

# Heat Wave in the Context of Climate Change: A Cross Sectional Study on Awareness and Practices among Health Workers in North East Nigeria

Adah Ruth<sup>1</sup>, Olusonde Oluseyi<sup>2</sup>, Nashon Benjamin<sup>3</sup>

<sup>1</sup>Department of Paediatrics, Jos University Teaching Hospital, Jos. Plateau State, Nigeria

<sup>2</sup>National Primary Health Care Development Agency, Abuja Nigeria

<sup>3</sup>Adamawa State Ministry of Health, Yola, Adamawa State, Nigeria

**Abstract:**-The most obvious evidence of global warming and climate change is the frequent heat waves experienced globally. There have been reports of increased morbidity and mortality associated with heat wave periods. Although heat wave as an effect of global warming is a worldwide phenomenon, very few studies on issues of climate change come from resource poor countries of the tropics. The recent heat waves experienced in Adamawa state Nigeria is of public health concern. The perception and practice of health workers during heat wave conditions not only affects their health but that of the public they serve. This study aims at determining health workers' perceptions of cause of the heatwave, its effect on health and protective measures taken.

The study was a descriptive cross-sectional one conducted among health workers in Yola, Adamawa state during the April 2019 heatwave. Largely open-ended questionnaires were used to obtain data from 80 health workers (doctors, nurses, community health extension workers-CHEWs) working in different levels and agencies of the health sector. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Univariate and bivariate analysis were carried out and the level considered statistically significance was set at  $p < 0.05$ . The results indicate that majority (68.8%) of health workers perceived that the increased environmental heat was associated with severe discomfort. A large proportion (72.5%) of health workers had cause to educate individuals on heat management but only few (25%) had good knowledge on heat related morbidity and 13.8% were aware of any existing guidelines on management of heat waves. Ignorance and misconceptions exist surrounding the cause and effects of the heat waves in the context of changing climate with the vast majority (90%) perceiving themselves as having no role to play in climate change. Trees and shades (29.2%) were the most frequently used methods for protecting self from heat at home, while few practiced increased fluid intake (7.1%). Almost a fifth (17.5%) of respondents practiced no method of keeping cool at work. On this basis, it is recommended that there be collaborative efforts by the state ministries of health and related agencies to expand the narrative of climate change to include the health threat. Involving health workers in communication, advocacy and managing the effect is required if the targets of the 13th SDG is to be achieved.

**Keywords:** Global warming, workers, knowledge, morbidity cooling

## I. INTRODUCTION

Climate change is a global phenomenon and has multifaceted effects on individuals and communities. It not only impacts on the ecological system, developmental, agricultural, social and economic activities, it also affects health of the populace.<sup>1-2</sup> One definite evidence of climate change is global warming which is responsible for increased frequency, duration, and intensity of the heat waves which is being experienced worldwide.<sup>3</sup> Human activity that increases the abundance of heat-trapping gases in the atmosphere has been identified as the major contributor to global warming.<sup>4</sup> Heat waves have been described in climatology as the occurrence of at least three consecutive hot or days of elevated temperatures outside the normal range of climate variability for a specific region.<sup>5</sup> The World Meteorological Organization defines a heatwave as "when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5°C temperatures. If the maximum temperature of any place continues to be more than 45° C consecutively for two days, it is called a heat wave condition."<sup>6</sup>

Trend analysis of climatic data from different parts of Nigeria and Adamawa state shows that mean temperature is on an increase.<sup>7,8</sup> In the month of April 2019, daytime temperature peaked at 45°C in Adamawa state, far above the historical average over 38 years has been 28.1°C.<sup>9,10</sup> Although the country is yet to develop clear definition for heat wave, populations who have experienced such heat waves at maximum temperatures less than that recorded in Adamawa have recorded heat associated morbidity and mortality.<sup>11</sup> During the 2003 heat wave in France, about 15,000 deaths were recorded while significant morbidity and mortality were also reported during similar episodes in India, Australia, the United States and the United Kingdom.<sup>12-17</sup> Heat related morbidity reported during these spells such as dehydration, heatstroke, heat exhaustion, heat cramps, exacerbation of psychiatric and other chronic illnesses and even death depends on age, size and the sensitivity of the exposed individual or population.<sup>11,14,15</sup> To combat heat and its health effects in living and working spaces, various national, regional and organizational guidelines recommend long,

medium and short term approaches.<sup>18-20</sup> Specific short term measures have been advocated such as avoiding outdoors activities during the peak period of the heat, opening windows for ventilation, frequent showers, wearing of light clothes, increase fluid intake and use of air conditioners.

