Research article

Perception of Climate Change: validation of a questionnaire in Italy

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Abstract

Background and aim. Climate Change (CC) is a worldwide concern with important consequences for Public Health. A more sustainable and responsible way of living is necessary in order to reduce CC consequences, and adequation to this is directly related to risk perception and knowledge about the phenomenon. The aim of this study was to validate a questionnaire to measure the knowledge of Italians on CC and its consequences.

Material and methods. The questionnaire was administered online to high school students, their parents and teachers that were participating to a meeting at Sapienza University. The questionnaire contained a sociodemographic section and 19 questions on causes and consequences of CC and ways to fight it. The statistical analysis was performed with Statistical Package for Social Sciences (SPSS) version 25.

Results. Sixty-four individuals answered the online questionnaire. The analysis of internal consistency was performed by 12 dichotomous variables that measured the knowledge level on CC. The analysis showed a standardized Cronbach's alpha equal to 0.39, corresponding to a low reliability. When females were excluded, the alpha value rose to 0.497, and ascended to the reliable value of 0.639 when refining the selection of the included questions.

Conclusion. The Cronbach's alpha value found showed a low reliability but achieves acceptable levels when considering only males and excluding some of the initial questions. Future studies should be performed in order to highlight the reliability of this tool to assess the knowledge about CC among the population. *Clin Ter 2019; 170(3):e184-191. doi: 10.7417/CT.2019.2131*

Key words: *climate change, validation, survey, students, Italy*

Introduction

Climate change (CC) is a worldwide concern and is considered "the biggest global health threat of the 21st century" (1). The phenomenon, mostly caused by human activity, is related to the increasing emission of greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The atmospheric concentrations of this gases have all increased since the beginning of the industrial era, mid of the 1700s, due to human activity - for example use of fossil fuel and agriculture. In 2011 the concentrations of these greenhouse gases were, respectively, 391 ppm, 1803 ppb, and 324 ppb, and exceeded the pre-industrial levels by about 40%, 150%, and 20%. The concentrations of CO2, CH4, and N2O also exceed substantially the highest concentrations recorded in past 800,000 years, through ice cores. The mean rates of increase in atmospheric concentrations over the past century are, with very high confidence, unprecedented in the last 22,000 years (2). Due to this scenario, the amount of heath trapped in the atmosphere gained, causing an escalation in Earth's temperature.

The consequences of this increase in temperature are many. Among the various impacts, such as those on environmental matrices and on animals, human population has also been affected. Hazards to human health include those from thermal stress, extreme weather events, exposure to air pollutants, aeroallergens and infectious agents - particularly those related to waterborne and vector borne diseases, and among those the re-emerging infectious diseases. There are also sociodemographic effects, such as forced migration as a result of environmental threat, and consequences on food productivity. (3-5). The largest health impacts worldwide seem to occur from vector-borne infectious diseases, and this is already affecting Europe (6).

In order to slow down the temperature increase and, therefore, the impact of CC, a transformation process is needed for society to pursue a way of a more sustainable and responsible functioning towards the environment (7). This will demand an increase in the population's awareness about this topic, as well as a bigger understanding of causes and consequences of CC (8, 9). Citizens with a deep knowledge about causes and consequences of CC will be more likely to act to fight it, since they will recognize that it constitutes a risk for their future (10, 11). It is possible to conclude that an aware population will be fundamental in order to fight global warming. With this aim, surveying the populations on this topic becomes an important tool for understanding what is their current level of knowledge.

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The objective of this study was to evaluate the validity and reliability, of an Italian questionnaire about knowledge on CC. This tool aims to identify: participants' awareness about the phenomenon and their source of information on the subject; comprehension about CC causes and consequences; understanding of actions that could diminish the impacts of global warming. In doing so, it will be possible to measure Italians understanding of CC, that so far has not been done.

Methods

The study was conducted at Sapienza University, during a presentation for visiting students from Italian high schools.

Questionnaire

The questionnaire was built on the basis of the documents developed by the 2015 *Lancet* Commission on Health and Climate Change (12).

The first section contained sociodemographic information on age, sex, marital status and educational level. The subsequent section contained 19 questions about CC.

To complete the survey, respondents were required to click on answers or entering free text in specific boxes. The questions contemplated only one correct answer.

