

Knowledge, Perception and Attitude in Relation to Climate Change: A Cross-sectional Survey

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Abstract

A cross-sectional online survey was conducted using multiple online channels, where hundreds of responses were recorded from seven different countries, in order to provide a better understanding of the global public opinion about the awareness, perception and attitude about climate change. The results reflected that majority of people believe in the actual happening of Climate Change both by natural as well as anthropogenic causes. While most respondents believed in the anthropogenic causes of climate change, some people still displayed their confidence in the natural causation of climate change and thus affirmed their awareness of its natural causes. There was however, a difference of opinion regarding the mechanism behind the greenhouse effect. The respondents also provided their opinion on the impact of carbon aerosols on the atmospheric temperature. Further, the respondents were optimistic on the issue of climate change reversal and had also preferred some mitigation steps such as the use of geo-engineering over adjusting to the existing impacts of climate change. Although, people confirmed their belief in the human-induced nature of climate change, yet their agreement of having faced bizarre things about climate change like the lack of consensus among the scientists and climate change being a hoax shows their unawareness about the appropriate knowledge and the propaganda against this planetary emergency. Therefore, this study could prove helpful for policy makers and other stakeholders as it shows how much is done and how much more is pending.

Introduction

The planet's warming, described by IPCC as unambiguous, can be observed in the exponential rise in atmospheric and oceanic warming, glacier melting and increasing sea levels (IPCC, 2014). Indeed, greenhouse gas emissions increased as a result of economic and population growth, have increased atmospheric concentrations of unknown carbon dioxide, methane and nitrous oxide over the last 800,000 years (IPCC, 2014). The CO₂ emissions are said to have risen by 4.7 per cent since the Paris Agreement (Berwyn, 2018), as the years 2015–2018 have been reported as the four warmest years. In 2018, global average temperature exceeded 1 degree above pre-industrial (1850–1900) levels (WMO, 2019) and if the current greenhouse gas emissions proceed in the same way, the world is predicted to reach the climate-risk threshold as early as 2030. But still the ambiguity in understanding the human-induced climate change has made it impossible for common man to understand its causes, impacts and take meaningful action against it (Gifford, 2011; Norgaard, 2011; Weber, 2010; Dunlap, 2013). Therefore, there has always been a big gap between the anthropogenic climate change view of the ordinary people and that of the scientists (Weber and Stern, 2011; Dunlap, 2013). In addition, several individuals have contributed to the dissemination of disinformation about the human-induced global warming that is being funded by the fossil fuel lobbies to promote climate skepticism and denial of climate change for their own reasons (Dunlap, 2013). Thus while the belief in climate change shows tremendous progress, it is difficult for researchers, practitioners, and policy makers to be on a common forum (Hornsey et al., 2016).

Awareness of the public's understanding of climate change is therefore required (Sullivan and White, 2019), as the consequences of climate change rely not only on the magnitude of the climate catastrophe,

but also on the exposure and vulnerability of human and natural systems that again differ across time and space and rely on socio-economic, geo-political, demographic and environmental factors (IPCC, 2012). Despite this substantial variability in both human and natural environments, the effect of climate change on all continents and oceans is observed (IPCC, 2014; Rignot et al., 2019; WMO, 2019). Therefore, to stop the planet from being a permanent 'Hothouse,' a deeper understanding of the facts, perception and attitude about climate change is required from the global public opinion. Likewise, the deeper transformation of human values, equal allocation of wealth, behavioral improvements, reorientation of institutions, technical advances, enhancement of carbon sinks in the biosphere and new structures for governance will benefit (Steffen et al., 2018). In turn, it will produce a broad range of intimate, collective, and government-wide initiatives to resolve the global climate change crisis (IPCC, 2018; Goldberg et al., 2019). Therefore, in order to reduce the distance between climate change stakeholders, this survey asks some questions about the concept, causes, impacts and climate change mitigation steps, with the goal of providing data and knowledge that may be helpful to policy makers and stakeholders.