There is an emerging role for health professionals in mitigation, adaptation, impact reduction and early warning as targeted in the 13th Sustainable Development Goal (SDG).<sup>23-25</sup> In a general sense health workers engage a broad range of people and disseminate information on prevailing health, social and environmental issues which may include extreme climate events. They also play a critical part in detection and management of heat wave and other climate related health effects.<sup>26</sup>

Nigeria's contributions to greenhouse gas emissions is significant, coupled with being very vulnerable to effects of climate change. The Northeastern part of Nigeria where Adamawa is situated has been assessed to be at extreme risk of the negative impact of climate change, the efforts to educate Adamawa citizens on this imminent danger and set up actionable plans to protect them can best be described as feeble.<sup>21</sup> A study on awareness on climate change across different states in Nigeria showed very low awareness among persons living in Adamawa state.<sup>22</sup> It is however expected that health workers in Adamawa who are engaged in promoting health through education of patients and the public be aware of climate related health issues and protective practices than the general population. Thus, the perception and practices of health workers during the heat wave in Adamawa state though unknown is relevant in addressing the deficit in knowledge and management of the effects of the heat wave on the population and form part of a larger states' response to the climate change.

#### Research Questions

1. What are the perceptions of health workers regarding the heat wave and climate change?
2. What are common protective practices carried out by health workers in Adamawa State during the heat wave condition?
3. Was advice on heat management required by individuals from health workers during the period?
4. What are the health workers sources of information on prevention and management of the health effect of the heat wave?

#### Objectives

To determine the perceptions of the cause, health effects and practices of health workers during the heat wave in Adamawa state.

## II. METHODS AND MATERIALS

### *Study Area and Definition of Heat Waves*

Adamawa state is situated in North Eastern Nigeria. It occupies approximately 36,917km<sup>2</sup> and situated at an elevation of 299 meters above sea level. It lies between latitude 7 and 110 N and between Longitude 110 and 140 E. The current population of the State as projected from the 2006 census to be 4, 256,000 with an annual growth rate of 2.9%. The climate of the State is characterized by two distinct seasons, the dry season lasts from November-April while the rainy season spans from May to October. Mean annual rainfall in the state ranges is about 700mm in the North-west, to 1600mm in the extreme southern part of the state.<sup>22</sup> It is considered one of the hottest states in the country and during the study period, outdoor temperatures ranged from 44-45°C.<sup>9</sup>

All 100 health workers from 21 Local Government Areas (LGA) of Adamawa state attending a non-related 3day training in the State Capital -Yola in the month of April 2019 were invited to fill the questionnaires. The health workers consisted of physicians, nurses and community health extension workers (CHEW) from different agencies and facilities of the health sector. A self-administered largely open-ended questionnaire was developed to obtain information on biodata, perspective on cause and effect of heat waves and cooling practices at home and at work. The question on knowledge of heat related morbidities had 3 levels of scores, Poor, Fair and Good level of Knowledge if they proffered 0, 1 and 2 correct answers respectively. Ethical approval was obtained from Adamawa State Ministry of Health Research Ethics Committee. Data was entered into an excel sheet and imported into SPSS version 23 and univariate and bivariate analysis were carried out and the level considered statistically significance was set at  $p < 0.05$ .

## III. RESULT

Of the 100 questionnaires distributed 80 were returned filled given a response rate of 80.0%. CHEWs formed 65%, Nurses 23.8% and Doctors 11.3%. The majority (40%) worked in primary health centers, over a quarter (27.5%) worked in secondary and tertiary health centers and about a third (32.5%) worked as administrators in the State Ministry of Health (SMOH) and Adamawa State Primary Health Care Development Agency (AdPHCDA).

