Research article

Geo-demographics and source of information as determinants of climate change consciousness among citizens in African countries

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A B S T R A C T

Climate change constitutes one of the greatest threats to human health globally and there have been increasing interests in understanding the dynamics of climate change consciousness particularly in less industrialised countries of Africa. Research on cross-country, sub-regional and continent differences in climate change consciousness are rare especially in sub-Saharan Africa. Thus, to complement the existing body of literature, this study was conducted on cross-national predictors of public climate change consciousness. Data from the Afrobarometer round 7 for thirty-four [34] African countries, collected between 2017 and 2020, were used to investigate the influence of geographical, socio-demographics, and source of information on public consciousness of climate change. Statistical analyses of *t*-test, ANOVA and multiple regression were conducted to test the formulated hypotheses. Results showed a low level of climate change consciousness (CCC) among participants. Radio news was the major source of information for the sampled African citizens. There were significant differences in the CCC of male and female as well as between urban and rural respondents. Significant differences were also found among the sub-regions, educational levels, age groups and occupations. Sources of information and demographic variables significantly influenced the level of CCC among participating citizens. Educational attainment was the single most potent predictor of climate change consciousness. The study recommends that African citizens need capacity building on climate change awareness and initiatives which would assist in mitigating the effects of climate change.

1. Introduction

A growing body of evidence suggests that climate change poses one of the greatest risks to human survival. Recent estimates suggest that, between 2023 and 2027, there is 66% chance that annual average near-surface global temperature will be more than 1.5 °C [1]. The previous decade has had annual meetings where various environment-inclined stakeholders around the globe discussed strategies to mitigate climate change impact on humanity and the planet. Change in the atmosphere and the planet's climate are the results of natural as well as human-made activities, the latter becoming more dominant in the last few decades. The consequences of climate

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change on environment's elements and human survival are enormous and well documented [2–4]. Its effects are linked with the varying structures in human societies. Individuals who make up societies shape these structures by their attitudes. While individuals act as though their behavior has no bearing on how the climate is changing, conclusions from research indicate that human activities, directly or indirectly, have altered the global atmosphere's composition, and normal climate variability observed over time [2,5].

Sub -Saharan Africa has been recorded to have the lowest per capita greenhouse gas emission but classified as the world most sensitive region to the effects of climate change [1,6]. Climate change is having an increasingly deleterious impact on people in Africa, contributing to food and water insecurity, population displacement, human health and safety, social and economic development, particularly in rural areas. Thus, climate change is threatening livelihoods and pushing over a hundred (100) million people into severe poverty – putting the entire region at risk. The evidence suggests that most African communities lack strength and capability to face the consequences of very extreme weather conditions occasioned by climate change. This calls for in-depth analysis of the underlying variables in climate change consciousness and behavior of African citizens.

Environmental psychological research on risk perceptions and awareness of climate change has been interested in understanding individual factors that predict climate change perceptions, and the extent to which they have predictive potency. From the available literature, these predictors can be grouped into four categories: socio-demographic, socio-cultural, political, and psycho-cognitive variables [7]. reported that the socio-demographics - level of education, gender, income, and party affiliation - accounted for 6% variance in risk perception of four demographic variables in Sarlahi district, Nepal. Researchers [8], in their analysis of data obtained from 119 countries, reported that educational attainment predicted climate change awareness while the understanding of anthropogenic cause predicted climate change risk perceptions. Evidence from the study suggested that perceived local temperature change best predicted climate change risk perceptions among Asian and African countries [9]. analyzed people's awareness and the factors of status of climate change. The study's findings revealed no significant relationship amongst occupation, gender, decision role, guardian, and ownership of land, and familiarity with climate change. It was found that demographic variables such as age, education, and family size had significant effects on the knowledge of climate change; whereas age, years of schooling, training, and cooperative involvement had significant effects on people's climate change awareness [10]. used a multilevel regression to investigate the association among internet usage, social media news items, and Europeans' perceptions of climate change efficacy and reported modest differences between the news media and perceived climate change efficacy. According to the study, the use of Facebook was found to have a negative relationship with perceived climate change efficacy. In addition, sub-regions that engaged more in social media for information scored low in perceived climate change.

