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Analysing the Socio-Economic and Health Impacts of High Temperatures in Abuja Metropolis and Its Coping Strategies

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Abstract: *The paper analyses the socio-economic and health impacts of high temperatures in Abuja metropolis; trends, vulnerabilities and coping strategies. The research design for this study was cross-sectional because it reflected situations, attitudes, perspectives and behaviors of people. The cross-sectional research design was chosen with the aim of collecting information that was thorough and accurate. F.C.T lies between latitudes 8° 25´and 9° 25´ north of the Equator and longitudes 6° 45´ and 7°45´ East of Greenwich Meridian, Abuja the FCT is geographically located in the centre of the country with a landmass of approximately 8000 km² of which the actual city, that is, the Federal Capital City (FCC) occupies 250 km2 landmass. The strength of Abuja's economy is attributed to its diverse economic activities ranging from construction and real estate, tourism and leisure, agriculture and a dynamic service sector that includes infrastructure development. Others include Agro- Allied and transportation. The people engage also in different types of farming with 30% of its population being traders and 22% civil servants, although other staple crops are produced such as, cassava, okro, vegetables, plantain, millet, sorghum and beans etc., yam production remains the staple crop. Other livelihood activities are trading, skilled and unskilled labour.*

Keywords: socio-economic and health impacts, high temperatures, Abuja metropolis, coping strategies

INTRODUCTION

Globally, different countries are experiencing climate change as a result of more frequent unexpected high temperature regime. Huynen, Martens, Schram, Weijenberg, & Kunst, (2001) noted that the frequency and intensity of high temperature would continue to rise in the 21st century because of climate change. Extant studies also noted that extended periods of midday and nighttime high temperature conditions create cumulative stress on the human body, increasing the risk of illness and death from heat exposure. The Intergovernmental Panel on Climate Change (IPCC) assessment reports, especially the Fifth Assessment Report (AR5), highlighted that there is no doubt about the warming of the climate system (IPCC 2011). Similarly, Karimipour, (2022), Zhang, Huang, Yin, Xiao (2019), He, Wang, Liu &Ulpiani, (2021) reported that in the background of the current global warming, high temperature has become an important factor affecting the human environment in cities, while rapid urbanization process has aggravated

the urban heat island effect (UHI) leading to the frequent occurrence of extreme weather externalities. Studies have shown that as cities warm, existing discrepancies in temperature between high and low areas of heat vulnerability intensify (Huynen, et, al. 2001). Elliot, (2016) defined high temperature as a period of abnormally hot weather often accompanied by high humidity, especially in oceanic climate. Lugo (2017) posited that high temperature has the capacity to modify the local climate of a city and its environs, while Amit (2014) stated that high temperature exacerbates environments with island effect caused by the concentration of concrete and asphalt surfaces, reduction of vegetation, and anthropogenic heat sources. World Meteorological Organization, (2022) defined high temperature as "a weather process in which the maximum daily temperature is higher than 32 °C and lasts for more than three days" and it is slightly different in many nations of the world. The China Meteorological Administration defines high temperature as "a day with a maximum daily temperature ≥ 35 °C, and a high-temperature day for more than three consecutive days is a high-temperature heat wave. Analysis of data collected using mobile traverses in 101 Asian and Australian cities shows that high temperature magnitude may vary between 0.5 to 11 Degrees Celsius with an average value close to 4.1degrees Celsius in different cities of the world. In a related analysis, Gulyás & Unger, (2006) using data from 110 European cities revealed that high temperature magnitude varies by 1 Degree Celsius to 10 Degrees Celsius with an average maximum value close to 6 Degrees Celsius. Some scholars analyzed the mechanism of the UHI effect from the perspective of urban space and found out that there is a synergistic effect between high-temperature heat waves and UHI effect, thus, it is necessary to study the distribution characteristics of high-temperature heat waves and the influencing factors of UHI from the perspective of the urban high temperature and thermal environment (Meng , 2014).

