

Article

Public Perceptions on Human Health Risks of Climate Change in Cyprus: 2018 and 2021 Survey Results

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Abstract: Understanding public perceptions on the health impacts of climate change will help to better address planetary health challenges. This study aimed to assess differences in perceptions in the Cypriot population regarding climate-related health risks, information sources used, and self-assessed health status over a three-year period, along with the relationship between sociodemographics and perceptions on climate-related health risks. Two cross-sectional surveys on environmental health risks and climate change, information sources, and self-assessed health were conducted in July–December 2018 ($n = 185$) and August–September 2021 ($n = 202$) among adults living in Cyprus. A descriptive analysis of the survey responses was conducted. Between-survey and within-survey associations were examined among environmental and health risk perceptions and stratified by sociodemographics (age, sex, educational level) using chi-square tests. The perceived views on most questions about environmental health risks and climate change were not different between the two surveys ($p > 0.05$). With environmental factors in mind, such as climate change, pollution, and toxic waste, most respondents ($>72\%$) considered that health issues such as asthma, cancer, obesity, type II diabetes, and high blood pressure would occur much more often or somewhat more often in the next 10 years. In both surveys, the most popular sources of information about environmental health risks were social media/the internet, followed by TV news and TV films and documentaries. Notable differences in several perceptions on climate-related health risks were observed between females and males, while age and educational level did not influence most perceptions. Women were more likely than men to report that environmental factors such as temperature rise, extreme weather events, and air pollution will be extremely influenced by climate change ($p < 0.05$). The study survey populations recognized the important linkages between climate change and human health, including their drivers. Sex was an important factor for differentiated perceptions on environmental health risks and climate change. Such survey results on perceptions about climate change and their impact on population health can be used to inform public awareness and risk communication campaigns.

Keywords: perceptions; survey; climate change; public health; environment



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1. Introduction

Human health and climate change are inextricably linked, with extensive evidence of their interactions. However, not all effects of climate change on human health are well known, and some of these effects are poorly understood. To factor in and forecast how these effects will influence our daily lives and disease trajectories, the planetary health concept was recently coined to describe linkages and systems jointly operating between proximate causes of disease, ecological drivers, and the development of health problems [1]. Climate change may be associated with a documented rise in the incidence of non-communicable diseases, especially cancers [2], and due to changes in temperature and extreme weather

events it is expected that vector-borne and viral diseases will become more prevalent globally [3]. Declining air quality and adverse extreme weather events are predicted to increase in future years as well [4].

In order to develop effective national and local climate mitigation and adaptation policies, it is important to analyse public perceptions of environmental health risks and to identify their underlying drivers. The climate crisis may hit more marginalised population groups in society [5], and understanding how public perceptions might differ among various sociodemographic groups may be important. Information on risk perception and possible gaps in knowledge among various sociodemographic groups can aid policy makers in developing tailored policies against climate change that enjoy higher acceptance rates by the public. The general public mostly evaluates risks according to subjective perceptions, intuitive judgements, and information from media coverage [6], whereas, climate change experts and policy makers likely tend to base their risk perceptions more on research findings [7]. There is a considerable gap between expert assessments and the lay understanding of climate change health risks, as exemplified in the recent Intergovernmental Panel on Climate Change report [8].

Whereas the projected global temperature rise is likely to range from 1.8 °C to 4.0 °C [9,10] over the 21st century, the largest warming phenomena for Europe are likely to be manifested over southern Europe and the Mediterranean region during warmer months, with annual mean temperature increases potentially anticipated to be as large as 5.5 °C [11]. This is relevant for people living in the Mediterranean region, as it is a hot spot for climate change that has been hit hard by rising air temperatures, droughts, reduction in air quality, and adverse weather events, all of which are projected to increase in future years [11]. Forecasts for the Mediterranean region indicate that the mean temperature is expected to rise by about 1–3 °C in the next three decades and between 3.5–7 °C by the end of the 21st century, ranking the region ahead of projected global temperature changes [11]. In particular, the Eastern Mediterranean area is anticipated to become a future ‘hot spot’, with air temperatures surpassing 38 °C during multiple weeks per year [12]. The effects of climate change in Cyprus have been extensively manifested in recent years. Nicosia, the capital of Cyprus, reached 46 °C in September 2020, the highest daily maximum temperature ever recorded in the city. The Eastern Mediterranean and Middle East will face an increase in the occurrence and intensity of heat waves [13]. Cyprus already suffers from the highest level of water stress in Europe, and this trend is anticipated to continue in the near future [14].

Thus, this study aimed to explore whether Cypriot public perceptions regarding climate-related health risks, the choice of information sources, and self-assessed health differed over a three-year time period, along with whether perceptions on climate-related health risks were influenced by sociodemographic factors such as sex, age, and educational level. Two online cross-sectional surveys took place three years apart, in 2018 and 2021.

2. Methods

2.1. Study Design and Population

The first survey was conducted from 5 July to 31 December 2018, and the second from 13 August to 25 September 2021, both online. Eligible participants were adults (≥ 18 years old) currently living in Cyprus, and both convenience and snowball sampling were used in both surveys. The general public was informed about the second study via social media posts and electronic mailing lists of Cyprus University of Technology, while social media posts, electronic mailing lists of Cyprus University of Technology, and an article in the *Phileleftheros* Cyprus-wide newspaper were used to spread awareness about the first survey. Both surveys were open (i.e., everyone with the link could respond) and did not collect any personal information. The first survey was hosted at the EUSurvey platform [15] and the second on REDCap [16]. We assumed that different people were surveyed in 2018 and 2021, as no identifiers were included in the two surveys and we could not know whether there were people who responded to both surveys. The Cyprus National Bioethics Committee approved both surveys (EEBK/EII/2018.01.113 and EEBK/EII/2021.01.173).

