

AWARENESS AND KNOWLEDGE OF HEALTH IMPLICATIONS OF CLIMATE CHANGE IN OJI RIVER LGA OF ENUGU STATE, SOUTHEAST NIGERIAEmmanuel I. Umegbolu^{1*}¹General Out-patient Department, General Hospital Oji River, Enugu State, Nigeria.***Corresponding Author: Dr. Emmanuel I. Umegbolu**

General Out-patient Department, General Hospital Oji River, Enugu State, Nigeria.

Article Received on 10/05/2020

Article Revised on 01/06/2020

Article Accepted on 22/06/2020

ABSTRACT

Background: Climate change is defined by the Intergovernmental Panel on Climate Change as any change in climate over time, whether due to natural variability or as a result of human activity. Awareness and knowledge about climate change vary across the globe, being higher in the developed countries than developing ones. Findings from Nigerian studies are conflicting; while some report levels of over 80%, others report as low as 13%. **Aim:** This study aimed to determine the awareness and knowledge of health implications of climate change in Oji-River LGA of Enugu State. **Materials and method:** Copies of the questionnaire were administered to a sample size of 109 respondents obtained randomly from a cross-section of the population. Data were collected over a period of one month (February- March 2020) and analysed as proportions, t-test, ANOVA and Pearson product moment correlation using MaxStat (version 3.60) statistical software. P-values ≤ 0.05 were considered significant. **Results:** 95.82% of the respondents were aware of climate change, and 87.85% had knowledge of its health implications. Age, sex, education level, type of residence, occupation and sources of climate change information did not significantly affect awareness and knowledge (p-values were >0.05). The correlation between awareness and knowledge was very weak and non-significant ($r=0.19$, $p=0.60$). **Conclusion:** 95.82% awareness and 87.85% knowledge of climate change were found in Oji-River LGA. This needs to be sustained. Also, exploiting places of religious worships, social media and incorporating climate change education in schools could further help to increase awareness and knowledge.

KEYWORDS: Climate, change, awareness, knowledge, Oji-River.**INTRODUCTION**

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as any change in climate over time, whether due to natural variability or as a result of human activity.^[1] Global warming, which is an aspect of climate change, results from an imbalance between the incoming and outgoing radiation in the atmosphere. The sequence of events is such that solar radiation which enters the atmosphere is partially absorbed by the earth's surface and re-emitted as infrared radiation. This radiation is subsequently absorbed by greenhouse gases, which generate heat in the process, and eventually lead to global warming. Of the existing seven theories of climate change, only the anthropogenic theory of global warming (AGW) has been recognized and projected by the IPCC. This theory contends that emissions of greenhouse gases, principally carbon dioxide, methane, and nitrous oxide, are causing a catastrophic rise in global temperatures. Amongst all the known greenhouse gases, water vapour appears to be the major one responsible for about 36 to 90% of the greenhouse effect. Others include CO₂ (<1 to 26%), methane (4 to 9%) and ozone (3 to 7%). It has been observed that during the past century, human activities

such as burning wood and fossil fuels and cutting down or burning forests had led to an increase in the concentration of CO₂ in the atmosphere by approximately 50%. This has led to the prediction that continued burning of fossil fuels and deforestation could double the amount of CO₂ in the atmosphere during the next 100 years, assuming natural 'sinks' do not grow in pace with emissions.

But in spite of the popularity of the AGW theory, which blames human activity for climate change, it is still not the only or even the most credible theory of climate change. It just happened to be the one that best advanced the agenda of the individuals and interest groups who so successfully promoted it.^[2]

Today, climate change remains a contentious matter, despite the existing numerous studies on it. This is so because not everyone believes in its reality, which is why the debate on it continues to rage unabated. However, available statistics have shown that an overwhelming majority of climate scientists (97%) agree that climate change is happening now; that it is being driven primarily by human activity; and that we can do

something to reduce its impact and progression.^[3] The existing controversy notwithstanding, the number of studies on climate change continues to grow by the day. Some of the evidence in support of global warming, which is an aspect of climate change, include that between 1906 and 2005 global temperature had risen by 0.56°C, rising sea levels of about 10 cm over the past century, declining snow cover and glaciers, and change in the ocean currents and wind patterns around the world, among others.^[4]