Urban high temperature depends not only on the characteristics of physical processes but also on urban planning methods (Yang, Wang, Kaloush&Dylla, 2016). Authors like (Hsieh & Huang, 2016) observed a strong relationship between the high temperature effect and urban configuration noting that the wind and thermal environment of cities is influenced by the land use characteristics. Gago, Roldan, Pacheco-Torres &Ordonez, (2012) reported that at the macroscopic scale, the urban climate map (UCmap) is now widely agreed upon and maturely applied to predict the heat island effect, such as the climate zoning proposed by Tokyo and Stuttgart. The relationship between high temperature, urban sprawl patterns and hazards under scenario simulation prediction, as well as the evaluation study of existing coping mechanism and disaster prevention systems and urban resilience has been studied in detail by some researchers. At the mesoscopic and microscopic scales, the interaction between high temperature, spatial and climatic factors is multi-directional and integrated, where street height to width ratio (H/W), sky view factor (SVF), street orientation, and green cover are the main spatial factors that are generally considered to have an impact on local heat waves.

Several authors agreed that population upsurge is yet another issue that leads to an uptick in high temperature, According to Taiwo (2015), over 50% of the world population is now located in the cities and near city areas, this issue of urban migration which incites rapid population growth in urban and semi-urban areas has been severally noted as a factor in high temperature (Elliotyet, al; (2016 & Nwaerimaet, al. 2018). Gartland, (2010) reported that the 2003 high temperature in Europe was unprecedented in terms of loss of life, with over 30,000 deaths and the deaths were attributed to excessive and persistent high temperature which plagued the continent within that period. Milligan (2004) noted that beyond high temperature effects on humans, extreme temperature also had dire environmental impacts some of which resulted in destruction

of large areas of forest by fire, the drying out of rivers which caused damage to water ecosystems and excessive melting of glaciers (Charabi & Bakhit, 2011; Stone, Hess & Frum, 2010). The sobering results of high temperature studies in Europe show that humans have contributed to at least a doubling of the risk of extreme temperature event in the European continent over the last 150 years. In Nigeria, Taiwo (2015) & Akanne (2010) stated that Nigerian cities like Lagos and Abuja are experiencing high temperature as a result of alteration of the cities structures such as buildings, roads, and other infrastructure which absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. The cities where structures are highly concentrated, and greenery is limited become "islands" of higher temperatures relative to outlying area because the surface areas have been altered, this alteration has a negative impact on the temperature. Some notable instances of alteration include change from low-single storey buildings to multi story buildings; jettisoning of asbestos roofing for aluminium, metal and corrugated roofing, etc., which have resulted in changes in radiation characteristics of the surfaces across different land use types (Nwaerimaet, al. 2018). It is well documented that high temperature is a major contributor to rapid increase of the energy consumption for cooling purposes. Geoft, Neil, Lisa & Jim, (2012) agrees that considerable rise in electricity demand affects in a negative way local vulnerability level, increases heat related mortality and morbidity and augments the concentration of harmful pollutants.

MATERIALS AND METHODS

Study Area

F.C.T lies between latitudes 8° 25´and 9° 25´ north of the Equator and longitudes 6° 45´ and 7°45´ East of Greenwich Meridian, Abuja the FCT is geographically located in the centre of the country with a landmass of approximately 8000 km² of which the actual city that is, the Federal Capital City (FCC) occupies 250 km2 landmass. Also, there is a divergent temperature level across the study area. Map of the study area is as shown in Figure 3.1. below

