

## Article

# Characteristics of Climate Concern—Attitudes and Personal Actions—A Case Study of Hungarian Settlements

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**Abstract:** This article discusses one of the most important social factors of climate protection: climate concern. Most research in this area focuses on North America and Western Europe or presents international comparative statistics. Our work is innovative because we have designated a lesser-known post-socialist region in East-Central Europe as a sample area, and we intend to conduct in-depth analyses at the municipal level. Our study describes the second largest city in Hungary, Debrecen, and its agglomeration. Based on a questionnaire survey in 2020 (N = 512), we examined opinion factors, and we have presented features consistent with or different from the findings in the relevant literature. In the statistical analysis, chi-square tests and binary logistic regressions were applied to reveal significant differences between the responses of different types of respondents. As response variables, we used the questions about general concerns regarding air pollution, knowledge about climate change, beliefs about tackling, perceived threat, behavioural responses, personal actions, and demography. We found that the concern about air pollution and a feeling of threat to respondents' life was mainly affected by the degree of climate concern. We conclude that the knowledge of local communities on climate change has increased, and risk perception has improved. Still, there is no clear relationship between the level of concern and climate-conscious behaviour. The findings provide ideas for promoting local climate management and awareness-raising in the European Union or other countries.

**Keywords:** climate concern; perceptions of climate change; Hungary; questionnaire survey; binary logistic regression



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## 1. Introduction

The unfavorable environmental and social effects of climate change (CC) had been specified by numerous scientific fields, e.g., climate policy [1–4], environmental science [5–10], meteorology [8,11–13], economics [8,14–17], soil science [18], agriculture and food security [9,19], and sociology [15,17,20]. Most of the facts and processes related to global warming (GW) are known to the general public, and people are afraid of negative processes. Sixty-three percent of respondents in the United States (US) said that CC affected their local community [21]. Intensifying climate concerns were justified by the report known as Growing Public Climate Concern in 2021 [22]. The largest Asian nation, China, has also seen a relatively high awareness among the public of CC in the last decade [23]. According to the survey of Eurobarometer in 2021 [24], 93% of citizens see CC as a serious problem and 78% see it as a severe problem in the European Union (EU).

High levels of climate concern contribute to the support of climate policy measures and often lead to awareness and pro-environmental behaviour. However, according to many, climate sensitivity has not yet reached the level at which climate protection can be truly adequate [25–34]. Some authors said COVID-19 further distracted people from CC

over the past two years [35,36], and the pandemic has slowed down the processes aimed at combating CC [37,38]. So, on the one hand, there have been signs that some of the attention diverted to climate change. However, on the other hand, some social movements and international organisations have increased the commitment to climate sensitivity [39–41]. As a result, sensitivity has increased further in some countries [42,43]. Accepting this statement, we believe that continuous monitoring of the climate concerns of the population is current.

When it comes to climate fears, certain conceptual polemics are worth mentioning. According to some authors, people think “GW” is a more severe problem than “CC”. CC is, therefore, less frightening for many than GW, i.e., these people are less concerned about it [44–48]. There is no difference in environmental and social impacts, but the different terminology can influence the population’s attitude towards the problem [49]. According to others, the above phrases have minor implications for value judgment and concern. The research of Villar and Krosnick [45] shows similar population sensitivity regarding both terminologies. Regardless of the different observations, we assume that the proper use of specific words and concepts in a context can be very important, especially in policy conversations and media coverage.

The literature listed above shows that most studies focus on populous countries. At the same time, much less information is available on the climate concerns of smaller nations. Due to the historical past, climate concerns may be different in a country like Hungary. Therefore, we considered it worthwhile to thoroughly examine a certain Hungarian area. We think that analyses of local climate change issues are not yet available here, and profound research in a post-socialist EU member state gives new experiences about Europeans’ environmental awareness.

The main aim of this study is to provide a comparable and relevant view of aspects of climate change concerns in the Hungarian context. Based on the above starting points, in the first part of this paper, the factors that determine climate concerns in general are summarised based on the related literature. Then, taking these factors into account, a case study is presented in which the attitudes of the population of the group of settlements studied are described in detail. Firstly, the second section summarises the climate concerns factors and formulates hypotheses based on the related literature. Then we present a case study that details the climate concerns and attitudes of the affected population. We emphasised the conceptual terminology and examined whether the concepts of “GW” and “CC” affect the degree of concern to interpret attitudes. The results reveal aspects that are not covered by national statistics.

## 2. Literature Review and Hypothesis

### 2.1. General and Personal Concerns

Studying the concerns for environmental problems has been a well-researched topic since the 1990s [50–53]. CC emerged as a new element among the difficulties over the past 20 years and soon became the most well-known cause for concern [32,54–56]. The initial comprehensive publications on climate concern and risk perception were published in the US [57–59], but studies on other countries, i.e., in Europe or the member states of the EU, have also appeared gradually [60–63]. Numerous studies on CC and environmental attitudes have been carried out in Hungary, but few have examined local climate concerns [64].

Analyzing the level of concern was generally used for studying the risk perception of CC, which may occur at international [65], national [23,66], and individual [28] levels [62]. According to Yu et al. [67], there are three aspects of climate concern: (1) general concern; (2) personal concern, which mainly focuses on the effects on the individual; and (3) personal concern, which focuses primarily on the effects on social communities. There is a significant difference between general and personal concerns [56]. General concern can be observed in the case of most people since the majority already know about the adverse effects of CC and, therefore, consider it a serious problem. General concern, however, does not mean that

one feels personally affected and considers CC to be a serious problem in the immediate environment. Therefore, while the individual considers CC a problem, he/she may not be concerned about it [56,68,69]. According to Whitmarsh [28], the “perceived threat of CC” and the “personal importance of CC” should be interpreted separately.

The climate concerns of the individuals may vary in different countries and social groups due to various cultural factors [56]. Survey research confirms that CC is considered a “very serious” problem in most European countries [24,56,60,61,69–72]. Concern has traditionally been lower in the US, China, Russia, and some Eastern and Central European countries [56,73–75]. According to Smith and Mayer [76], seeing CC as a perceived threat is strongest in English-speaking countries; it is moderate in non-English-speaking Western European countries, and is lowest in post-socialist countries.

