ANALYSIS

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Climate Change

Climate change impact on workers' health, safety and productivity

Joshua, OLU✉, **Adeshina Sherif MAJEKODUNMI**

Affiliation: Centre for Environmental Studies and Sustainable Development, Lagos State University, Ojo Lagos, Nigeria

✉**Corresponding Author:**
Name: Joshua, OLU
Address: Centre for Environmental Studies and Sustainable Development, Lagos State University, Ojo Lagos, Nigeria
Phone: +234-7030831499
Email: olu@lujosh.com
Orcid No: 0000-0002-5865-3640

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ABSTRACT

Climate change is a global phenomenon which effects continue to generate attention. Workers are exposed to many types of climate change related hazards depending on the type of work, geographic region, season, and duration of work time. This study aim to evaluate the effects of climate change on workers with respect to their health, safety and productivity. In this study, data was collected from a total of 200 respondents who were workers across four occupational sectors: agriculture, fishing, construction and food production using well structured questionnaires. There was significant difference between the perceptions of climate impact among the workers in the four sectors from the model final χ^2 (15, N= 200) = 38.211, p= 0.001 Nagelkerke R^2 = 0.186. There was no significant relationship between low productivity and climate change related hazards in workplace, from Omnibus χ^2 (5, N= 200) =

8.642, p= 0.124. The climate change related hazard affected the health and safety which subsequently result in a low productivity by the workers. Increased ambient temperature has more significant effect on the workers in their workplace environment.

Keywords: Workplace, Climate change, Hazards, Temperature, Environment

1. INTRODUCTION

The variation in seasonal weather activities in recent time had generate lots of concern for the global community at large. Climate change is one of the biggest threats facing development and productivity with the developing countries being more vulnerable due to low adaptive capacities. Environmental degradation has presented a myriad of challenges to the human race and the most heinous one has been climate change (Mpambela and Mabvurira, 2017). According to Segyuin (2008), climate change (CC) is a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period. Gukurume (2013) is of the opinion that climate change is a process of global warming, in part attributable to the greenhouse gases generated by human activity. These events are expected to increase if the global mean temperatures remain on the rise (Gillis, 2014). Climate change is causing unprecedented, unpredictable and irreversible changes to the earth's ecosystem at an alarming rate which affects a wide range of sustainable development issues such as health, food security, employment, livelihoods, gender equality, education, housing either directly or indirectly (Sugirtha and Littleflower, 2015). People are not affected by climate change in a uniform way. The variation comes with geographic location, culture, social, economic and political characteristics of societies. Workers respond to these effects in one way or the other (Mpambela and Mabvurira, 2017).

Environmental conditions may directly influence work productivity, in particular for those activities that need physical work. A research in relation to climate change, cannot elude including an analysis of how global warming will affect the productivity and work capacity of people who are exposed to thermal stress (Marchetti, Capone and Freda, 2016). In a study by Kjellstrom, Kovats, Lioyd *et al.,* (2009), in terms of absolute change in labor productivity by the 2080, the greatest absolute losses (11.4% to 26.9%) are foreseen in Southeast Asia, Andean and Central America, Eastern Sub-Saharan Africa and the Caribbean. Eastern and Western Europe and Southern Latin America will have the smallest losses (0.1% to 0.2%); the combined effects of less warming and greater wealth (people work in less labor-intense jobs) result in a considerably smaller impact in all regions (the greatest loss being 16% in Central America) (Kjellström *et al*., 2009; Lundgren, Kuklane, Gao and Holmer, 2013).

Workers are exposed to many types of hazards that depend on their type of work, geographic region, season, and duration of work time (National Institute for Occupational Safety and Health (NIOSH), 2008) The most exposed workers are essentially those working in industries where the jobs are performed outside for example Agriculture, construction sector workers and those working at high indoor temperatures or who experience increased body heat due to the nature of their tasks (Jay and Kenny, 2010). Industries involving indoor activities with risks of excessive heat exposure are the glass, ceramic, brick, and rubber fabrication industries; foundries; greenhouses; canning and textile industries; and laundries, kitchens, and warehouses (Morioka *et al.* 2006; Noweir and Bafail, 2008). The aim of this study is to evaluate the effect of climate change on workers with respect to their health, safety and productivity.