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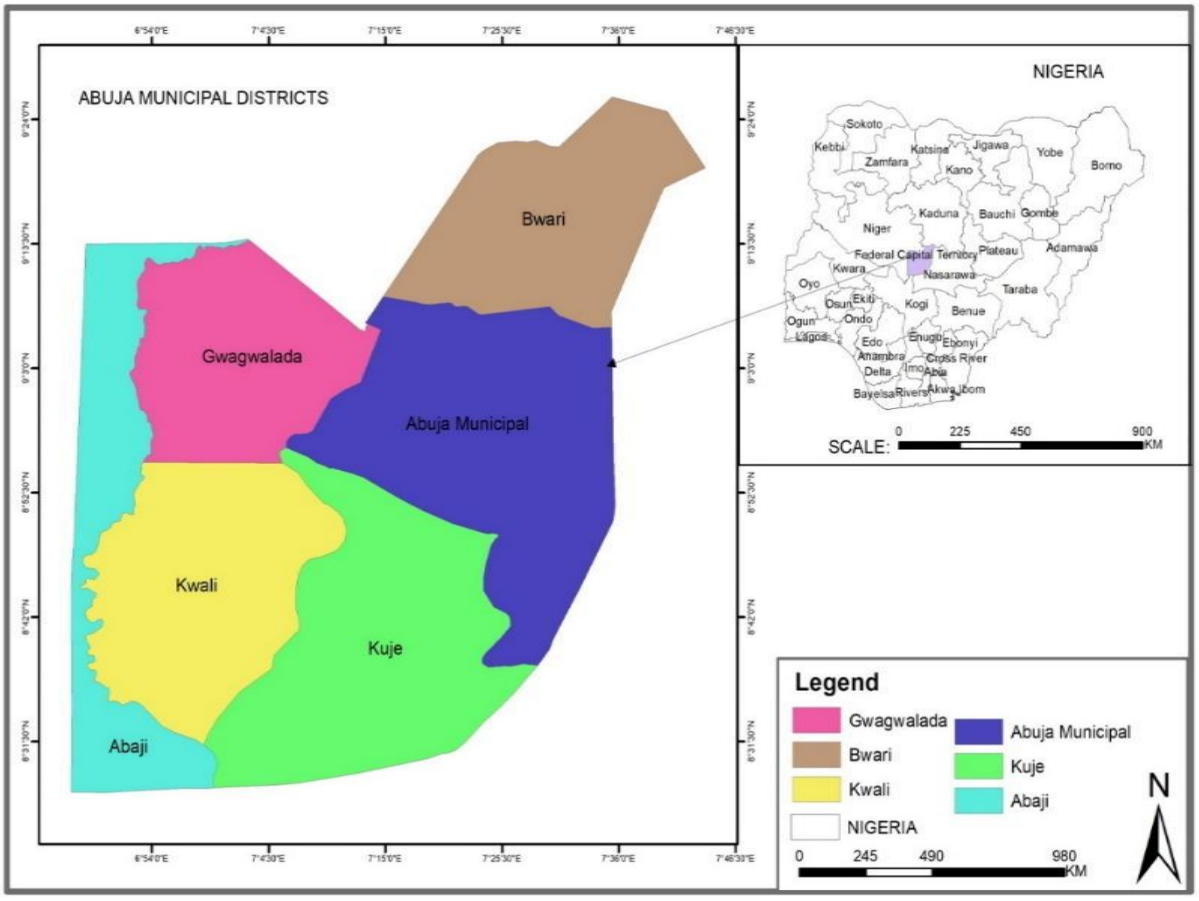

Fig: 1 Map showing Abuja Municipality
Source: University of Port Harcourt Cartographic Laboratory, (2023)

Population Sampling

This work assessed high temperature and coping mechanism in Abuja metropolis especially in selected communities of Abuja municipal Area. The choice of the communities was based on prevalent high occurrence, population density, urbanization and difference in their various temperature level. Therefore, all the people in the community formed the study population of persons according to National Bureau of Statistics (2022).

Nature and Sources of Data

The researcher used both primary and secondary sources of data. The primary data was a set of close ended questionnaire that was administered to respondents as well as Nigerian Meteorological Agency's (NiMet) monthly average temperature 2019-2024. The structure of the questionnaire was such that generated information on variables such as socio-economic characteristics, The researcher approached the respondents personally to ask them to fill in the questionnaires with the help of two assistant researchers

from Institute of Natural Resourses, environment and sustainable development (INRES) The personal approaches in the survey process was shown by the willingness of researcher to guide respondents when completing the questionnaires, reading questions to them in cases where respondents could not read, up to translating the questionnaire into a local language when respondents could not speak or read the national language (English), since the questionnaires were written in English. The secondary data was sourced from published and unpublished materials.

Primary Method

The questionnaire, personal interview methods and NiMET average temperature data 2019-2024 were the main primary data collected and employed in this study. Based on this, information was obtained through the administration of a self-designed questionnaire to respondents. 400 questionnaires were distributed to all the number of respondents. Results from the interview and observation helped in the analysis especially with regards to triangulating of data that was collected from the field while the NiMET data provided more insights in understanding the temperature data variation within the period of 2019-2024.

Secondary Method

Secondary technique of data collection for this study was dependent on extensive document reviews. In this light, information was sourced from related empirical works already published by other scholars. This took the form of literature review. Consequently, information was extracted from textbooks, journals, magazines, the internet and other print materials.

