

EFFECTS OF CLIMATE CHANGE ON HEALTH RISKS IN NIGERIA

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ABSTRACT

Climate change has adverse consequences on human health as well as exacerbates health risks. Climate change is as certain as human death so long as population increases and economic activities generate gaseous wastes, thus resulting in the increase of anthropogenic carbon dioxide (CO₂). Society illusion implicated in climatic change amplifies health risks, and can increase morbidity rate to catastrophic levels. This paper addresses possible illusions on climatic risks and investigates health risks that could arise in Nigeria from climate change. We employed structured survey to elicit risk perception responses on health risks and climate change from health personnel in Nigeria and other citizens. We adopt Z-score and simple regression analyses to test the extent of relationship between climate change and morbidity rate and descriptive statistics on society illusion on climate change. This study found that there is prevailing illusion on climate change and there is significant evidence for increase in health risks and morbidity rate instantiated by climatic variability. We recommend the introduction of stiff penalties for poor waste management, deforestation, awareness campaign for climate change and health risks. Weather insurance policy cover by organizations be adopted for credit rating. Flooding risk could be an additional cover under health and life insurance policies. An emergent health care strategy by government to respond to health risk pandemic caused by climate change should focus on malaria, meningitis, cholera, high blood pressure and pneumonia.

Key Words: *Catastrophic risks, climate change, health risks, morbidity rate, risk perception, societal illusion*

INTRODUCTION

Climate change was defined by IPCC (2007) Fourth Assessment Report as “change in the state of the climate that can be identified (e.g. by using statistical test) by changes in mean and/or variability of its properties, and that persists for an extended period typically decades or longer.” It is being synonymously termed as global warming (BNRCC, 2008). IPCC (2007) links it to the changes in global average temperature between (0.74 ± 0.18) . The results are fiercer weather lasting for longer cycles; extreme scorching heat, precipitation of rainfall, increased intensity of storms, hurricane, floods, droughts, outbreak of fire, induces earthquake, acid rain, and indirectly connected to malnutrition and poverty. One World guide (2010) describes climate change as a pincer threat based on ‘advancing Sahara’ and flood –prone coastal region that is below or close to sea level. The two threats are present in northern and southern Nigeria respectively. The World Health Organization (WHO) (1990) considers the consequences of global warming as the most pressing problem of the 21st century. The world’s climate system is fundamental to supporting continuity of life.

The implications of climate change on human health could be direct and indirect. According to BNRCC the direct consequences of climate change in Nigeria include cerebra-spinal

meningitis, cardiovascular respiratory disorder of the elderly, skin cancer, high blood pressure, malaria, cholera and citing UNDP (2005) note the dangers to child and maternal health. The dangerousness of unmanaged climatic variability is increase in morbidity rate caused by exacerbation of old and new viscera health risks like skin cancer, high blood pressure, heat stroke, influenza, psychosis and possibly neurosis. There are fewer studies on effects on morbidity rate than on mortality rate (Kalkstein and Valimont, 1987).

There is a large body of extant literature on the impact of climate change on human health, Kalkstein and Valimont (1987) collations show that medical scientists and climatologists using regression techniques mainly did them.

The attitude of the average citizen in Nigeria towards consequences of climatic change seems to regard it as transcendental and an illusion accompanies its origin, and that is not likely to pose problem. A casual observation of living style in Nigeria like dumping of refuse in canals, usage of perfumes, purchasing second hand cars, waste disposal and mass use of electric generators implicate a low understanding of their effects on climatic changes that requires more elucidation. As it were, global warming could propagate intense earthquakes, storms and flooding with consequential catastrophic risks such as witnessed in Haiti and Japan. The culpable illusion and pattern of morbidity require empirical analysis to excite adequate policy responses in Nigeria.

Statement of Problem

Climate change is to a great extent induced by human activities that causes variability in the intensity of heat burning the earth surface and the degree of rainfalls for long period. This could provoke dangerousness of health risks that increases morbidity rate. The mitigation process could be dynamically inclusive if the society develops adequate perceptions of health risks and climate changes, thus removing the illusions thereof.