### *2.2. Relationship between Concern and Knowledge, Beliefs, Scepticism*

Knowledge of the causes and consequences of CC is closely associated with climate concerns, but the lack of concern is not directly proportional to the lack of knowledge [61,77]. For this reason, Whitmarsh [78] says that scientific knowledge about CC generally does not predict belief in it. In addition, it is an essential fact that the proportion of climate sceptics is increasing in many countries [79], but these individuals generally have a similar level of knowledge as non-sceptics [80]. Based on data from Climate Change in the American Mind 2019 and the European Social Survey 2016–2017, it can be stated that the majority of respondents in the US and the EU accept that the CC is a fact, its origin is mainly anthropogenic, and its negative effects will occur [62,63,75,81,82]. However, a certain proportion of the population still doubts these [61,79].

Low-level climate concerns in certain groups may also be the result of the lack of knowledge, the misunderstanding of the problem or the lack of information [58,83]. Those who have insufficiently informed associate misconceptions and confuse CC with other environmental problems, most often the destruction of the ozone layer [66,84].

The risk perception and concern level strongly depend on personal experience [66]. Those who have already experienced the negative consequences of CC, or are convinced anyway that the changes will occur, are much more concerned about the problem [54,66,74]. In addition, there are quite “everyday” factors that influence concerns: e.g., several studies show that people are more concerned about CC on hot days than cold days [56,85–87]. These everyday factors play an important role in understanding CC’s local impacts and public support for climate action [74,88–94].

### *2.3. Relationship between Concern, Action and Behaviour*

Thorough knowledge of the causes and consequences of CC raises concerns that could lead to pro-environmental behaviour [70,95,96]. People who are not aware of the possible consequences and risks are less likely to become climate-conscious [83]. In contrast, those who perceive and/or are concerned about CC are more likely to feel personal responsibility. They are more likely to take action or be willing to pay a higher price to mitigate CC [97–103] and support the mitigation climate policy [34,96,104,105]. According to Lorenzoni [84], limited personal responsibility is linked to climate concerns in the US. For example, in the study of Leiserowitz et al. [75], only 40% of American respondents said that their family and friends had made efforts to reduce CC. In Europe, Bodor et al. [63] and Bodor and Grünhut [82] found an improving trend in personal responsibility for mitigating CC. However, in Central and Eastern Europe, the proportion of people who consider it their responsibility to mitigate CC is relatively low compared to other countries. In Hungary, deep concern is accompanied by a feeling of low personal responsibility and will to act.

### *2.4. Relationship between Concern and Demography*

Shi et al. [77] found that demographic indicators (gender, age, and education) do not predict climate concern but strongly influence its extent and the level of knowledge. Higher educational level suggests a higher level of risk perception, which positively affects

climate concern [61,65,74,77,78,80,106,107]. Other authors, however, did not find such connections [108–111] or found the opposite [54]. Research on age is also controversial. The level of concern may increase with age. Therefore the older age group is likely to show a higher level of climate concern [54,80,109,110]. However, this finding is denied by some publications [61,77,78,107]. Considering gender, women are generally more worried about CC than men [57,59,61,77,78,108,112–115]. The results are contradictory, but overall, women, younger people, and those with higher educational levels are more concerned about CC. Men, older age groups and people with lower educational levels are more sceptical and less worried [61,116].

### 2.5. Limitations of Previous Studies

Several factors influence climate concerns, so research results are often contradictory and have many limitations, making it difficult to assess and interpret the results. The level of general and personal concern depends on the time of data collection. In some periods, increasing concern about a specific problem (e.g., war, terrorism) reduces concern about another problem (e.g., climate change) [56]. In addition, a relationship can be found between the level of concern and the wealth of the country or individual, which makes international comparisons even more difficult. The media strongly influences knowledge, beliefs, and scepticism, which directly affect public concern [58]. In addition, the lack of trust and concern has also been explained by political orientation [80], which, however, not all research can sufficiently assess. Some findings on action, behaviour, and concern confirm, and some refute the clear link between these factors, so further research is needed. Demography is the area with the most significant number of contradictions.

Furthermore, the studies also differ in their methods of statistical analysis. For some samples, dichotomy can affect the robustness of Chi-square tests and binary logistic regressions, thus part of the researchers use ordinal logistic regression for analysis.

In sum, the factors mentioned above influence each other in a complex way, and their combined analysis is a missing element in current research. Therefore, the results of the study should be treated carefully with reservations.

### 2.6. Hypothesis Formulation

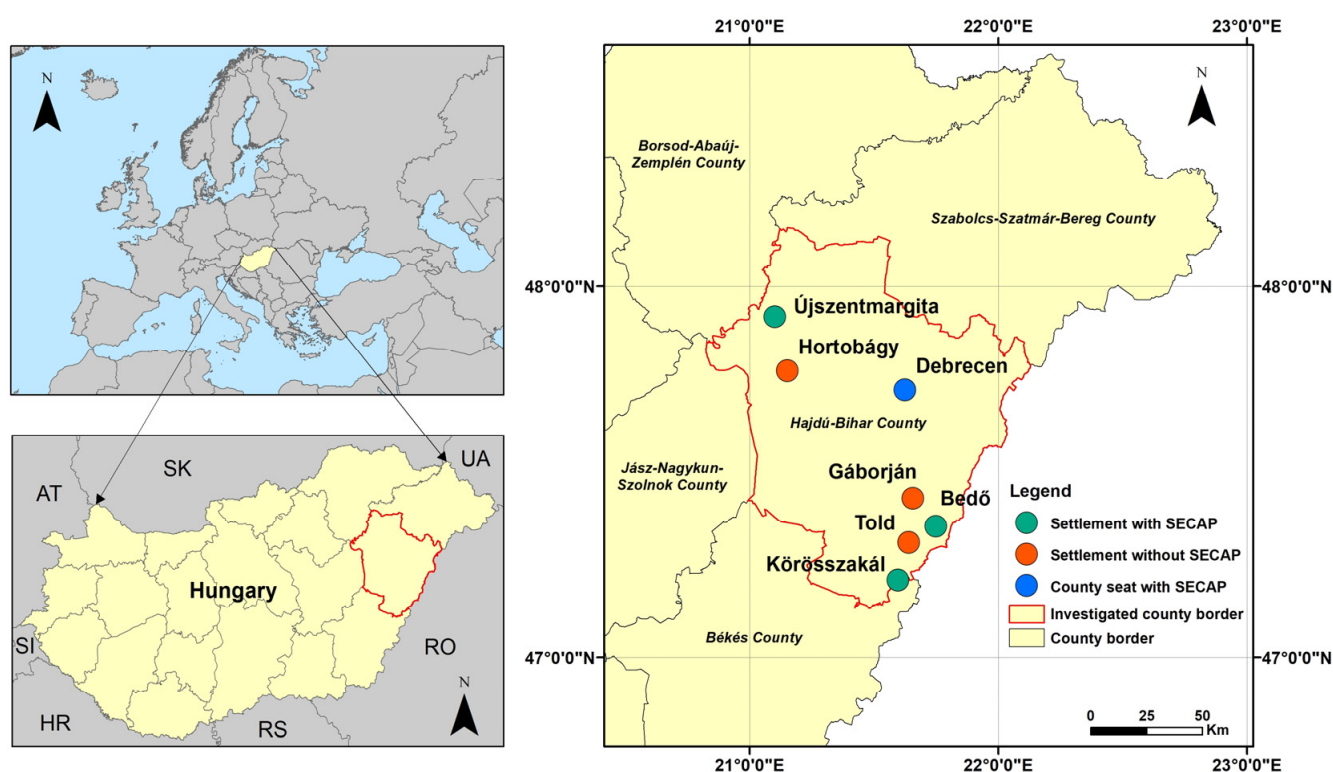
Our primary research question was whether the use of the words determines the degree of general concern and individual responses. We examined whether the concepts of “GW” and “CC” have different effects on the degree of concern to interpret attitudes. Our preconception (hypothesis 1) is that the term “GW” causes higher levels of concern among respondents than the words “CC”. The second research question was whether there is a link between concern and risk detection activity. Do fears affect individual responses and attitudes? Our preconception (hypothesis 2) is that people who show higher concern and risk perception are better informed (hypothesis 2/a). These individuals have a more comprehensive range of knowledge, are less sceptical (hypothesis 2/b), and are more willing to take personal actions. In these cases, a sense of responsibility for CC and personal commitment to action is more pronounced (hypothesis 2/c) than in the case of those who are less concerned. In addition, variables (knowledge, risk perception, willingness to act, and demographic factors) have been identified that can significantly impact the level of concern.