Methods of Data Analysis

The outcomes of the investigation of the research was analysed using tables and basic percentages. The results were analysed using descriptive and inferential statistical methods. The data was also presented in a tabular manner with explanations to provide a better understanding of the findings. Hypotheses I and 2 which states that there is no statistically significant health risk associated with high temperature in the study area and that there is no statistically significant effect in strategies adopted by the residents to cushion the impact of high temperature in Abuja metropolis were tested using Chi square statistical tool package for social sciences (IBM/SPSS) version 22 respectively. The choice of Chi Square statistically tool was that it is used to investigate whether distributions of categorical variables differs from another. It's a measure for comparing expectations and testing relationship between categorical variables.

Results and Discussion

The results of health risk associated with high temperature, Summary of chi- square ,Coping measure adopted, Health associated with temperature, Summary of Chi- square on health risk, Summary of Chi – square on coping measure and Revealed that the ×2cal is 217.648 are presented Table 1- 7 and Fig 2&3 Respectively.

Determine the health risk associated with high temperature in Abuja metropolis

Table 1. Health risk associated with high temperature in Abuja metropolis

S/N	Answer Alternatives	SA	A	D	SD	Total
1	High temperature causes heat cramps	219(57.48 %	114(29.92 %	30(7.87%)	18(4.72%)	381(100%)
2	High temperature causes heat exhaustion	217(56.96 %)	115(30. 18%)	29(7.61%)	20(5.25%)	381(100%)
3	High temperature causes heatstroke.	167(43.83 %)	183(48.03 %)	20 (5.25%)	11(2.89%)	381(100%)
4	High temperature causes hyperthermia	234(61.42 %)	122(32. 02%)	19(4.99%)	6(1.57%)	381(100%)
5	High temperatures cause asthma attacks, respiratory and cardiovascular health conditions.	231(60.63 %)	121(31. 76%)	19(4.99%)	10(2.62%)	381(100%)
6	High temperature causes cholera	140(36.75 %)	121(31.76 %)	50(13.12%)	70(18.37%)	381(100%)
7	High temperature causes meningitis	180(47.24 %)	130(34.12 %)	40(10.50%)	31(8.14%)	381(100%)
8	High temperature causes malaria	103(27.03 %)	197(51.71 %)	53(13.91%)	28(7.35%)	381(100
9	High temperature causes pneumonia.	197(51.71 %)	103(27.03 %)	28(7.35%)	28(7.35%)	381(100

Table 2: Summary of chi-square analysis on health risk associated with high temperature in the study area.

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	306.388a	24	.000
Likelihood Ratio	291.780	24	.000
Linear-by-Linear Association	51.688	1	.000
N of Valid Cases	3404		

Hypothesis 2

Hypothesis 2 which states that there is no statistically significant relationship in coping measures adopted by residents to cushion the impact of high temperature in the study area was tested using Chi square statistical tool package for social sciences (IBM/SPSS) version 22

S/N	Answer Alternatives	SA	A	D	SD	Total
1	Use of air conditioning or fan is a measure to solve menace of high temperature in the study area.	180(47.24%)	130(34.12%)	40(10.50%)	31(8.14%)	381(100%)
2	Wearing light and loose-fitting clothingis a measure to solve menace of high temperature in the study area.	167(43.83%)	183(48.03%)	20 (5.25%)	11(2.89%)	381(100%)
3	Keep cool is a measure to solve menace of high temperature.	140(36.75%)	121(31.76%)	50(13.12%)	70(18.37%)	381(100%)
4	Keeping skin wetis a measure to solve menace of high temperature in the study area.	231(60.63%)	121(31. 76%)	19(4.99%)	10(2.62%)	381(100%)
5	Using a spray bottle or dampsponge and by taking cool showers is a measure to solve menace of high temperature in the study area.	234(61.42%)	122(32. 02%)	19(4.99%)	6(1.57%)	381(100%)
6	Staying hydrated during days of extreme heatis a measure to solve menace of high temperature in the study area.	217(56.96%)	115(30. 18%)	29(7.61%)	20(5.25%)	381(100%)
7	Keep drinking water before you feel thirsty, especially when outdoors or performing physical activity	219(57.48%)	114(29.92%)	30(7.87%)	18(4.72%)	381(100

Table 3: Summary of chi-square analysis on coping measures adopted by residents to cushion the impact of high temperature in Abuja metropolis.

