

CLIMATE CHANGE WORRY IN SLOVENIA: ASSOCIATIONS WITH SOCIODEMOGRAPHIC DETERMINANTS AND MENTAL WELLBEING

ZASKRBLJENOST ZARADI PODNEBNIH SPREMENB: POVEZAVE S SOCIODEMOGRAFSKIMI DETERMINANTAMI IN DUŠEVNIM BLAGOSTANJEM

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ABSTRACT

Introduction

To describe climate change worry on a sample of adult residents of Slovenia and analyse its associations with socio-demographic variables, including mental wellbeing.

Keywords

Climate change
worry

Climate change

CCWS (Climate

Change Worry Scale)

Mental wellbeing

Methods

Data from the cross-sectional study among online panellists, SI-PANDA 2024/2025, were analysed. A survey (n=1522 adults, aged 18-74) was conducted in September 2024. To measure climate change worry, a Climate Change Worry Scale (CCWS) was used, and mental wellbeing was assessed using the WHO-5 Well-Being Index.

Results

The mean CCWS score in a sample of adults was 22.6, on a scale from 10 to 50 (higher score, higher level of worry). Regarding age ($p < 0.001$), those most worried about climate change were people aged 55-64 years ($M=24.1$), followed by the 25-34 age group ($M=23.6$) and the oldest (65-74; $M=23.1$). People with risk of depression ($M=25.1$) and people with poor mental wellbeing ($M=24.6$) reported significantly higher ($p < 0.001$) levels of climate change worry than people with excellent wellbeing. Higher CCWS scores were also achieved by people with risky stress behaviour ($p=0.004$) and those with a worse financial situation ($p=0.001$).

Conclusions

There are medium levels of climate change worry in a sample of adult residents of Slovenia. Climate change is perceived as a threat not only by young people, but also by older adults. Individuals with poor mental wellbeing, a risk of depression, or risky stress behaviour were more likely to report higher levels of climate change worry. Public health measures should reduce climate change worry by empowering vulnerable groups through environmental, group and community-based activities.

IZVLEČEK

Uvod

Raziskati zaskrbljenost zaradi podnebnih sprememb v povezavi s sociodemografskimi spremenljivkami, z duševnim blagostanjem in s tveganim stresnim vedenjem.

Ključne besede

podnebna
zaskrbljenost

podnebne
spremembe

CCWS (lestvica

zaskrbljenosti

zaradi podnebnih
sprememb)

duševno

blagostanje

Metode

Analizirani so bili podatki, zbrani v drugi izvedbi raziskave SI-PANDA 2024/2025: Vedenjska perspektiva in zdravje, ki je presečna, spletna raziskava med spletnimi panelisti. Nosilec raziskave je Nacionalni inštitut za javno zdravje, izvedena je bila v septembru 2024, v njej je sodelovalo 1522 odraslih prebivalcev Slovenije, starih med 18 in 74 let. Za merjenje podnebne zaskrbljenosti je bila uporabljena lestvica zaskrbljenosti zaradi podnebnih sprememb (angl. Climate Change Worry Scale - CCWS), za duševno blagostanje pa WHO-5 (angl. Well-Being Index).

Rezultati

V povprečju so anketirane osebe dosegle 22,6 točk na lestvici zaskrbljenosti zaradi podnebnih sprememb (CCWS), z razponom lestvice od 10 do 50 točk, kjer višje število točk pomeni višjo stopnjo podnebne zaskrbljenosti. Glede na starost ($p < 0,001$) so bile zaradi podnebnih sprememb najbolj zaskrbljene osebe, stare 55-64 let ($m = 24,1$), sledijo osebe iz starostne skupine 25-34 let ($m = 23,6$) in najstarejši (65-74 let; $m = 23,1$). Osebe z verjetnostjo za depresivno motnjo ($m = 25,1$) in tisti z možno prisotnostjo težav v duševnem zdravju ($m = 24,6$) so poročali o pomembno višji stopnji podnebne zaskrbljenosti ($p < 0,001$) kot osebe brez težav v duševnem zdravju ($m = 21,9$). Višje vrednosti na CCWS lestvici so dosegle tudi osebe s tveganim stresnim vedenjem ($p = 0,004$) in slabšim finančnim stanjem ($p = 0,001$). Glede na spol ($p = 0,475$), doseženo izobrazbo ($p = 0,558$), zaposlitveni status ($p = 0,088$) in okolje, v katerem živijo ($p = 0,991$), ni bilo statistično značilnih razlik.