## 3. Materials and Methods

### 3.1. Study Area and the Method of Sampling

The selected Hungarian study area represents a typical Central European mid-size city and its catchment area (Figure 1). One of the selected settlements is a town with county seat legal status, while the other six settlements are villages. It was important to include villages with and without a local climate strategy (SECAP: Sustainable Energy and Climate Action Plan) in equal numbers when selecting the villages. In addition, it was a priority that the permanent population of the pairs of settlements should be nearly the same and

that their distance from each other should not exceed 50 km. The county seat, Debrecen, has a SECAP as well. Our initial aim was to have a total sample of at least 500 respondents. In choosing the sample of villages with SECAP, the aim was to have residents of about 5–6% of the population. In addition, it was a criterion that the same number of samples were taken from villages without SECAP. A larger sample from Debrecen was included in the analysis. The outbreak of COVID-19 considerably hampered the field survey, so a sample size of 200 respondents was defined. In addition, another aim was to have a sample number that could be analysed independently by the municipality. The questionnaire survey was conducted between July and September 2020. The number of respondents is 512. The distribution of respondents by the municipality and demographic group is presented in Appendix A.



**Figure 1.** Location of the study area. Source: edited by the authors.

The sampling framework was provided by the Hungarian Central Statistical Office (HCSO) data according to the type of locality and data on localities of Hajdú-Bihar County [117]. The interviewees were determined by quota sampling, representative of gender and age per settlement. In the sample selection, only the adult population aged 18 and over was taken into account from the 15–19 age group used by the HCSO. Data collection was carried out by personal interviews, using Leslie Kish’s systematic sampling, visiting apartments. Leslie Kish’s systematic sampling is used for random selection within a household. Households were selected first, and then the interviewee was chosen. The selected respondents read the questions by the interviewer and helped with interpreting the questions where necessary.

### 3.2. Wording Effect

The term “climate change” was used in our questionnaires instead of “global warming” or “global climate change”. The first question in the questionnaire measured the general concern using a Likert scale: “How concerned are you about the following problems in Hungary?” (1 = not at all concerned; 5 = totally concerned). Twelve problems were listed in the questionnaire. Half of them focused on environmental issues, while the other half focused on social ones. To analyze the effects of the different terminologies (“GW” or “CC”)

on the grade of concern, “GW” and “CC” were listed separately among the problems. The former was the first on the list, while the latter was the fifth.

### 3.3. Data Analysis

Statistical analysis of the data was performed using the software SPSS 22. Chi-square tests and binary logistic regressions were applied in the statistical analyses.

Chi-square tests were applied to expose and analyze whether there are significant differences among respondents’ answers of different types.

The following questions of the questionnaire were used for the chi-square tests:

1. “Where do you get news on CC? Please, mark 3 and rank them!”;
2. “What actions do you take to combat CC? What do you always, occasionally or never do; and what would you do but do not have the chance to do?”;
3. “Please, tell how much you agree with the following statements!” Response options were given on a Likert scale of five.

Regression analysis was applied to predict the probability of which variables affect the degree of climate concern. Since dependent variables were recoded into dichotomic variables (1 or 0), binary logistic regression was used for the analyses. Independent variables with the highest regression coefficient (B) have the most significant impact on the prediction of the dependent variables. If, in the case of an independent variable, it is true that  $B = 0$ , it does not affect the studied event. Thus, the hypothesis of  $H_0: B = 0$  is tested in the analysis [118,119]. The advantage of this method is that it also determines the odds ratio (Exp(B)) values and their 95% confidence intervals from the regression coefficients (95% C.I. for Exp(B)). If  $\text{Exp}(B) > 1$ , the chance of the event increases with the increasing predictor. If  $\text{Exp}(B) < 1$ , the chance of the event decreases with the growing predictor [28].

The three dependent variables used for the analysis:

1. General concern regarding GW: code 1 means respondents who chose the category “totally concerned” on the Likert scale of five for the question “How concerned are you about GW in Hungary?” (N = 263); code 0 means the rest of the cases (N = 249). The model successfully categorised 78.9% of the total cases (0.428 Nagelkerke R<sup>2</sup>), 82.1% of the concerning answers, and 75.4% of the other cases. Results are presented in Appendix B;
2. General concern regarding CC: code 1 means respondents who chose the category “totally concerned” on the Likert scale of five for the question “How concerned are you about CC in Hungary?” (N = 261); code 0 means the rest of the cases (N = 251). The model successfully categorised 72.0% of the total cases (0.296 Nagelkerke R<sup>2</sup>), 75.1% of the concerned answers, and 68.8% of the other cases. Results are presented in Appendix C;
3. CC can be considered a very serious problem: code 1 means respondents who chose the category “very serious” on the Likert scale of four for the question “Do you consider CC a serious problem?” (N = 229); code 0 means the rest of the cases (N = 283). The model successfully categorised 71.6% of the total cases (0.316 Nagelkerke R<sup>2</sup>), 63.3% of the very serious answers, and 78.4% of the other cases. Results are presented in Appendix D.