2.2. Data Collection

The questionnaires consisted of four parts: self-assessed health, environmental health risks and climate change, information sources, and demographics (SI_1). Extra categories for SARS-CoV-2/COVID-19 and mental health were added in some questions of the 2021 survey, as it took place during the COVID-19 pandemic period. Details on the tools used in the development of the questionnaire can be found in the Supplementary Materials (SI_2).

2.3. Statistical Analysis

Descriptive statistics of the two surveys are reported as means with standard deviations (SD) for continuous variables or as sample size and percentages for categorical variables. The scoring rules of the SF-36 Health Survey [17] were applied, and all items were scored using a scale from 0 to 100, meaning that a high score corresponds to a positive health status. The scales obtained from the self-assessed health part of the questionnaires were tested for their internal consistency using Cronbach's alpha.

Associations of perceptions on environmental health risks, the information sources and health status of participants between the 2018 and 2021 surveys, and associations between perceptions on environmental health risks and sociodemographic variables were explored by cross-tabulation and tested using Pearson's chi-square test.

Sociodemographic variables included sex (female, male), age (18–34, 35–54, >54 years of age), and educational level (non-university, university-bachelor's degree, postgraduate or PhD). We selected this age group categorization so that the three age groups would each have an adequate number of respondents for associations to be made. One participant who selected to not disclose sex identity was excluded from the associations with sociodemographics. The chi-square test assumption that the expected value of cell counts should be ≥ 5 in at least 80% of cells was satisfied by re-grouping categorical variables (SI_2, Table S1).

All analyses were conducted in R 4.2.1 with RStudio 2022.02.3.

3. Results

3.1. Study Population Characteristics

In the 2018 survey, 194 questionnaires were completed, of which nine were excluded for not satisfying the criterion of living in Cyprus at that time. Similarly, in the 2021 survey, 207 questionnaires were completed, of which 202 were included in the analysis, excluding five respondents who did not live in Cyprus. Most respondents were female (61% in 2021 vs. 55% in 2018), while the median age of the respondents was 36 years in 2021 and 39 years in 2018 (Table 1). Most respondents reported a high level of education (80% holding at least a university degree in both years) and were employed or self-employed (71% in 2021 vs. 77% in 2018). In the 2021 survey, 46% reported being married and 43% having child(ren), while 59% reported being married and 60% having child(ren) in 2018. Most respondents' current residence was either in Limassol (48% 2021 vs. 44% 2018) or Nicosia (36% 2021 vs. 38% 2018) districts, and 48% (2021) and 37% (2018) described their place of residence as a large city.

Table 1. Demographic characteristics of survey respondents (2018 and 2021).

	2021	2018	<i>p</i> -value *
Number of responses	202	185	
Age in years (mean (SD))	36 (12.8)	41 (14.7)	
Age category (%)			0.002
18–34 years	98 (48.5)	69 (37.3)	
35–54 years	85 (42.1)	76 (41.1)	
>54 years	19 (9.4)	40 (21.6)	

Table 1. Cont.

	2021	2018	<i>p</i> -value *
Sex			0.233
Female	124 (61.4)	101 (54.6)	
Male	77 (38.1)	84 (45.4)	
Prefer not to say	1 (0.5)	NA	
Place of birth (%)			0.069
Large city	118 (58.4)	97 (52.4)	
Suburb near large city	17 (8.4)	29 (15.7)	
Small city	31 (15.3)	35 (18.9)	
Rural	36 (17.8)	24 (13.0)	
Educational level (%)			0.029
I have never been to school/Non complete primary school	1 (0.5)	1 (0.5)	
High School/Vocational High School (diploma)	21 (10.4)	19 (10.3)	
Higher (after high school) non-tertiary Education	8 (4.0)	0 (0.0)	
Higher Tertiary Education (non-university)	10 (5.0)	13 (7.0)	
University (Bachelor's degree)	59 (29.2)	37 (20.0)	
University- Postgraduate (Master's Degree)	73 (36.1)	76 (41.1)	
PhD	30 (14.9)	39 (21.1)	
Occupational status (%)			0.001
Employed/self-employed	145 (71.8)	143 (77.3)	
Retired	5 (2.5)	18 (9.7)	
Student	30 (14.9)	18 (9.7)	
Unemployed/Out of employment	20 (9.9)	5 (2.7)	
Housekeeping	2 (1.0)	1 (0.5)	
District (%)			0.398
Paphos	10 (5.0)	19 (10.3)	
Limassol	96 (47.5)	81 (43.8)	
Nicosia	73 (36.1)	70 (37.8)	
Famagusta	4 (2.0)	3 (1.6)	
Larnaka	17 (8.4)	11 (5.9)	
Another district	2 (1.0)	1 (0.5)	
Place of residence description (%)			0.197
Large city	97 (48.0)	69 (37.3)	
Suburb near large city	42 (20.8)	47 (25.4)	
Small city	29 (14.4)	34 (18.4)	
Rural	34 (16.8)	35 (18.9)	
Community rate as a place to live (%)			0.036
Very good	67 (33.2)	86 (46.5)	
Somewhat good	109 (54.0)	83 (44.9)	
Somewhat bad	19 (9.4)	15 (8.1)	
Very bad	5 (2.5)	1 (0.5)	
Don't know	2 (1.0)	0 (0.0)	
Marital status (%)			0.001
Unmarried	100 (49.5)	56 (30.3)	
Married	93 (46.0)	109 (58.9)	
Divorced	7 (3.5)	16 (8.6)	
Widowed	2 (1.0)	4 (2.2)	0.001
Children (%)			
Yes	86 (42.6)	110 (59.5)	
No	116 (57.4)	75 (40.5)	

* *p*-value based on chi-square test. The variables (characteristics) are shown in bold text and the variables' categories are shown in plain text.