2. MATERIALS AND METHODS

Study Area

The targeted population for this research work covers workers that are most exposed to climate change hazards such as: increased ambient temperature; air pollution; ultraviolet (UV) radiation; extreme weather; expanded vector habitats. This set of workers are essentially those working in industries where the jobs are performed outside and those working at high indoor temperatures or who experience increased body heat due to the nature of their tasks across south-western region of Nigeria.

Population and sample size of the Study

The population under study consists of 400 workers spread across the four sectors that were investigated in this study In order to determine the sample size, a 5% level of significance is used. The sample size was derived using Yamane (1973) formula

$$n = N/[1+ N (e)^2]$$

Where

n = sample size

N = Population of the study

e = level of significance/Error estimate at 5%

1 = Constant

$$n = \frac{400}{1+ 400\ (0.05)^2}$$

$$n = \frac{400}{1+ 400\ (0.0025)}$$

$$n = \frac{400}{1+ 1}$$

$$n = \frac{400}{2} = 200$$

= 200

Method of Data Analysis

The data gathered for the study were subjected to descriptive and inferential statistics with focus on the major research questions. The data was processed and analyzed using SPSS (version 22). Descriptive analysis such as frequency, percentage etc. was used to describe the sample.

A total score was calculated for the available items where necessary. A 2x2 chi-square was used to compare gender significance in the awareness/knowledge of climate change impact on occupational health and safety associated with low productivity among the respondents with significance established at $p < 0.05$. The perceptions of climate impact among the workers in the four sectors were investigated by conducting a multinomial logistic regression at statistical significance of $p < 0.05$.

To identify the factors significantly associated with low productivity among perceptions of workers on climate change related hazards in workplace logistic regression analyses were conducted using binary logistics with stepwise model with statistical significance of $p < 0.05$. To evaluate the relationship between workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased ultraviolet (UV) radiation effects and Vector-borne diseases effect in workplace. A multinomial logistic regression at statistical significance of $p < 0.05$.

3. RESULTS

Socio Demographic Data of the Respondents

From Table 1, 30% of the respondents in the agriculture sector, 18.5% of them were in to fishing activities, 27.0% of them were in the construction occupation and 24.5% of them were into food production. The workplace environment which indicate where the respondents work shows that 74.5% of them work completely outdoor, 24% work partially indoor, 1.0% work completely indoor and 0.5% work partially outdoor.

Table 1 socio-demographic distribution of the respondents

	Frequency	Percentage
Gender		
Male	163	81.5
Female	37	18.5
Age		
<20	6	3.0
20-24	25	12.5
25-29	30	15.0
30-34	30	15.0
35-39	39	19.5

40-44	28	14.0
45-49	15	7.5
50+	27	13.5
Marital status		
Single	60	30.0
Married	140	70.0
Educational Qualification		
Primary	22	11.0
Secondary	63	31.5
NCE	14	7.0
OND	16	8.0
HND	16	8.0
B.Sc	24	12.0
M.Sc	1	0.5
Ph.D	-	-
No formal Education	44	22.0
Employment Status		
Employed	98	49.0
Self-Employed	102	51.0
Sector of Occupation		
Agriculture	60	30.0
Fishing	37	18.5
Construction	54	27.0
Food Production	49	24.5
Workplace Environment		
Completely Indoor	2	1.0
Partially Indoor	48	24.0
Completely Outdoor	149	74.5
Partially Outdoor	1	0.5
Personal protective equipment (PPE) Usage		
Yes	8	4.5
No	191	95.5

Workers Knowledge about Climate Change

Table 2 shows that 99.5% of the respondents claimed to have heard about the term climate change, 88.5% of the respondents believes that human activities are one of the factors responsible for climate change, 98.0% of the respondents believes that climate change leads to low productivity and 91.5% of them agreed that prevention of climate change is a duty of all human.

