UNIOSUN Journal of Engineering and Environmental Sciences. Vol. 2, No. 2. Sept. 2020
DOI: 10.36108/ujees/0202.20.0241

The Effect of Climate Change on the Health of Aged People in Ibadan, Nigeria

Kehinde, O. J. and Adeboyejo, A. T.

Abstract: Susceptibility to ill health among aged people had been linked with climate change impacts in rapidly urbanising cities. Therefore, this study evaluates to the vulnerability of aged people to the health impacts of climate change in Ibadan, Nigeria. Data on clinically diagnosed climate related diseases (CRDs) (2000 - 2014) among aged people (>50 years) and temperature and rainfall parameters (1970 - 2007) in Ibadan were obtained and projected to year 2050. Also, the relationship between the climatic parameters and incidence of the five most prevalent CRDs were analysed using multiple regression. The increasing trend of mean maximum temperature (r = 0.47) and rainfall (r = 0.15) is associated with incidences of hypertension (34.4%), respiratory diseases (21.2%) and diarrhoea (14.3%) among aged people (> 60 years), mostly male folk (67.2%). The linear composite of disease communalities extracted 84.0% variance of the data set with the following component scores: skin disease (0.98), hypertension (0.96), respiratory disease (0.92), diarrhoea (0.89) and malaria (0.45). Further, CRDs (R^2 = 27%, p = 0.012) in Ibadan among aged people could be significantly attributed to influences of climatic parameters. The study suggests building aged peoples' resilience to emanating impacts through health and nutritional improvement programs, and re-introduction of neighbourhood parks and gardens.

Keywords: Vulnerable Group, Climate Change, Aged People, Health Impairment, Climate Related Diseases

I. Introduction

The physical, environmental, economic and social factors in any nation are known to contribute immensely to the state of health of the people especially the vulnerable ones which include children, women and the aged [1, 2]. However, the uncontrollable rate of urbanisation and its attendant problems had further exacerbated impairments that the vulnerable suffered in the face of existing precarious situations impressed on them by factors operating in most developing nations and those of changes in climate [3, 4, 5]. The aged people become more susceptible to impacts around them owing to the ageing of their immune system, their weakened economic viability and lack of special attention on their health in terms of health care services in the nation.

Given aged peoples' susceptibility to emerging impacts of climate change, they had become sickly having suffered from food- and water-borne diseases like diarrhoea, cholera, respiratory diseases, malaria, typhoid and blindness among others [6, 1]. The aged are further faced with life threatening health risks due to increasing heat waves and fluctuating rainfall pattern. This was largely resulting from their decreased mobility, irregularities in usual supply of nutritional food and safe water and haphazard distribution of and limited access to health care facilities on the one hand and the existing precarious poverty, economic dislocation and deaths of promising and breadwinners in the family [7, 1].

These aged vulnerable individuals having been left at the mercies of their environment, inadequate and less functioning resources and their immediate relatives and neighbours who may not be able to aid them when they are in distress; had often resorted to using unsafe

Kehinde, O. J. (Department of Estate Management, Lead City University, Ibadan, Nigeria)
Adeboyejo, A. T. (Department of Urban and Regional Planning, LAUTECH, Ogbomoso)
Corresponding author: olamijukehinde@gmail.com
Telephone Number: +234-803-439-9739

sources of water for domestic chores, cooking and even drinking. Their immunities become further broken down as they survived on a less nutritious and imbalanced diet. Worst still, they cannot even afford to attend hospitals to seek medical interventions for their ailments as quickly as possible and within threshold distances nor purchase drugs for their recuperation. They are even mostly unable to link their predicaments to climate change impacts neither do they have an understanding of salient issues [6, 4]. Against this backdrop, the study evaluates the health impairment of aged people to the impacts emanating from climate change in Ibadan, Nigeria with a view to mitigating the impacts and enhancing their capacities to further cope.

II. Materials and Methods

A. Brief of the Study Area

This study was carried out in the metropolis of Ibadan, Nigeria (see fig. 1). Ibadan is situated in the rainforest, along longitude $3^0 48^{'}$ East and $3^0 57^{'}$ East, and latitude 7^0 $23^{'}$ North and 7^0 $27^{'}$ North, covering a distance of 145km northeast of Lagos and extends across northwest to southeast direction. The peaks of the town range from 160 – 275 m above sea level at Mapo, Mokola and Aremo with mean annual temperature and rainfall of about 33^0C and 1150mm respectively with the hottest month is February (36^0C) while July is the coldest month (29^0C) [7]. Ibadan metropolis has a population of 1,343,147 [8]. This study focuses on the health impacts of climate change on aged people (≥ 50 years) in Ibadan.