3.2. Differences in Perceptions between 2018 and 2021

3.2.1. Environmental Health Risks and Climate Change Perceptions

The perceived views on most questions about environmental health risks and climate change did not differ between the two surveys ($p > 0.05$), with the exception of the perceived role of environmental factors in causing asthma in children ($p = 0.046$) and the perceived

level of danger for exposure to toxic waste on human health ($p = 0.025$) (Tables S2–S8). Specifically, 83% of the respondents in 2018 considered that environmental factors played a major role in causing asthma in children, compared to 74% having the same views in the 2021 survey (Table S5). Similarly, more respondents in 2018 than 2021 considered toxic waste to pose very serious danger for their health (83% vs. 72%, Table S8).

Overall, most respondents reported that they have observed extreme evidence of climate change on the planet (49% in 2021 vs. 42% in 2018), followed by observing quite a bit of evidence of climate change for 34% in 2021 vs. 43% of respondents in 2018 (Table S2). With environmental factors such as climate change, pollution, and toxic waste in mind, most respondents considered that health issues such as asthma (92% in 2021 and 2018), cancer (88% in 2021 vs. 90% in 2018), obesity (73% in 2021 vs. 75% in 2018), type II diabetes (72% in 2021 vs. 74% in 2018), and high blood pressure (77% in 2021 vs. 82% in 2018) would occur much more frequently or somewhat more frequently in the next ten years (Table S3). The most frequently reported environmental factors that would be extremely influenced by climate change were temperature rise (78% in 2021 vs. 76% in 2018), extreme weather events (74% in 2021 and 2018), and air pollution (67% in 2021 vs. 66% in 2018) (Table S4).

Most respondents reported that environmental factors play a major role in causing allergy problems (86% in 2021 vs. 89% in 2018), asthma in children (74% in 2021 vs. 83% in 2018) and adults (74% in 2021 vs. 78% in 2018), and cancer in children (71% in 2021 vs. 77% in 2018), whereas fewer respondents reported the same for illnesses such as vector borne diseases, thyroid, brain, and breast cancers, and birth defects (Table S5). Fewer than half of the respondents reported that they were able to do a great deal of things to protect themselves from infectious diseases (46% in 2021 vs. 40% in 2018) and health problems caused by environmental problems (44% in 2021 vs. 41% in 2018), while fewer than 10% of the respondents believed that they could do nothing to protect themselves from the problems mentioned above or that they did not know how to protect themselves from these problems (Table S6).

Environmental factors were reported as being very important in causing diseases (77% in 2021 vs. 81% in 2018) (Table S8). Chemicals in water and food (78% in 2021 vs. 85% in 2018), air pollution (75% in 2021 vs. 83% in 2018), toxic waste (72% in 2021 vs. 83% in 2018), and water pollution (71% in 2021 vs. 81% in 2018) were reported by most respondents as posing very serious dangers to health (Table S8). Flooding, noise pollution, and invasive species were perceived as the environmental factors with the least danger for health, as less than half of the respondents reported that they pose a somewhat major danger to health (Table S8).

3.2.2. Information Sources

In both surveys, the most popular sources of information about environmental health risks were social media/the internet (80% in 2021 vs. 83% in 2018), followed by TV news (62% in both 2021 and 2018) and TV films and documentaries (64% in 2021 vs. 57% in 2018) (Table 2). Less popular sources of information were publications/brochures/information materials (45% in 2018 vs. 27% in 2021), events such as conferences, fairs exhibitions, festivals, etc. (30% in 2018 vs. 5% in 2021), and the radio (24% in 2018 vs. 7% in 2021). It was noteworthy that almost 44% of respondents in 2021 chose politicians as an information source about environmental health risks, in contrast to 2018, when only 1% of respondents selected this source (Table 2).

Table 2. Preferred information sources used to receive information regarding environmental health risks to the 2018 and 2021 survey question: “Choose up to five sources of information where you get information about environmental health risks from”.

Information Sources	2018	2021
	N (%)	N (%)
Social media and the internet	153 (83)	162 (80)
Television news	115 (62)	125 (62)
Films and documentaries on television	106 (57)	130 (64)
Publications, brochures or information materials	84 (45)	55 (27)
Education/Lectures/Courses	79 (43)	92 (46)
Events (conferences, fairs exhibitions, festivals, etc.)	56 (30)	10 (5)
Conversations with relatives, family, friends, neighbours	51 (28)	74 (37)
Newspapers	47 (25)	43 (21)
The radio	44 (24)	14 (7)
Books	37 (20)	61 (30)
Medical doctors	32 (17)	43 (21)
Magazines	22 (12)	41 (20)
Other	8 (4)	13 (6)
Politicians	1 (1)	88 (44)

For both surveys, education/lectures/courses (85% in 2021 vs. 89% in 2018) and books (80% in 2021 vs. 87% in 2018), followed by events such as conferences, fairs, etc. (78% in 2021 vs. 79% in 2018), medical doctors (74% in 2021 vs. 76% in 2018), and publications/brochures/information materials (70% in 2021 vs. 78% in 2018) were perceived as the most reliable sources of information (Table S9). Social media and the internet, TV news, and TV films/documentaries were perceived as less reliable in 2021 compared to 2018 ($p < 0.05$, Figure 1).