Zaključki

Pri odraslih osebah so prisotne srednje ravni zaskrbljenosti zaradi podnebnih sprememb, ocenjene z lestvico CCWS. Podnebnih sprememb kot grožnje ne zaznavajo le mladi, ampak tudi starejše generacije odraslih. O večji zaskrbljenosti zaradi podnebnih sprememb so poročale osebe z možno prisotnostjo težav v duševnem zdravju, verjetnostjo za depresivno motnjo in osebe s tveganim stresnim vedenjem. Glede na to, da gre za presečno raziskavo, ne moremo izključiti možnosti, da zaskrbljenost zaradi podnebnih sprememb negativno vpliva na duševno blagostanje. Javnozdravstveni ukrepi za zmanjševanje skrbi zaradi podnebnih sprememb naj se osredotočijo na opolnomočenje ranljivih skupin z medgeneracijskimi okoljskimi dejavnostmi, podpornimi skupinskimi pristopi in vključujočim delovanjem v skupnosti. Krepitev podnebne pismenosti, spodbujanje okoljske samozmožnosti ter vključevanje duševnozdravstvene podpore v podnebno komuniciranje lahko pripomorejo k zmanjšanju psihološke stiske in krepitevi odpornosti.

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1 INTRODUCTION

Climate change, one of the major global challenges, poses a threat to public health (1). It adversely affects global health both directly (through more frequent extreme weather events, increased heat stress, etc.) or indirectly (via adverse changes in air pollution, the spread of zoonotic disease vectors, water and food insecurity, displacement and migration, mental health) (1,2). Ragavan et al. proposed climate change as one of the social determinants of health, since besides adverse health impacts, it contributes to increasing healthcare costs, disproportionately affects the vulnerable and exacerbates the effects of other social determinants (3). Climate change may also influence people's behaviour, attitudes and emotional wellbeing (4,5).

Worry is described as repetitive thinking about uncertain and negative future events, accompanied by anxiety-like emotions (6). Climate change worry thus refers to persistent thoughts about climate change and its consequences (4, 7), which may become repetitive or uncontrollable (4). Climate change worry differs from climate anxiety primarily in the presence of emotional, physiological, or behavioural symptoms associated with the latter (4, 7). According to the literature, climate worry serves as an initial stage in the coping process, while climate anxiety can be a potential outcome of prolonged climate change worry (7). However, worry is only one among many emotions related to climate change described in the literature, such as fear, despair, uncertainty, sadness, grief, hopelessness, anger, guilt and frustration (4, 5, 8).

Given the real threat that climate change poses to health and wellbeing, worry in this context is a normal and reasonable response reflecting a perception of threat (6,9). A review of the literature shows that many people experience some degree of climate change worry (6). A large number of studies focused on younger populations, whereas considerably fewer have examined adults. A study conducted between 2016 and 2017 across 23 European countries found that just over a quarter of adult respondents reported being very or extremely worried about climate change (10). However, a study published in 2024 reported a statistically significant increase in climate change worry between 2016 and 2021 across 28 European countries, particularly in those where the initial level of concern was low (11). In a cross-sectional study conducted in 2020-2022 involving adults from 11 European countries, Slovenia ranked third in the proportion of individuals expressing climate change worry (51.3%), following Portugal (63.7%) and Austria (53.2%). The assessment was based on a single question regarding climate change worry, and no data were available on the sociodemographic distribution of responses. The results indicated that, in Slovenia, climate change worry was associated with anxiety but not with depression or sleep disturbances (12).

In 2021, Alan E. Stewart introduced the Climate Change Worry Scale (CCWS), a more complex psychological instrument (4). Due to its recent development, there remains a relative paucity of research and data utilising the CCWS.

Data on climate change worry among residents of Slovenia are scarce. While a study on this topic was being conducted among adolescents in Slovenia, to the best of our knowledge, no study had been conducted on a representative sample of adults (aged 18-74 years).

Therefore, the aim of this study was to investigate climate change worry among the adult population of Slovenia (aged 18-74 years) using the CCWS scale. Our objective was to analyse differences in CCWS mean scores between sociodemographic groups and to determine how mental wellbeing and stress behaviour are associated with the CCWS score. The findings are likely to have important implications for the Slovenian public health strategy.

Based on data from international literature, we hypothesise that the level of climate change worry among adult residents of Slovenia is comparable to that observed in other European countries (CCWS score between 20 and 30) (7, 13, 14). Furthermore, we hypothesise that higher CCWS scores are associated with being female (16), younger, more educated, a student, living in a rural environment, or having a worse financial situation. Additionally, we expect that individuals with poor mental wellbeing, a risk of depression, or risky stress behaviour will report significantly higher levels of climate change worry (13, 15-17).

2 METHODS

2.1 Study design

The source of data was the second round of the SI-PANDA 2024/2025 Behavioural perspective and health survey, conducted at the National Institute of Public Health (NIJZ) (18). The study protocol was reviewed and approved by the National Medical Ethics Committee of the Republic of Slovenia (KME RS) in March 2024. All research participants were voluntary members of the online access panel JazVem/Opinia.Club. The source population comprised all panel members aged 18-74 years. Recruitment was conducted using stratified quota sampling based on gender, age and statistical region. Informed consent was obtained electronically prior to participation. Participants confirmed their voluntary involvement by selecting the option 'I agree to participate in the research' after confirming they were at least 18 years old and had read the research information. Those who selected 'I do not agree to participate in the research' were excluded from the research. The questionnaire, which was developed in cooperation with the Dutch National Institute for Public Health and the Environment (RIVM), contained questions to collect demographic data and various questions about pandemic preparedness and behaviours (19). The CCWS was added to the Slovenian questionnaire specifically

for the second round of data collection at the discretion of the Slovenian research group members. The second round of the survey, conducted in September 2024, included 1,522 adult participants aged 18 to 74 years. The survey data were weighted by gender, age group and statistical region to ensure representativeness. The sample was quota, so the standard deviations and intervals do not represent statistical randomness, but rather the variance within the sample.