Table 2 Respondents knowledge about climate change

	Frequency	Percentage
Have you heard the term climate change		
Yes	199	99.5
No	1	0.5
Which of these climate related changes are you familiar with?		
	Increased temperature	
Yes	159	79.5
No	41	20.5
	Air pollution	

Yes	88	58.0
No	112	44.0
	Ozone depletion	
Yes	54	27.0
No	146	73.0
	Extreme weather	
Yes	56	28.0
No	144	72.0
	Vector-borne diseases	
Yes	54	27.0
No	146	73.0
Human activities are one of the factors responsible for climate change?		
Yes	177	88.5
No	23	11.5
Climate change leads to low productivity?		
Yes	196	98.0
No	4	2.0
Prevention of climate changes a duty of all of us?		
Yes	183	91.5
No	17	8.5

Workers Perceptions on Climate Change Related Hazards in Workplace

Table 3 shows the perception of the workers who were the respondents in this study, on climate change related hazarda in workplace.

Table 3 Respondents perceptions on climate change workplace related hazard Cronbach's alphas for the 25 items was 0.784

Items	SDA n(%)	DA n(%)	NS n(%)	A n(%)	SA n(%)
Increased ambient temperature effect at workplace					
The hot weather experienced at your workplace causes illness?	3(1.5)	3(1.5)	1(0.5)	130(65)	63(31.5)
Heat related injury is common among workers in your workplace?	2(1.0)	4(2.0)	8(4.0)	144(72.0)	42(21.0)
Whenever the environment of your workplace becomes too hot, you always stop working for some hours or the whole day	2(1.0)	2(1.0)	10(4.5)	107(53.5)	79(39.5)
There have been Heat-related deaths among workers in your workplace	12(6.0)	17(8.5)	44(22.0)	88(44.0)	39(19.5)
Drinking cool water at the workplace helps to reduce heat stress	1(0.5)	2(1.0)	3(1.5)	103(51.5)	91(45.5)
Air pollution effects at workplace on workers					
There have been rise in higher sensitivity to substances among workers in your workplace?	3(1.5)	4(2.0)	6(3.0)	113(56.5)	74(37.0)
Most workers in your workplace complain of difficulty in breathing due to dirty air around your workplace	7(3.5)	2(1.0)	4(2.0)	118(59.0)	69(34.5)
Your employer makes provision of nose masks for all the workers in your workplace	4(2.0)	2(1.0)	15(7.5)	118(59.0)	61(27.2)
Whenever it appears that the air around your workplace is polluted with some grains or particles, you normally stop working for some hours	9(4.5)	9(4.5)	37(18.5)	87(43.5)	58(29.0)
There have been increase in asthmatic diseases among workers in your workplace	1(0.5)	-	14(7.0)	105(52.5)	80(40.0)
Ozone layer depletion leading to increased UV radiation effects on workers at workplace					
When you stay outdoor working for longtime your skin starts to itch you?	6(3.0)	1(0.5)	2(1.0)	111(55.5)	80(40.0)
Among the workers in your workplace working outdoor, there have been	8(4.0)	6(3.0)	31(15.5)	99(49.5)	56(28.0)