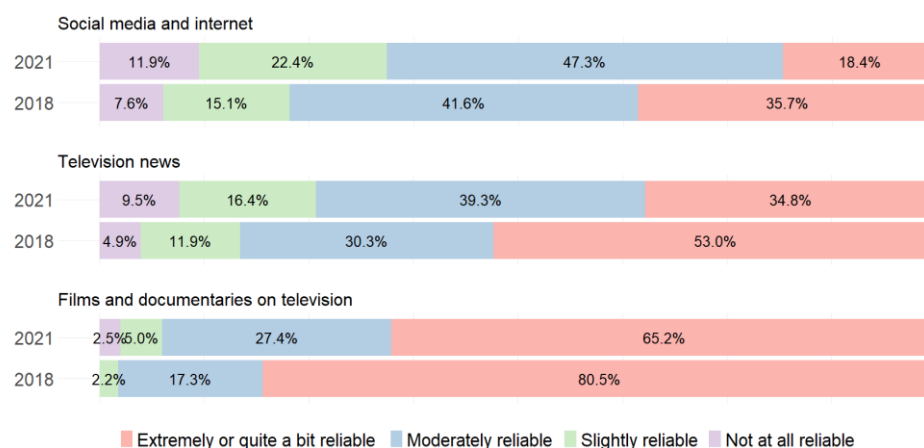


Figure 1. Perceived reliability of information sources in the 2018 and 2021 survey question “How reliable do you consider the following information sources to be?” Only information sources for which perceived reliability was significantly different between the two surveys are shown.

Most respondents in both surveys reported they would like to have more information about the state of the environment in their community (76% in 2021 vs. 85% in 2018, $p < 0.05$), the impact of climate change on the Cypriot population (81% in 2021 vs. 87% in 2018), and recommendations on what they can do to protect themselves and their family from environmental health problems (79% in 2021 vs. 87% in 2018) and from the consequences of climate change (79% in 2021 vs. 88% in 2018) (Table S10).

The top sources of information as identified by the respondents to both surveys for receiving information in the future regarding environmental health risks were social media and the internet (68% in 2021 vs. 72% in 2018), TV news (55% in 2021 vs. 56% in 2018), and

TV films/documentaries (51% in 2021 vs. 50% in 2018) (Table S11). However, dissimilarities in perceptions between the two survey years were observed for some sources of information, such as radio, medical doctors, magazines, publications/brochures/information materials, and events. Notably, 54% of respondents to the 2021 survey selected politicians as a source of information through which they would like to receive information regarding environmental health risks, compared to 3% of respondents in 2018 who selected this information source.

3.2.3. Self-Assessed Health

In general, the perceptions for own health assessment were not different between the two survey years ($p = 0.105$, Table S12). About half of the respondents assessed their health as very good (49% in 2021 vs. 57% in 2018), while very few considered their state of health as poor or average (2% in 2021 vs. 5% in 2018). Except for the energy/fatigue scale, all health scales had a mean score above 55 (Table S13). The scales of physical functioning (93 in 2021 vs. 88 in 2018) and role limitations due to physical health (81 in 2021 vs. 78 in 2018) had the highest mean scores, whereas scales related to psychological or emotional health (energy/fatigue scale (55 in 2021 vs. 54 in 2018) and emotional well-being (60 in 2021 vs. 63 in 2018)) scored the lowest. These scores indicate that the respondents perceived their physical health as being better than their psychological/emotional health. The mean score for health change scale (55 in 2021 vs. 52 in 2018) indicated that respondents assessed their current health to be about the same compared to a year ago. All scales had an acceptable Cronbach's alpha (coefficient ≥ 0.70), suggesting that the items comprising each scale have relatively good internal consistency.

3.3. Associations of Perceptions on Environmental Health Risks and Climate Change with Sociodemographics

We evaluated whether the respondents' perceptions of environmental health risks and climate change were affected by sociodemographic factors (sex, educational level, and age). Significant differences were observed for several perceptions between males and females in both surveys, while educational level and age did not affect most perceptions.

Regarding sex differences, in both surveys more females than males stated that they have observed extreme evidence of climate change (Table S14). Comparably, in the 2021 survey more female than male respondents reported that mental health problems (65% vs. 35%), cancer (57% vs. 33%), asthma (55% vs. 35%), infectious diseases (48% vs. 29%), obesity (44% vs. 25%), high blood pressure (40% vs. 20%), and type II diabetes (40% vs. 17%) will, keeping environmental factors in mind, occur much more often in the next ten years (Table 3). This contrast was not as apparent in the 2018 survey, except for the perceptions concerning cancer and asthma; a higher percentage of women than men reported that cancer (65% vs. 43%, $p = 0.004$) and asthma (59% vs. 38%, $p = 0.01$) will occur much more often in the next ten years.

In both surveys, more women compared to men reported that environmental factors such as temperature rise (82–84% vs. 68–69%), extreme weather events (80–81% vs. 63–66%), and air pollution (75–80% vs. 44–55%) will be extremely influenced by climate change ($p < 0.05$), (Table 4).