Climate change is fraught with negative impacts which can be broadly categorised as those on the physical environment, those on other living organisms (animals and plants), those on the economy, and those on human health.^[5]

With particular reference to health, the overall balance of effects of climate change, resulting mainly from the environmental, ecological and social impacts of a changing climate, is likely to be negative, and will be felt more in low-income countries and the vulnerable ones in high-income countries.^[6] In terms of spread, these health impacts of climate change are not evenly distributed globally because of differences in climatic conditions. This is why some geographic areas will have more rainfall, while others will experience more drought, and severe weather events, including heat waves and storms.^[7] In addition, the health impacts will be felt most acutely in countries with low levels of gross domestic product (GDP), low investments in health per capita and in countries with high disease burden such as South-East Asia and sub-Saharan Africa.^[8]

The identified climate change vulnerable groups include the elderly, the very young, the disabled, or those living alone; those that have existing medical conditions, such as heart disease or asthma; and those living in urban neighbourhoods that are already stressed by air pollution, aging infrastructure, and the heat island effects, which makes cities hotter than surrounding rural areas.^[9]

The direct health impacts of climate change include changes in air quality, cancer, cardiovascular diseases and stroke, water and food insecurity, increase in incidence of infectious and foodborne diseases, extreme weather events, temperature extremes, sea level rise, social disruption and population displacement, and HIV/AIDS, among others. As a result of rising temperature and changing rainfall patterns, climate change is expected to have a substantial effect on the burden of infectious diseases that are transmitted by insect vectors and through contaminated water. This is confirmed by research which has shown that insect vectors of diseases tend to be more active at higher temperatures.^[7] In the same manner, water borne infections are also strongly affected by climate change. Studies have shown that during drought or excess rainfall and flooding, epidemics of water borne infections can arise as a result of water contamination. This was

exemplified by the 1993 epidemic of diarrhoeal disease due to *Cryptosporidium* in Milwaukee in which the heavy spring rains were implicated.^[7]

The burden of these diseases arising from climate change is expected to increase with time. Consequently, it has been forecast that by 2030, there will be 10 % more diarrhoeal disease than there would have been without climate change; and if global temperatures increase by 2 to 3°C, as expected, it is estimated that the population at risk for malaria will increase by 3 to 5%.

Addressing climate change involves two major processes, namely adaptation and mitigation.

Adaptive measures are specific actions which need to be taken in order to prevent or ameliorate the negative effects of climate change. They are aimed at addressing the problems which have already occurred, because climate change is a long time process which is already in progress and cannot easily be reversed, even if the factors that gave rise to it are suddenly halted. The need for adaptation to climate change is inevitable no matter how efficiently we manage to reduce the growth in emissions because the inertia in the climate system will lead to climate change and resulting impacts on natural and managed systems.^[10]

On the other hand, mitigation refers to measures taken to reduce the amount and spread of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere. Mitigation is essential because it has been established that higher global temperatures will give rise to greater adverse consequences of climate change. Essentially, mitigation strategies, which are measures put in place to slow or halt the progression of the ongoing climate change, include reduction in fossil fuel combustion, reduction in the use of wood burning and other biomass for indoor cooking, increased use of public transport, cycling and walking, reforestation to help in the trapping of excess CO₂, carbon capture and storage, the use of renewable energy sources, modification of transportation methodologies by reducing or avoiding travel, and creation of carbon emission caps and taxes which will compel companies to pay for excess carbon emission.^[6]

The first global effort aimed at addressing the problems of climate change dates back to 1979 when the first world climate conference took place in Geneva, Switzerland. Over the years a number of these conferences had taken place in different countries and at different times. The most recent conference, the Paris Climate Conference, was held in December 2015. The major thrust of that conference was the adoption of the first- ever universal, legal binding global climate deal by 195 countries. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C.

For future predictions about how the climate would change, climate scientists make use of projections in emissions of CO₂ and other GHGs, which in turn depends on how people will produce and use energy, what national and international policies might be implemented to control emissions, and what new technologies might become available. Scientists try to account for these uncertainties by developing different scenarios of how future emissions –and hence climate forcing–will evolve. Each of these scenarios is based on estimates of how different socioeconomic, technological, and policy factors will change over time, including population growth, economic activity, energy-conservation practices, energy technologies, and land use.