Less than half (43.8%) were females and 85% of respondent were married. while 7.5% were aged 21- 30 years, 23.8% were 31-40 years, 37.5% fell into the age group of 41-50 years, which was the largest group and those aged 51-60 years accounted for 31.3%. All (100%) respondents considered this season hotter than that of previous years

Table I: Health workers' perception of severity, role, cause and effect of the heat wave

Variable	Number(%)	X <sup>2</sup>	P
<b>Perceived severity of discomfort related with present heat wave (n-80)</b> No discomfort Mild Discomfort Moderate Discomfort Severe Discomfort	0(0) 8(10) 17(21.3) 55(68.8)	46.675	0.000*
<b>During this current heat spell, did you have any one complain to you or seek health advice from you as a Health worker about the heat and its effect?</b>  Yes No	  39(48.8) 41(51.2)	  0.050	  0.823
<b>During this current heat spell, have you had to educate any patient / caregiver on management of the heat?</b> Yes No	58(72.5) 22(27.5)	16.200	0.000*
<b>Can the high environmental temperatures cause detrimental health effects?</b>  Yes No	  76 (95) 4 (5)	  64.800	  0.000*
<b>Answers given as specific heat related illnesses (n-142)</b> <b>Correct</b> Heat Rash Fever/hyperthermia Dehydration Fatigue Difficulty in concentration Heatstroke Sunburn Excessive cry in infants  <b>Misconceptions/incorrect</b> Specified Viral exanthems Meningitis Respiratory tract infection diarrhea Scabies Malaria Heart diseases Bleeding Cancer Viral Conjunctivitis	30 (21.1) 19 (13.4) 9 (6.3) 5 (3,5) 2 (1.4) 2 (1.4) 1(0.7) 1(0.7)  25 (17.6) 19 (13.4) 8 (5.6) 5 (3.5) 5(3.5) 4(2.8) 4 (2.8) 1(0.7) 1(0.7) 1(0.7)	107.634	0.000*
<b>Perception on cause of increasing temperatures in Adamawa and worldwide(n-80)</b> <b>Related or Correct</b> Global warming Environmental degradation Deforestation Gas/air pollution Increase pop/crowding Ozone layer depletion Industrialization <b>Misconceptions</b> Meant to be/fate Sun increasing in size Gods punishment <b>No idea</b>	1 (1.3) 1 (1.3) 22 (27.5) 19 (23.8) 12(15.0) 6 (7.5) 2(2.5)  7 (8.8) 2 (2.5) 1(1.3) 7(8.8)	75.925	0.000*

<b>Can actions of individuals or yourself contribute to climate change positively or negatively(n-80)</b>			
Yes	8(10)		
No	72(90)	51.200	0.000*

• *Statically significant*

Even though almost all (95%) respondents knew that the heat wave was detrimental to health, when told to mention 2 conditions caused by the heat, only 25% got both answers correct (good knowledge) 40% had both incorrect answers (poor knowledge) and 35% got one correct and one incorrect answer (fair knowledge).

Overall only 69 (48.6%) of the 142 entries for direct health effect of heat were correct and 73(51.4%) were incorrect. Only one respondent mentioned the phrase ‘global warming’ while most (78.8%) mentioned issues related to global warming, 12.5% had misconceptions and 8.8% had no idea. While only a tenth believed themselves to have a contributory role in climate change.

Table II: Health workers source of information and required education concerning heat wave

Variable	Frequency(%)	$\chi^2$	P
<b>Are you aware of the existence of any state, national or international guideline/recommendations/document on protection against the health effect of the heat and its management?</b>			
Yes	11(13.8)	42.050	0.000*
No	69(86.2)		
<b>Have you received any information on prevention or management of the health effect of heat wave through other avenues?</b>			
Yes (Electronic, print &, social media, internet, child, friend, school)	26(32.5)	9.800	0.002*
No	54(67.5)		
<b>Do you require education on health impact of heat wave and its management in your line of work? (n-80)</b>			
Yes	67(83.75)	36.450	0.000*
No	13(16.25)		

A small proportion (13.8%) of health workers were aware of guidelines to protect against heat wave and its health implications Less than a third (32.5%) of health workers got

information on the current heat wave through other sources with only 14 of them (17.5%) from the media.