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	217.646a	18	.000
Likelihood Ratio	193.754	18	.000
Linear-by-Linear Association	34.503	1	.000
N of Valid Cases	2667		

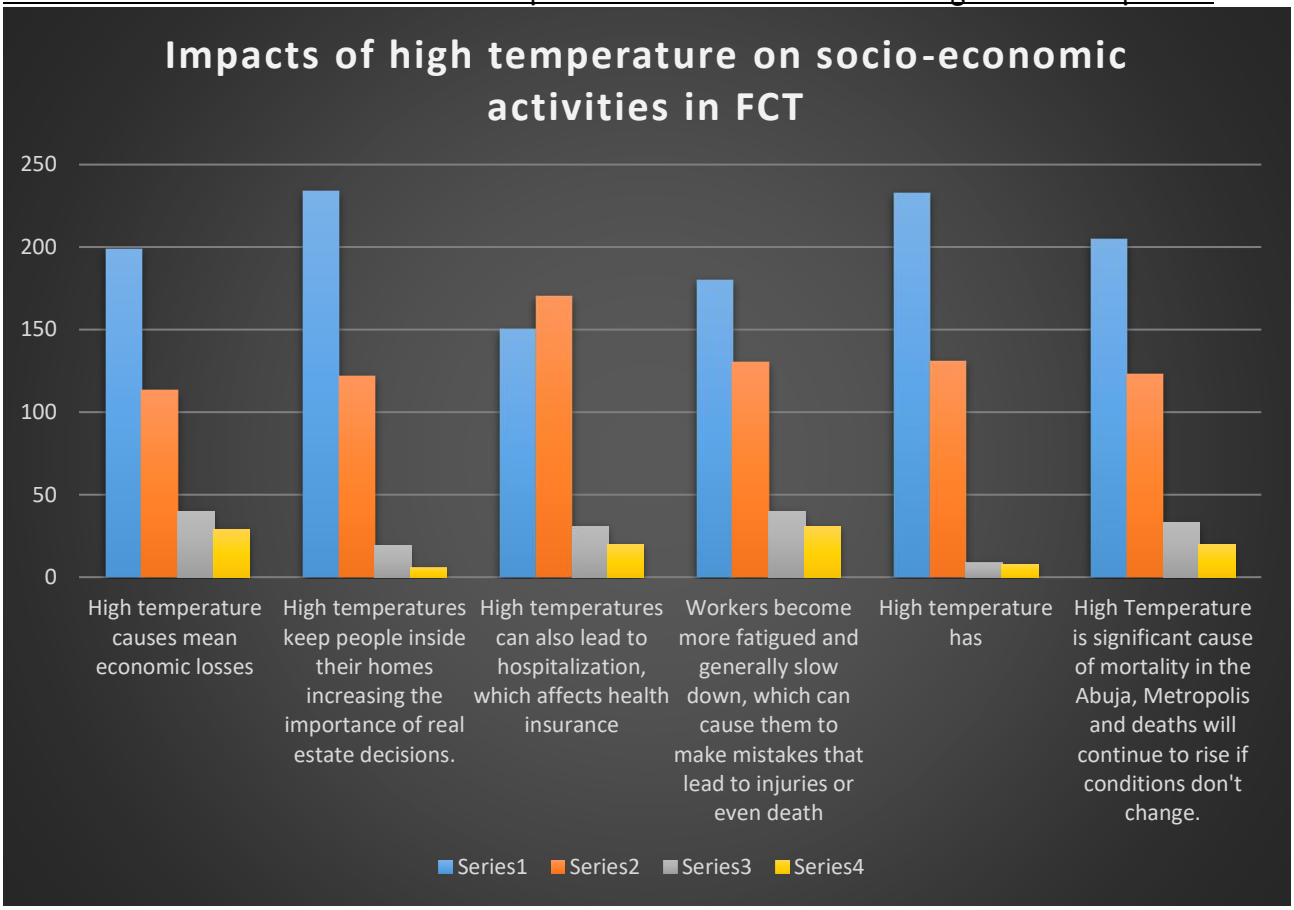

Fig 2. Showing impacts of High Temperature on Socio-Economic activities in the study area