[11] path-analytic study was on the effect of socio-demographics and mediating effects of attitudinal variables on the mitigation of climate change in Kuala Lumpur region, Malaysia. Findings from the study indicated that the socio-demographics such as ethnicity, age, gender, income, and education greatly influenced the individual's attitude, awareness, knowledge, and risk perception of climate change [12]. studied the effect of socioeconomic factors on knowledge and adaption of climate change among farmers of Banke district, Nepal. The study showed that, except for the age of head of household, gender, age, household headship, farming experience, education, access to mass media, interaction with the extension workers, and non-governmental organizations had a positive effect on climate change awareness. Also, access to media, income, farming experience, education, farm size, gender of household head, and contact with extension workers reportedly affected farmers' climate change adoption.

A study of households in Nuevo Leon, Mexico, by [13] argued that financial self-efficacy and knowledge strongly influenced the extent of household climate change mitigation and adaptation actions. The ordinal regression analysis further showed that respondents' educational level and age affected the action taken. In another study [14], investigated levels of awareness about climate change among social media users and non-users and found significant differences in awareness about climate change between social media users and non-users in Pakistan. Respondents displayed different levels of interest in climate change awareness according to their age, gender, level of education and other factors [15]. study on households of coastal areas in Selangor, Malaysia found more than half of the respondents showing high level of awareness about sea level and climatic variation but moderate awareness about impacts of coastal hazards. Results of the *t*-test analysis in the study revealed that educated male participants, of working age, whose livelihood activities are related to natural resources and had earlier experienced extreme coastal hazards displayed higher levels of climate change awareness than their female counterparts. More recently [16], carried out a study in southern and central Punjab, Pakistan to assess farmers' climate change awareness. More than two-third (70.8%) of the sampled farmers demonstrated climate change awareness though with differing perceptions. Factors such as education, experience, income, access to credit and extension services and adaptation strategies were reported to relate to farmers' climate change awareness. Overall, climate change awareness was found to be a significant predictor of climate change adaptation.

Research conducted on climate change awareness on the African continent and about African countries [17–21] have shown that increased awareness on climate change is germane to its mitigation. In a study by Ref. [21], it was found that majority of the respondents received climate change knowledge through television and radio. Evidence from the study further showed that four factors (availability, dissemination, perception, and control of the impact) predicted awareness of change in climate. Using the Bayesian hierarchical logistic model to investigate drivers of smallholder farmers' awareness of climate change and its risks to agriculture in Zambia [22], found that more than two-third of the farmers were aware of attendant hazards to agriculture occasioned by climate change. Further, information sources, socio-demographics, adaptive factors, impact-related shocks, and climate change predicted participants' climate change awareness of the respondents.

Consciousness comes across with a varied set of meanings. Loosely defined, consciousness is a subjective concept which refers to a person's awareness of his or her environment, ideas, feelings, or sensations. Individual consciousness varies - it is either low or high. Once an individual becomes conscious, he or she often adapts his or her behavior to match the current level of awareness [23]. Research on climate change consciousness has gained increased momentum in recent years in view of its use as metrics for measuring

individual and group resilience to climate change and climate variability [24–27].

There are several theoretical perspectives for explaining how consciousness results in behavior changes. These include (i) the Theory of Reasoned Action, (ii) Theory of Planned Behavior, (iii) Social Cognitive Theory, (iv) Self-Determination Theory, and (v) Elaboration Likelihood Model [28,29]. This study is, however, anchored on the social cognitive theory (SCT). The social cognitive theory postulates that human and environmental factors are all interactive determinants of human behavior [30]. SCT does not conceive of humans as passive agents in their environment; rather humans are seen agentic, playing active role in the dynamics of human-environment interactions that bring about both beneficial and life-threatening changes including climate change. Through anthropogenic activities such as deforestation, industrial pollution and poor waste management, individuals and communities contribute significantly to shifts in temperatures and weather conditions which result in climate change over time. Knowledge of these dynamics could raise human consciousness in a manner that leads to positive climate change behavior and climate change action that mitigate climate change threats at local and global levels [31–33]. Thus, SCT provides a theoretical foothold for explanations about determinants of climate change consciousness as undertaken in this study.