The survey covered different categories of questions: definition of CC and greenhouse gases; knowledge about the effects of global warming; arguments and options to fight pollution and CC.

The questionnaire was made available online through a Google Docs tool. At the beginning of a lesson about CC and its' impacts on health, students and their accompanying parents and teachers present in the classroom were invited to answer the questionnaire. The link to access to the questionnaire was available for everyone on the 20th February 2019. All respondents could read and speak Italian. Annex 1 shows the questionnaire.

Questionnaire: Climate change and health

Dear participant, Sapienza University of Rome, a memeber of the Planetary Health Alliance, is conducting a survey on the perception of the climate change issue.
Please answer with the most sincerity, thank you.

Socio-demographic

1. Age
_____

2. Sex
M
F

3. Marital status
Single
Married
Divorced
Widower
Cohabitant

4. Occupation
a. Medical Doctor
b. Nurse
c. Preventative health experts
d. Scientist (biological, natural, environmental, chemical, physical and mathematical)
e. Medical student
f. Nursing student
g. Student of preventative health
h. Science student (biological, natural, environmental, chemical, physical and i. mathematical)
j. High school student
k. Middle school student
l. Other: _____
☐

5. Did you attend a specific graduate education?
No
Yes

6. If yes, what year?

☐ _____

7. Did you attend conferences?
No
Yes

8. If yes, what year?

☐

_____

9. If yes, what were they about?

☐

_____

10. If you have already graduated, what year?

☐

_____

11. Write your Country of residence

☐

_____

Climate Change
1. Have you ever heard of climate change?
Yes
No

2. If yes, where did you hear about it?

☐

_____

3. What are the main factors that can change the climate on Earth?
a. Changes that occur in solar radiation
b. Variations of the albedo: the fraction of solar radiation that is reflected in various parts of the Earth
c. The introduction of gases that modify the chemical composition of the atmosphere
d. All of these answers are correct
e. None of the answers are correct
f. I don't know

4. What gases are rising in the atmosphere as a result of human activities that cause the increase of Earth's temperature?
a. Carbon dioxide
b. Methane
c. Nitrogen oxides
d. All previous answers are correct
e. None of the answers are correct
f. I don't know

5. What are the main impacts of climate change?
a. Temperatures increase
b. Glaciers retreat
c. The level of the seas is growing
e. Biodiversity is reduced
f. Food production is at risk
g. Water scarcity increases
h. Extreme weather conditions are more frequently produced (ie storms, floods, droughts and heat waves)
i. The economy suffers
j. Diseases spread
k. The populations will have to face water and food shortages, with consequent possible conflicts and migrations

6. Most scientists agree that the warming is due to the increasing concentrations of greenhouse gases, which imprison the heat in the atmosphere, a process determined by human activities and not just by natural causes.
a. True
b. False
c. I don't know

7. What temperature increase do UN climate experts predict by 2100?
a. 1°–3,8°C
b. 1,4°–5,8°C
c. 1,9°–6,8°C
d. I don't know

8. What is the average temperature of the Earth today? *
a. 22°C
b. 18°C
c. 15°C
d. 12°C
e. I don't know

9. If you attended a University course, was the topic of climate change addressed during this course? *
a. Yes
b. No
c. I cannot answer this question

10. Do you think climate change can have an impact on the health of the environment?
a. Yes
b. No

11. Do you think climate change can have an impact on animal health?
a. Yes
b. No

12. Do you think climate change can impact the health of human populations?
a. Yes
b. No

13. If yes, how can it impact?

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14. Do you think a citizen can help reduce the impact of climate change?
a. Yes
b. No

15. If yes, which transportation options would best help fight climate change?
a. Going on foot
b. Taking public transports
c. Taking the bus
d. Moving by driving their own cars
e. Taking the bike
f. Using car pooling
g. Taking flights
h. All previous answers are correct
i. None of the answers are correct
j. I don't know

16. If yes, which energy options would best help fight climate change?
a. Reducing the consumption of home appliances
b. Lowering the temperature of the heating systems
c. Keeping chargers always plugged in
d. Using devices with reduced consumption
e. Keeping lights always on
f. Turning off the lights that are not needed
g. All previous answers are correct
h. None of the answers are correct
i. I don't know

17. If yes, which garbage options would best help fight climate change?
a. Differentiating waste
b. Using single-use devices
c. Reusing the packaging
d. Using plastic objects
e. Reducing waste
f. All previous answers are correct
g. None of the answers are correct
h. I don't know