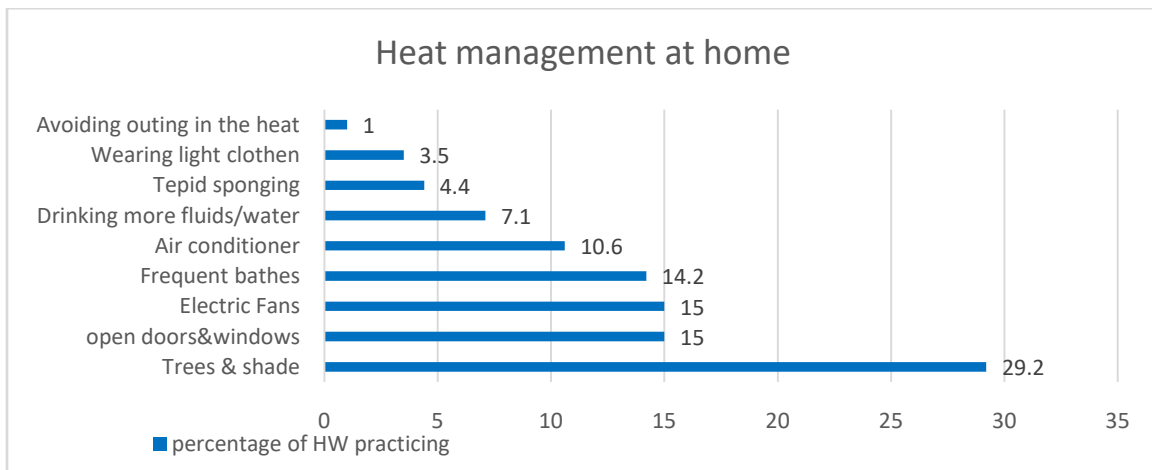
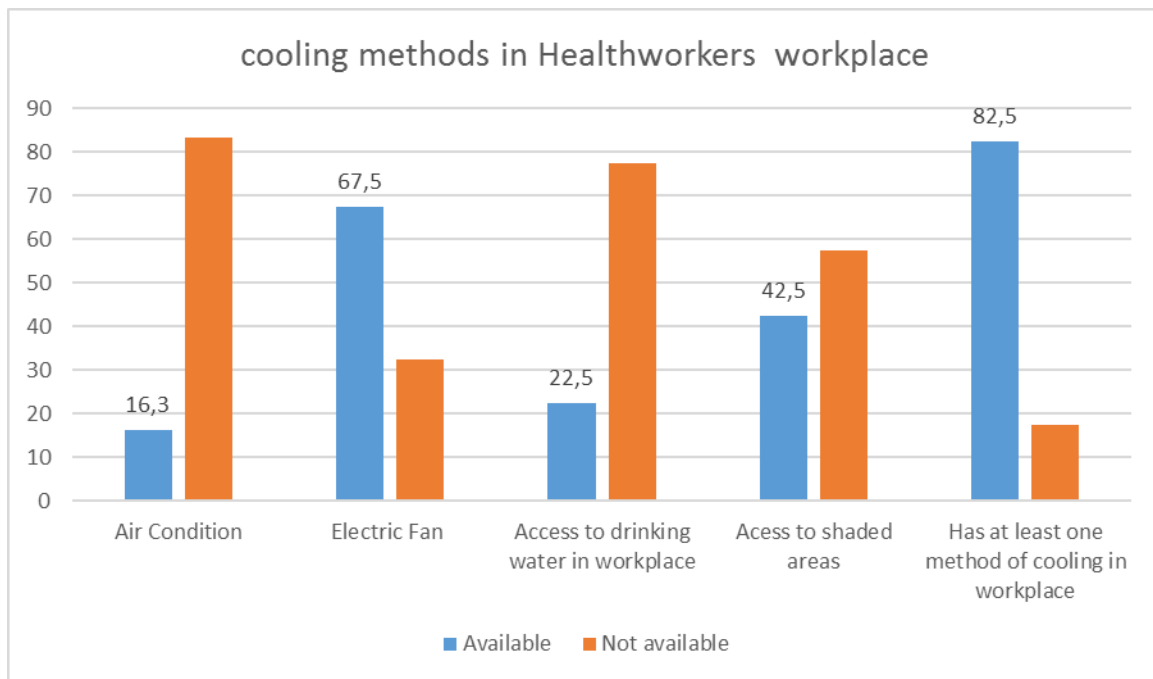