Awareness and knowledge about climate change vary across the globe, being higher in the developed countries than developing ones. Findings from past studies in Nigeria are conflicting. While some studies report fairly high awareness level of over 80%, others report as low as 13%.^[11-13] Therefore, this study aims to determine the level of awareness and knowledge of the health implications of climate change in Oji-River LGA., Enugu State, Southeast Nigeria, in order to compare it with similar previous studies.

MATERIALS AND METHODS

This was a cross-sectional study involving available residents of Oji-River LGA of Enugu State.

Oji-River Local Government Area (LGA), one of the seventeen Local Government Areas of Enugu State, was created out of the old Awgu Division in 1976. It is one of the five LGAs that make up Enugu West Senatorial District. It is bordered in the West and South by Anambra State, in the North by Udi and Ezeagu LGAs, and in the East by Awgu LGA. Oji-River LGA is located within 6° 16' N and 7° 16' E co-ordinates with a total area of 403km² and a population of 126,587.^[14] The LGA is made up of six towns, namely Oji urban centre, Inyi, Awlaw, Achi, Akpugoeze and Ugwuoba. Most of the inhabitants of Oji River LGA are Christians, with Catholic and Anglican denominations in the majority. The main economic activity of the people of Oji-River LGA is subsistence farming. In the urban area of the LGA, there are pockets of small time business men and women. Few civil servants are also found in the urban Centre.

Oji River LGA has a number of institutions ranging from academic to non-academic ones. The non-academic institutions include a power transmitting station, tannery, a veterinary clinic and a General Hospital. The tertiary institutions found in Oji River are Federal Co-Operative College, School of Health Technology and Police Training College. The population of Oji-River LGA by the 2016 estimate is 173, 800.

The entire population of the LGA by the 2016 estimate constituted the population of the study.

A sample size of 399 was obtained using Taro-Yamane formula: $n = N/1+N (e)^2$

Where n= sample size,

N=population,

e= margin of allowable error (0.05)

However, because of the current Corona virus disease pandemic (COVID-19), the sample size was reduced to 109 using accidental sampling technique.

A self-designed questionnaire titled “Awareness and knowledge of health implications of climate change in Oji-River LGA of Enugu State, Southeast Nigeria” was used as the instrument for data collection. Copies of the questionnaire were administered to available respondents using house-to-house and office-to-office methods of administration. The literate respondents were allowed to fill out the questionnaire themselves, while the semi-literate and the illiterate ones were helped to fill theirs by the researcher. Completed copies of the questionnaire were collected immediately to minimize the attrition rate. In all, 109 copies of the questionnaire were administered and same were completed and returned.

Data were collected for a period of four weeks (from 14th February 2020 to 14th March 2020) and analysed as descriptive statistics of proportions (after adaptation from the Likert 4 point scale), t-test, ANOVA and correlation (Pearson product moment correlation) as inferential statistics using MaxStat (version 3.60) statistical software. P-value of ≤0.05 was considered significant.

RESULTS

Table 1 presents the respondents’ demographics. From the table it is seen that a total of 109 respondents filled the questionnaire. 28 (25.7%) of the respondents were aged 18 years and below, while 81 (74.3%) were above 18 years of age; 34 (31.2%) were males, 75 (68.8%) females; 32 (29.4%) had education up to secondary school level, 77 (70.6%) had post-secondary school education; 45 (41.3%) lived in rural areas, 64 (58.7%) were urban; and 77 (70.6%) were students, while 32 (29.4%) were of various occupations.

Table 1: Respondents’ demographics (N=109).

Variables	Number	Proportion (in %)
Age (in years):		
≤18	28	25.7
>18	81	74.3
Sex:		
Male	34	31.2
Female	75	68.8
Level of education:		
≤Sec. School	32	29.4
>Sec. School	77	70.6
Type of residence:		
Rural	45	41.3
Urban	64	58.7
Occupation:		
Student	77	70.6
Non-student	32	29.4

Table 2 shows the level of awareness and knowledge according to age. From the table it is evident that among those aged 18 years and below, awareness was 100%, while knowledge was 88.2%. Among those older than 18 years, awareness was 98.7%, and knowledge 84.3%. This finding demonstrates that awareness and knowledge were slightly higher among those aged 18 years and below, compared to those older than 18. Statistically, there was no significant difference between the two age categories in awareness and knowledge ($p=0.37, 0.39$).