Methodology

We performed a six-month cross-sectional survey in order to understand the global public opinion about the knowledge, perception and attitude in relation to climate change. An anonymous self-administered e-questionnaire was posted and reposted on the social networking platforms like email, WhatsApp, Facebook, Twiter, Instagram, Researchgate, Academia, and Linkedin; besides sharing the link with our personal contacts. Although the e-questionnaire was distributed among the residents of our country, we didn't constrict our survey as residents from some other countries also participated in the survey.

Questionnaire

We developed an e-questionnaire to assess the global public opinion about the knowledge, perception and attitude in relation to climate change. The questionnaire was based on similar questionnaires on the perception and knowledge of climate change (Thompson 2017). The questionnaire collected some basic demographic data on age, sex, ethnicity, and education level; and included questions on knowledge, perception, impacts, and mitigation practices on climate change and collected the responses using a combination of free text, Likert and multi-level response scales. Questions on knowledge were used to assess the people's general understanding about climate change. Questions on perception were used to assess their understanding towards the causes of climate change. Questions on mitigation practices were used to assess the actual compliance to the different measures. In order to make the survey user friendly, almost about eighteen questions were Yes/No type while as only two questions were multiple choice type. We used an easy to understand terminology to ensure that the said questions are understood by people from all spheres of life.

Data Analysis

Data were fed into SPSS version 25 (SPSS Inc Chicago USA) for statistical analysis. The demographic variables and the percentages of the categorical variable were illustrated by the descriptive statistics.

Further Chi square test was used for testing the relationship between the demographic and the categorical variables.

Results

Respondents' demographic characteristics

A total of 171 respondents (aged from under 19 to above 55) from seven different countries including India, Pakistan, Bangladesh, Uzbekistan, Turkey, Nigeria, and America completed the survey. Most of the responses were obtained from India (92.3%, n = 158), followed by Pakistan (4.6%, n = 8) and one each from the rest of the countries. Further, maximum responses were obtained from students (35%) followed by teachers (31.5%) and researchers (10.5%) and males (63.1%) surpassed females in the survey.

Respondents' knowledge about the concept and impacts of climate change

Although climate change is characterized by the global warming, geographic regions may experience different local changes (such as droughts, floods, storms and sea level rise). Questions therefore included the general perception of the concept and impacts of climate change and the responses of the respondents towards the questions (Table 1) shows that a clear majority of 94.1% respondents agreed that the climate change is happening in real sense and it directly corresponded with the next observation of the study wherein 98.2% of them showed their belief in global warming. The belief was further strengthened by the majority's belief on impact of climate change on glaciers and ice sheet (95.9%) and on oceans other than rising sea levels (95.3%). There was a statistically significant association between the educational background ($\chi^2 = 6.995$, p = 0.005), profession ($\chi^2 = 7.785$, p = 0.005), gender ($\chi^2 = 5.034$, p = 0.022) and the knowledge and perception of climate change. Respondents with a good education background and research were more accurately aware about the concept, causes and impact of climate change.

Table 1
Responses to climate change (concept and impacts)

Questions	Number	Percent (%)
As per your opinion, is climate change real?	161	94.1
Yes	10	5.8
No		
Is global warming Happening?	168	98.2
Yes	3	1.7
No		
Do you believe that glaciers and ice sheets are melting because of the climate change?	164	95.9
Yes	7	4
No		
Does climate change have impact on oceans other than rise in sea levels?	163	95.3
Yes	8	4.6
No		

Respondents' knowledge towards the causes of climate change

The knowledge towards the causes of climate change and the mechanism behind the greenhouse effect (Table 2) shows that majority of the respondents (64.9%) agreed on the natural causation of climate change which was contrary to the response of another question in which the majority (97%) of the respondents agreed upon its anthropogenic causation. 95.9% of the respondents agreed upon the contribution of CO₂ and CH₄ in climate change, however, the response on mechanism behind the greenhouse effect was varied between absorption of infrared light emitted by the earth (49.1%), Ozone depletion (30.4%) and direct absorption of sunlight (20.4%). Furthermore, majority of the respondents (97.6%) also confirmed their knowledge on the impact of soot on atmosphere, with 74.2% of them specifying the impact as the increase in temperature.