The following questions from the questionnaire were used as independent (predictor) variables for the analysis:

1. General concern regarding air pollution: code 1 means respondents who chose the category “totally concerned” on the Likert scale of five for the question “How concerned are you about air pollution in Hungary?” (N = 288); code 0 means the rest of the cases (N = 224);

2. From the understanding and knowledge section: “*What do you think is the reason for CC?*” question was used, which was open-ended. We grouped the responses and created the following categories: 1. “totally caused by human activities” (N = 382); 2. “partly caused by artificial activities and partly by natural factors” (N = 34); 3. “totally caused by natural factors” (N = 18); 4. “don’t know/no response” (N = 38); and 5. “not be possible to decide based on the response” (N = 40);
3. From the beliefs about tackling section: “*Do you think something can be done to act against CC?*” question was used. 1. “yes” (N = 441); 2. “no” (N = 44); and “don’t know” (N = 26);
4. From the perceived threat section: “*Do you feel CC as a threat to your life at the moment?*” question was used. Code 1 means respondents who chose the category “totally” on the Likert scale of five (N = 144); code 0 means the rest of the cases (N = 368);
5. From the behavioural responses section: “*Would you be willing to change your lifestyle, eating, and shopping habits to contribute to the fight against CC?*” question was used. Code 1 represents respondents who chose the category “yes, for sure” (N = 260); code 0 represents respondents who chose the categories “probably yes”; “probably no”; “definitely no”; or “definitely not because I cannot afford it” (N = 252);
6. The question was used from the personal actions section: “*What actions do you take to combat CC?—Use and purchase energy-saving devices*”. Code 1 represents respondents who chose the category “always do it” (N = 390); code 0 represents respondents who chose the categories “occasionally do it”; “don’t do it”; or “would do it but don’t have the opportunity” (N = 122);
7. Demography: gender, age, the highest level of education (Appendix A).

#### 4. Results

Considering terminology, no significant difference was found in using different terms. Thus, our preliminary hypothesis was not confirmed (hypothesis 1). Regarding the 12 possible problems, GW (Mean: 4.29; SD: 0.876) was considered the third, while CC (Mean: 4.25; SD: 0.966) was the fifth most worrying problem in Hungary by the respondents. The number of completely worrying respondents is also nearly the same (N = 263 and N = 261). Demographic indicators of those concerned about GW and CC also show a similar picture: the majority are women (57.4% and 57.9%), aged 50–64 (29.7% and 28%), with 8 grades of primary school or less (26.2% and 24.1%).

The demographic indicators of respondents who consider CC a very serious problem (N = 229) differ slightly, as the majority of them are women (56.8%), aged 18–34 (31.9%), with college or university qualifications (29.3%).

##### 4.1. Analysis of the Answers Given by Respondents Totally Concerned about GW/CC

###### 4.1.1. Knowledge and Personal Action

The chi-square analysis shows that respondents totally concerned about GW and CC are not much better informed than those less concerned about the problems (Table 1). Hypothesis 2/a was not confirmed. Nearly the same proportion of respondents identified the possible sources of information: TV, radio, and the internet. There was only one significant difference in obtaining information: those who were less concerned about GW were more likely to get information from the internet (73.5%).

Based on the chi-square analysis, it can generally be stated that those who are completely concerned will take the listed actions against CC at a higher rate than those who are less concerned (Table 1). Respondents who are totally worried about GW and CC are significantly more likely to use more energy-efficient devices (80.6% and 82.8%, respectively). Those who are totally concerned about GW are more likely to buy from local or domestic producers (46.8%). Our hypothesis is partially confirmed (hypothesis 2/c).

**Table 1.** Differences in responses to questions about knowledge and personal action according to the level of GW/CC concern (chi-square results). Source: edited by the authors.

Question in the Questionnaire	Answer Categories (Given Beforehand or Coded)	GW		CC	
		Totally Concerned	Rest of the Cases	Totally Concerned	Rest of the Cases
<b>Marked the answer</b>					
<b>What is your source of information related to CC?</b>	Family, friends	36.9%	34.1%	37.5%	33.5%
	TV	79.8%	79.5%	77.8%	81.7%
	Radio	49.0%	42.2%	47.5%	43.8%
	Daily and weekly newspapers	24.7%	27.3%	25.3%	26.7%
	Workplace	9.1%	8.4%	9.6%	8.0%
	Internet	64.6% *	73.5% *	66.3%	71.7%
	School	6.8%	7.6%	7.3%	7.2%
	Information forums for residents	3%	3.2%	4.6%	1.6%
	Scientific books, journals	11%	12.9%	10.7%	13.1%
	Via NGOs	3.4%	4.0%	4.2%	3.2%
<b>Always takes the actions</b>					
<b>What actions do you take to combat CC? What do you always, occasionally or never do; and what would you do but have no chance to do?</b>	Collecting waste selectively	76.4%	76.3%	74.7%	78.1%
	Buying from local/ domestic producers	46.8% *	35.7% *	41.8%	41.0%
	Using, buying energy efficient devices	80.6% *	71.5% *	82.8% **	69.3% **
	Buying environmentally friendly products	37.3%	35.3%	37.9%	34.7%
	Using renewable energy	6.5%	6.8%	7.3%	6.0%
	Public transport	40.7%	39.4%	39.5%	40.6%
	Walking/bicycling	80.2%	73.1%	79.7%	73.7%
	Using electric cars	1.5%	1.2%	1.5%	1.2%

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

#### 4.1.2. Attitudes Related to CC

The chi-square analysis and responses to the listed statements confirm that CC is treated as a more important issue by those respondents who are totally concerned (Table 2), which justifies hypothesis 2/b and hypothesis 2/c. In order to examine responsibility, two statements were made. The first says, "The Hungarian government is doing everything to control CC." Those less concerned about CC were significantly more likely to agree, although their proportion is still quite low (14.7%). The second is "I also need to take action on CC.", a statement with which groups that are completely concerned were significantly more likely to agree totally (73.8% and 73.9%, respectively). The personal commitment of concerned respondents to the problem is likely to be higher, as a higher proportion of respondents totally agreed with the statement "The problem of CC is extremely important to me" (75.7% and 74.3%, respectively). Thus, hypothesis 2/c has been confirmed.



**Table 2.** Differences in responses to questions about attitudes according to the level of GW/CC concern (chi-square results). Source: edited by the authors.