Table 2: Age and awareness and knowledge.

Age (in years)	Awareness (in %)	Knowledge (in %)
≤18	100	88.2
>18	98.7	84.3
t	1.000	1.000
p	0.3739	0.3892

Table 3 presents the influence of sex on awareness and knowledge. As shown in the table, awareness among the males was 97.3%, while knowledge was 88.6%. Among the females, awareness was 100%, while knowledge was 90.7%. This finding indicates that awareness and knowledge were slightly higher among the females compared to the males, however p-values of 0.37 and 0.36 respectively, indicate that there was no significant difference between the two sexes in awareness and knowledge.

Table 3: Sex and awareness and knowledge.

Sex	Awareness (in %)	Knowledge (in %)
Male	97.3	88.6
Female	100	90.7
t	1.000	1.020
p	0.3739	0.3652

The influence of educational level on awareness and knowledge is shown in Table 4. As revealed in the table, those with educational level up to secondary school had awareness of 95.6% and knowledge 86.9%, while those with post-secondary school education had awareness of 100% and knowledge 86.2%. This shows that those with education level above secondary school had slightly higher awareness, but slightly lower knowledge compared to the other group. There was no significant difference between the two educational levels in awareness and knowledge ($p=0.37, 0.33$).

Table 4: Educational level and awareness and knowledge.

Educational level	Awareness (in %)	Knowledge (in %)
≤ Secondary school	95.6	86.9
>Secondary school	100	86.2
t	1.000	1.110
p	0.3739	0.3291

Table 5 shows the extent to which type of residence affects awareness and knowledge. From the table it is seen that among the rural dwellers, awareness was 98.3% and knowledge 87.7%, while in the urban area, awareness was 99.2% and knowledge 88.9%. This finding indicates that urban dwellers had slightly higher levels of awareness and knowledge than their rural counterparts. The difference between the two groups was not statistically significant ($p=0.62, 0.83$).

Table 5: Type of residence and awareness and knowledge.

Type of residence	Awareness (in %)	Knowledge (in %)
Rural	98.3	87.7
Urban	99.2	88.9
t	0.535	0.223
p	0.6212	0.8341

The effect of occupation on awareness and knowledge is presented in Table 6. As shown in the table, awareness among students was 99.4% and knowledge 90.6%, while among non-students awareness was 97.4% and knowledge 89.3%. This finding indicates that students were more aware of climate change and also had more knowledge of its health implications than the other non-students group. The difference in means in awareness and knowledge between students and non-students was not significant ($p=0.51, 0.89$).

Table 6: Occupation and awareness and knowledge.

Occupation	Awareness (in %)	Knowledge (in %)
Students	99.4	90.6
Non-students	97.4	89.3
t	0.731	0.149
p	0.5051	0.8885

Table 7 shows the different sources of climate change information. As is evident in the table, majority of the respondents got their information from school, print media and radio (25.4%, 22.5% and 19.6% respectively), while others got theirs from TV (16.7%), social media (10.9%), and friends (4.3%). Religious institutions played practically no role (the church-0.6%, mosques-0%). Statistical analysis indicates that there were no significant difference in means ($p=0.19$) among the various sources of information about climate change.

Table 7: Sources of climate change information.

Source	Number	Proportion (in %)	F	p
Radio	27	19.6		
TV	23	16.7		
Print media	31	22.5		
Social media	15	10.9		
Friends	6	4.3		
School	35	25.4		
Church	1	0.6		
Mosque	0	0		
Total	138	100	1.676	0.1855

The relationship between awareness and knowledge is presented in Table 8. From the table it is seen that there was a very weak non-significant positive correlation between awareness and knowledge, $r=0.19$, $p=0.60$. This finding indicates that awareness of climate change did not automatically translate into knowledge about it.

Table 8: Correlation between awareness and knowledge.