Purpose of Study

This study highlights the implications of health risk perceptions and attitude to climatic changes of Nigerians that invariably may contribute to accentuated environmental disasters, and the exacerbation of health risks. The consequences of worsening health risks and morbidity rate as an outcome of exacerbation of prevalent diseases and emergent ones like high blood pressure, psychosis, neurosis and congenital malformations as a consequence of effects of climate change on health needs to be exposed to help promote mitigation policies.

Hypotheses

Ho₁: There is no significant relationship between temperature-related morbidity in Nigeria and climate change

Ho₂: Climate change has no correlation to the illusion of Nigerians on effects of climatic changes on human health

CONCEPTUAL FRAMEWORK

Risk perception explains attitude and behaviour of persons in risky situations. There are two perspectives; psychometric paradigm and cultural theory, (Sjoberg, 2003). Slovic (2000) explains that the psychometric paradigm is based on various risks characteristics thereby unveiling the cognitive structure of risk. The people's risk perceptions are related to the attributes of sources of risks, like dread and new risks. Dread was represented by the attributes: catastrophic, consequences fatal, not easily reduced, uncontrollable, risk increasing and involuntary. The factor new risks are indicated by: unknown to those exposed, not observable, risk unknown to science and effect delayed. Slovic claims that the higher the score of a risk source on this factor the higher its perceived risk.

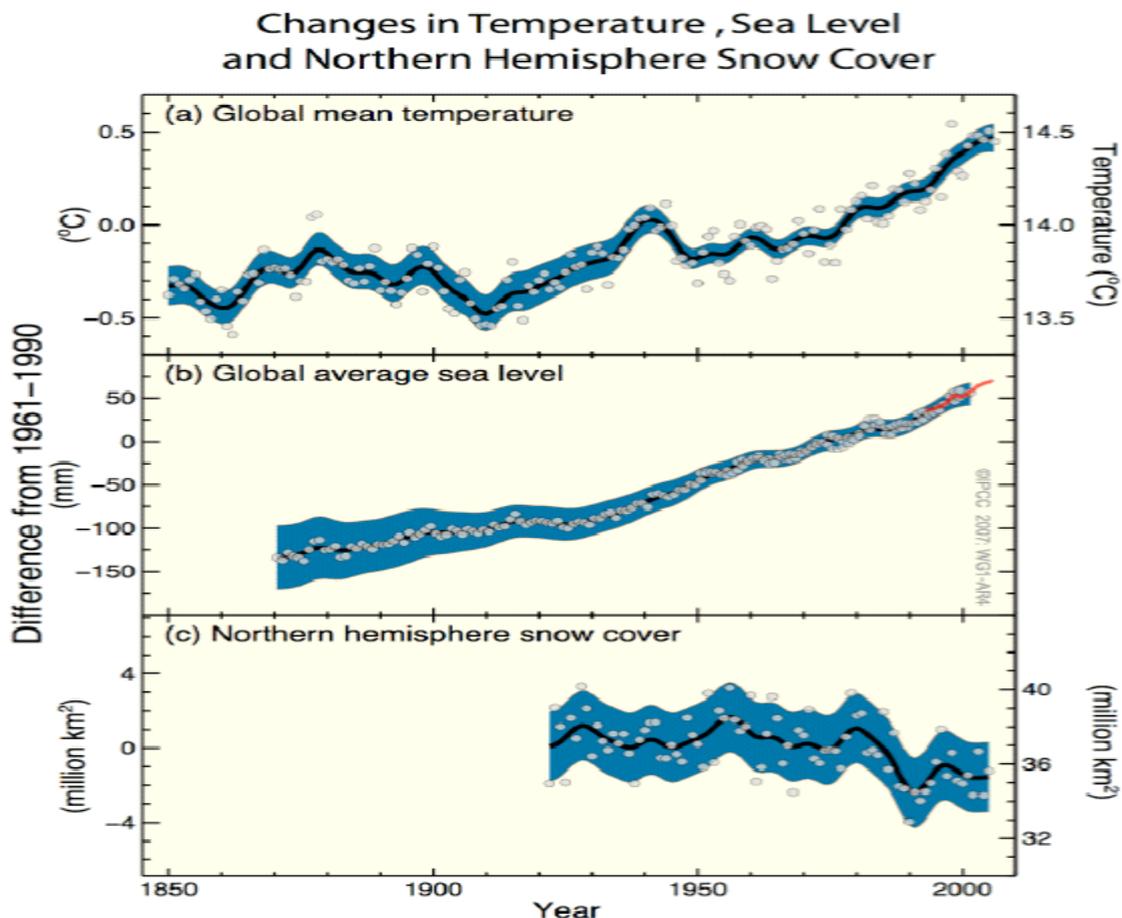
Cultural theorists led by Douglas and Wildavsky (1983) link risk perception to culture which was associated with four ways of social life: hierarchists, individualists, egalitarians, fatalists