Question in the Questionnaire (Response Category: Totally Agree)	GW		CC	
	Totally Concerned	Rest of the Cases	Totally Concerned	Rest of the Cases
1. The Hungarian government is doing everything it can to control CC.	10.6%	11.6%	7.7% *	14.7% *
2. The problem of CC is extremely important to me.	75.7% **	40.6% **	74.3% **	42.2% **
3. I also need to take action on CC.	73.8% **	51.4% **	73.9% **	51.4% **
4. I am experiencing the effects of CC.	75.3% **	47.4% **	77.0% **	45.8% **
5. Natural factors are primarily responsible for CC.	16.3%	13.3%	14.2%	15.5%
6. Human activities are primarily responsible for CC.	72.6% **	48.2% **	71.3% **	49.8% **
7. CC and its negative effects are inevitable.	50.6% **	36.1% **	49.4% *	37.5% *
8. I'm sure that CC is a real problem.	93.5% **	77.1% **	94.6% **	76.1% **
9. CC will have harmful effects on future generations.	93.9% **	73.9% **	93.1% **	74.9% **

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

Perceived risks and beliefs in the impacts that would occur were studied with three statements: “I am experiencing the effects of CC.”; “CC and its negative effects are inevitable.”; and “CC will have harmful effects on future generations.” Those who are completely concerned about GW and CC agree in a higher proportion (75.3%, 50.6%, and 93.9%, and 77.0%, 49.4%, and 93.1%). Thus, less concerned people have a lower degree of risk perception and a view of future impacts different from reality. The knowledge of the cause of CC was studied with two further statements, while the judgement of the reality of the problem and uncertainty were examined with another statement: “Natural factors are primarily responsible for CC”; “Human activities are primarily responsible for CC.”; and “I’m sure that CC is a real problem.” Respondents who are totally concerned about these two problems are significantly more likely to believe that CC is primarily due to anthropogenic activities (72.6% and 71.3%) than those who are less concerned and are more likely to believe that CC is a real problem (93.9% and 93.1%). Less concerned respondents are more sceptical, as they are significantly less likely to agree with the claim that CC is a real problem (73.9% and 74.9%). There was no significant difference between the responses of concerned and less concerned groups as to whether natural factors were responsible for CC (Table 2). The results confirm hypothesis 2/b.

#### 4.2. Analysis of the Responses Given by Respondents Considering CC a Very Serious Problem

##### 4.2.1. Knowledge and Personal Action

As in the previous case, the chi-square analysis shows that respondents who consider CC very serious are not much more informed than those who believe it is less serious (Table 3). Respondents marked most frequently TV, internet, and radio as their primary sources of information. In three cases, significant differences were found as TV (83.4%) and daily and weekly newspapers (30.7%) were identified as sources of information with a higher probability by respondents who considered CC to be less serious. At the same time, NGOs were marked with higher proportion by those who considered CC to be very serious (6.1%). Our preliminary hypothesis was not confirmed in this case either (hypothesis 2/a).

There was no significant difference between those considering CC to be very serious and less serious in the chi-square analysis regarding the steps always taken to combat CC since the two groups do the listed activities in nearly the same proportion (Table 3). Therefore, our hypothesis was not supported (hypothesis 2/c).

**Table 3.** Differences in responses to questions about knowledge and personal action according to the level of CC seriousness (chi-square results). Source: edited by the authors.

Question in the Questionnaire	Response Categories (Given Beforehand or Coded)	CC	
		Considers Very Serious	Rest of the Cases
<b>Marked the answer</b>			
<b>What is your source of information related to CC?</b>	Family, friends	36.2%	35.0%
	TV	75.1% *	83.4% *
	Radio	45.4%	45.9%
	Daily and weekly newspapers	20.1% *	30.7% *
	Workplace	7.4%	9.9%
	Internet	72.9%	65.7%
	School	7.4%	7.1%
	Residential information forums	3.9%	2.5%
	Scientific books, journals	13.5%	10.6%
	Via NGOs	6.1% *	1.8% *
<b>Always takes the actions</b>			
<b>What actions do you take to combat CC? What do you always, occasionally or never do; and what would you do but have no chance to do?</b>	Selective waste collection	76.4%	76.3%
	Purchase from local/domestic producers	43.2%	39.9%
	Using, buying energy effective devices	77.7%	74.9%
	Buying environmentally friendly products	37.6%	35.3%
	Using renewable energy	7.0%	6.4%
	Public transport	37.6%	42.0%
	Walking/bicycling	78.2%	75.6%
	Using electric cars	1.7%	1.1%

\*  $p < 0.05$ .

#### 4.2.2. Attitudes Related to CC

Based on the chi-square analysis and the responses to the above-mentioned statements, it can be concluded, as in the previous analysis, that CC is treated as a more important issue by respondents who consider the problem to be very serious (Table 4). In all cases, the responses of the two studied groups showed a significant difference, supporting hypothesis 2/b and hypothesis 2/c.

**Table 4.** Differences in responses to questions about attitudes according to the level of CC seriousness (chi-square results). Source: edited by the authors.

Questions in the Questionnaire (Response Category: Totally Agree)	CC	
	Considers Very Serious	Rest of the Cases
1. The Hungarian government is doing everything it can to control CC.	6.1% **	15.2% **
2. The problem of CC is extremely important to me.	72.5% **	47.3% **
3. I also need to take action on CC.	75.5% **	52.7% **
4. I can feel the effects of CC.	72.5% **	53.0% **
5. Natural factors are primarily responsible for CC.	10.5% *	18.4% *
6. Human activities are primarily responsible for CC.	71.2% **	52.3% **
7. CC and its negative effects are inevitable.	48.5% *	39.6% *
8. I'm sure that CC is a real problem.	93.4% **	79.2% **
9. CC will have harmful effects on future generations.	91.7% **	78.1% **

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

Considering the government's responsibility, less concerned respondents were significantly more likely (15.2%) to agree that "The Hungarian government is doing everything it can to control CC", although their proportion is only a fraction of the respondents in the group. In terms of individual responsibility, the situation is reversed, with those who consider CC very serious (75.5%) being more likely to totally agree with the statement "I also need to take action against CC."

There is also a significant difference in responses to statements focusing on personal commitment (statement 2), perceived risks and impacts (statements 4, 7, and 9), the knowledge of the cause of CC and the reality of the problem (statements 6 and 8). Respondents who consider CC to be a very serious problem are more likely to completely agree with the statements.

Respondents considering CC less serious totally agree with the statement (5) aimed to analyse the knowledge of the causes of CC, "Natural factors are primarily responsible for CC" with significantly greater probability (18.4%).