18. How would you define "Biodiversity"?
a. The variety of ecosystems that surrounds us
b. The variety of ecosystems and species that surrounds us
c. The variety of ecosystems, species and genes that surrounds us
d. I don't know

19. How would you define the environmental capital/ ecosystem services?
a. The soil from which we get food
b. The raw materials we need to build our homes and make the clothes we wear
c. The services to improve the ecosystem
d. The main characteristic of an environment
e. The richness we get by exploiting the environment
f. The drinking water we drink
g. The clean air we breathe
h. All previous answers are correct
i. I don't know

Statistical analysis

The statistical analysis was carried out using SPSS 25.0. A statistically significant difference was accepted at a p value of less than 5%.

Descriptive statistics for quantitative variables were performed using mean, standard deviation (SD), median and minimum and maximum.

In order to evaluate internal consistency and reliability of each domain of the questionnaire, it was used the Cronbach's alpha coefficient. High values have been considered those above 0.70.

Results

A total of 64 respondents completed the survey and 89.1% of them were high school students. The mean age was 18.13 (SD 1,96), with 93.8% being 18 years old or younger. The majority of participants were female (82.8%) and single (92.2%). Regarding the region of residence, 71.4% were from the center of Italy, and all the others were from the South (Table 1).

The analysis of internal consistency of the 12 dichotomous variables on binary values for the knowledge level showed a standardized Cronbach's alpha equal to 0.39, corresponding to a low reliability

In the analysis by item the value of the alpha remained stable (Table 2).

Performing the analysis separately on males and females populations, the questionnaire showed a better reliability among the first group, with a Cronbach's alpha equal to 0.497. In Table 3 it is possible to see the alpha for each eliminated item considering only male participants, and it can be observed that refining the questionnaire removing the item about gases responsible for causing climate change brings the Cronbach's alpha to the reliable value of 0.639. In table 4 it is possible to see the values for the sample of women only, with a Cronbach's alpha equal to to 0,372.

About the causes of CC, 60.9% of participants answered correctly that all the mentioned factors were responsible for modifying Earth's climate, followed by 31.3% that marked only the emission of greenhouse gases as a responsible factor for the phenomenon. Regarding which are the greenhouse gases, the answer chosen by most participants was

Table 1. Characteristics of the participants

Variables	N(%) or mean (SD)
Gender	
females	53 (82,8)
males	11 (17,2)
Age	18,13 (1,96)
Civil Status	
Married	3 (4,7)
Cohabitant	2 (3,1)
Single	59 (92,2)
Professional status	
Other	5 (7,8)
High school student	57 (89,1)
High school teacher	2 (3,1)
Region of residence (Macro area)	
Center	46 (71,9)
South and islands	18 (28,1)

CO_2 alone, with 35.9% of answers, followed by the correct alternative, that was "all the mentioned gases" (CO_2, N_2O and CH_4), with 32.8% of correct answers. Still, on the matter of what causes CC, 93,8% of respondents marked "True" to the affirmative that most scientists agree on humans' responsibility on the emission of the gases that causes the temperature to get higher.

Regarding Earth's temperature, only 28.1% marked correctly that the planet's average temperature is 15°C, with majority of answers for 18°C; only 31.3% correctly answered to the forecasts about future temperature increase until 2100 (1,4°–5,8°C).

About the impacts of CC, respondents mostly agreed that it could affect the health of the environment (98.4%), animals (98.4%) and humans (93.8%).

Concerning actions that could be taken to lessen the progression of CC and its impacts, there were three questions that approached energy use, means of transportations and waste generation and disposal. The 71,9% of participants correctly answered to the question about energy use, with lower numbers for waste disposal (62.5%) and transport (56.3%).