Variables	Awareness (in %)	Knowledge (in %)
Age (in years):		
≤18	100	88.2
>18	98.7	84.3
Sex:		
Male	97.3	88.6
Female	100	90.7
Level of education:		
≤Sec. School	95.6	86.9
>Sec. School	100	86.2
Type of residence:		
Rural	98.3	87.7
Urban	99.2	88.9
Occupation:		
Student	99.4	90.6
Non-student	97.4	89.3
p	0.60	
r	0.19	

DISCUSSION

Awareness and knowledge of climate change could have a strong positive correlation, that is, as awareness is increasing, knowledge should also increase in the same direction. However, this does not always happen because of some extraneous factors which could affect both. These factors include age, sex, educational level, type or place of residence, occupation, source of climate change information, among others.

This study found awareness of climate change among the respondents to be 95.82%. This finding was close to what had been reported by a researcher in Nigeria (81.8%), and another in Guyana (87%).^[11, 15] However, it is in direct contrast with what had been found previously by other researchers who reported awareness of 50% among respondents in Turkey, 40% in the Niger Delta Region of Nigeria, and low level in Ghana.^[16-18] The apparently high level of awareness of climate change demonstrated by this study is not unexpected, given the fact that awareness creation has been going on over the years as a result of efforts of governments around the world, individuals, organisations, Agencies, Information and Communication Technologies, among other factors. As it stands, it is possible that future studies on climate change awareness might still demonstrate further increase in awareness considering the fact that its creation has continued to grow all around the world with the passage of time.

As expected, awareness of climate change should naturally lead to acquisition of some knowledge about it. This general knowledge of climate change consists in being able to identify its causes, its manifestations, effects/impacts, and ways of addressing the problem.

This study has revealed that respondents had 87.85% knowledge of climate change, particularly its health implications. Among the respondents, females (90.7%) demonstrated slightly better knowledge of climate change when compared to the male counterparts (88.6%). With this finding, the study has verified what was reported earlier by other studies that demonstrated greater knowledge of climate change among women compared to men.^[19, 16] On the other hand, a knowledge level of 87.85% demonstrated by this study does not agree with what had been reported by earlier researches that found knowledge levels of 40%, 72.8%, 73.3%, and 50% respectively in their own settings.^[17, 11, 15, 16]

The greater knowledge of climate change found in this study could also be attributed to the fact that those factors responsible for the increased and increasing awareness were also at play here.

Sources of information about climate change include radio, television, print media, social media, school, friends, among others. In this study, the main sources of information about climate change were the school (25.4%), print media (22.5%), radio (19.6%) and television (16.7%). Others include social media (10.9%), friends (4.3%) and places of worship (0.6%). These findings confirm that the identified sources of climate change information which include mass media, family, trainings, seminars, internet, social media, and education, among others, were similar to what had been reported by a previous study.^[20]

Furthermore, the study found that age, sex, education level, type of residence, occupation, and sources of climate change information did not have any statistically significant influence on awareness and knowledge of climate change, including its health implications. This validates what had been previously reported by.^[18, 16] However, it did not support the findings of another study which reported that religion, gender, parental education, occupation and income could affect student's awareness of climate change in Bangladesh.^[21] The study was also in contrast with the one that found educational attainments as the single strongest predictor of climate change risk awareness among the study participants.^[22]

Finally, the study found a weak positive and insignificant correlation between awareness and knowledge of climate change ($r=0.19$, $p=0.60$). This finding highlights the fact that awareness does not always match knowledge. In other words, awareness of climate change does not automatically translate to its knowledge, showing that some respondents had awareness of climate change without possessing the requisite knowledge of what it is

all about. This suggests that awareness creation alone is not enough, it needs to be coupled with enlightenment on what climate change is all about.

Limitations of the study

COVID-19 pandemic affected the sample size because of lockdown and social distancing. It was not possible to achieve that targeted sample size.

CONCLUSION

The study demonstrated a high level of awareness of climate change (95.82%) and knowledge of its health implications (87.85%) among the study participants. Age, sex, education level, type of residence, occupation, and sources of climate change information did not significantly affect awareness and knowledge. The correlation between awareness and knowledge of climate change was very weak, positive and non-significant ($r=0.19$, $p=0.60$).