[34] warned that countries of African must rise to the challenge of climate change, especially with respect to behavior change, to guarantee the continent's future. Specifically, [34] warned that "there are substantial development risks in Africa under any level of warming" and went further to advise that "Actions on climate change in mitigation and adaptation will be rewarded by significant benefits and co-benefits in macroeconomic stability, job creation, and decreased negative impacts of climate change on development" (p. 11). However, despite a growing volume of research on climate change awareness, perception, and adaptation worldwide, there is a paucity of empirical studies on predictors of climate change consciousness (CCC) in African countries. Considering the implications of this research gap for sustainable development in the continent, it is imperative to continually explore Africans' level of consciousness about climate change. Thus, this study investigated the predictive potential of demographic variables (age, gender, education, occupation, geographic place of resident, and sub-region) and five sources of information on climate change consciousness among African countries, with the hope of contributing to the understanding of factors that influence climate change consciousness and adaptation among African citizens. It is hoped that the findings would provide additional insights into the development of climate change policy and mitigation strategies for countries in Africa.

The following questions were raised to guide the study at 0.05 level of significance.

1. What are the main sources of information and types of climate change consciousness being promoted among the sampled African citizens?
2. Are there differences in climate change consciousness of respondents according to gender, place of residence, sub-region, education, age, and occupation?
3. Are there significant relationship between geo-demographic, sources of information and climate change consciousness among the citizens?
4. What are the contributions of the independent variables to the climate change consciousness among the citizens?

2. Methods of the research

2.1. The study area

In terms of both physical and population indices, Africa is the second largest Continent on the globe. Its population was projected to be 1.37 billion people, or nearly 14% of the world's population, according to the UN World Population Prospect (2021). The land area of the continent is 30, 244, 000 km^2 (11,700,000 mi^2), or 6% of the world's total surface area. The eight principal geographic zones of the continent are: African Great Lakes, the Ethiopian Highlands, Rain Forest, the Sahara, Sahel, Savanna, Southern Africa, and Swahili Coast. There are 54 independent countries in Africa, including 48 on the continent's mainland, six nations on islands, and two disputed territories, Somaliland, and the Western Sahara. The five sub-regions that make up the continent are the Central Africa, East Africa, North Africa, Southern Africa, and West Africa.

2.2. Data source

The study used the Afrobarometer data Round 7 released in 2019 by the pan-African, non-partisan research network which collected data on various social, political, economic, and environmental issues that affect the people on the continent (www. afrobarometer.org). The Afrobarometer data is a representative cross-national survey conducted since 1999, using multi-stage, stratified, random probability sampling technique to sample the respective populations, aged 15 above. The stratification was first on subnational unit of government (state, province, sub-region, etc.), then by location (urban or rural). Sample sizes are usually between 1200 or 2400 with a margin of sampling error of not more than±2.8 percentage and a confidence level of 95%. Data for this study were collected from January 2016 to December 2018. A face-to-face interviews technique was used. The sample size varies due to the different population sizes in the respective countries and range from 1200 for Benin to 2392 for Mozambique. The merged data contains 45, 823 respondents from 34 countries (Benin, Botswana, Burkina Faso, Cameroon, Cabo Verde, Côte d'Ivoire, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, São Tomé and Príncipe, Senegal, Sierra Leone, South Africa, Sudan, eSwatini, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe) (https://www.afrobarometer.org/data/).

2.3. Conceptual framework and variables of the study

The study was conceived against the background concerns raised within the literature on climate change awareness/consciousness in which socio-demographics such as age, gender, household size, occupation, and level of education attained are frequently referenced. However, the direction of relationship between and among these variables are yet to be clearly delineated. For this study, it was assumed there would a causal relation between CCC and socio-demographic factors. This assumption, formulated for interrogation in the study, informed the conceptual framework as presented in Fig. 1.

In the conceptual framework, CCC is recognized as the dependent variable and measured with 8 items: (i) climate conditions compared to ten years ago, (ii) the severity of droughts, (iii) severity of flooding, (iv) heard about climate change, (v) climate change meaning, (vi) climate change - main cause, (vii) climate change - affecting country, and (viii) climate change - needs to be stopped by ordinary people. The statements are assessed using a 9-point Likert scale.

The independent variables in the conceptual framework are presented at three levels as outlined below.

(a) *Individual level:* Socio-demographic variables (Gender, age, education, and occupation).
(b) *Geographic variables:* Place of residence - urban and rural and sub-regional location. For sub-regional grouping, the 34 sampled countries are grouped into the five [5] sub-regions of the continent: West Africa, East Africa, Central Africa, Southern Africa, and North Africa.
(c) *Sources of information*: newspaper news, television news, radio news, social media news and internet news are measured by a 7-point scale of "Never", "Less than once in a month', "A few times a month", "A few times a week", "Every day", "Refused", and "Don't know".