B. Methods of Data Collection

A pro-format questionnaire was designed to record observations on clinically diagnosed climate related diseases (such as malaria, typhoid, diarrhoea, cholera, respiratory diseases and blindness) (2000 - 2014) among old age people from Central Records Unit of University College Hospital, Ibadan; and data on temperature and rainfall patterns were also obtained from Nigeria Meteorological Agency (NIMET) (1970 - 2007). Elicited information from the questionnaire include but not limited to addresses and residential densities of patients, climate related illnesses suffered, sex of patients, month and year of admission, diagnosis and prognosis among others.

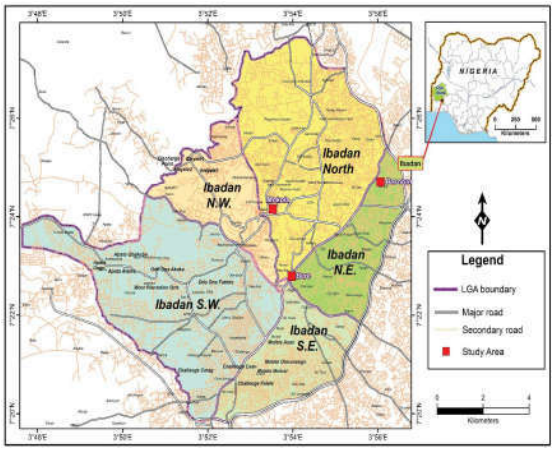


Fig.1: Ibadan Metropolis
Source: Culled from [9]

C. Method of Data Analysis

The study however, uses frequency tables, cross-tabulations and charts to illustrate such information as spatial variations in the incidences and prevalence of climate related diseases. This was done to enhance visual impression of results. While Chi-Square test was specified to establish the significance of any observable variation in the relationship among variables, Pearson Correlation was used to test the relationship between the incidences of Climate related diseases and their years of occurrence on the one hand and the relationships between temperature and rainfall, and their year of occurrences on the other hand. Principal Component Analysis was also used to factor analyse the incidence of climate related diseases for a disease factor

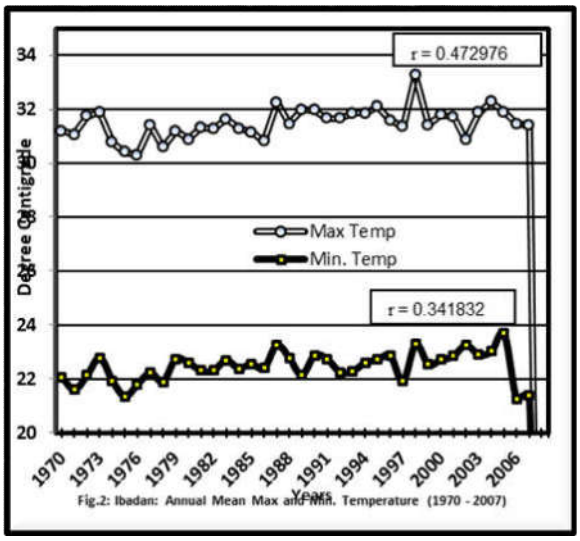
and to know their variances. However, Multiple Regression analysis was employed to examine and test the strength of the relationship between climatic parameters (independent variable) and the incidences of climate related diseases (dependent variables). Generalization and conclusions were thus carefully inferred from the results of the findings of this study.

III. Results and Discussion

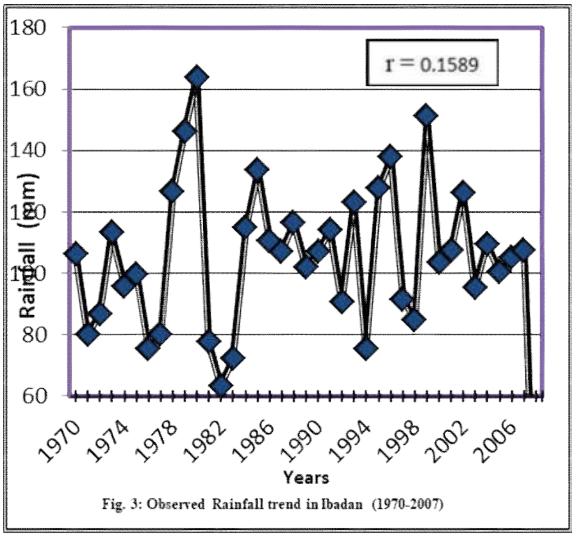
A. The Trend in Climatic Parameters in Ibadan