7.61% of them disagreed and strongly disagreed respectively. This was in line with Coates & Enbiale (2022) study on socio-economic impacts of climate change in developing countries that pose considerable threat to the well-being of all humanity by aggravating climate change, causing droughts, floods, and increases in the frequency and intensity of severe weather events with high economic cost. This assertion agrees with Kalkuhl, Leonie & Wenz (2018) study on the Impact of Climate Conditions on Economic Production which shows that one degree of temperature increase reduces output by 2-3%. Also, regions lose 9% of economic output on average and more than 20% of output in tropical regions. 61.42% of the respondents strongly agreed that high temperatures keep people inside their homes, 32.02% of them agreed, 4.99% of them disagreed, while 1.57% strongly disagreed. Again, this corroborates with the work of Spagnolo & De Dear, (2003) that mitigation measures approach to minimising the impact and extent of climate change includes keep people inside their homes increasing the importance of real estate decisions.

Also, 39.37% of the respondent's strongly agreed that high temperatures can also lead to hospitalization, which affects health insurance, 44.62% of them agreed, 8.14%of them disagreed, while 5.25% of them strongly disagreed. This shows that majority of the respondents which amounted to 83.99% were of the

opinion that high temperatures can also lead to hospitalization, which affects health insurance. This agrees with Barclay (2008) who reported that changes in temperature can affect the development and survival of malaria parasites and the mosquitoes that carry them which triggers malaria and hospitalization. Again, it corroborates with Wandiga & Barclay (2008) study which shows that the frequency of outbreaks had been more pronounced, requiring only two months for the emergence of a malaria epidermic that leads to hospitalization. 47.24% of the respondents strongly agreed that workers become more fatigued and generally slowdown, which can cause them to make mistakes that lead to injuries or even death, 34.12% of them agreed, 10.50% of them disagreed, while 8.14% strongly disagreed. Data analysis on High temperature having adverse effect on productivity of the construction industry, 61.15% respondents strongly agreed, 34. 38% of the respondents agreed, 2.36% of them disagreed, while 2.10% of them strongly disagreed. Thus, it is crystal clear that majority which accounted for 95.53% believed high temperature has adverse effect on the productivity of the construction industry. Finally, 53.81% of the respondents agreed that high temperature is a significant cause of mortality in the Abuja, metropolis, 32.28% of them agreed, 8.66% of them disagreed, while 5.23% of them strongly disagreed., This corroborates with Lindemann, (2017) study that stated that over half of known human pathogenic diseases can be aggravated by high temperature.