2.4. Data analysis

The data were subjected to descriptive and inferential statistical analyses. To describe the demographic characteristics and level of climate change consciousness, frequency, percentage, mean score and standard deviation were used. The *t*-test statistic was used to determine whether differences existed between gender, age, location, education, occupation, and sub-region while correlations were conducted to examine the relationship and influence of demographic, geographic location, and the source of information variables on climate change consciousness. The multiple regression test was subsequently carried out to assess the most parsimonious sets of demographics, geographic location, and source of information variables that best predicted climate change consciousness of African citizens at region and sub-regional levels.

3. Results

A total of 45823 survey responses was collected. Of the sample, 22936 (50.1%) were females, while 22887 (49.9%) males. Their ages ranged from 18 to 65 above with the mean age at 45 years. We observed that 36.9% of the respondents had secondary education, 28.2% primary education 14.5% post-secondary while 20.1% had no education. With respect to the place of residence, 44.8% were from urban area and 55.2% were from rural. The sub-regional distribution of the respondents shows that 40.1% were from West Africa, 32.8% from Southern Africa, 11.3% East Africa and 7.9% each were from North Africa and Central Africa respectively. Approximately 20% were housewives, 24.3% were into farming/agriculture, 13.9% were engaged in trading/retailing, 9.8% students, 9.7% were artisans, 8.8% unskilled workers, 8.1% professional while 5.8% were unemployed.

Research Question 1. What are the main sources of information and types of climate change consciousness being promoted among the sampled African citizens?

Results in Table 1 indicate that radio news was the most common source of information for the participants. Other sources of information such as television news, newspaper news, internet news and social media news were low. The distributions revealed positive skewness which is indicative of low level of CCC consciousness among participants.
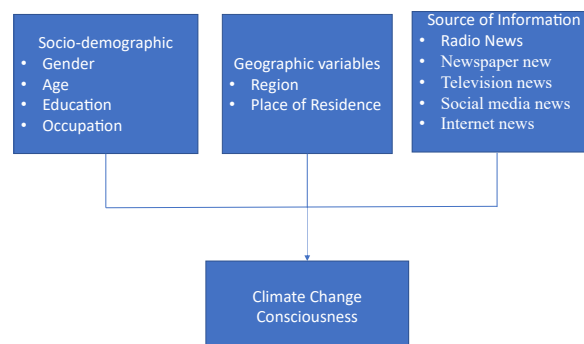
Fig. 1. Conceptual framework of relationship among the study variables.

Table 1
Sources of climate change information and consciousness promoted (N = 45823).

	Mean	Std. D	Skewness (SE = 0.011	Kurtosis (SE = 0.023
Radio news	2.59	1.597	−0.614	−0.847
Television news	2.00	1.826	0.103	−1.309
Newspaper news	0.89	1.486	1.960	4.991
Internet news	1.18	1.816	1.427	1.836
Social media news	1.22	1.871	1.427	1.867
Climate conditions compared to ten years ago	2.61	2.073	1.536	2.745
Severity of droughts	6.34	17.728	4.972	23.055
Severity of flooding	6.94	17.616	4.969	23.035
Heard about climate change	0.80	1.424	4.850	25.268
Climate change: meaning	3.93	2.893	0.194	−1.738
Climate change: main cause	6.57	15.410	5.633	30.908
Climate change: affecting country	11.03	22.517	3.621	11.238
Climate change needs to be stopped by ordinary people	6.58	15.432	5.603	30.693

A little more than half (56.4%) of the respondents claimed to have heard about climate change while as much as 40.9% answered in the negative and 2.6% responded as "Don't know" Haven't "heard enough". The high standard deviations (SDs) recorded on severity of droughts (17.728), severity of flooding (17.616), climate change main cause (15.410), climate change affecting country (22.517), and climate change needs to be stopped by ordinary people (15.432) indicate that the values are spread out over wide ranges given that they are far from their respective means. So, it may be safe to conclude on research question one that the current means of communication of climate change consciousness among African citizens are only capable of promoting low level consciousness and incapable of bringing about the expected climate change behavior and action.

Research Question 2. Are there differences in climate change consciousness of respondents according to gender, place of residence, sub-region, education, age, and occupation?