Table 2. Statistical analysis of internal consistency of the questionnaire

	Scale mean when the item was deleted	Scale variance when the item was deleted	Correct Item-total Correlation	Cronbach's Alpha when the item was deleted
Mainfactor_CC	7.5156	2.571	.058	.405
Greenhouse_gases	7.7969	2.609	.047	.407
Rising_temperature	7.8125	2.567	.080	.394
Scientist_consensus	7.1875	2.853	-.010	.403
Mean_temperature	7.8438	2.705	-.004	.424
Impact_environment	7.1406	2.853	.086	.386
Impact_animals	7.1406	2.853	.086	.386
Impact_humans	7.1875	2.758	.108	.379
Healthprof_actions	7.2813	2.618	.129	.372
Actions_transport	7.5625	2.282	.247	.320
Actions_energy	7.4063	2.309	.284	.308
Actions_Waste	7.5000	1.937	.538	.175

Table 3. Statistical analysis of internal consistency of the questionnaire considering only Males

	Scale mean when the item was deleted	Scale variance when the itemwas deleted	Correct Item-total Correlation	Cronbach Alpha when the item was deleted
Main factor_CC	7.6364	3.055	.039	.517
Greenhouse_gases	8.0000	3.600	-.303	.639
Rising_temperature	8.1818	2.364	.481	.372
Scientist_consensus	7.4545	3.273	.000	.501
Mean_temperature	8.2727	2.618	.375	.420
Impact_environment	7.5455	2.873	.302	.453
Impact_animals	7.5455	2.873	.302	.453
Impact_humans	7.5455	2.873	.302	.453
Healthprof_actions	7.4545	3.273	.000	.501
Actions_transport	7.8182	2.564	.281	.445
Actions_energy	7.6364	2.655	.345	.429
Actions_Waste	7.9091	2.491	.309	.434

DIscussion

Results of Cronbach's alpha showed a low reliability of the questionnaire. However, it should be taken into consideration that the situation in which the test was applied may have reduced the capacity of testing the reliability of the results. The questions were made available for answering at the beginning of a non-obligatory lecture, with a relaxed atmosphere and in the participants' mobile phones. This may have led to fills with inattention, without seriousness, and even done with the help of colleagues, which could have changed our results. This becomes more evident taking into consideration the difference between the Cronbach's alpha value considering females or only males. There was a much bigger population of females, distributed in small groups of friends, which could have influenced the results.

It is also worth considering that the questions evaluated different types of knowledge, from scientific information on climate to daily life pro-environment actions. This can have affected the internal consistency of the questionnaire (13, 14), therefore lowering the alpha value. This could explain

Table 4. Statistical analysis of internal consistency of the questionnaire considering only Females

	Scale mean when the item was deleted	Scale variance when the item was deleted	Correct Item-total Correlation	Cronbach Alpha when the item was deleted
Main factor_CC	7,4906	2,524	,055	,387
Greenhouse_gases	7,7547	2,458	,130	,352
Rising_temperature	7,7358	2,621	,012	,402
Scientist_consensus	7,1321	2,809	-,020	,390
Mean_temperature	7,7547	2,727	-,052	,426
Impact_environment	7,0566	2,862	,000	,375
Impact_animals	7,0566	2,862	,000	,375
Impact_humans	7,1132	2,756	,067	,369
Healthprof_actions	7,2453	2,535	,136	,350
Actions_transport	7,5094	2,255	,235	,303
Actions_energy	7,3585	2,273	,268	,292
Actions_Waste	7,4151	1,824	,614	,105

why the value increases when one of the scientific questions, about greenhouse gases, is taken out from the analysis.

The results obtained from the replies to the questionnaire revealed a low level of knowledge on CC among the high school students, which was also found in other surveys with students (11, 15). This should be seen as an opportunity to give information and build concern on the subject: an effective strategy to overcome challenges due to stable or declining interest among adults (16). Adolescents are still forming their worldviews (17), and, at this phase, knowledge can overcome skepticism (11). As they spend considerable amount of time in schools, the role of teachers in building this knowledge should be essential, specially taking into consideration that individuals are more receptive to receiving CC information from trusted messengers (19). Research results suggest that teachers are among the trusted messengers for adolescents (18, 20). Also, according to a research performed in the US, it is possible that even if the role of educators is limited to effectively informing that global warming is real, students can deduce the anthropological causes of the phenomenon, even if teachers do not believe in it (18). The window of opportunity to educate teens, therefore, should not be missed.

It is important to consider that the education strategies should aim to reduce the psychological distance of CC, as information-based interventions alone are unlikely to determine effective engaging among young populations (20). Relevant factors to work with are perceived self-efficacy and the co-benefits of fighting CC, such as improvements in public health or energy security (21).

Future studies could determine whether this tool is useful for assessing knowledge about CC among high school and university students, as well for adult populations.

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