The two perspectives help the understanding of how societal illusion arises. In medical parlance, Houlston (1965) describes illusion as inaccurate perception. For example, a sting on the floor is mistaken to be a lizard. Perception, she says is the process of forming meaning to something from the stimulus of our senses. This is quite important to understanding inaccurate perception of Nigerians in respect of how climate change can influence a catastrophic dimension to health risks. Societal illusion is a more risky construct because of the aggregate effect on national character or identity whereby every member of the society by their everyday behaviour will unwittingly contribute to global warming.

Literature Review

Climate change is a complex interaction between earth’s atmosphere- stratosphere and troposphere -on one hand and land biosphere (Allen, 2004; Solomon et al, 2008). Human activities generate CO₂ and other green house gases as waste by-products, which traps heat from escaping from the troposphere thereby mechanising global warming. To maintain biodiversity, the ocean dissolves the CO₂ and plants absorb it for growth. When the threshold is exceeded, global warming- increase in temperature results. According to Masters (2011), these facts are incontrovertible; the arguments are the level of confidence that humans are responsible for the gases, thus the word ‘anthropogenic’. Figure 1 shows the time series of temperature rise for 150 years.

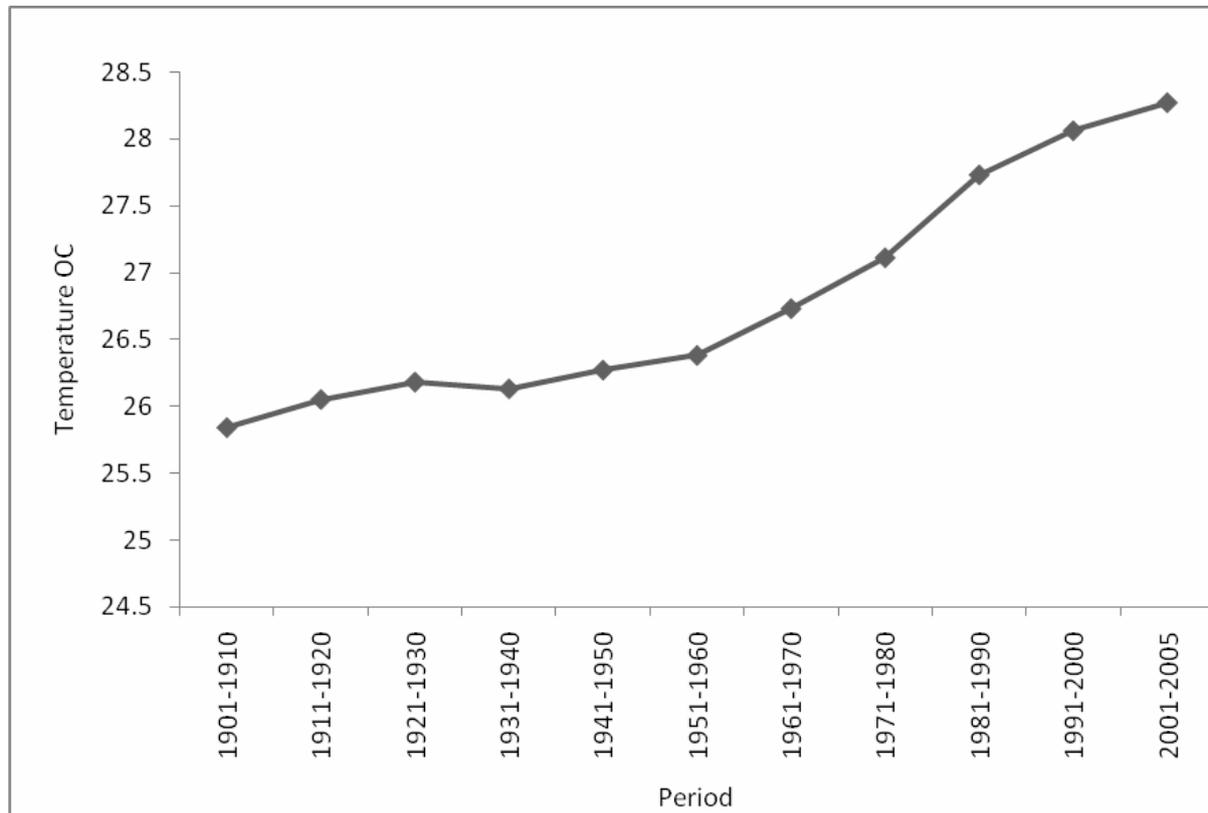
Figure 1: Time series of temperature rise for 150 years.