Based on the results in Table 2, it can be observed that the mean score of females (mean = 46.245) is higher than the mean score for male (Mean = 43.346). This implies that the female respondents appear more conscious about climate change than their male counterparts. The *t*-test statistic shows that there is a significant difference in the climate change consciousness of male and female Africans. Similarly, the mean score (47.781) of African rural residents is higher than their urban counterparts (mean = 41.114) and a statistically significant difference could also be observed. This means that rural residents are more conscious of climate change than those from urban areas.

These results are not surprising because, first, in the socialization processes of most African communities, female gender is more exposed to the environment than the male. Second, they are more into the buying, processing, and selling of agricultural products which are subjected to the variation of weather.

Regarding the plausible explanation for the discernible variations in climate change awareness among African urban and rural inhabitants, rural dwellers are more in touch with nature, and depend on the flora and fauna's natural resources for their livelihood. Most individuals in rural areas work in agricultural sector and have been primarily impacted by the effects of climate change over the years. This first experience with nature could be a major source of awareness of climate change.

The one-way analysis of variance results (Table 3) shows that the mean scores of respondents in the five sub-regions of Africa differed significantly from one another (F (4, 45818) = 2179.851; $p < 0.001$). The means equally differ on education (F (4, 45755) = 53.789; $p < 0.001$), among age groups (F (6, 45816) = 10.020; $p < 0.001$) and among occupational groups (F (7, 45815) = 51.742; $p < 0.001$). This implies that there are significant differences among respondents according to sub-regions, educational levels, age groups and occupation.

Research Question 3. Are there significant relationships between geo-demographic variables, sources of information and climate change consciousness among African citizens?

The bivariate analysis in Table 4 shows that significant relationships exist between each of the sources of information and climate change consciousness. In other words, those sources of information significantly related to the level of climate change consciousness among African citizens. Demographic characteristics - including gender, age, education, occupation, place of resident and sub-region of respondents - are also related to their levels of climate change consciousness. However, age and newspaper news are not related to climate change consciousness on the African continent.

Table 2
Climate change consciousness according to male and female, urban and rural respondents.

Gender	N	Mean (SD)	t	p
Male	22883	43.346 (69.03)	−4.504	0.000
Female	22936	46.245 (68.76)		
Urban/rural				
Urban	20515	41.114 (62.87)	−10.311	0.000
Rural	25308	47.781 (73.30)		

Table 3
One-way ANOVA summary for climate change consciousness according to sub-region, education, age, and occupation.

Sub-region	Mean	Std. D	Statistics
West Africa	27.1583	11.10579	$F_{(4,45818)} = 2179.851; p < 0.001$
East Africa	116.0565	130.47351	
Southern Africa	50.0836	77.87544	
North Africa	29.9889	11.28576	
Central Africa	24.7384	10.61785	
Education			
No formal education	36.1056	43.06310	$F_{(4, 45755)} = 53.789; p < 0.001$
Primary	48.3898	71.75362	
Secondary	47.5384	75.42489	
Post-secondary	42.5271	72.80820	
Don't know	38.1898	35.50560	
Age			
18–25	42.2735	64.19752	$F_{(6, 45816)} = 10.020; p < 0.001$
26–35	47.3437	73.45638	
36–45	45.2415	69.71794	
46–55	43.0498	66.10763	
56–65	42.8474	65.37920	
Over 65	48.6733	73.65050	
Don't know	79.1739	101.28821	
Occupation			
Students	34.2497	51.24746	$F_{(7, 45815)} = 51.742; p < 0.001$
Housewife	51.1928	75.54038	
Agriculture	42.1701	62.61377	
Trader/Retailer	46.5851	70.12941	
Unskilled	44.6945	71.26976	
Artisan	55.3320	84.69608	
Professionals	37.6686	64.63096	
Other	40.0250	61.02180	
Total	44.7962	68.90302	

A significant positive correlation was observed between climate change consciousness and each of gender ($r = 0.021$, $p < 0.01$), education ($r = 0.024$, $p < 0.001$), place of residence (urban/rural) ($r = 0.048$, $p < 0.001$), and sub-region in the continent ($r = 0.020$, $p < 0.001$). Of the five sources of information, however, only radio news ($r = 0.024$, $p < 0.01$) was found to be positively correlated with climate change consciousness. All other sources - television news, newspaper news, internet news and social media news - are found to be negatively correlated with climate change consciousness.