Figure 1: Methods used to manage heat by health worker at home



**Figure 2:** Methods available to manage heat at workplace

#### IV. DISCUSSION

The study of Health workers awareness of heat wave and its health effects is an attempt at using the heat wave in the index period to sensitize and involve the health sector of Adamawa state in climate change and management of climate related health events.

Although Adamawa is one of the hottest states of the country, different professionals from various LGA, assessed the weather as hotter than previous years and most of them associated it with severe levels of discomfort. This perception of heat related discomfort, has been reported as the basic concept understood by many Nigerians as the effect of climate change.<sup>22,27</sup> There is a need for broader, deeper knowledge of the effect the heat wave beyond the subjective sensual awareness and effect. The range of sources of information were narrow and the information from avenues such as social media is unlikely to be appropriate or sufficient for the health workers role in communicating and managing heat related problems. Media has played an active role in spreading the message and increasing understanding of climate change globally however media accounted as a source of information for a very small proportion of health workers in our study. This is in line with a study by Akpan et al that showed that perception of the Nigerian public has not been significantly influenced by media on climate change.<sup>27</sup> With less than a fifth of the respondents being aware of guidelines on management of heat effects, and almost three quarters of them engaging members of the public on required heat management information, the validity of messages passed to the public is in question. To close this gap, the Adamawa state ministry of health thought to coordinate efforts with other agencies such as metrological agency, ministry of environment, education and

agriculture in developing effective warning systems and contextual messages for both health workers and the public. Guidelines used by health workers in other nations have aided in reduction of heat related morbidity and mortality.<sup>6,11,17,18</sup> Therefore, the development or adaptation of guidelines for appropriate response by the public and health workers in the Adamawa setting for subsequent events cannot be overemphasized.

Although a general awareness of the detrimental effect of the increased environmental temperatures exist among the health workers there was limited awareness of specific heat related illnesses among the health workers. The etiology of certain diseases occurred more during the dry hot harmattan season in northern Nigeria such as meningitis and Upper Respiratory Tract Infections (URTI) were wrongly perceived as being caused by the heat by some health workers, This has been a widespread myth particularly concerning meningitis spread in northern Nigerian and has the potential to negatively influence correct protective and therapeutic measures against such diseases, as affected individuals may have inappropriate measures carried out on them by health workers with such misconceptions adding to morbidity and mortality.<sup>28</sup> In general, health workers living and working in hotter regions of the country require regular update on complications of the heat, more so during the heat wave periods.<sup>25</sup>

Efforts at mitigation, impact reduction and early warning during heat waves may be undermined by the perception of health workers that they had no role in climate change. Contributory to this perception may be the notion displayed by some respondents, referred to as the 'God-frame' thinking, by Pugliese and Ray, attributing the extreme heat to fate or the supernatural thus assuming themselves helpless against the



climate change.<sup>29</sup> With the misconception and ignorance seen among this relatively more educated and literate subset of the public, one can only expect a higher level of ignorance in the general population. As individuals or as a group, health workers are strong opinion leaders in communities in Adamawa state therefore dispelling these misconceptions would aid in empowering them for advocacy and drive the political agenda on climate change.<sup>26</sup>

