarly, the reliability of the data extracted from the designed questionnaire was also statistically tested and reflected very closely the respondents' perception upon the environmental qualities of the studied areas ascertained by Cronbarch's Alpha far greater than 50%. Therefore, institutionalisation of public health infrastructures and/or system as part of urban developmental planning is a desired need and implementation couple with changes in hygiene behaviour among populace can help in declining risk associated with spread of diseases in a built environment.

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