Research Question 4. What are the contributions of the independent variables to the climate change consciousness among African citizens?

Table 5 summarizes the results of the analysis of the variables by sub-regions. The independent variables - gender, age, education, occupation, urban/rural, countries, radio news, television news, newspaper news, internet news, and social media news - when combined in the regression analysis, have significant contribution ($R^2 = 0.065$; $F_{(11, 45375)} = 117.86$; $p < 0.001$) to the climate change consciousness among West African citizens. The analysis of variance performed on the multiple regressions yielded an F- ratio value of 117.86 and was found to be significant at 0.05 level. This implies that demographic, geographic and sources of information variables accounted for 6.5% of the variance in climate change consciousness among the sampled respondents in West Africa.

For East Africa, the eleven independent variables have significant contribution to predict climate change consciousness in the sub-region with the value (R^2 (adj) $= 0.986$; $F_{(11, 5169)} = 33807.43$ $p < 0.001$). This indicated that demographic, geographic and source of information variables accounted for 98.6% of the variance in climate change consciousness of East Africans.

According to the regression results for Southern Africa, the independent variables significantly predict climate change consciousness. Age, education, and newspaper news were among the most effective predictors of CCC ($R = 0.493$, Adjusted $R2 = 0.243$ $F_{(11, 14984)} = 438.43$ p 0.001). When combined, these variables explained 24.3% of the variance in CCC.

In North Africa, the predictive variables of climate change consciousness when put together accounted for 53% of the variance in climate change consciousness (R-value $= 0.350$, Adjusted $R^2 = 0.120$, $F_{(11,3586)} = 45.65$ $p < 0.001$). Furthermore, the relative contributions of the predictor variables to the variance of CCC of respondents are gender, age, occupation education and newspaper news.

The regression analysis for the Central Africa sub-region with value for the combined effect (R ($=0.302$) and Adjusted $R^2 = 0.088$) indicates that the eleven independent variables explained 8.8% of the variance in climate change consciousness in region. The influence of the variable is statistically significant. Gender, place of resident, education, and newspaper news are the best predictors of CCC among the people in Central Africa sub-region.

Table 6 reveals that with the predictor variables of demographic, geographic and sources of information in the regression model, there is significant prediction of climate change consciousness ($R^2 = 0.013$; $F_{(11,45748)} = 56.424$; $p < 0.001$). This indicates that geo-demographic, and sources of information variables accounted for 1.3% of the variance in climate change consciousness of Africans.

Additionally, Table 6 demonstrates that each of the independent variables significantly influenced the prediction of Africans'

Table 4

Correlation matrix showing the relationship between geo-demographic, sources of information and climate change consciousness among African citizens.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender	1											
2. Age	−0.089[a]	1										
3. Education	−0.090[a]	−0.203[a]	1									
4. Urban/rural	−0.001	0.056[a]	−0.281[a]	1								
5. Sub-region	0.000	0.004	0.223[a]	−0.098[a]	1							
6. Occupation	−0.106[a]	0.077[a]	0.106[a]	−0.100[a]	0.055[a]	1						
7. Radio news	−0.147[a]	0.056[a]	0.120[a]	−0.059[a]	−0.079[a]	0.034[a]	1					
8. Television news	−0.040[a]	−0.034[a]	0.326[a]	−0.396[a]	0.192[a]	0.091[a]	0.235[a]	1				
9. Newspaper news	−0.103[a]	−0.029[a]	0.288[a]	−0.208[a]	0.133[a]	0.080[a]	0.212[a]	0.381[a]	1			
10. Internet news	−0.092[a]	−0.197[a]	0.375[a]	−0.273[a]	0.150[a]	0.065[a]	0.101[a]	0.420[a]	0.482[a]	1		
11. Social media news	−0.075[a]	−0.216[a]	0.355[a]	−0.262[a]	0.136[a]	0.055[a]	0.094[a]	0.395[a]	0.438[a]	0.852[a]	1	
12. Climate Change consciousness	0.021[a]	0.009	0.024[a]	0.048[a]	0.020[a]	−0.022[a]	0.024[a]	−0.066[a]	−0.004	−0.043[a]	−0.056[a]	1

[a] Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table 5
Coefficient of multiple regression analysis for the relative influence of geo-demographic, and sources of information on climate change consciousness by sub-region.