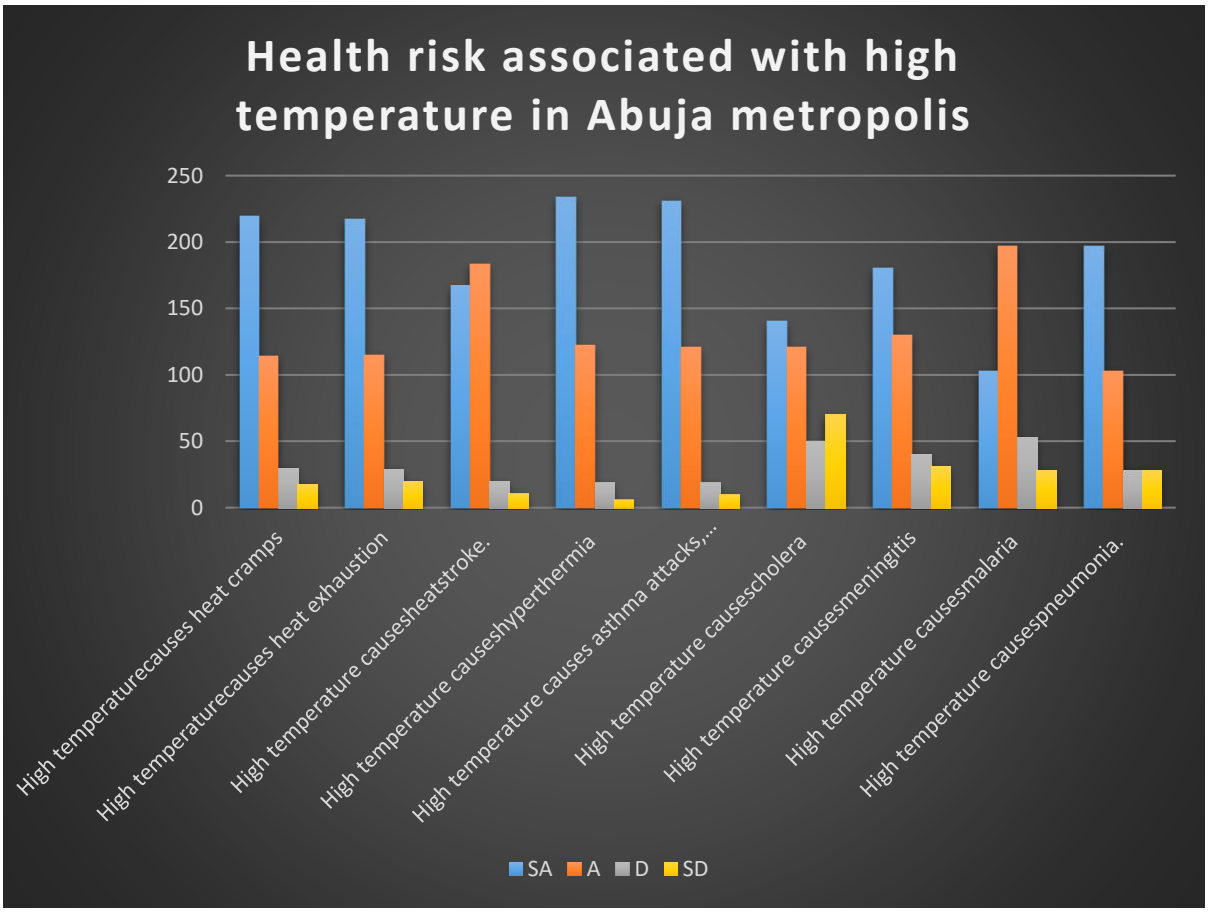

Fig 3. Showing health risk associated with high temperature in Abuja metropolis

The health risk associated with high temperature in Abuja metropolis review that 57.48% of the respondents strongly agreed that high temperature causes heat cramps. 29.92% of them strongly agreed, 7.8% of them disagreed, while 4.72% of them strongly disagreed. This analysis result is obvious to the fact that majority of the respondents 87.4% were of the opinion that high temperature causes heat cramps in the study area. Furthermore, 56.96% of the respondents strongly agreed that high temperature causes heat exhaustion, 30.18% of them agreed, 7.61% of them disagree, while 5.25% of them strongly disagreed. Again, this shows that 87.14% majority of the respondents are of the opinion that high temperature causes heat exhaustion in the study area. 43.83% of the study population strongly agreed that high temperature causes heat stroke, 48.03% of them agreed, 5.25% of them disagreed, while 2.89% strongly disagreed. 61.42% of the respondents strongly agreed that high temperature causes hyperthermia, 32.02% of them agreed, 4.99% of them disagreed, while 1.57% of them strongly disagreed. This shows that 93.44% of the respondents alluded to the fact that high temperature causes hyperthermia in the study area. 60.63% of the respondents strongly agreed that high temperature causes asthma attacks, respiratory and cardiovascular health conditions, 31 76% of them agreed, 4.99% of them disagreed, while 2.62% of them strongly disagreed. 36.75% of the respondents strongly agreed that high temperature causes cholera, 31.76% of them agreed, 13.12% of them disagreed, while 18.37% strongly disagreed. This shows that majority of the respondents totalling 68.51% were of the view that high temperature causes cholera in the study area. 47.24% of the study population strongly agreed that high temperature causes meningitis, 34.12% of them agreed, 10.50% of them disagreed, while 8.14% of them strongly disagreed. This shows that high temperature is associated with meningitis in the study area. Furthermore, 27.03% of the study population strongly agreed that high temperature causes malaria, 51.71% of them agreed, 13.91% of them disagreed, while 7.35% of them strongly disagreed. Finally, 51.71% of the entire study population strongly agreed that high temperature causes pneumonia, 27.03% of them agreed, 7.35% of them disagreed, while 7.35% of them strongly disagreed. This is in line with He & Zhao (2020) study that high temperature impacts human health negatively and has sparked an increase in the number of observed cases and/or the introduction of many diseases reported in cities of the world. This also agrees with Lindemann, (2017) study which shows that over half of known human pathogenic diseases can be aggravated by high temperature and climate change. Nitschke &Krackowizer(2017) corroborated with these findings in a study nothing that high temperature affects both mortality and morbidity globally. Similarly, Samet (2000) highlighted that high temperature influences proliferation of diseases caused by vectors and environmental exposure that may affect the rate and occurrence of morbidity and premature mortality. In the same vein, World Health Organization (2010) study on the health effects of climate change shows that high temperature is known to impact health infections and diseases, cardiovascular and respiratory diseases, particularly among elderly persons making life a burden to persons with respiratory illnesses such as asthma. This also agrees with Githeko (2000) that the greatest effects of high temperature and climate change is when the temperatures are 14° C to 18° C at the lower end, and 35° C to 40° C at the upper end. Mosquito species, such as the Anopheles gambiae complex, A. funestus, A. darling, Culex quinquefasciatus, and Aedes aegypti, common in the Caribbean, are the main vectors transmitting most vector-borne diseases, and they are sensitive to temperature changes. The study also stated that higher temperatures is linked to epidemics as cholera, Rift Valley fever and malaria.