Source: IPCC (2007)

In Nigeria, the consequences of climate change are the advancement of Sahara by 600 metres annually, longer cycle of very harsh weather in forms of excess. The major ones are dry and rainy seasons. Odjugo (2010) classifies the period 1901-2005 into three periods; 1901-1935, 1936-1969, 1970-2005. He identifies the last period as the most critical period of climate change with mean 1.7°C change in temperature over 105 years. Figure 2 show the time series of temperature changes within the period. IPCC (2007) is warning that a mean 2°C change by 2050 will have dire consequences on human living conditions.

Figure 2: Time series of Temperature changes within the period.



Source: Odjugo (2010)

Climate change creates overwhelming problems for an already impoverished populace. Flooding is a consequence of climate change from sea level rise and poor infrastructural planning of drainage system. For example, the southern part of Nigeria is prone to flooding, and in particular, Lagos state, the commercial nerve centre of Nigeria is noted to be one meter above sea level (Agbo, 2011), is threatened with possible extinction. Figure three is a typical flooded sub-urban area. The health risk implication could be deduced to include direct water borne diseases like typhoid, cholera, pneumonia, diarrhoea and malaria. High temperatures is known to amplify ailments like meningitis, measles, chicken pox and it is suspected that new health risks like high blood pressure and dehydration in pregnancy may give higher morbidity rate.

Figure 3: Flooding of a city after a heavy rain



Source: BNRCC (2008)

What is Health Risk?

Health risk combines two words that align to explain the concept. WHO (1996) defines health as a state of complete physical, mental and social well-being and not merely an absence of diseases or infirmity. This definition subsists since 1948 and helps to guide us into understanding health risk. The inverse of this definition means the presence of a disease and lack of completeness in physical, mental, and social/emotional well being tantamount to health risk.

In insurance literature, risk means to exposure to danger, chance of loss or loss of opportunity income, and uncertainty concerning the occurrence of a loss (Mehr, 1970, Rejda, 2008). Finance theory explains it as variability from expected value or outcome (Barnejee, 2008 and Olowe, 2008). We adopt The World Health report (2002) definition that says risk is “probability of an adverse outcome, or a factor that increases that probability.”

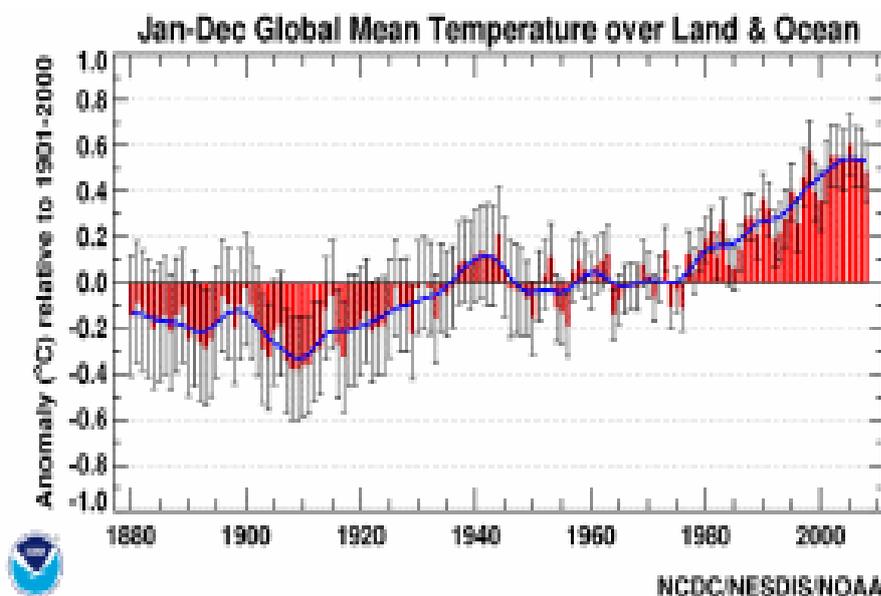
A compendium of the definitions of health and risk means health risk is “danger to health”, “chance of loss of health”, “variability from health”, and “worsening of ill health”. Business Dictionary (2011) explains that human health risk is the degree of likelihood that one or more exposures to a hazardous substance may have damaged the health of an exposed person.