Table 2
Responses to knowledge and causes of climate change

Questions		Number	Percent (%)
Do you think that earth might in reality be warming up because of some natural phenomenon?		111	64.9
Yes		60	35
No			
Do you think that Anthropogenic (man-made) causes are more responsible for global warming than the natural ones?		166	97
Yes		5	2.9
No			
Do you believe that greenhouse gases (CO ₂ & CH ₄) are responsible for global warming?		164	95.9
Yes		7	4.0
No			
In your understanding, how do greenhouse gases impact environment?		35	20.4
Direct absorption of sunlight		84	49.1
Absorption of infrared light emitted by the earth.		52	30.4
Ozone depletion in the stratosphere.			
Do you believe that black carbon aerosols (Soot) have impact on climate?		167	97.6
Yes		4	2.3
No			
Do you believe that occurrence of aerosols in the atmosphere increase the temperature?		127	74.2
Yes		44	25.7
No			

Respondents' knowledge and attitudes towards the suggested mitigation measures

When asked about their knowledge and attitude (Table 3) regarding various mitigation measures 85.9% of them believed that there was still time for the reversal of climate change and that combating climate change was not the job of leaders alone (80.7%). 98.2% said yes to afforestation, 94.7% agreed on the

changing lifestyle and 90.6% agreed on shifting from nonrenewable energy to renewable energy. 64.3% chose spending money and time on the reversal of climate change over adaptation. Further, 62.5% agreed upon the cooling impact of sulfate aerosols on the atmospheric temperature and 63.1% advocated the use of geoengineering as the mitigation measure. However, going meatless as a strategy for combating climate change was just accepted by meager proportion of 19.8% respondents

Table 3
Responses to knowledge and attitude towards the suggested measures

Questions	Number	Percent (%)
Is there still time to reverse the climate change?	147	85.9
Yes	24	14
No		
Do you believe that world leaders can alone curb the climate change?	138	80.7
Yes	33	19.2
No		
Can afforestation reduce the impacts of climate change?	168	98.2
Yes	3	1.7
No		
Do you think that by bringing about some changes in our life style has the potential to reduce the impacts of climate change?	162	94.7
Yes	7	4
No	2	1.1
Not Answered		
Can shift in the energy resources from non-renewable to renewable reverse the climate change?	155	90.6
Yes	16	9.3
No		
In your opinion, is it better to adapt to the climate change than to spend money and time on the reversal of the same?	61	35.6
Yes	110	64.3
No		
Are you aware of the fact that certain aerosols (sulfate aerosols) decrease the atmospheric temperature by reflecting back the sunlight?	107	62.5
Yes	64	37.4
No		

Questions	Number	Percent (%)
Through the principles of geo-engineering, sulfate aerosols can be put into the atmosphere to lower down the temperature. Do you support this approach?	108	63.1
Yes	63	36.8
No		
Do you think that going meatless is an appropriate option for the reduction of the emission of the greenhouse gases?	34	19.8
Yes	137	80.1
No		

Respondents' perception of bizarre things about climate change

When asked about the most bizarre thing they have faced over climate change (Table 4) 38% agreed that it was lack of consensus of the scientists over the matter followed by climate change being a hoax agreed upon by 29.8%, debate over global warming versus global cooling agreed upon by 22.8% and natural causes behind the climate change agreed upon by 9.3% as the most bizarre thing they had ever faced vis-à-vis the climate change.

Table 4
Responses to perception of bizarre things about climate change

Question	Number	Percent (%)
What is the most bizarre thing you have encountered about climate change?		
a) No proper consensus of the scientists over the matter	65	38
b) Natural causes of climate change	16	9.3
c) Global warming Vs Global cooling	39	22.8
d) Climate Change is a hoax	51	29.8