Regarding the perceived degree of danger to human health from environmental factors, the percentage of women compared to men who believed that environmental factors such as air (85–90% vs. 58–74%), water (82–87% vs. 53–73%), and agricultural (70–71% vs. 42–48%) pollution, chemicals in water and food (86–94% vs. 64–75%), and toxic waste (82–87% vs. 55–79%) pose a very serious danger to human health was consistently higher ($p < 0.05$) in both surveys (Table 5).

Table 3. Perceived frequency of health issues in next ten years, by sex, in 2018 and 2021 survey question: “With environmental factors such as climate change, pollution, and toxic waste in mind, how often do you think the following health issues will occur in ten years compared to now in Cyprus?”.

	Female (2021) N (%)	Male (2021) N (%)	<i>p</i> -value *	Female (2018) N (%)	Male (2018) N (%)	<i>p</i> -value *
Number of responses	124	77		101	84	
The amount of people with an injury			0.129			0.176
Much more	17 (13.7)	11 (14.3)		21 (20.8)	9 (10.7)	
Somewhat more	49 (39.5)	20 (26.0)		37 (36.6)	36 (42.9)	
About the same or less	58 (46.8)	46 (59.7)		43 (42.6)	39 (46.4)	
The amount of people with asthma			0.001			0.010
Much more	68 (54.8)	27 (35.1)		60 (59.4)	32 (38.1)	
Somewhat more	52 (41.9)	37 (48.1)		36 (35.6)	42 (50.0)	
About the same or less	4 (3.2)	13 (16.9)		5 (5.0)	10 (11.9)	
The amount of people with cancer			<0.001			0.004
Much more	71 (57.3)	25 (32.5)		66 (65.3)	36 (42.9)	
Somewhat more	47 (37.9)	33 (42.9)		30 (29.7)	35 (41.7)	
About the same or less	6 (4.8)	19 (24.7)		5 (5.0)	13 (15.5)	
The amount of people with obesity			<0.001			0.972
Much more	55 (44.4)	19 (24.7)		32 (31.7)	28 (33.3)	
Somewhat more	47 (37.9)	26 (33.8)		43 (42.6)	35 (41.7)	
About the same or less	22 (17.7)	32 (41.6)		26 (25.7)	21 (25.0)	
The amount of people with diabetes type 2			0.001			0.604
Much more	49 (39.5)	13 (16.9)		30 (29.7)	25 (29.8)	
Somewhat more	48 (38.7)	34 (44.2)		47 (46.5)	34 (40.5)	
About the same or less	27 (21.8)	30 (39.0)		24 (23.8)	25 (29.8)	
The amount of people with high blood pressure			0.004			0.467
Much more	50 (40.3)	15 (19.5)		42 (41.6)	30 (35.7)	
Somewhat more	52 (41.9)	37 (48.1)		44 (43.6)	36 (42.9)	
About the same or less	22 (17.7)	25 (32.5)		15 (14.9)	18 (21.4)	
The amount of people with infectious diseases			0.003			
Much more	60 (48.4)	22 (28.6)		NA	NA	
Somewhat more	45 (36.3)	29 (37.7)		NA	NA	
About the same or less	19 (15.3)	26 (33.8)		NA	NA	
The amount of people with mental health problems			<0.001			
Much more	81 (65.3)	27 (35.1)		NA	NA	
Somewhat more	33 (26.6)	32 (41.6)		NA	NA	
About the same or less	10 (8.1)	18 (23.4)		NA	NA	

* Statistical *p*-value based on chi-square test. The health issues are shown in bold text.

In both surveys environmental factors were reported as being very important in causing diseases by more females than males (86–90% vs. 64–69%) (Table S15), while more female respondents perceived that environmental factors play a major role in causing allergy problems, cancer in children, breast, prostate, brain, and thyroid cancer, obesity, diabetes type II, vector-borne diseases, and infectious diseases (Table S16).

A few differences by educational level and age were observed in the 2021 survey (Tables S17–S44). A larger percentage of respondents holding a bachelor’s degree (41%) or higher (34%) compared to respondents with no university degree perceived that SARS-CoV-2 poses a somewhat serious danger to health ($p = 0.03$, Table S21). For the same question, age differences were observed as well; more respondents in the older age groups (44% and 53%) compared to the 18–34 year-old group (31%) considered that SARS-CoV-2 poses a very serious danger to health ($p = 0.015$, Table S28). The percentage of respondents with no university degree (23%) who believed that environmental factors play a minor role in causing high blood pressure was half the percentage of respondents holding a university

degree (47%) or higher (44%) ($p = 0.02$, Table S22). Age differences were observed for the same question for a different disease as well; more respondents in the older age groups (86% and 79%) compared to the 18–34 age group (63%) perceived that environmental factors play a major role in causing asthma in children ($p = 0.015$, Table S29).

Similarly, in the 2018 survey there were a few differences in perceptions by age or educational level (Tables S31–S44). Specifically, more respondents with a master’s degree or PhD compared to respondents with lower educational levels perceived that environmental factors play a major role in causing infertility, and fewer respondents with a bachelor’s degree believed that environmental factors play a major role in causing prostate cancer (27%) and thyroid cancer (41%) compared to respondents with no university degree and a postgraduate or PhD degree (Table S36). Fewer respondents in the over 55 years age group perceived that temperature rise (65%) and radiation level (43%) will be extremely influenced by climate compared to the other two younger age groups (Table S40). A similar trend was observed for views on the danger level of environmental factors, with fewer respondents over 55 years old believing that water pollution (68%), toxic waste (70%), and biodiversity loss (30%) pose very serious dangers to health compared to respondents in the younger age groups (Table S42). With regard to the role of environmental factors in causing illnesses, more respondents in the 18–34-year-old age group believed that environmental factors play a major role in causing vector-borne (80%) and infectious (62%) diseases compared to the two older age groups (Table S43).