Climate change is a factor that can increase the frequency and severity, that is probability of ill health or instantiate it. The highest health risk is for sickness to result in death known as morbidity. Climate change might accentuate health risks and morbidity rate. Although, past researches focused and found significance evidence on correlation between climate change and mortality rates particularly high temperatures and death of the elderly (Bridger et al., 1976; Lye and Ramal, 1977; Jones et al, 1982). Sprung (1979) observes that the elderly suffers from physiological responses and often are unable to increase their cardiac output sufficiently during extreme hot weather. Persinger (1980) links the high fluctuations in temperature to some medical disorders like high blood pressure, heat stroke, bronchitis, asthma, glaucoma, goitre, eczema and herpes zoster. According to him, complications could be expected from these disorders at higher temperatures since the body responds to thermal stress by forcing blood into peripheral areas to promote heat loss through the skin. The sudden surge of blood increases central blood pressure and encourages constriction of blood vessels near the core of the body.

The killer risk causing climate changes is the emission of gases –carbon dioxide (CO₂), methane, (CH₄), nitrous oxide (N₂O) and chlorofluorocarbons- causing green house effect going by the 2007 UN Copenhagen conference on climate changes (WHO, 1996). Nwoke, Nwoke and Ukpai (2009) link the green house effect to the depletion of ozone layer through the photochemical reaction of these gases. Health is endangered when ambient temperature becomes so high that it affects the central nervous system, might influence increase in high blood pressure. The penetration of ultra violet rays causes skin cancer and we reason that the foetus in pregnant women is at great risk if they are exposed to high level ultra violet rays as ozone layer continue to be depleted.

Global warming causes the sea and ocean levels to rise and during the rainy seasons, it fuels a greater probability of flooding. This aggravates the vulnerability of the poor living conditions to malaria, cholera and pneumonia.

Figure 4: Annual Average Global Surface Temperature Anomalies 1880-2008



Source: NCDC/NESDIS/NOAA

Societal Illussions on Climate Change and Health Risks in Nigeria

Oxford advanced learners dictionary defines illusion as “a false idea or belief about a situation.” When applied to climate change and health risks, it could be illustrated as an

underestimation of climate changes and the possible relatedness to health risks. We link illusions to risk perception since the later is the personal or group subjective value, idea or belief associated with the degree of existence of a danger. The daily activities of humans are intuitively based on perception. The qualitative aspect of risk is the construct based on experience and information as well as the perceived or attributed factors of an object (Slovic, 2000). Mitigation strategies will therefore be shaped by individual and collective perceptions of risk. Various studies, factors which influence risk perception are: the characteristics of risk source itself (Slovic, 2000), world views or value attitudes (Dake, 1991; Peters and Slovic, 1996), ethnic-cultural and socioeconomic background (Vaughan and Nordenstam, 1991), and personal variables such as profession (Barke et al 1997). There is need to conduct research into cultural context of what intuitively drive perception of risk of Nigerians.

Societal illusion on climate change in Nigeria seems shaped by lack of experience and information that Slovic emphasized under cultural theory. Another possible factor is the ethnic-cultural background that ascribes everything that happens as an “act of God”. This value attitude tends to take away positive responses to protect public goods such as environmental protection. The generation of green house gases through bush burning, use of firewood for cooking, importation and use of second hand cars and mass use of generators which more or less are connected to poverty level and socioeconomic background constitute an illusion of control behaviour. Perception of risk of climate change relationship with health risk affects a voluntary effort of persons in avoiding those acts. This conforms to the cultural theory and psychometric perspectives of risk perception and how it cognitively reflects an illusion.