Most methods employed by health workers to protect themselves from the heat wave, were targeted at cooling the individual. The tendencies of the respondents towards using shades of trees during the heatwave for cooling may be used as an obvious benefit woven into the narrative of tree planting as a climate adaptation measures. This could boost the current tree planting campaign going on in the state and discourage indiscriminate felling of trees.<sup>30</sup> Even though there is evidence, that electric fans and air conditioning offers some protection against the impacts of heat on health, surrounding considerations are that of frequent power outage and cost implications.<sup>31</sup> These are possible reasons why only a small proportion of health workers used these electric devices. Surprisingly, simple energy saving methods associated with little or no cost such as, staying indoors during the hottest periods of the day, wearing light clothes, frequent showers, tepid sponging and drinking more fluids to avoid dehydration seem to be least practiced by the health workers. Additionally, less than a quarter of health workers had drinking water available or accessible to them at the work place where the hottest part of the day is usually spent, with some having no single strategy available to them at the workplace for their protection from the heatwave. This uncondusive work environment may not only affect health negatively but productivity as well. Patients who visit these facilities are likely to be exposed to same conditions as the service providers adding to their morbidities. There is a need to teach and institute simple measures to protect health workers and the public from the effects of the heat in a setting like Adamawa where electricity supply is insufficient to power Air Conditioners and fans.

## V. CONCLUSIONS

The findings of this study suggest that although most health workers had need to inform individuals of the management of the heat wave many were not aware of the underlying cause, specific heat related morbidities or their roles in mitigating extreme weather events.

There is a need to develop a heat wave guide or action plan for health workers and health information directed at the public to protect individuals from the potentials risk by joint effort of the state ministries of health and environment. An expansion of the narrative of climate change to include the health threat and involvement of health workers in communication, advocacy and managing the effect is required if the targets of the 13<sup>th</sup> Sustainable Development Goal is to be attained in Nigeria.

## REFERENCES

- [1]. Meehl GA, Tebaldi C. More intense, more frequent, and longer lasting heat waves in the 21st century. *Science* 2004; 305: 994–997
- [2]. Costello A, Abbas M, Allen A, Bell S, Bellamy R, Friel S et al. Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *Lancet* 2009;373:1693–733
- [3]. Adebayo, A. A., Climate: Resource and resistance to agriculture. 8th Inaugural Lecture, Federal University of Technology, Yola, Nigeria, 19th May 2010
- [4]. Coutts C, Hahn M. Green infrastructure, ecosystem services, and human health. *Int J Environ Res Public Health*. 2015;12(8):9768–9798. doi:10.3390/ijerph120809768
- [5]. Overview of Impacts, Adaptation, and Vulnerability to Climate Change.” IPCC Climate Change 2001: Working Group II: Impacts, Adaptation and Vulnerability. <[http://www.grida.no/climate/ipcc\\_tar/wg2/061.htm#1434](http://www.grida.no/climate/ipcc_tar/wg2/061.htm#1434)
- [6]. World Meteorological Organization and World Health Organization, 2015: Heatwaves and Health: Guidance on 1447 Warning-System Development, WMO- No. 1142
- [7]. Odjugo P. A. O. Regional evidence of climate change in Nigeria. *Journal of Geography and regional Planning*. 2010; 3(6): 142–150
- [8]. A.A. Adebayo, Zemba A.A, Ray H.H, Dayya S.V. Climate change in Adamawa state, Nigeria: evidence from Agro climatic Parameters. *Adamawa State University Journal of Scientific Research (ADSUJR)* 2012; 2(2)
- [9]. <https://www.accuweather>. Accessed on 11/04/2019
- [10]. Auwal f. Abdussalam. Changes in indices of daily temperature and precipitation extremes in Northwest Nigeria. *Science world journal* 2015; 10 (2)
- [11]. Kovats RS, Hajat S Heat stress and public health: a critical review. *Annual Review of Public Health* 2008; 29: 41–55.
- [12]. Fouillet A, Rey G, Wagner V, Laaidi K, Empereur-Bissonnet P, Le Tertre A, Frayssinet P, Bessemoulin P, Has the impact of heat waves on mortality changed in France since the European heat wave of summer 2003? A study of the 2006 heat wave *Int. J. Epidemiol.* 2008; 37 :309–17
- [13]. Kakkad K, Barzaga ML, Wallenstein S, Azhar GS, Sheffield PE. Neonates in Ahmedabad, India, during the 2010 Heat Wave: A Climate Change Adaptation Study. *J Environ Public Health*. 2014; 2014
- [14]. Murari K K, Ghosh S, Patwardhan A, Daly E, Salvi K, Intensification of future severe heat waves in India and their effect on heat stress and mortality. *Reg. Environ. Change* 2015 ;15, 569–579
- [15]. Nitschke, M.; Tucker, G.; Hansen, A.; Williams, S.; Zhang, Y.; Bi, P. Impact of two recent extreme heat episodes on morbidity and mortality in Adelaide, South Australia: A case-series analysis. *Environ. Health* 2011, 10, doi: 10.1186/1476-069X-10-42
- [16]. Smith, Tiffany T.; Zaitchik, Benjamin F.; Gohlke, Julia M. “Heat Waves in the United States: Definitions, Patterns and Trends,” *Climatic Change*. 2013; 118: 811–825. doi:10.1007/s10584-012-0659-2.
- [17]. Katherine G. Arbuthnott & Shakoor Hajat. The health effects of hotter summers and heat waves in the population of the United Kingdom: a review of the evidence *Environmental Health* 2017; 16(119)
- [18]. Victoria State Government (2018). Heat Health Plan for Victoria. Melbourne, Australia.
- [19]. Retrieved from: <http://bit.ly/2XAZH9s>- 14/09/2019
- [20]. World Health Organization (2011). Public Health Advice on Preventing Health Effects of Heat. Copenhagen, Denmark Retrieved from: <http://bit.ly/pubhealth2>
- [21]. International Federation of Red Cross and Red Crescent Societies, (2019). Heatwave guide for cities: Geneva, Switzerland <https://www.climatecentre.org>
- [22]. United Nations Framework Convention on Climate Change UNFCCC (2012) Status of ratification of the Kyoto Protocol.