	West Africa		East Africa		Southern Africa		North Africa		Central Africa	
	β	t	β	t	β	t	β	t	β	t
(Constant)		47.08		262.83		−6.61		21.09		18.91
Gender	0.13	17.55*	0.00*	2.96	0.01	1.13	0.08*	5.01	0.11*	6.59
Age	−0.04	−5.11*	−0.01*	−3.264	0.04*	5.25	0.08*	4.54	0.02	1.31
Education	−0.11	−12.65*	0.01*	3.705	0.03*	4.31	−0.27*	−14.91	−0.10*	−5.42
Occupation	0.00	0.00	−0.00	−0.801	0.01*	0.65	−0.08*	−4.34	−0.02	−0.94
Urban/rural	−0.02	−2.78*	−0.00	−0.621	−0.03*	−4.44	−0.00	−0.24	0.06*	3.42
Country	0.07	10.02*	−0.99*	−593.22	0.48*	66.61	0.04*	2.69	0.12*	6.56
Radio news	−0.06	−7.64*	0.00*	2.391	−0.05*	−5.89	−0.02	−1.48	−0.03	−1.88
Television news	−0.01	−0.66	−0.03*	−12.17	−0.10*	−11.72	0.02	0.89	−0.01	−0.48
Newspaper news	−0.01	−1.25	−0.01*	−4.378	0.03*	2.807	−0.05*	−2.87	−0.04*	−2.27
Internet news	−0.10	−7.04*	−0.01*	−3.106	0.00*	0.286	−0.03	−0.76	−0.06	−1.68
Social media news	0.02	1.12	0.01*	2.853	−0.05*	−4.11	0.03	1.02	−0.05	−1.53
	R = 0.257		R = 0.993		R = 0.493		R = 0.350		R = 0.302	
	R^2 = 0.066		R^2 = 0.986		R^2 = 0.243		R^2 = 0.123		R^2 = 0.091	
	Adjusted R^2 = 0.065		Adjusted R^2 = 0.986		Adjusted R^2 = 0.243		Adjusted R^2 = 0.120		Adjusted R^2 = 0.088	
	$F_{(11,18375)}$ = 117.86 p < 0.001		$F_{(11, 5169)}$ = 33807.43 $p < 0.001$		$F_{(11,14984)}$ = 438.43 p < 0.001		$F_{(11,3586)}$ = 45.65 p < 0.001		$F_{(11,3586)}$ = 32.67 p < 0.001	

Table 6
Coefficient of multiple regression analysis for the relative influence of geo-demographic, and sources of information on climate change consciousness.

	β	t	p
(Constant)		10.470	0.000
Gender	0.031*	6.379	0.000
Age	0.004	0.882	0.378
Education	0.059*	10.933	0.000
Occupation	0.008	1.650	0.099
Urban or rural	0.032*	6.144	0.000
Sub-region	0.032*	6.521	0.000
Radio news	0.042*	8.573	0.000
Television news	−0.078*	−13.631	0.000
Newspaper news	0.026*	4.738	0.000
Internet news	0.012	1.310	0.190
Social media news	−0.065*	−7.200	0.000

R = 0.116, R^2 = 0.013, Adjusted R^2 = 0.013, F = 56.424 $p < 0.001$.

climate change consciousness. Place of residence (urban/rural) was the most parsimonious variable that predicts CCC across the continent (Beta = 4.410; t = 6.144; p < .05); followed by gender (Beta = 4.225; t = 6.379; p < .05), education (Beta = 3.714; t = 10.933; p < .01), radio news (Beta = 1.824; t = 8.573; p < .01), sub-regions (Beta = 1.701; t = 6.521; p < .01); and newspaper (Beta = 1.219; t = 4.738; p < .01).

4. Discussion

In this study, the influence of demographic, geographic and sources of information on climate change consciousness among African citizens were explored using data from the Afrobarometer data Round 7 released in 2019. Furthermore, the study examined the relationship between geographic factors, demographic of age, gender, education occupation, sub-region, and sources of information on climate change consciousness. Some of the results corroborated findings of previous studies conducted outside and within the African continent [35].

The findings showed a significant difference between the CCC levels of male and female respondents. Similarly, there was also a significant difference between the CCC levels of urban and rural respondents in climate change consciousness on the other hand. These results are consistent with some previous studies that have identified differences in climate change awareness according to demographic variables such as gender [22,36], and place of residence (rural or urban) [11],[19].