Illusion is observable by a susceptible lack of angst among Nigerians, who dump waste into canals and drainages that may exacerbate flooding and generate CH₄; generate CO₂ by burning refuse in the urban areas, utilizing wood for cooking, use of generators for energy, importation of fairly used vehicles; and releasing CHCl₃ from the use of cosmetic perfumes. Agbo (2011) haps on the presence of illusion particularly in Lagos state where residence have tendency to dump domestic waste in water passages and construct houses illegally to block drains. He alludes that even some of the drains are constructed slanting against the flow of water. The causes of illusion if it exists, whether cultural or psychometric, need empirical evaluation to address the fundamental errors that are contributing unknowingly to climate change.

METHODS AND ANALYSIS

A number of statistical tools were employed in this study. These include: descriptive statistics, Z-score and regression analysis.

Descriptive Statistics :

This was employed to describe and summarize the data collected. Simple descriptive statistical techniques such as frequency counts, percentages, means, and standard deviations were employed.

Z-score

This measure was employed to test for significance of morbidity of the diseases. In the survey, a number of diseases were examined. An average Z-score benchmark was determine based on how varied the disease are as well as their potency or severity. This value was used to determine potent disease for regression analysis. In all, four diseases were identified.

Regression Analysis

This was employed to ascertain the relationship between morbidity rate and temperature. It was used to in analyzing data to determine the predictive potency of temperature to

morbidity rate from 1970 to 2006. The dependent variable is morbidity rate (Y_t) and independent variable is temperature change (X_t).

The implicit form of the model is specified as:

$$Y = \alpha + \beta X_t + \varepsilon_t$$

Where: Y_t = Aggregated morbidity rate, X_t = Temperature change

α = Constant term, β = Coefficient, ε_t = Error term

Table 1: Descriptive statistics (i.e. mean and standard) of responses of medical practitioners on frequency of some diseases in Nigeria

	5	4	3	2	1	Mean	SD	Variance	Z- Score
Malaria	32	15	5	1	1	4.41	0.88	0.744	-40.30
Meningitis	29	18	5	1	1	4.35	0.872	0.761	-38.23
Cholera	40	10	3	1	-	4.63	0.760	0.517	-74.07
Diarrhoea	23	15	10	4	2	3.98	1.124	1.264	-22.76
Measles	16	21	9	2	6	3.72	1.250	1.563	-7.5
Chicken pox	6	20	16	5	6	3.33	1.197	1.434	-6.8
Asthma	17	17	13	5	2	3.78	1.110	1.233	-18.92
Skin Cancer	18	19	9	7	1	3.85	1.089	1.185	-29.47
Conjunctivitis	6	7	10	16	15	2.50	1.328	1.764	6.98
Pneumonia	15	13	25	1	-	3.78	0.883	0.780	-27.78
Congenital malfunction	13	17	8	11	5	3.41	1.311	1.718	-7.300
High blood pressure	25	14	8	6	1	4.04	1.115	1.244	-32.77
Stroke	28	15	5	6	-	4.20	1.016	1.033	-51.85
Heart failure	29	17	6	1	1	4.33	0.890	0.792	38.23
Selimonellcityphi - typhoid	17	14	14	6	1	3.77	1.096	1.201	-20.98
Cataracts	8	9	10	15	11	2.77	1.368	1.871	-2.35
Dehydration in pregnancy	8	16	10	13	6	3.13	1.272	1.617	-2.183
Neurosis	13	11	15	11	3	3.38	1.228	1.509	-11.78

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics (i.e. mean and standard) of responses of medical practitioners on frequency of some diseases in Nigeria. The table reveals that the most frequent disease in the list is Malaria, with a highest mean point of 4.51. This shows that malaria is a major health problem in the country and varies by weather such as temperature which allows the carrier of malaria parasites than other diseases. The least frequent observed disease in the list is Cataracts with the lowest mean point of 2.79.