It is therefore recommended that the present level of awareness be sustained. Exploiting places of religious worships, social media and incorporating climate change education in schools could help to further increase awareness and knowledge of climate change in the area of the study. Awareness creation needs to be coupled with adequate enlightenment on what climate change is all about, in order to match awareness with knowledge.

ACKNOWLEDGEMENTS

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: Not required.

REFERENCES

1. Intergovernmental Panel on Climate Change. Climate change 2014: synthesis report contributions of working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva; IPCC, 2014.
2. Bast JL. Seven theories of climate change. Chicago; The Heartland Institute, 2010.
3. Public Health Institute/Centre for Climate Change and Health. Climate change 101: climate change basics, 2016. Available at climatehealthconnect.org/.../climate101. Accessed 5 March 2020.
4. Marotta R, Chan K. Global climate change and health, 2008. Available at <https://www.cugh.org>files>. Accessed 1 March 2020.
5. Philander SG Encyclopaedia of global warming and climate change, New Delhi; SAGE Productions, 2008.
6. McMichael AJ, Lindgren E. Climate change: present and future risks to health and necessary responses. *J Int Med.*, 2011; 270: 401-413.
7. Shuman KE. Global climate change and infectious diseases, *T New Eng J Med.*, 2010; 362(12): 1061-1063.
8. Glaxosmithkline. Climate change and health: framing the issue, 2011. Available at www.gsk.com/.../climate-change.pdf. Accessed, 5 February 2020.
9. United States Environmental Protection Agency. Heat island effect, 2010. Available at [https://www.epa.gov>heat islands](https://www.epa.gov>heat%20islands). Accessed, 10 March 2020.
10. Mertz O, Halsanaes K, Olesen JE, Rasmusen K. Adaptation to Climate Change in Developing Countries. *Env Man*, 2008; 43: 743-752.
11. Oruonye ED. An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis, Taraba State, Nigeria. *J Geo Reg Plan*, 2011; 4(9): 513-517.
12. Ojomo E, Elliot M, Amjad U, Bartram J. Climate change preparedness: a knowledge and attitudes study in Southern Nigeria. *Env*, 2018; 2: 435-448.
13. Akpomi, ME. Promoting knowledge of climate change amongst Nigerians: implications for Education Managers. *J Edu. Pract*, 2016; 7(32): 132-138.
14. National Population Commission. Report of Nigeria's National Population Commission on the 2006 census, 2006. Available at <https://www.jstor.org/stable/25434601>. Accessed 10 October 2014.
15. Hope SSA. Knowledge, attitude and practices study on climate change adaptation and mitigation in Guyana, 2016. Available at <https://www.adaptation.undp.org/.../clima>. Accessed, 7 February 2020.
16. Korkmaz M. Public awareness and perceptions of climate change: differences in concern about climate change in the West Mediterranean Region of Turkey. *App Eco Env Res.*, 2018; 16(4): 4039-4050.
17. Nzeadi TC, Egbule CL, Chukwuone NA, Agu VC. Climate change awareness and adaptation in the Niger Delta Region of Nigeria. *Af Tech Pol Stu Net W Pap Ser*, 2011; 57: 1-32.
18. Awusi E, Asare K. Climate change knowledge and awareness creation in relation to media among senior higher school students in Birim Central Municipal, Ghana. *IOSR J Env Sci, Tox Tech.*, 2016; 10(9): 83-89.
19. Worlu DJ, Glory AN. Teachers' awareness of climate change: implications for innovative teaching. *Int J Ed Ev*, 2016; 2(6): 24-31.
20. Barred AB. Assessing the level of awareness on climate change and sustainable developments among students of Partido State University, Camarines Sur, Philippines. *J Sust Edu*, 2018; 17: 2151-7452.
21. Rahman SMA, Tasmin S, Uddin MK, Islam MT, Sujauddin M. Climate change among the high school students: case study from a climate

- vulnerable country. *Int J Built Env Sus.*, 2014; 1(1): 18-26.
22. Lee TM, Markowitz EM, Howe PD, Ko C-Y, Leiserowitz, AA. Predictors of public climate change awareness and risk perception around the world. *Nat Clim Chan*, 2015; 5: 1004-1023.