Table 4. Perceived influence level of environmental factors by climate change, by sex, to the 2018 and 2021 survey question: “To what degree do you think that the following factors are being influenced by climate change?”.

	Female (2021) N (%)	Male (2021) N (%)	<i>p</i> -value *	Female (2018) N (%)	Male (2018) N (%)	<i>p</i> -value *
Number of responses	117	71		101	84	
Temperature rise (global warming)			0.028			0.049
Extremely influenced	98 (83.8)	48 (67.6)		83 (82.2)	58 (69.0)	
Quite a bit influenced	15 (12.8)	16 (22.5)		15 (14.9)	17 (20.2)	
Moderately, Slightly or Not influenced	4 (3.4)	7 (9.9)		3 (3.0)	9 (10.7)	
Extreme weather events			0.037			0.037
Extremely influenced	94 (80.3)	45 (63.4)		82 (81.2)	55 (65.5)	
Quite a bit influenced	17 (14.5)	19 (26.8)		13 (12.9)	23 (27.4)	
Moderately, Slightly or Not influenced	6 (5.1)	7 (9.9)		6 (5.9)	6 (7.1)	
Contamination of air (%)			<0.001			0.004
Extremely influenced	94 (80.3)	31 (43.7)		76 (75.2)	46 (54.8)	
Quite a bit influenced	18 (15.4)	22 (31.0)		19 (18.8)	21 (25.0)	
Moderately, Slightly or Not influenced	5 (4.3)	18 (25.4)		6 (5.9)	17 (20.2)	
Contamination of water			<0.001			0.003
Extremely influenced	84 (71.8)	21 (29.6)		69 (68.3)	39 (46.4)	
Quite a bit influenced	24 (20.5)	29 (40.8)		22 (21.8)	23 (27.4)	
Moderately, Slightly or Not influenced	9 (7.7)	21 (29.6)		10 (9.9)	22 (26.2)	
Contamination of food			<0.001			<0.001
Extremely influenced	75 (64.1)	16 (22.5)		65 (64.4)	31 (36.9)	
Quite a bit influenced	26 (22.2)	31 (43.7)		25 (24.8)	27 (32.1)	
Moderately, Slightly or Not influenced	16 (13.7)	24 (33.8)		11 (10.9)	26 (31.0)	
Contamination of land			<0.001			0.002
Extremely influenced	88 (75.2)	21 (29.6)		65 (64.4)	36 (42.9)	
Quite a bit influenced	17 (14.5)	26 (36.6)		26 (25.7)	24 (28.6)	
Moderately, Slightly or Not influenced	12 (10.3)	24 (33.8)		10 (9.9)	24 (28.6)	
Radiation level			<0.001			<0.001
Extremely influenced	88 (75.2)	35 (49.3)		66 (65.3)	35 (41.7)	
Quite a bit influenced	22 (18.8)	20 (28.2)		29 (28.7)	23 (27.4)	
Moderately, Slightly or Not influenced	7 (6.0)	16 (22.5)		6 (5.9)	26 (31.0)	

* Statistical *p*-value based on chi-square test. The environmental factors are shown in bold text.

Table 5. Perceived danger level of environmental factors for health, by sex, to the 2018 and 2021 survey question: “How dangerous do you think the following environmental exposures are for your health?”