#### 4.3. Effects of the Studied Independent Variables on Total Concern and the Judgement of the Personal Responsibility

In binary logistic regression models, only two of the predictive variables were statistically significant in all three cases: total concern regarding air pollution and a feeling of total threat to one's own life (Appendices B–D) have a strong positive effect on all three dependent variables. Therefore, those who believe that air pollution is a totally concerning problem in Hungary and who consider that CC is a total threat to their own lives are more likely to think that GW and CC are totally concerning problems in Hungary and that CC is a very serious problem. In addition to these variables, only educational level showed a partially significant impact on total concern about CC, which predicts negatively (Appendix C).

In addition to the predictors mentioned above, the total concern about GW was significantly affected by age, educational level, and knowledge. Age has a partially significant, strong, and positive effect, while educational level has a negative effect, which is only partially significant. Regarding knowledge, those who believe that CC is caused partly by humans and partly by natural factors have a strong negative impact on concern about GW.

Considering demographics, a partially significant, strong negative effect on the seriousness of CC can be observed in the case of age. On the other hand, behavioural responses have a significantly strong positive effect, while beliefs about tackling CC have a partially significant, strong positive effect on the dependent variable. Gender and personal actions were not significant in either case (Appendices B–D).

## 5. Discussion

Over the past two years, numerous publications have drawn attention to the fact that the COVID-19 pandemic and the fight against CC have similarities in many aspects: none of them considers national borders, and humanity needs to act immediately before it is too late [115]. Although the pandemic and CC are connected in some respects, the pandemic has rather distracted people from other concerns, including CC. Therefore, this work aimed to examine the main aspects of climate concerns at the municipal level in Hungary's second-largest city and agglomeration area. The main novelty of our study is that it reveals the urban climate concerns of a Central European country on the example of a typical mid-size city and its agglomeration.

The main findings related to municipal level climate concerns are the following, reflecting national and international results:

1. *Local-level results are non-congruent with previous national and international results regarding (a) general and (b) personal climate concerns.*

(a) In terms of general concern, our results show that of the 12 possible problems, global warming (mean: 4.29) was the third, while climate change (4.25) was the fifth most concerning problem in Hungary. Pollution of rivers and lakes was ranked first (4.37), air pollution second (4.32), and polluting lifestyles fourth (4.27). Air pollution is one of Hungary's most serious environmental problems, affecting the whole country and causing many respiratory diseases. In addition, the Tisza and the Danube rivers run through Hungary, and Lake Balaton is located in the country, so the population often experiences pollution empirically. Furthermore, many people consider polluting lifestyles to be the source of air, river, and lake pollution. GW and CC are among these five most serious problems. There is no remarkable difference between their averages, which means that the two problems are considered almost equally serious. The results are in line with the survey conducted by Baranyai and Varjú [120] and the Hungarian Society of Conservationists [121], where CC was also in the middle of concerning problems. While respondents in the EU considered CC to be the world's most serious problem in 2021 [24], CC is generally among the last issues in the questionnaire surveys in the US compared to other problems [54,56,58,84,122]. According to our results, the total number of people who are totally concerned about GW and CC is about half of the total sample in both cases. The different terminology did not result in significant differences. Therefore hypothesis 1, which suggests that GW is causing higher levels of concern, was not confirmed. Our results are consistent with Villar and Krosnick [45], as the respondents consider the two problems equally serious.

(b) In terms of personal concern, according to our data, respondents considering CC a very serious problem account for 44.7% of our total sample. This is higher than the average of the countries examined in the European Social Survey in 2016–2017 [81] and much higher than the Hungarian national result, and even close to that of countries with particularly high values. According to Climate Change in the American Mind data for November 2019 [75], 42% of the respondents personally consider GW to be "extremely" or "very" important, which is lower than our municipal results.

According to data collected in different years, the level of concern about CC varies widely and relatively rapidly in the countries studied [58].

2. *According to our municipal results, respondents showing a higher level of climate concern and risk perception (a) are not much better informed, (b) but less sceptical and have a broader knowledge than those who are less concerned. These results are also non-congruent with the earlier Hungarian national and international surveys.*

(a) In our survey, respondents with high and low levels of climate concern identified media and information potential sources in nearly the same proportion. Thus, hypothesis 2a, according to which those who show a high level of concern and risk perception are better informed, could not be justified. This is not in line with the research of Brulle et al. [58], who believe that media coverage of CC directly affects public concern.

(b) Analyzing knowledge and belief, we found that those with high levels of climate concern and risk perception were more likely to think that anthropogenic activities were primarily responsible for CC and more likely to believe that CC was a real problem. Less concerned respondents expressed more sceptical views. The results confirm hypothesis 2b, i.e., those who show a high level of concern and risk perception have a broader knowledge and are less sceptical. Our data are in line with the assumptions of Tjernström and Tietenberg [83], who studied 26 countries from all continents, because less concerned respondents who considered CC to be a less serious problem had lower risk perception, and their views of future impacts also differed from reality. Based on our data, it can be stated that the assumption of Poortinga et al. [61], that climate scepticism is typical of Central and Eastern European countries, was not confirmed in our sample.

3. *Our local level results contradict the earlier Hungarian national level and international results regarding (a) actions aiming to mitigate CC and (b) responsibility and personal commitment regarding CC.*

(a) Regarding actions aiming to mitigate CC, our research confirms that those who show a high level of climate concern do the listed CC actions in a higher proportion than those less concerned. However, there was no difference between respondents with high and low-risk perceptions. Thus, our preliminary assumption (hypothesis 2c) that those who show a high level of concern and risk perception are more willing to take personal steps to fight against CC was partially verified. Our results are in accordance with the findings of Bouman et al. [34] and Whitmarsh [29], as Bouman et al. [34] found no clear correlation between the level of concern and behaviour associated with mitigation in most of the studied 23 European countries. According to Whitmarsh [29], many energy-saving or energy efficiency actions are generally not implemented because of the concern. In the Climate Change in the American Mind 2019 survey [75], only 40% of American respondents stated that their family and friends had made efforts to mitigate CC.

(b) According to the results of our research, respondents with a high level of climate concern and risk perception have a higher sense of responsibility and personal commitment than those who are less concerned, as they responded in a much higher proportion that they had to take individual action against CC. In addition, a higher proportion of them replied that CC is an extremely important problem for them. Our preliminary hypothesis (Hypothesis 2c) was confirmed, according to which those who show a high level of concern and risk perception have a higher sense of responsibility and personal commitment to CC. Our results at the local level are not following the results of Bodor et al. [63] and Bodor—Grünhut [82], who found that personal responsibility for mitigating CC is relatively low in Central and Eastern Europe, and great concern in Hungary is accompanied by a low sense of personal responsibility. In comparison, limited personal responsibility is linked to climate concerns in the US [84].