The observed fluctuations in climatic parameters in Ibadan within 1970-2007 review period show that the mean maximum temperature ranged from 30.3^{0}C in 1976 to 33.3^{0}C in 1998 with an annual increase of 0.08^{0}C while the mean minimum temperature ranged from 21.24^{0}C in 2006 to 23.68^{0}C in 2005. The observed variability increases with years given mean maximum (r = 0.47) and mean minimum (r = 0.34) temperatures (see fig. 2). However, within the same review period, the trend of rainfall distribution was irregular with sharp increases in quantities observed in 1970 (80.0 mm) and 1980 (163.8 mm), and an unprecedented drop in 1982 (63.4 mm) despite the flood in the city that year (see fig. 3). The existence of a weak but positive Pearson's Correlation Coefficient (r = 0.16) is a pointer to the continuous but slow increase in rainfall with those years [7, 10].

With continuing urban expansion and encroachment of Ibadan city into the hinterlands, the warming tendency of the city is bound to escalate with years [3, 5]. The predictions of the mean maximum and minimum temperatures with Pearson's Correlation Coefficients r = 1.0 and 0.99 respectively and that of rainfall r = 1.0 signified that the warming of the city will continue to 2050 though, increasing quantity



Source: Adapted from [7].



Source: Adapted from [7].

of rainfall have/may not culminate into an easement of water stresses especially given the bottleneck in the services of the State Water Corporation in Ibadan.

B. The Incidence and Typology of Climate Related Diseases (CRDs) in Ibadan

This study within a review period (2000-2014), identified eight (8) climate related diseases (CRDs) among the aged people (≥

50years) admitted and treated at the University College Hospital (U.C.H), Ibadan. The CRDs include: Hypertension (35.1%), Respiratory Disease (21.7%), Diarrhoea (14.6%), Malaria (7.5%), Skin Disease (7.3%), Asthma (6.9%), Typhoid Fever (4.5%) and Blindness (2.4%) of which the first five, representing 86.1% were most prevalent in that order. The evident increase in local warming had its toll on incidences of these CRDs, making the aged people more vulnerable especially given their weak adaptive capacities [6, 10].

For the first three most prevalent CRDs, Ibadan North (IBN) was worst hit with respiratory disease (29.4%) and hypertension (28.6%), and following next to the worst hit by diarrhoea (19.4%); while Ibadan South-west (IBSW) had followed IBN in the incidences of hypertension (22.4%) and of respiratory disease (23.1%) and was worst hit by diarrhoea (27.8%) whereas, Ibadan South-east was third-placed with the incidences of diarrhoea (13.0%) and respiratory disease (8.8%) whilst the third worst hit by in the incidence of hypertension was Egbeda (8.1%). Notedly, though not statistically significant, the intra-urban differentials in CRDs incidences were more pronounced in the metropolis than elsewhere given the X^2 = 58.848 and p = 0.519, except at places outside Ibadan and Egbeda LGA. Also, it was clear that patronage for CRDs treatment at the College Hospital decreases with distance away from the clinic. However, given numbers of referral cases and patronages for treatment of all sorts, it was obvious that the University College Hospital, Ibadan is notable for its crop of professionals and medical equipment acquisitions among others.

C. Temporal and Spatial Variations in Climate Related Diseases (CRDs) Incidences in Ibadan

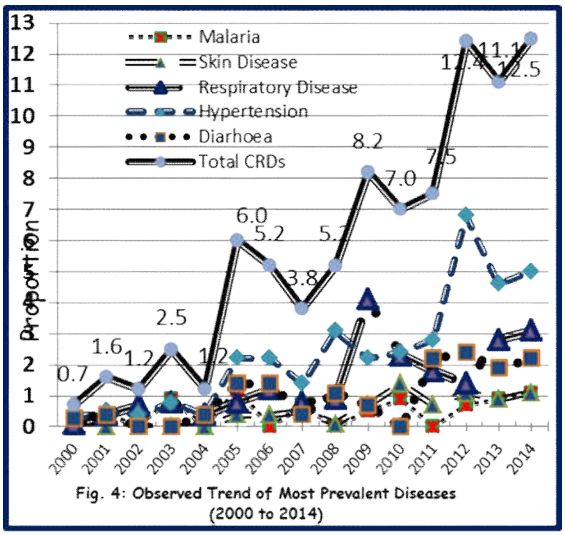
The trend of climate related diseases (CRDs) incidences increases with years in a dinosaur trajectory motion given the Pearson's Correlation Coefficient (r = 0.93) though, with drops during years 2002, 2004, 2006, 2007, 2010 and 2013. One would observe the tendency for a drop in incidence between 2-3 years (not statistically proven). The total incidences of CRDs ranged from 0.7% in 2000 to 12.5% in 2014 and with Pearson's Correlation Coefficient (r) of 0.99, the projected trend suggests increasing incidences of CRDs to the year 2050 (see fig. 4).