	Female (2021) N (%)	Male (2021) N (%)	<i>p</i> -value *	Female (2018) N (%)	Male (2018) N (%)	<i>p</i> -value *
Number of responses	124	77		101	84	
Air pollution			<0.001			0.006
Very serious danger	105 (84.7)	45 (58.4)		91 (90.1)	62 (73.8)	
Somewhat serious danger	18 (14.5)	26 (33.8)		10 (9.9)	18 (21.4)	
Somewhat minor danger or No danger at all or Don't know	1 (0.8)	6 (7.8)		0 (0.0)	4 (4.8)	
Water pollution			<0.001			0.014
Very serious danger	102 (82.3)	41 (53.2)		88 (87.1)	61 (72.6)	
Somewhat serious danger	20 (16.1)	29 (37.7)		12 (11.9)	16 (19.0)	
Somewhat minor danger or No danger at all or Don't know	2 (1.6)	7 (9.1)		1 (1.0)	7 (8.3)	
Chemicals in water and food			<0.001			0.001
Very serious danger	107 (86.3)	49 (63.6)		95 (94.1)	63 (75.0)	
Somewhat serious danger	16 (12.9)	22 (28.6)		6 (5.9)	16 (19.0)	
Somewhat minor danger or No danger at all or Don't know	1 (0.8)	6 (7.8)		0 (0.0)	5 (6.0)	
(Toxic) waste			<0.001			0.197
Very serious danger	102 (82.3)	42 (54.5)		88 (87.1)	66 (78.6)	
Somewhat serious danger	17 (13.7)	26 (33.8)		9 (8.9)	15 (17.9)	
Somewhat minor danger or No danger at all or Don't know	5 (4.0)	9 (11.7)		4 (4.0)	3 (3.6)	
Heatwave			<0.001			0.009
Very serious danger	65 (52.4)	23 (29.9)		50 (49.5)	23 (27.4)	
Somewhat serious danger	51 (41.1)	30 (39.0)		41 (40.6)	49 (58.3)	
Somewhat minor danger or No danger at all or Don't know	8 (6.5)	24 (31.2)		10 (9.9)	12 (14.3)	
Flooding			<0.001			0.001
Very serious danger	48 (38.7)	16 (20.8)		39 (38.6)	13 (15.5)	
Somewhat serious danger	55 (44.4)	26 (33.8)		40 (39.6)	39 (46.4)	
Somewhat minor danger or No danger at all or Don't know	21 (16.9)	35 (45.5)		22 (21.8)	32 (38.1)	
Water scarcity			0.002			0.008
Very serious danger	74 (59.7)	32 (41.6)		64 (63.4)	35 (41.7)	
Somewhat serious danger	41 (33.1)	27 (35.1)		31 (30.7)	37 (44.0)	
Somewhat minor danger or No danger at all or Don't know	9 (7.3)	18 (23.4)		6 (5.9)	12 (14.3)	
Agricultural pollution			<0.001			0.004
Very serious danger	87 (70.2)	32 (41.6)		72 (71.3)	40 (47.6)	
Somewhat serious danger	34 (27.4)	35 (45.5)		22 (21.8)	36 (42.9)	
Somewhat minor danger or No danger at all or Don't know	3 (2.4)	10 (13.0)		7 (6.9)	8 (9.5)	
Noise pollution			0.037			0.546
Very serious danger	44 (35.5)	21 (27.3)		26 (25.7)	19 (22.6)	
Somewhat serious danger	47 (37.9)	22 (28.6)		42 (41.6)	31 (36.9)	
Somewhat minor danger or No danger at all or Don't know	33 (26.6)	34 (44.2)		33 (32.7)	34 (40.5)	
Consumption habits			0.026			0.885
Very serious danger	65 (52.4)	26 (33.8)		41 (40.6)	33 (39.3)	
Somewhat serious danger	39 (31.5)	30 (39.0)		39 (38.6)	31 (36.9)	
Somewhat minor danger or No danger at all or Don't know	20 (16.1)	21 (27.3)		21 (20.8)	20 (23.8)	

Table 5. Cont.

	Female (2021) N (%)	Male (2021) N (%)	<i>p</i> -value *	Female (2018) N (%)	Male (2018) N (%)	<i>p</i> -value *
Invasive species			0.013			0.025
Very serious danger	35 (28.2)	15 (19.5)		26 (25.7)	11 (13.1)	
Somewhat serious danger	52 (41.9)	23 (29.9)		40 (39.6)	29 (34.5)	
Somewhat minor danger or No danger at all or Don't know	37 (29.8)	39 (50.6)		35 (34.7)	44 (52.4)	
Exhaustion of natural resources			0.035			0.105
Very serious danger	69 (55.6)	31 (40.3)		60 (59.4)	38 (45.2)	
Somewhat serious danger	42 (33.9)	29 (37.7)		32 (31.7)	32 (38.1)	
Somewhat minor danger or No danger at all or Don't know	13 (10.5)	17 (22.1)		9 (8.9)	14 (16.7)	
Biodiversity loss			0.013			0.031
Very serious danger	67 (54.0)	29 (37.7)		54 (53.5)	33 (39.3)	
Somewhat serious danger	43 (34.7)	28 (36.4)		34 (33.7)	28 (33.3)	
Somewhat minor danger or No danger at all or Don't know	14 (11.3)	20 (26.0)		13 (12.9)	23 (27.4)	
Soil degradation			0.011			0.001
Very serious danger	67 (54.0)	26 (33.8)		57 (56.4)	25 (29.8)	
Somewhat serious danger	37 (29.8)	28 (36.4)		29 (28.7)	46 (54.8)	
Somewhat minor danger or No danger at all or Don't know	20 (16.1)	23 (29.9)		15 (14.9)	13 (15.5)	
SARS-CoV-2 (virus causing COVID-19)			0.147			
Very serious danger	54 (43.5)	23 (29.9)		NA	NA	
Somewhat serious danger	38 (30.6)	28 (36.4)		NA	NA	
Somewhat minor danger or No danger at all or Don't know	32 (25.8)	26 (33.8)		NA	NA	

* Statistical *p*-value based on chi-square test. The environmental factors are shown in bold text.

4. Discussion

We used data from two adult surveys conducted three years apart (2018 and 2021) to assess perceptions of the general population of Cyprus on topics associated with the climate and health nexus. While the two surveys did not use the same respondents, their samples were both drawn from the adult population of Cyprus. Most respondents to both surveys were aware of climate change evidence and the environmental impact of climate change, including linkages between environmental components and non-communicable diseases (NCDs); most perceptions did not differ over the three-year period in which the surveys took place. We observed differences by sex in most perceptions of climate-related environmental health risks, while age and educational level were not as important as factors affecting perceptions.

The perceptions of both surveys' respondents were in accordance with the planetary health framework [1], with more than half of the respondents reporting that ecological drivers such as climate change could alter proximate causes of disease, such as extreme weather events, including air, water, and food pollution. Respondents to both surveys recognized the link between proximate causes of disease and specific health outcomes; the majority reported that, accounting for environmental factors, the incidence of NCDs will be higher in the next decade and that environmental exposures are dangerous for human health.