Discussion

This study generally showed that the respondents were well aware about the concept, effects, causes and mitigation measures of climate change. The results suggested that students, teachers and researchers were the maximum responders, possibly because of their higher concerns for the environment and the society at large. Meanwhile, the reason males outnumbered females could be because, women like other minorities doubt their abilities (Selm et al., 2018) in deciding about such crucial issues. Coming to the

actual study, majority of the respondents confirmed their belief in climate change which could be for the fact that they might have observed the climate changing in their life time as suggested by Wei et al (2014), Maibach et al (2018), Akrofi et al (2019). This belief was enhanced by the majority opinion in the climate change impacts on glaciers and icesheet (Moon et al., 2018) and on oceans other han rising sea levels like coral bleaching, ocean acidification, increasing water temperatures (Hoegh-Guldberg et al., 2017). Regarding the belief in natural causation of climate change the results suggested that people were aware about the natural phenomenon like volcanic eruptions (Pfister and White, 2018). Moreover, it could also be because of the religious beliefs of the people as religious believers tend to see climate change as non-anthropogenic in nature (Shao and McCarthy, 2020). However, the majority vote for anthropogenic climate change and on greenhouse gases as contributors is confirmed by Wei et al (2014) and impact of carbon aerosols on atmospheric temperature because black carbon affects the surface energy budgets after absorbing the sunlight (Hodnebrog et al., 2016). Regarding the mechanism behind the impact of the greenhouse gases on the environment, most people confirmed infrared absorption by greenhouse gases which is an apt reason, as high frequency and high energy solar radiations after transferring some portion of energy to the earth's surface, get released back as low energy long wave infrared radiations into the atmosphere which are then trapped by the greenhouse gases, thus not allowed to go back into the space (Mann, 2020). In case of mitigation measures, majority believed that there was still time for the reversal of climate change which could be attributed to the research being carried out on climate change in the present times (Yang et al., 2018) and people were ready to contribute showing that they knew it as a job of every one and not just the world leaders (Wei et al., 2014). People were ready to change their lifestyles (wei et al., 2014) and shift from non-renewable to renewable energy resources (Akrofei et al., 2019) for the betterment of the global climate. People also voted for spending time and money for the reversal of the climate change over the adaptation to the climate change impacts (Mostafa, 2016) showing that people are ready to pay money for carbon-labeled products. Furthermore, a majority of the respondents also confirmed their belief in the impact of sulfate aerosols on the atmospheric temperature and supported the use of the same in lowering the atmospheric temperature by applying geo-engineering principles as these aerosols are proven to mimic the volcanic aerosols in causing the global cooling (Robock, 2000; Mahajan et al., 2019). People alos supported afforestation as a mitigation measure for the fact that they basically understand the role of forests in abating the air pollution and thus protecting the global climate (Miripanah et al., 2019). The vote on going meatless as discarded by the majority was entirely not surprising as the study of Chai et al (2019) suggests that instead of going meatless, its sustainable reduction could help in achieving the desired goals. Improper consensus of the scientists on the climate change as the most bizarre thing voted about the climate change shows that they might not be knowing that approximately 90–100% of the publishing climate scientists believe in the human-caused global warming (Cook et al., 2016), followed by climate change being the hoax, a propaganda by the politicians is actually being fueled by their egoistic selves and negligence of the pro-climatic positions (Mildenberger and Tingley, 2019).

Conclusions

The findings indicate that people across nations are aware about the actual happening of climate change and they do know what are the major causes, impacts and mitigation measures of climate change. People are also aware of the impacts of climate change on glaciers, ice sheets, rise in sea levels and other less popular oceanic impacts which could possibly be ocean acidification, increase in water temperature, coral bleaching etc. Time is still left for reversing the climate change and people are willing to take part in climate action rather than rejecting the opportunity as the duty of world leaders alone. Further, sulfate aerosols, solar geoengineering, afforestation, change in life style, shifting energy resource use, spending of time and money were noted as some common strategies to reverse the already happening climate change rather than letting it happen further and adapting to it.

Declarations

Ethical Approval

This article does not contain any studies involving animals or humans performed by any of the authors. Further the authors declare that they have no conflicts of interest.

Consent to Participate

'Not Applicable'

Consent to Publish

We ensure that all the authors mentioned in the manuscript have agreed for authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.

Availability of data and materials

The authors confirm that the data supporting the review are available within the article.

Competing Interests

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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Authors Contributions

Suhaib A. Bandh conceived, designed, and prepared the final draft of this review, while Mohazib Pirzada, and Shahnaz Bashir helped in screening the relevant literature. Tanzeela Rehman did the primary work of surveying the sample population to collect the data. Anh Tuan Hoang reviewed and edited the manuscript. All authors together at the end gave final shape to this manuscript.

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