4. *Our municipal level results are in accordance with the international results indicating that demographic indicators do not affect the grade of climate concern and risk perception but affect those differently.*

The majority of our respondents, who show a high level of climate concern, are women aged 50–64 and with an educational level of 8 grades of primary school or less. Respondents with a high level of risk perception have different demographic indicators. Most of them are women aged 18–34 with a college or university degree. According to numerous international literature sources, in terms of demography, women [57,78,112,114], the younger age group [77,78,107], and those with higher educational levels [65,74,80,106] generally tend to be more concerned about CC. Our results are partly consistent with the data of international research, but mostly they are in accordance with the findings of Shi et al. [77], according to which demographic indicators (gender, age, and level of education) do not predict clearly the level of climate concern, but influence its grade.

5. *In addition, the variables were identified which may have a significant effect on the level of concern and risk perception.*

In our sample, high levels of climate concern and risk perception were influenced by knowledge, beliefs, climate-conscious behaviour, age, and educational level in different directions and grades in the regression models. Only two of the predictor variables were statistically significant on the level of concern in all three regression models: total concern about air pollution and a feeling of total threat to one's own life, which have a robust and positive effect. For this reason, our municipal data are only partially consistent with the findings of Gregersen et al. [62], i.e., knowledge predicts concerns about CC. Moreover, our data support the assumption of Bouman et al. [34], that there is no clear correlation between the level of concern and climate-conscious behaviour.

## 6. Conclusions

Central and Eastern European settlements are rarely analysed in current sustainability studies; therefore, this paper contributes to the related literature. The novelty of this study is the exploration of municipal climate concerns in a Central and Eastern European region, where, according to preliminary research, low national-level climate concern is typical. Our work aimed to explore climate consciousness and understand the factors that influence climate concerns to help climate protection and local actions. Our results show that the investigated variables affect the level of worries differently. Knowledge about climate change determines the level of concern, and, given the proper knowledge, individuals exhibit climate-conscious behaviour, which is expressed in action. The results confirm the critical importance of educating the public, transferring knowledge and demonstrating good practices for choosing appropriate adaptation actions. Our research confirms that local levels can produce different results than national and international results. The municipal level is critical in adaptation, yet we find local climate protection stalls in some regions. In order to strengthen cooperation between certain municipalities and the population, it is necessary to identify gaps and uncertainties that hinder particular interventions. After exploring these factors, public awareness-raising events can be organised in a targeted way, transferring potential knowledge, the lack of which hinders the success of climate protection. Since the environmental problems of the studied rural settlements are similar in many respects, the methods used here can be applied elsewhere, including the neighbouring countries; furthermore, our results can also provide a basis for making adaptation more efficient for environmental awareness-raising and regional development.

Our case study has temporal and spatial limitations. On the one hand, the data collection was made in 2020, and data collected in different years may be different from this. On the other hand, our research focuses on only a certain area in Hungary, so different results may arise in various rural regions of the country and the capital and its catchment area. Thirdly, local surveys of this kind are not available in Hungary. Therefore, a comparison of our results is only possible with the results of works focusing on a similar topic at the national level, which is also incomplete.

Consequently, further local research should be carried out in Hungary and the post-socialist region of Eastern Europe, making the characteristics and shortcomings related to climate concerns at the local level better identifiable and understandable. Furthermore, this future research could provide information from the Central and Eastern European region that generates comparable data. Future municipal research may also focus on time series analyses spanning several years, thus providing more comprehensive results. Reflecting on the finding that approaching CC as a perceived threat is strongest in English-speaking countries, more moderate in non-English-speaking Western European countries, and lowest in post-socialist countries [62,76], we assume that updating international research on the subject in the future is timely to examine trends. In addition, repeated research on the subject at the national level seems reasonable.

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editing, E.K.; A.D.K. and D.B.; visualization, E.K.; A.D.K. and D.B.; supervision, E.K.; A.D.K. and D.B. All authors have read and agreed to the published version of the manuscript.

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## Appendix A

**Table A1.** Respondents by settlements and demographic groups. Source: edited by the authors.

Settlements	Number of Respondents	Population (People)	SECAP
Bedő	16	255	yes
Told	16	316	no
Körösszakál	50	886	yes
Gáborján	50	914	no
Újszentmargita	90	1546	yes
Hortobágy	90	1579	no
Debrecen	200	196,858	yes
<b>Complete sample</b>		<b>N = 512</b>	
<b>Demographic groups</b>		<b>Number of respondents</b>	
<b>Gender (representative)</b>			
Women		273	
Men		239	
<b>Age group (representative)</b>			
18–34		153	
35–49		131	
50–64		130	
above 65		98	
<b>Highest educational level (non-representative)</b>			
Primary school or less		110	
Vocational school		94	
Vocational high school		48	
Grammar school		107	
Technical school in higher education		32	
College or university		121	

## Appendix B

**Table A2.** Binary logistic regression results for predicting total concern regarding GW. Source: edited by the authors.

Dependent Variable Independent Variables (Comparative Groups in Brackets)	Total Concern Regarding GW						95% C.I.for Exp(B)	
	B	SE	Wald	df	Sig.	Exp(B)	Lower	Upper
	Gender (Woman)							
Man	0.120	0.232	0.270	1	0.604	1.128	0.716	1.777
	Age (18–34)							
35–49	0.257	0.295	0.761	1	0.383	1.294	0.726	2.307
50–64	1.248	0.331	14.220	1	0.000	3.485	1.821	6.667
above 65	0.806	0.350	5.307	1	0.021	2.240	1.128	4.448
	Highest level of education (Primary school or less)							
Vocational school	−1.112	0.372	8.931	1	0.003	0.329	0.159	0.682
Vocational high school	−0.265	0.459	0.332	1	0.564	0.768	0.312	1.888
Grammar school	−0.708	0.365	3.760	1	0.052	0.493	0.241	1.008
Technical school in higher education	−0.891	0.522	2.915	1	0.088	0.410	0.148	1.141
College/University	−0.293	0.374	0.613	1	0.434	0.746	0.358	1.554
	Considers air pollution concerning (rest of the cases)							
Totally	2.503	0.247	102.737	1	0.000	12.217	7.530	19.823
	Reason of CC (caused totally by human activities)							
Partly artificial, partly natural factors	−1.087	0.473	5.280	1	0.022	0.337	0.133	0.852
Totally natural factors	1.276	0.708	3.252	1	0.071	3.584	0.895	14.347
Don't know/no response	−0.458	0.453	1.020	1	0.312	0.633	0.260	1.538
Not possible to decide based on the response	0.075	0.418	0.032	1	0.857	1.078	0.475	2.446
	Feels CC threatening his/her own life (rest of the cases)							
Totally	0.977	0.260	14.149	1	0.000	2.657	1.597	4.420
	Willing to change his/her lifestyle in order to fight against CC (rest of the cases)							
Yes, for sure	0.013	0.233	0.003	1	0.954	1.013	0.642	1.600
	Purchases, uses energy efficient devices (rest of the cases)							
Always	−0.044	0.269	0.026	1	0.871	0.957	0.565	1.622
	It is possible to act against CC (no)							
Don't know/no response	−0.565	0.623	0.822	1	0.365	0.569	0.168	1.927
Yes	−0.428	0.455	0.883	1	0.347	0.652	0.267	1.591
Constant	−1.217	0.576	4.464	1	0.035	0.296		