cases of poor vision and eye damages?					
The skins of workers in your workplace working outdoor are always darken and make them look older?	2(1.0)	6(3.0)	12(6.0)	108(54.0)	72(36.0)
Most workers working outdoors in your workplace, do complain of suppress proper functioning of their body's immune system and the skin's natural defenses which make them to fall sick easily?	6(3.0)	8(4.0)	40(20.0)	88(44.0)	58(29.0)
There have been some skin infection cases among workers working outdoors in your workplace?	3(1.5)	2(1.0)	11(5.5)	107(53.5)	77(38.5)
Extreme weather effect on workers at their workplace					
Whenever there is flooding at your workplace, you always stop working for some days or hours?	3(1.5)	4(2.0)	9(4.5)	118(59.0)	66(33.0)
There have been cases of accident or injury resulting from flood debris, sediments and chemicals flow from the flood in your workplace	4(2.0)	4(2.0)	33(16.5)	100(50.0)	59(29.5)
Whenever there is consistent thunder strikes most workers in your workplace become emotional and mentally distress and scared and this affect productivity	14(7.0)	19(9.5)	25(12.5)	101(50.5)	41(20.5)
There have been cases of death from havoc caused by extreme weather condition in your workplace to workers?	4(2.0)	4(2.0)	35(17.5)	95(47.5)	62(31.0)
After extreme weather effect such as flood, there is always increase in water borne disease e.g. typhoid, diarrhea, cholera etc among workers in your workplace?	1(0.5)	4(2.0)	8(4.0)	106(53.0)	81(40.5)
Vector-borne diseases/expanded habitats					
There have been increased insect population such as mosquitoes, ticks, sandflies and blackflies in your workplace?	4(2.0)	6(3.0)	5(2.5)	136(62.5)	49(24.5)
There have been increased vector-borne infections such as malaria, dengue fever, leishmaniasis, lyme disease etc among workers?	3(1.5)	-	6(3.0)	127(63.5)	64(32.0)
Workers do suspend operation due to this increase in vector borne infections?	8(4.0)	26(13.0)	8(4.0)	104(52.0)	54(27.0)
Your employer is taking some measure to reduce this vectors attack on workers at workplace?	1(0.5)	2(1.0)	7(3.5)	110(55.0)	80(40.0)
Those workers working outdoors are more prone to this vectors attack	3(1.5)	5(2.5)	6(3.0)	116(58.0)	70(35.0)

SDA: Strongly disagree, DA: Disagree, NS: Not sure, A: Agree, SA: Strongly Agree

HYPOTHESIS TESTING AND ANALYSIS

Test of hypothesis 1

H_0: There is no significant difference between the perceptions of climate impact among the workers in the four sectors.

A multinomial logistic regression analysis (Table 4) was conducted to investigate the prediction level of the perceptions of climate impact among the workers in the four sectors studied in this research and it was found that the perceptions of climate impact among the workers in the four sectors studied in this research, with model final χ^2 (15, N= 200) = 38.211, p= 0.001 Nagelkerke R^2 = 0.186. The analysis shows from Table 4, perceptions of climate impact among the workers in the four sectors studied in this research, has a model that is fit (χ^2 =592.145, df=549, p=0.099).

We therefore will accept the H_1 which states that there is significant difference between the perceptions of climate impact among the workers in the four sectors and reject the H_o which states that there is no significant difference between the perceptions of climate impact among the workers in the four sectors.

Table 4 Multinomial Logistic Regression Analysis of the perceptions of climate change impact among the sectors studied

.Predictor	Coefficients	Standard Error	Wald	Df	Significance	Odd ratio	95% CI
Sector-Agriculture							
Constant	-3.202	2.805	1.302	1	0.254	-	-

EWW	-0.153	0.100	2.323	1	0.127	0.858	0.705-1.045
ITW	-0.087	0.113	0.587	1	0.440	0.916	0.734-1.144
ODW	0.258	0.106	5.907	1	0.015	1.294	1.051-1.593
VDH	0.021	0.096	0.049	1	0.825	1.022	0.846-1.233
APW	0.122	0.103	1.400	1	0.237	1.130	0.923-1.382
Sector-Fishing							
Constant	2.861	2.901	0.973	1	0.324	-	-
EWW	-0.026	0.115	0.052	1	0.819	0.974	0.776-1.219
ITW	0.146	0.133	1.241	1	0.265	1.160	0.894-1.505
ODW	0.121	0.106	1.313	1	0.252	1.129	0.918-1.388
VDH	-0.314	0.103	9.269	1	0.002	0.731	0.597-0.894
APW	0.085	0.106	0.650	1	0.420	0.918	0.747-1.130
Sector-construction							
Constant	-4.177	2.945	2.011	1	0.156	-	-
EWW	-0.116	0.106	1.198	1	0.274	0.891	0.724-1.096
ITW	0.058	0.120	0.235	1	0.628	1.080	0.838-1.339
ODW	0.171	0.104	2.740	1	0.098	1.187	0.969-1.454
VDH	-0.086	0.099	0.760	1	0.383	0.917	0.755-1.114
APW	0.178	0.106	2.803	1	0.094	1.195	0.970-1.471