Table 2 below shows the severity of some diseases determined in the survey. The data were obtained from the ranking by medical practitioners across the country. From the table, it is observed that highest severe diseases in the list is Cholera, with a highest mean score of 4.63 and Z score 74.07; next to it malaria, 4.41, -40.3; meningitis, 4.35, -38.23; heart failure, 4.33; stroke, 4.2, -51.85; and high blood pressure, 4.04, -32.77. The identified diseases are used in the next analysis by regressing the morbidity on temperature changes 1971-2006.

Table 2: Descriptive statistics of medical practitioners’ response to severity of diseases with respect to climatic change

	5	4	3	2	1	Mean	SD	Variance	Z- Score
Malaria	34	16	4	1	-	4.51	0.717	0.514	-61.81
Meningitis	24	19	10	-	1	4.20	0.877	0.769	-34.51
Cholera	29	1	6	1	2	4.273	0.989	0.980	-24.15
Diarrhoea	14	19	17	5	-	3.76	0.942	0.888	-25.45
Measles	14	22	8	4	6	3.63	1.263	1.596	-6.41
Chicken pox	6	17	17	7	8	3.11	1.212	1.469	2.12
Asthma	14	16	16	6	2	3.63	1.104	1.219	-16.67
Skin Cancer	10	24	8	6	5	3.53	1.203	1.446	-5.14
Conjunctivitis	13	8	8	13	12	2.94	1.510	2.280	-0.58
Pneumonia	10	20	22	3	-	3.67	0.840	0.706	-18.18
Congenital malfunction	7	18	9	13	7	3.09	1.278	1.633	1.644
High blood pressure	20	14	11	6	4	3.73	1.269	1.609	-13.26
Stroke	21	15	8	4	4	3.87	1.253	1.570	-13.37
Heart failure	23	15	8	5	2	3.98	1.152	1.37	-22.55
Selimonellcityphi – typhoid	7	18	13	10	5	3.23	1.187	1.409	-2.46
Cataracts	8	10	10	11	13	2.79	1.419	2.013	3.53
Dehydration in pregnancy	8	15	14	10	6	3.17	1.236	1.528	-2.10
Neurosis	6	10	17	14	6	2.92	1.174	1.379	3.65

and 2 for frequency and severity of diseases respectively. In all, four diseases are determined to have mean points above average values of Z-score. These are malaria, Meningitis, cholera and pneumonia. The four diseases were further aggregated and classified as morbidity rate, i.e. incidence of disease in a time period from a specific population at the beginning of the period.

RESEARCH HYPOTHESES

Hypothesis One

Ho₁: There is no significant relationship between temperature-related morbidity in Nigeria and climate change

Table 3 shows the results of data analysis to test the hypothesis at 0.05 significance level using regression analysis.

Table 3: Estimated regression coefficients for the influence of climate change on morbidity rate

Model	Un-standardized coefficients		Standardized coefficient	t	Sig.
	B	Std. Error			
1. (constant)	-11264.031	4665.178		-2.414	0.021
Temperature	458.576	169.025	0.417	2.713	0.010
R ² value = 0.174					
F-value = 7.361					
Std. Error = 922.205					

Simple regression analysis was used to determine the influence of climate change on morbidity rate. The table shows the result of the functional forms of ordinary least square regression analysis. The result of the analysis shows the coefficient of determination (R^2) of 17.4% that is, the independent variable (i.e. climatic change) is able to explain 17.4% of the total variation in morbidity rate. Table 3 also revealed that temperature change significantly influence morbidity rate ($p < 0.010$). The significance of the extent of morbidity rate could be attributed to the fact that climate change predicts morbidity rate, that is, the higher the climate change, the higher the morbidity rate and vice versa.. The result showed that F calculated is 7.361. Meanwhile, F tabulated at 5% is 4.17. Since F calculated is greater than F tabulated, the null hypothesis [H_0], which says there is no significant relationship between temperature-related morbidity in Nigeria and climate change, so, the alternative hypothesis is accepted. The study establishes a significant relationship exists between climate change and morbidity rate in Nigeria.

Hypothesis Two

H₀₂: Climate change has no correlation to the illusion of Nigerians on effects of climatic changes on human health

To indicate whether climate change is not related to the illusion of Nigerians on effects of climatic changes on human health, descriptive statistics is used. Randomly selected university students across the country ranked the likelihood of the attributes causing climate change and environmental behaviours exacerbating effects of climate change.