- [23]. Odjugo, P. A. Ovuoyovwiroye Analysis of climate change awareness in Nigeria. *Academic Journals*. 2013; 8(26):1203-1211. <http://www.academicjournals.org/SRE>
- [24]. Xiang J, Hansen A, Pisaniello D, Bi P. Perceptions of Workplace Heat Exposure and Controls among Occupational Hygienists and Relevant Specialists in Australia. *PLoS ONE* 2015; 10(8) e0135040. <https://doi.org/10.1371/journal.pone.0135040>
- [25]. Lianping Yang, Wenmin Liao, Chaojie Liu, Na Zhang, Shuang Zhong, and CunruiHuang Associations between Knowledge of the Causes and Perceived Impacts of Climate Change: A Cross-Sectional Survey of Medical, Public Health and Nursing Students in Universities in China *Int J Environ Res Public Health*. 2018; 15(12): 2650
- [26]. Julia Hathaway and Edward W. Maibach. Health Implications of Climate Change: a Review of the Literature About the Perception of the Public and Health Professionals. *Curr Environ Health Rep*. 2018; 5(1): 197–204
- [27]. Perry Sheffield, Kathleen durante. Emerging roles of health care providers mitigate climate change impacts WHO/Europe web site at <http://www.euro.who.int/pubrequest>.
- [28]. Akpan C.S, Anorue L.I, Ukonu M.O, An Analysis of the Influence of the Nigerian Mass Media on Public Understanding of Climate Change. *Journal of Alternative Perspectives in the Social Sciences*. 2012; 4 (4): 688-710
- [29]. Abdussalam, A.F. and Qaffas, Y. Spatiotemporal Patterns and Social Risk Factors of Meningitis in Nigeria. *Open Access Library Journal*. 2016. 3:8: e2909. <http://dx.doi.org/10.4236/oalib.1102909>.
- [30]. Pugliese A, Ray J (2009). Awareness of Climate Change and Threat Vary by Region Adults in Americas, Europe most likely to be aware, perceive threat. <http://www.gallup.com/poll/124652/awarenessclimate-change-threat-vary-region.aspx>. Accessed 12/9/2019
- [31]. Mohammad M. A., I. M. Polycarp, Jatau D. F, Hamid M.Y. and Goji T.C: The use of fruit Trees as Strategy for Combating Desertification in Nigeria. *The Nigerian Journal of Tropical Agriculture*. 2006; 7(2): 234-241.
- [32]. Naughton MP, Henderson A, Mirabelli MC, Kaiser R, Wilhelm JL, Kieszak SM, et al. Heat-related mortality during a 1999 heat wave in Chicago. *Am J Prev Med*. 2002;22(4):221–7