Hypotheses Testing

Hypothesis 1

Hypothesis I which states that there is no statistically significant health risk associated with high temperature in the study area was tested with Chi square statistical tool

Determine the health risk associated with high temperature in Abuja metropolis

Table 4. Health risk associated with high temperature in Abuja metropolis

S/N	Answer Alternatives	SA	A	D	SD	Total
1	High temperaturecauses heat cramps	219(57.48%)	114(29.92%)	30(7.87%)	18(4.72%)	381(100%)
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6	High temperature causes cholera	140(36.75%)	121(31.76%)	50(13.12%)	70(18.37%)	381(100%)
7	High temperature causes meningitis	180(47.24%)	130(34.12%)	40(10.50%)	31(8.14%)	381(100%)
8	High temperature causes malaria	103(27.03%)	197(51.71%)	53(13.91%)	28(7.35%)	381(100
9	High temperature causes pneumonia.	197(51.71%)	103(27.03%)	28(7.35%)	28(7.35%)	381(100

Table 5: Summary of chi-square analysis on health risk associated with high temperature in the study area.

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	306.388a	24	.000
Likelihood Ratio	291.780	24	.000
Linear-by-Linear Association	51.688	1	.000
N of Valid Cases	3404		

Hypothesis 2

Hypothesis 2 which states that there is no statistically significant relationship in coping measures adopted by residents to cushion the impact of high temperature in the study area was tested using Chi square statistical tool package for social sciences (IBM/SPSS) version 22.

S/N	Answer Alternatives	SA	A	D	SD	Total
1	Use of air conditioning or fan is a measure to solve menace of high temperature in the study area.	180(47.24%)	130(34.12%)	40(10.50%)	31(8.14%)	381(100%)
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7	Keep drinking water before you feel thirsty, especially when outdoors or performing physical activity	219(57.48%)	114(29.92%)	30(7.87%)	18(4.72%)	381(100

Table 6 Summary of chi-square analysis on coping measures adopted by residents to cushion the impact of high temperature in Abuja metropolis.

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	217.646a	18	.000
Likelihood Ratio	193.754	18	.000
Linear-by-Linear Association	34.503	1	.000
N of Valid Cases	2667		

Table 7 revealed that the x2cal is 217.646. The obtained p −value of 0.000 is less than 0.05; therefore, the null hypothesis which states that there is no statistically significant relationship of coping measures adopted by residents to cushion the impact of high temperature in Abuja metropolis is rejected. This indicated that there was a significant relationship of coping measures adopted by residents to cushion the impact of high temperature in Abuja metropolis

SUMMARY AND CONCLUSION

The study assessed high temperature and coping mechanisms in Abuja metropolis. Findings of the study on sex distribution of the respondents revealed that a total of 81.4% of the respondents were males, while 18.6% were females. This shows that males were more in number than females in the study area. This can be attributed to cultural gender bias that does not allow most married Muslim women right to daily public interaction and social engagements as their male gender. In terms of respondent age, the age polarized more around the ages of 35-45 years with a total of 26.50% respondents of the study population, 23.62% respondents were in age bracket of 26-35, while 19.69%, 17.59% and 12.60% of the 23.62% respondents were within the age bracket of 18-25, 46-55 and 56 and above respectively. This shows that majority of the respondents were youths who possess the ability to work for longer hours in high temperature environment. This is in line with Emmanuel, (2012) that temperature pose a risk to the elderly than the youths because as we age, our bodies become less efficient to withstand high temperatures.

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