Using food production as reference

Test

	χ^2	Df	Significance
Goodness-of-fit	592.145	549	0.099
Model- Final	38.211	15	0.001
Likelihood ratio			
Constant	6.842	3	0.077
ITW	3.773	3	0.287
ODW	6.679	3	0.083
VDH	15.022	3	0.002
APW	6.659	3	0.084
EWW	2.876	3	0.411
Pseudo R Square			
Cox and Snell- 0.174			
Nagelkerke- 0.186			
McFadden- 0.070			

CI- Confidence interval

ITW-Increased ambient temperature effect at workplace total scores

APW-Air pollution effects at workplace on workers total scores

ODW- Ozone layer depletion leading to increased UV radiation effects on workers at workplace total scores

EWW: Extreme weather effect on workers at their workplace total scores

VDH : Vector-borne diseases/expanded habitats total scores

Test of hypothesis 2

H_0: Gender is of no significance in the awareness/knowledge of climate change impact on occupational health and safety leading to low productivity among the respondents

A chi-square test of independence (Table 5) was performed to examine the relationship between awareness/knowledge of climate change impact on occupational health and safety leading to low productivity and gender. The relation between these variables was not significant, χ^2 (1, N = 200) = 0.114, p=0.735, we therefore accept the H_0 which state that gender is of no significance in the awareness/knowledge of climate change impact on occupational health and safety leading to low productivity among the respondents

Table 5 Sex of Respondents * Climate change lead to low productivity Cross tabulation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.114	1	.735		
Continuity Correction	.000	1	1.000		
Likelihood Ratio	.106	1	.745		
Fisher's Exact Test				.562	.562
Linear-by-Linear Association	.114	1	.736		
N of Valid Cases	200				

Test of hypothesis 3

H_0: There is no significant relationship between the workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace.

A multinomial logistic regression analysis (Table 6) was conducted to evaluate the prediction the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace environment and it was found that workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace, with model final χ^2 (9, N= 200) = 24.569, p= 0.003 Nagelkerke R^2 = 0.161. The analysis shows that workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace has a model that is fit (χ^2 =169.735, df=411, p=1.000). We therefore will accept the H_1 which states that there is significant relationship between the workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace and reject the H_o which states that there is no significant relationship between the workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace.

Table 6 Multinomial Logistic Regression Analysis of the workplace environment and the perceptions of the workers with respect to increased ambient temperature, increased UV radiation effects, Vector-borne diseases effect in workplace.

Predictor	Coefficients	Standard Error	Wald	df	Significance	Odd ratio	95% CI
Workplace Environment-Completely Indoor							
Constant	-33.416	1556.388	0.000	1	0.983	-	-
ITW	5.450	0.443	151.117	1	0.000	232.863	97.655-555.273
ODW	-3.103	66.376	0.002	1	0.963	0.045	0.000-1.418E55
VDH	0.938	44.030	0.000	1	0.983	2.554	0.000-7.681E37
Workplace Environment-Partially Indoor							
Constant	-28.505	1556.365	0.000	1	0.985	-	-
ITW	6.108	0.093	4318.870	1	0.000	449.255	374.443-539.015
ODW	-4.100	66.374	0.004	1	0.951	0.017	0.000-5.213E54
VDH	1.260	44.029	0.001	1	0.977	3,524	0.000-1.059E38
Workplace Environment-Completely Outdoor							
Constant	-29.364	1556.364	0.000	1	0.985	-	-
ITW	6.152	0.000	-	1	-	469.832	469.832-469.832
ODW	-3.949	66.374	0.004	1	0.953	0.019	0.000-6.059E54
VDH	1.164	44.029	0.001	1	0.979	3.202	0.000-9.623E37
Test							
					χ^2	Df	Significance
Goodness-of-fit					169.735	411	1.000

Model- Final	24.559	9	0.003
Likelihood ratio			
Constant	0.354	3	0.950
ITW	11.987	3	0.011
ODW	11.144	3	0.007
VDH	2.742	3	0.433
Pseudo R Square			
Cox and Snell- 0.116			
Nagelkerke- 0.161			
McFadden- 0.097			