Generally speaking, the incidences of CRDs was highest in April (10.3%) during the wake of the rainy and lowest in February (5.4%) at the tail end of dry seasons. For highest incidence (highest patronage for CRDs treatment) across spatial units, the high residential density had three top incidences in March (11.4%), November (10.8%) and September (9.9%); the medium residential density had top incidences in April (11.5%), October (10.6%) and in each of July and August (10.1%); the low residential density had its top incidences in May (18.7%), September (11.0%) and in each of April, October and December (8.8%) whilst at places outside Ibadan, the incidences were pronounced in August (19.5%), May (16.1%) and January (9.2%) [9, 10, 11].

D. Gender and Age Specificity of Climate Related Diseases (CRDs) Incidence in Ibadan

This study observed that more men (55.9%) than women (44.1%) were hit by CRDs in Ibadan. More explicitly (58.1%) and (55.7%), and (60.3%) among men from high and medium residential densities and from outside

Ibadan respectively were susceptible to the incidences of CRDs compared with women. However, at the low residential density more women (56.1%) than men were significantly worse hit ($X^2 = 15.426$ and $p = 0.031$).



Source: Adapted from [7].

Furthermore, majority of the aged people treated with any CRDs in Ibadan were aged 50-60 years (37.8%) followed by those aged 61-70 years (35.0%) and 71-80 years (19.6%). A cursory look shows that residents aged 50-60 years were most susceptible to malaria (40.0%); diarrhoea (39.8%), hypertension (39.4%) and respiratory disease (36.9%) whereas, skin disease was highest among those aged 61-70 years [11, 12]. One would observe that incidences of CRDs decrease with age consequent upon the fact that most aged people died before any notice of their ailments on the one hand for reason of weakened physiology and agility, and because few people survived beyond the life expectancy age of 55years and dearth of records on causes of death among aged people on the other hand.

E. Variation in Climate Related Diseases (CRDs) Induced Mortality in Ibadan

Only less than one-fifth (12.6%) of those diseased with any climate related disease (CRD) had expired within the review period [indicating more men (66.7%) than women (33.3%)] implying that recuperation rate for any of the CRDs was higher. The high residential density held the highest record of death (54.8%) blamed on CRDs incidences while the medium and low residential densities and places outside Ibadan had 26.9% and 11.8%, and 6.5% records of death from CRDs incidences respectively. By gender, more men in the high (66.7%) and medium (76.0%) residential densities and from places outside Ibadan (83.3%) than women had significantly expired whereas, at the low residential density more women (63.6%) than men had expired owing to CRDs incidences ($X^2 = 3.950$; $p = 0.047$) [12].

F. Relationship between Climatic Parameters and Climate Related Diseases in Ibadan

The tested relationship between climatic parameters (temperature and rainfall) and CRDs incidences extracted 84.0% variance of linear composites of disease factor with component scores of skin disease (0.979); hypertension (0.959); respiratory disease (0.917); diarrhoea (0.893) and malaria (0.453). Results further show that with $r = 0.519$ and coefficient of multiple determination $R^2 = 0.270$, about 27.0% incidence of CRDs are attributed to changes in climatic parameters. Consequently, other 73.0% incidence of CRDs in Ibadan may be due to other factors not here explained. The significance of relationship attested by $F = 5.169$ and $p = 0.012$. The calibration of predictive model $y = a + b_1x_1 + b_2x_2 + e$; where y = the linear composite of the diseases (malaria,

hypertension, diarrhoea, skin and respiratory diseases) and x_1 and x_2 are maximum temperature and average rainfall; weighs:

$$y = -62.812 + 1.74\,(max.Temp.) + 0.106\,(av.rainfall) + e \quad ...(1)$$

This shows that a unit increase in temperature will result in over 100% (1.74 fold) increase in the incidence of the five most prevalent CRDs whereas, a unit increase in rainfall distribution will only yield about 10.6% (0.106 fold) increase in CRDs incidences. However, a 35years projection shows that with correlation coefficient (r = 0.99), the incidence of CRDs will increase with years, ranging from 12.5% in 2015 to over 42% in 2050 [7, 10].