A European study conducted in 2015 [18] with an online survey of experts ($n = 104$), focus groups of lay people ($n = 108$), and a Eurobarometer public survey on the attitudes of European citizens towards the environment found that the top four environmental risks were the same as the ones reported in this survey (air pollution, water pollution, chemicals, and waste). However, compared to the expert assessment, there was agreement on only one out of four risks (air pollution), as the other top three environmental risks reported

by experts were urban problems, consumption habits, and agricultural pollution [18]. Additionally, invasive species were ranked as the lowest risk by all three groups [18]; similarly, here it was reported as the environmental parameter with the lowest health risk.

Communication strategies need to be reliably developed by credible sources and routed through the most popular information channels to the target audiences. Interestingly, the top sources of information for environmental health risks, i.e., social media, the internet, and TV news, were not considered reliable by the respondents. However, the respondents called for more information on environmental health risks and climate change from social media, the internet, and TV news.

The level of trust in institutions and experts is considered an important parameter affecting the public perceptions. In a U.S. survey, the most trusted sources of information about global warming-related health problems were primary-care doctors, family/friends, and the CDC [19]; however, the study was conducted in 2014, and it is possible that these perceptions may have changed. In a 2015 European study, a lack of trust in institutions as well as in mass media was observed, and could be associated with increased concern for environmental risks [18]. However, respondents reported that technology and science could provide solutions to environmental health risks; hence, institutions ought to find the means to better communicate information through the different channels used by the public (social media, television news, educational material) so that the messages disseminated about the links between climate change and environmental health risks are clear and specific. It is of note that worldwide media coverage of both health and climate change increased substantially (by 96%) from 2018 to 2019 [20].

Differences by sex were observed for perceptions of environmental health risks and climate change in both surveys. In this study, we observed only a few differences in perceptions by age, while US national survey data in 2015 showed that areas across USA with older populations perceived lower health risks from heat [21]. Similarly, a public survey in the USA in 2004 observed that older respondents showed less concern for climate change than younger respondents [22]. Age was shown to affect perceptions of climate change impact, while education was shown to be the most important factor on the understanding of environmental hazards in a study with face-to-face interviews in Serbia in 2020 [23]. In a mixed-methods study in Vietnam (2013), respondents with higher educational levels were more aware of climate change and its impacts [24]. In our study, most perceptions of environmental health risks did not differ by educational level, however, the majority of respondents were highly educated.

Based on the latest Eurobarometer survey in Cyprus ($n = 504$), about 83% reported that climate change was a very serious problem and 75% reported that they tend to totally agree with the view that adapting to the adverse impacts of climate change could have positive outcomes for citizens in the EU [25]; both reported percentages were above the EU average. These findings corroborated those found in this study, where the majority of respondents reported that environmental factors such as temperature rise, extreme weather events, and air pollution will be extremely influenced by climate change.

Responses to our surveys might have been influenced by meteorological phenomena that occurred during the study execution period. In effect, the average daily maximum temperature of the month of August from 1983 to 2017 in the Nicosia capital city of Cyprus ranged between 34.5 °C and 37.7 °C, while from 2018 to 2021 the average August daily maximum temperature in Nicosia steadily rose from 38.5 °C in 2018 to 39.8 °C in 2021 [26]. At the global level, the World Meteorological Organization (WMO) reported that 2019 ended with a global average temperature of 1.1 °C above estimated pre-industrial levels [27], and 2020 was one of the three warmest years on record, despite a cooling La Niña event [28]. Global mean sea level reached a new record high in 2021, and the maximum temperature measured in an agrometeorological station near Syracuse in Sicily on 11 August 2021 reached 48.8 °C, a provisional European record [29].

This study showed that both surveys' populations recognized the important linkages between climate change and human health, including their drivers, as depicted in the

planetary health model. Yet, as has been shown, prioritization of environmental risks may be influenced by local conditions for both experts and lay people [18], and it would be interesting to see how Cypriot scientists and experts would evaluate the various climate and health risks in comparison with the general public. Moreover, along with local conditions, lay people are influenced by their individual identity and background [30]; hence, a more representative sample of the Cypriot population would provide a more comprehensive picture of the population's perceptions. Political and demographic factors were found to be significant predictors of climate change beliefs and concern across 22 European countries and Israel [30]; hence, considering these all together could provide better understanding of public perceptions of climate change.

Limitations of this study include the small sample sizes of the two surveys and that the surveys were conducted online, unintentionally selecting for subjects who had access to the internet and used social media and email applications to respond. The majority of elderly persons may not use online media, and this is reflected in the low percentage of respondents aged 55 years and older (9–22%). The two surveys were cross-sectional, with different sample populations; hence, the few differences in perceptions observed between them could reflect either actual time trends or differences in the surveyed populations. Compared to the population census data [31], these surveys' respondents had a higher percentage of females (55–61% vs. 51%), a larger percentage lived in Limassol (44–48% vs. 28%), and more of them had a high education level (80–82% vs. 57%, with at least one university degree) [32–35]; thus, the study data may not be representative of the whole Cypriot population.

Future studies are warranted to explore how environmental risk factors impact on specific population health indicators and how perceptions, trust levels, and information source use may change in time.

Supplementary Materials: The following Supplementary Materials are included and they can be downloaded at: <https://www.mdpi.com/article/10.3390/cli10090129/s1>: SI_1: questionnaires; SI_2: supplementary tables, details on the development of the survey questionnaire and its analysis, including the CHERRIES checklist. The references of the Supplementary Materials are refs. [33–35].

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