CI- Confidence interval

ITW: Increased ambient temperature effect at workplace total scores

ODW: Ozone layer depletion leading to increased UV radiation effects on workers at workplace total scores

VDH: Vector-borne diseases/expanded habitats total scores

Test of hypothesis 4

H_0: There is no significant relationship between low productivity and climate change related hazards in workplace

A binary logistic regression analysis (Table 7) was conducted to investigate the prediction of climate change related hazards in workplace on low productivity. Using the enter method it was found that the perception of climate change related hazard at workplace on low productivity and the variance in the opinion of the respondents have Omnibus χ^2 (5, N= 200) = 8.642, p= 0.124 Nagelkerke R^2 = 0.238). The analysis shows that the perception of climate change hazard did not contributed significantly to the model, but the model is fit with the Hosmer-Lemeshow values (χ^2 =7.469, df=8, p=0.487)

Sectors studied = -8.285 + (0.294*ITW) + (0.238*APW) + (0.004*ODW) + (0.099*EWW) + (-0.007*VDH)

From the Omnibus χ^2 (5, N= 200) = 8.642, p= 0.124, we therefore will accept the hypothesis which states that there is no significant relationship between low productivity and climate change related hazards in workplace.

Table 7 Binary Logistic Regression Analysis of the low productivity and climate change related hazards in workplace

Predictor	Coefficients	Standard Error	Wald	Df	Significance	Odd ratio	95% CI
Constant	-8.285	4.561	3.299	1	0.069	0.000	-
ITW	0.294	0.246	1.425	1	0.233	1.342	0.828-2.175
APW	0.238	0.196	1.471	1	0.225	1.269	0.864-1.864
ODW	0.004	0.209	0.000	1	0.985	1.004	0.666-1.514
EWW	0.099	0.186	0.282	1	0.595	1.104	0.766-1.590
VDH	-0.007	0.156	0.002	1	0.963	0.993	0.732-1.347
Test							
					χ^2	Df	Significance
Omnibus					8.642	5	0.124
Hosmer and Lemeshow					7.469	8	0.487
Model Summary							
2-Log Likelihood- 30.574							
Cox and Snell R square- 0.042							
Nagelkerke R square- 0.238							

CI- Confidence interval

ITW: Increased ambient temperature effect at workplace total scores

APW: Air pollution effects at workplace on workers total scores

ODW: Ozone layer depletion leading to increased UV radiation effects on workers at workplace total scores

EWW: Extreme weather effect on workers at their workplace total scores

VDH : Vector-borne diseases/expanded habitats total scores

4. DISCUSSION

99.5% of the respondents said they have heard the term climate change, and 79.5% of them associated increased in temperature as a climate related change, 58% of them said air pollution is related to climate change while 27% and 28% of the respondents associate ozone depletion and extreme weather condition to climate change respectively.73% of the respondents were of the opinion that vector borne disease has nothing to do with climate change. In a study by Shi, Sarker, Akter and Bakali (2013), 46.4% workers thought temperature change, 29.1 % thought weather change, 18.2% thought seasonal changes over a long period of time and 6.4% think climate change means environmental change and that all these are associated with climate change.

With respect to the perception of the respondents in the study on climate change related hazards in workplace, 65% of the respondents agreed that the hot weather experienced at their various workplace causes illness and 31.5% of the respondents strongly agreed to this statement. 72% and 21% of the respondents agreed and strongly agreed respectively that heat related injury is common among workers in their workplace. Exposure to extreme heat conditions has been found to be hazardous to health (Kovats and Akhtar, 2008). 53.5% and 39.5% of the workers who serves as respondents in this study agreed and strongly agreed respectively that whenever the environment of their workplace becomes too hot, they always stop working for some hours or the whole day. 51.5% and 45.5% of the respondents agreed and strongly agreed that they do drink cool water at the workplace to help to reduce heat stress. This finding was also recorded by Langkulsen, Vichit-Vadakan and Taptagaporn, (2010), where five worksites found that most workers reported consuming fluids as needed during the course of their work shift and each worker noted that when they feel themselves becoming overheated, they would find a cool place to sit down and drink fluids.