The analysis of variance results revealed significant differences according to age group, education, sub-region, and occupation. Respondents with higher level of education showed more concern about climate change than their less educated counterparts. Women were also more concerned about the climate change challenge than the male respondents. These findings are consistent with previous reports on variability of CCC according to gender [37,38] and level of education [36,39].

In addition, positive significant relationship was found among demographic, geographic, and sources of information variables and climate change consciousness. Multiple regression results revealed that when the eleven independent variables were taken together,

they effectively predicted climate change consciousness in each of the sub-regions and the entire continent. The most consistent predictor variables were gender, education, radio news and place of residence (urban/rural). These results corroborated the conclusions of some previous studies [17,21,22] that found gender and age as predictors of climate change consciousness in Africa.

Literature evidence has revealed education as a predictor of climate change (39,40,41,17,42 43) and this is consistent with the findings of this study because there is a positive relationship between educational level and climate change consciousness. Indeed [39], opined that taking courses in climate change education leads to increased awareness, change in attitudes and behaviors that lead to climate change action.

Literature is replete with various dimensions of the climate change challenge. However, research evidence on public consciousness is inconsistent and contradictory. In this study we used a 34-country survey of Afrobarometer data to investigate the relative influence of geo-demographic characteristics and sources of information on public climate change consciousness. Findings of this study have highlighted major factors capable of predicting climate change consciousness among African citizens. More importantly, geo-demographic factors are found to be significant in the continent's climate change narratives.

The study revealed that most respondents possess low consciousness of climate change. Radio news was the major source of information for Africans. Females in Africa are more conscious of climate change than their male counterpart. It was also observed that there were regional differences in climate change consciousness among the five regions. Sources of information and demographic variables significantly influence the level of climate change consciousness among Africans. Across the 34 countries and region the level of educational attained is the single most potent predictor of climate change consciousness in Africa. Other factors associated with public consciousness of climate change include gender, place of residence and radio.

5. Conclusion and recommendations

The study revealed that most respondents possess low consciousness of climate change perhaps owing to low level education and sources of communication. Radio news, which appeal mainly to only one sensory modality (hearing) to the neglect of others (feeling, tasting, seeing, and smelling), was the major source of information about climate change. Female citizens in Africa appear more conscious of climate change than their male counterparts. It was also observed that there were regional differences in climate change consciousness among the five sub-regions. Sources of information and demographic variables significantly influenced the level of climate change consciousness among Africans. Across the 34 countries and sub-regions, the level of educational attainment is the single most potent predictor of climate change consciousness. Other factors associated with public consciousness of climate change include gender, place of residence and radio.

This study acknowledges the limits of secondary data sourced for information generated by the researchers. The researchers recognize the possibility of over-generalization and inadequate attention to nuances and peculiarities of sub-regional and country-specific data. Consequently, more local studies, based on primary data, are required to corroborate, or refute the findings of this study.

The major implication of this study is the need for policy and program initiatives on climate change action. Currently, it appears most African governments are hesitant to embrace climate change education and programs because of the widespread belief that the continent contributes insignificantly to climate change variables in view of its low-level carbon emissions. However, research evidence suggests that, though making least contributions to climate change, the African continent is likely to be hit hard by the climate change effects. [34], "African countries are projected to experience detrimental economic consequences from climate change by mid-century, in both warming scenarios" (p. 12). The Bank therefore concluded that "Without action, climate change would impede development across Africa" (p. 12).

The results of this study suggest the need for result-oriented climate change education programs at various levels of the education system as well as at the non-formal level to rapidly increase the level of climate change consciousness among African citizens. While it is recognized that many countries on the continent would lay claim to some efforts in this respect, this study does not suggest that the prevalent climate change information and communication strategies are achieving the expected results. [35] therefore suggested that active all-inclusive educational programs which are driven by comprehensive policy plans that include, among other things, effective monitoring mechanisms for productive outcomes be in place.

Ethical declaration

Not applicable.

Data availability statement

Data are obtainable from the Afrobarometer website at https://www.afrobarometer.org/data/.

Additional information

No additional information is available for this paper.

CRediT authorship contribution statement

Razaq Olugbenga Azeez: Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Isaac Tebogo**

Rampedi: Writing – review & editing, Writing – original draft, Conceptualization. **Ayodeji Peter Ifegbesan:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Abiodun Ogunyemi:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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