## Appendix C

**Table A3.** Binary logistic regression results for predicting total concern regarding CC. Source: edited by the authors.

Dependent Variable Independent Variables (Comparative Groups in Brackets)	Total Concern Regarding CC						95% C.I.for Exp(B)	
	B	SE	Wald	df	Sig.	Exp(B)	Lower	Upper
	Gender (Woman)							
Man	−0.009	0.212	0.002	1	0.965	0.991	0.654	1.502



Table A3. Cont.

Dependent Variable		Total Concern Regarding CC						
Independent Variables (Comparative Groups in Brackets)	B	SE	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Age (18–34)								
35–49	0.304	0.274	1.231	1	0.267	1.355	0.792	2.316
50–64	0.530	0.295	3.240	1	0.072	1.699	0.954	3.026
above 65	0.114	0.319	0.127	1	0.722	1.120	0.600	2.092
Highest level of education (Primary school or less)								
Vocational school	−0.916	0.347	6.973	1	0.008	0.400	0.203	0.790
Vocational high school	−0.251	0.411	0.372	1	0.542	0.778	0.347	1.742
Grammar school	−0.067	0.337	0.040	1	0.842	0.935	0.484	1.809
Technical school in higher education	−0.753	0.489	2.369	1	0.124	0.471	0.180	1.229
College/University	−0.448	0.346	1.676	1	0.195	0.639	0.324	1.259
Considers air pollution concerning (rest of the cases)								
Totally	1.480	0.214	47.846	1	0.000	4.395	2.889	6.685
Reason of CC (caused totally by human activities)								
Partly artificial, partly natural factors	−0.626	0.431	2.109	1	0.146	0.535	0.230	1.245
Totally natural factors	−0.810	0.594	1.859	1	0.173	0.445	0.139	1.425
Don't know / no response	−0.540	0.430	1.573	1	0.210	0.583	0.251	1.355
Not possible to decide based on the response	0.185	0.383	0.234	1	0.629	1.203	0.568	2.550
Feels CC threatening his/her own life (rest of the cases)								
Totally	1.258	0.245	26.365	1	0.000	3.517	2.176	5.684
Willing to change his/her lifestyle in order to fight against CC (rest of the cases)								
Yes, for sure	−0.008	0.213	0.001	1	0.970	0.992	0.654	1.505
Purchases, uses energy efficient devices (rest of the cases)								
Always	0.466	0.250	3.458	1	0.063	1.593	0.975	2.602
It is possible to act against CC (no)								
Don't know / no response	0.259	0.582	0.198	1	0.656	1.296	0.414	4.057
Yes	0.194	0.415	0.220	1	0.639	1.215	0.538	2.740
Constant	−1.433	0.526	7.439	1	0.006	0.238		

## Appendix D

Table A4. Binary logistic regression results for predicting CC as a “very serious” problem. Source: edited by the authors.

Dependent Variable		Considers CC a Very Serious Problem						
Independent Variables (Comparative Groups in Brackets)	B	SE	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Gender (Woman)								
Man	−0.103	0.214	0.232	1	0.630	0.902	0.592	1.373
Age (18–34)								
35–49	−0.094	0.275	0.116	1	0.734	0.911	0.531	1.561
50–64	0.060	0.290	0.043	1	0.836	1.062	0.601	1.876
above 65	−1.073	0.338	10.114	1	0.001	0.342	0.176	0.662

Table A4. Cont.

Dependent Variable	Considers CC a Very Serious Problem						95% C.I. for Exp(B)		
	Independent Variables (Comparative Groups in Brackets)	B	SE	Wald	df	Sig.	Exp(B)	Lower	Upper
	Highest level of education (Primary school or less)								
Vocational school	−0.025	0.352	0.005	1	0.944	0.976	0.490	1.944	
Vocational high school	−0.001	0.421	0.000	1	0.999	0.999	0.438	2.279	
Grammar school	−0.008	0.341	0.001	1	0.982	0.992	0.509	1.937	
Technical school in higher education	0.034	0.481	0.005	1	0.944	1.035	0.403	2.656	
College/University	0.428	0.347	1.523	1	0.217	1.535	0.777	3.031	
Totally	Considers air pollution concerning (rest of the cases)								
	0.808	0.217	13.844	1	0.000	2.244	1.466	3.435	
	Reason of CC (caused totally by human activities)								
Partly artificial, partly natural factors	−0.691	0.432	2.561	1	0.110	0.501	0.215	1.168	
Totally natural factors	−1.272	0.692	3.382	1	0.066	0.280	0.072	1.087	
Don't know/no response	−0.797	0.488	2.662	1	0.103	0.451	0.173	1.174	
Not possible to decide based on the response	0.064	0.395	0.026	1	0.872	1.066	0.491	2.312	
Totally	Feels CC threatening his/her own life (rest of the cases)								
	1.334	0.240	30.801	1	0.000	3.797	2.370	6.083	
Yes, for sure	Willing to change his/her lifestyle in order to fight against CC (rest of the cases)								
	0.931	0.215	18.808	1	0.000	2.537	1.666	3.865	
Always	Purchases, uses energy efficient devices (rest of the cases)								
	−0.379	0.256	2.193	1	0.139	0.684	0.414	1.131	
Don't know/no response	It is possible to act against CC (no)								
Yes	0.066	0.687	0.009	1	0.924	1.068	0.278	4.108	
Constant	1.009	0.472	4.567	1	0.033	2.743	1.087	6.919	
	−1.866	0.563	10.971	1	0.001	0.155			

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