Table 4: Summary of the Environmental Habits that can cause changes in climate which can result in increase in diseases

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Industrial Pollutant	50	1.00	5.00	115.00	2.3000	1.08214
Poor construction of drainages	50	1.00	5.00	135.00	2.7000	1.06924
Gas emission from exhaust pipe	50	1.00	5.00	195.00	3.9000	1.12938
Use of generator	50	1.00	5.00	190.00	3.8000	1.08797
Deforestation	50	1.00	5.00	155.00	3.1000	1.42585
Lack of good disposal	50	1.00	5.00	125.00	2.5000	1.39152
Use of firewood	50	1.00	5.00	175.00	3.5000	1.04511
Poor maintenance of vehicle	50	1.00	5.00	153.00	3.0600	1.36142
Use of perfume	50	1.00	5.00	117.00	2.3400	1.15370
Valid N (list wise)	50					

The total value of the five rating scale for Environmental Habits that can cause changes in climate which can result in increase in diseases, is 15. The mean is 3.5. Mean scores of 3.5 and above formed basis for the acceptance of the results. The above table reveals that three environmental habits met the 3.5 acceptance mean of environmental habits that can cause changes in climate. These environmental habits, which include gas emission from vehicle exhaust, use of generator, and use of firewood are considered to be major environmental habits that can cause changes in climate. The remaining six habits; industrial pollutant, poor construction of drainages, deforestation, lack of good disposal, poor maintenance of vehicle and use of perfume poor maintenance did not meet the 3.5 acceptance mean of environmental habit. They are therefore considered as not being environmental habits that can cause changes in climate. This is contradictory to the a priori implications of climate change and human activities causing anthropogenic CO₂. It portends a case of inaccurate understanding of the consequences of certain environmental habits to climate change. A case of illusion that these actions can not lead to climate change. Therefore, we reject the null hypothesis [H_0] that climate change is not related to the illusion of Nigerians on effects

of climatic changes on human health and accept the alternative hypothesis [H₁]. This means that climate change is related to the illusion of Nigerians on effects of climatic changes on human health.

CONCLUSION

Climate change is speeded up by increase in anthropogenic Co₂ and other green house gases plus the depletion of ozone layer which allows the penetration of ultra violet rays. Climate change or global warming cause sea level to rise and the consequences result in flooding from heavy rainfalls induced by precipitation, also from climate change. The deleterious effect of increase in ambient temperature is shown in this study to significantly influence increase in morbidity rate in Nigeria. Four diseases; cholera, meningitis, malaria and pneumonia were implicated as the major health risks exacerbated by climate change. Societal illusion is underscored in this paper as a nonchalant environmental habit that contributes to global warming in Nigeria.

Recommendations

Health care facilities are considered inadequate in developing economies and exacerbation of health risks in the event of adverse climate will occur. Government health policies should concentrate on providing medical care for diseases identified by this study to be possibly amplified to catastrophic levels namely malaria, meningitis, cholera and pneumonia. Climate change mitigation is by reducing collectively on a global scale the emission of Co₂ and green house gases. Nigerian policy makers must be aware of the need to wipe away the prevailing illusion on avoidable bad environmental habits highlighted in this research as industrial pollutant, poor construction of drainages, gas emission from exhaust pipe, use of generator, deforestation, lack of good disposal, Use of firewood, poor maintenance of vehicle and use of perfume. Morbidity rate correlation with climate change is a consequence of vulnerability to weak infrastructural systems to climate from flooding and exposure to excessive heat. We suggest various insurance contracts like flooding insurance and weather insurance to manage the catastrophe levels of health risks from climate change. There is need for heightened awareness among the general population on climate change and health risks. Community leaders, churches and mosques have relevant roles to play in guiding the people to understand climate change consequences (Agbo, 2011). Government in Nigeria could exploit the bond market to manage the consequences of climate change on Nigerian health infrastructure. Climate change can result in catastrophic health risks and further endanger the fragile social security's system, if not strategically managed. Planting of trees and conscious effort to dissuade deforestation should be essential part of public discourse and policy

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