59% and 34.5% of the respondents agreed and strongly agreed that most workers in their workplace complain of difficulty in breathing due to dirty air around their workplace. 2% of the respondents strongly disagree that their employer do provide them with nose masks at their workplace. 52.5% and 40% of the respondents agreed and strongly agreed respectively that there have been increase in asthmatic diseases among workers in their workplace. A study suggested that the increased length and severity of pollen season; more frequent, heavy precipitation events; and severe urban air pollution episodes are strong risk factors for respiratory allergic disease (D'Amato and Cecchi, 2008). Increasing asthma prevalence in the general population (and due to workplace exposures) can be expected to translate into increased numbers of workers with asthma, and for this group, exposure to respiratory irritants and allergens is a critical issue (Schulte and Chun, 2009).

55.5% and 40% of the respondents says when they stay outdoor working for longtime their skin starts to itch them. There is evidence that solar ultraviolet (UV) radiation increases risks of several diseases of the eye, including cortical cataract, conjunctival neoplasms, and ocular melanoma (Gallagher and Lee, 2006) Studies indicate that individuals with blue or gray eyes and light hair and skin color are at elevated risk of ocular melanoma (Vajdic *et al*.., 2001), in this study, 49.5% and 28% of the respondents agreed and strongly agreed respectively that among the workers in their workplace working outdoor, there have been cases of poor vision and eye damages.1.5% of the respondents strongly disagreed that there have been some skin infection cases had occurred among workers working outdoors in their workplace. 54% and 36% aof the workers agreed and strongly agreed respectively that the skin o workers in their workplace that work outdoor are always darken and make them look older. Excessive exposure to UV radiation can increase risk of cancer of the lip, basal cell carcinoma, squamous cell carcinoma, and malignant melanoma (Levy and Wegman, 2000; van der Leun *et al.,* 2008) Epidemiologic studies indicate that individuals with light skin, hair, and eye color are at elevated risk of cutaneous malignant melanoma.(44) In addition, certain drugs (e.g., chlorpromazine, tolbutamide, and chlorpropamide) can increase susceptibility to skin damage from UV radiation (Levy and Wegman, 2000).

59% respondents agreed that whenever there is flooding at their workplace, they always stop working for some days or hours, while 4.5% of them were not sure about such action. 50% of the respondents agreed that there have been cases of accident or injury resulting from flood debris, sediments and chemicals flow from the flood in their workplace, 29.5% strongly agreed with this while 16.5% were not sure if that ever happened. Flooding is the most frequent weather disaster (Euripidou and Murray, 2004; McMichael *et al.,* 2006) Potential health or safety hazards associated with flooding are exposures to mold, chemicals (e.g., carbon monoxide and hydrogen sulfide), biological agents, venomous snakes, fire ants, floodwaters, dust and dried flood sediment, flood debris, noise, electrical hazards, confined spaces, musculoskeletal hazards, drownings, blood-borne pathogen infection, eye injury, falls, and motor vehicles (Schulte and Chun, 2009). Floods and increased temperature may lead to situations where relief, emergency response, and cleanup workers are exposed to increased levels of molds and allergens (Schulte and Chun, 2009).

47.5% and 31% of the respondents agreed and strongly agreed respectively that there have been cases of death from havoc caused by extreme weather condition in your workplace to workers. 17.5% of the respondent were not sure if such incident occurred in their workplace, while 2% of the respondents strongly disagreed with such.

53% of the respondents agreed that after extreme weather effect such as flood, there is always increase in water borne disease e.g. typhoid, diarrhea, cholera etc among workers in their workplace, while 4% are not sure of this.

Changing temperatures can affect vector, pathogen, and host habitats (Haines and Patz, 2004). Shifting rainfall levels have mixed effects on the potential for infectious diseases, such as malaria and dengue fever (Woodward, 2004). In this study, 62.5% of the respondents agreed that there have been increased insect population such as mosquitoes, ticks, sandflies and blackflies in their workplace. 63.5% of the respondents agreed that vector-borne diseases such as malaria, dengue fever, lyme are among workers. Elevations in temperature have affected increased rates of extrinsic incubation in insect vectors (e.g., ticks and mosquitoes), extended vector transmission seasons, and expanded distribution seasonally and spatially (Barker and Lindsay, 2000; Lindgren, 2001; Skarphedinsson, Jensen and Kristiansen, 2005).