IV. Conclusion

The impacts of climate change as observed had been severe on the health of the aged people in Ibadan, Nigeria especially given existing pervasive poverty because on the one hand, they had to spend the little resources at their disposal for treatment of CRDs. On the other hand, the dearth of information on health care services and inadequate health facilities with a focus on the aged had added to their susceptibility while some of them had expired owing to their exposure to such CRDs within the review period.

Therefore, this study recommends that provisions should therefore be made for comprehensive health care programmes coupled with nutritional supports for the aged, the use of certified caregivers to cater for registered aged people owing to their decreased mobility; this will solve the problem they face having to travel over some inconvenient distances to get treatment for their CRDs. In addition, alternative transportation options can be arranged for them. Lastly, educating the aged people and their relations on resilience (psychological, physical, mental and social) building is pertinent just as much as bringing them close to nature (through re-introduction of neighbourhood parks and gardens).

References

[1.] Lee, T.M., Markowitz, E.M., Howe, P.D., Ko, C.-Y. and Leiserowitz, A.A. "Predictors of Public Climate Change Awareness and Risk Perception around the World", *Nature Climate Change*, vol. 5, no. 11, 2015, pp. 1014 – 1020.

[2.] Niang, I., Ruppel, O.C. and Abdrabo, M.A. "Climate Change, 2014: Impacts, Adaptation, and Vulnerability", In *Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel of Climate Change*, V. R. Barros, C. B. Field, D. J. Dokken et al., (eds.), 2014, pp. 1199 – 1265, Cambridge University Press, Cambridge, UK and New York, NY, USA.

[3.] Appiah, D.O., Bugri, J.T., Forkuor, E.K. and Boateng, P.K. "Determinants of Peri-Urbanization and Land Use Change Patterns in Peri-Urban Ghana", *Journal of Sustainable Development*, vol. 7, no. 6, 2014, pp. 95 – 109.

[4.] Lwasa, S. "Managing African Urbanization in the Context of Environmental Change", *Interdisciplina*, vol. 2, no. 2, 2014, pp. 263 – 280.

[5.] Linard, C., Tatem, A.J. and Gilbert, M. "Modelling Spatial Patterns of Urban Growth in Africa", *Applied Geography*, vol. 44, 2013, pp. 23 – 32.

[6.] Mattah, P.A.D., Futagbi, G. and Amekudzi, L.K. "Diversity in Breeding Sites and Distribution of Anopheles Mosquitoes in Selected Urban Areas of Southern Ghana", *Parasites and Vectors*, vol. 10, no. 1, article no. 25, 2017, https://doi.org/10.1186/s13071-016-1941-3.

[7.] Kehinde, O.J. "Household Vulnerability and Response Patterns to Climate Change and Poverty in Ibadan, Nigeria", *An Unpublished Ph.D Thesis* submitted to the Department of Urban and Regional Planning, Ladoke Akintola University of Technology, Ogbomoso, 2017.

[8.] National Population Commission (NPC), *The National Population Census 2006,* Federal Government of Nigeria.

[9.] Salami, R.O., Von Meding, J.K. and Giggins, H. "Assessing Habitats of Vulnerability

in African Cities: A Case of Poverty Housing in Ibadan Metropolis, Nigeria", A Paper Presented at the *Project Management Symposium,* the University of Maryland held on May 12 – 13, 2016.

[10.] Adeboyejo, A.T., Aluko, O.E. and Kehinde, O.J. "Impact of Climate Change on Aged Peoples' Health in Ibadan, Oyo State, Nigeria", Being A Paper presented at *The Seventh International Conference on Climate Change: Impacts and Responses*. UBC Robson Square, Vancouver, British Columbia 10-11 April, 2015.

[11.] Ilevbare, F.M. and Idemudia, E.S. "Influence of Gender and Age on Attitudes toward Climate Change: A survey of a Nigerian University Students Population", *Gender and Behaviour*, vol. 15 no. 4, 2017, pp. 9831-9845. http://www.ajol.info/index.php/gab/article/view/165789

[12.] Hathaway, J. and Maibach, E.W. "Health Implications of Climate Change: A Review of the Literature about the Perception of the Public and Health Professionals", *Current Environmental Health Reports*, vol. 5, 2018, pp. 197-204.