Outdoor workers may also be at increased risk from exposure to ticks and mosquitoes in enlarged habitats. When a mosquito or tick bites a worker, it may transfer a disease-causing agent, such as a parasite, bacterium, or virus. Mosquito-borne diseases include West Nile Virus, St.Louis encephalitis, eastern equine encephalitis, western equine encephalitis, and dengue, malaria, and LaCrosse encephalitis (NIOSH, 2008). Tick-borne diseases include Lyme disease, babesiosis, ehrlichiosis, Rocky Mountain spotted fever, southern tick-associated rash illness, tularemia, tick-borne relapsing fever, anaplasmosis, Colorado tick fever, Powassan encephalitis, and Q fever (NIOSH, 2008) Work sites with woods, bushes, high grass, or leaf litter are likely to have more ticks, and work sites with standing water are more likely to breed mosquitoes (Schulte and Chun, 2009). In this study, 55% and 40% of the respondents agreed and strongly agreed that their employer is taking some measure to reduce this vectors attack on workers at their workplace. 2.5% of the respondents disagreed that workers working outdoors are more prone to this vectors attack, while 58% and 35% agreed and strongly agreed to the assertion.

From table 4, the perception of the respondents on Ozone layer depletion leading to increased UV radiation effects on workers at workplace had a significant ($p=0.015$) effect at a coefficient value of 0.258 with a odd ratio of 1.294 with a 95% confidence interval ranged from 1,051 to 1,593 on the agriculture sector with food production as reference. Vector-borne diseases/expanded habitats had a significant ($p=0.002$) effect at a coefficient value of -0.314 with a odd ratio of 0.731 with a 95% confidence interval ranged from 0.597 to 0.894 on the fishing sector with food production as reference. The perception categories did not show any significance on the fishing sector with food production as reference.

In table 6, Increased ambient temperature effect at workplace had a significant ($p<0.05$) effect at a coefficient value of 5.450 with a odd ratio of 232.863 with a 95% confidence interval ranged from 97.655 to 555.273 on the completely indoor workplace environment with partially outdoor as reference. Increased ambient temperature effect at workplace had a significant ($p<0.05$) effect at a coefficient value of 6.108 with a odd ratio of 449.255 with a 95% confidence interval ranged from 374.443 to 539.015 on the partially indoor workplace environment with partially outdoor as reference. Only Increased ambient temperature effect at workplace had a significant ($p<0.05$) effect at a coefficient value of 6.152 with a odd ratio of 469.832 with a 95% confidence interval ranged from 469.832 to 469.832 on the completely outdoor workplace environment with partially outdoor as reference. In table 7, none of the perception on climate change hazard had significant effect on the low productivity.

5. CONCLUSION

Climate change affect either directly or indirectly wide range of sustainable development issues such as health, food security, employment, incomes and livelihoods, gender equality, education, housing and poverty. In this current study, majority of the respondents are aware of climate change and its effects. The completely outdoor workers among the respondents appear to be ones highly affected by the climate change related hazards. The climate change related hazards do affect the health and safety of these respondents with most of them stating clearly that some disease and infections had been developed by some of their colleagues in their workplace. The climate change related hazard also result in a low productivity by the workers. Increased ambient temperature had more significant effect on the workers based on their workplace environment.

Authors' contribution

Joshua OLU: He is the principal researcher that came up with the research topic, write up, questionnaire, structuring, data analysis, data interpretation and comprehensive final presentation for publication

Adeshina, Sherif, MAJEKODUNMI: He contribute to the structuring of the instrument used in this research. He was highly involved in the administration of the questionnaire and interpretation of the data analyzed.

Disclosure of conflict of interest

We undertake this research in order to discover how climate change impacts on the health, safety and productivity of workers in the study area without any biased or any conflict of interest with respect to any individual, organisation and government institute. The study was done under ethical and consent of respondents with anonymity.

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