2.2 Observed outcome

To measure climate change worry, a Slovenian translation of the Climate Change Worry Scale (CCWS) was used (4, 20). The Climate Change Worry Scale is a 10-item measure designed to assess the frequency of worries related to climate change (4). Items are limited to proximal and personal climate change worry (4). Answers are presented on a 5-point scale of frequency from never - 1 to always - 5. Item answers should be added up, obtaining a scale of possible values within a range from 10 to 50 (4, 13). A higher total score indicates a higher level of climate change worry (4, 13). The psychometric properties of the CCWS have been evaluated and supported in a validation study by Stewart (2021) (4). Slovenian researchers validated Slovenian translation of the CCWS on a sample of young individuals aged 18-24 years (20).

2.3 Explanatory variables

2.3.1 Demographic variables

We obtained basic demographic data from participants such as age (stratified into 10-year age groups), gender, education (for the purpose of statistical analysis answers were combined in two categories: secondary education or less (without school education, unfinished primary education, 1-7 grades, finished primary education, lower or secondary vocational education, secondary professional education, secondary general education) and post-secondary education or more (higher education, higher professional education (including 1st Bologna cycle), university education (including 2nd Bologna cycle), specialization, masters, doctorate), employment status (for the purpose of statistical analysis answers were combined in 5 categories: employed or self-employed (employed, self-employed), student, retired, unemployed and other (other, homemaker), financial situation (I'm struggling, I manage, but I have to be careful, financial situation is good, financial situation is very good) and living environment (rural, suburban, urban).

2.3.2 Mental wellbeing and stress

The presence of mental wellbeing was determined based on the WHO-5 questionnaire (21). The answers to the 5 survey questions were recoded. Then the sum of all answers of the recoded variable was divided into three

categories: 0-28 "risk of depression", 29-50 "poor mental wellbeing" and 51-100 "excellent mental wellbeing".

The Risky Stress Behaviour was operationalized as a binary variable (1 = YES - indicating Risky Stress Behaviour; 0 = NO - indicating the absence of Risky Stress Behaviour). The purpose of this variable was to identify individuals reporting both frequent stress experience and significant difficulties in coping with that stress, which are items adopted from the common methodology of the Finbalt Health Monitor project (22) and used in the CINDI Health Behaviour Surveys in Slovenia (NIJZ) since 2001.

A participant was categorized as meeting the criteria for Risky Stress Behaviour (1 = YES) if they met both of the following conditions:

1. On the question How often did you feel tense, stressed, or under a lot of pressure in the last 14 days?, they selected the response 'Often' or 'Every day'.
2. On the question How do you manage the tensions, stress and pressures you experience in life?, they selected the response "I still have a lot of trouble coping with them" or "I can't handle them; my life is almost unbearable"

All other participants were categorized as (0 = NO).

2.4 Statistical analysis

All statistical analyses were conducted using SPSS version 25. To examine differences in CCWS scores across various explanatory variables, a one-way analysis of variance (ANOVA) was used. This allowed us to determine if statistically significant differences existed between the groups. Where the ANOVA revealed a significant overall difference, post-hoc tests were performed to identify specific group comparisons. The association between climate change worry (CCWS) and mental wellbeing (WHO-5) was examined using the Pearson's correlation coefficient. Results were considered statistically significant at the 95% confidence level ($p < 0.05$).

3 RESULTS

3.1 Demographic characteristics of the sample

The final sample consisted of 1,522 adults, aged 18-74 years. The average age was 47.2 years ($SD=15.27$), 48.5% of the participants were female. Regarding education 51.4% had post-secondary education or more and most of the participants reported being employed or self-employed (63.2%). The majority of participants did not experience mental health problems (73.3%). Risky stress behaviours were observed in 3.3%. For detailed information see Table 1.

3.2 Characteristics of climate change worry (CCWS scores)

Prior to conducting the Analyses of Variance (ANOVA) to compare differences between groups, we calculated Pearson correlation coefficients to gain an initial insight into the relationships among the two continuous variables (climate change worry - CCWS and mental wellbeing - WHO-5). The correlation analysis revealed a statistically significant, weak, negative association between climate change worry and mental wellbeing ($r=-0.180$; $p<0.0001$). The negative direction of this association indicates that greater climate change worry is linked to poorer mental wellbeing.

The mean CCWS score in a sample of adult residents of Slovenia was 22.6. Regarding age, the highest levels of climate change worry were reported by individuals aged 55-64 years ($M=24.1$), followed by the 25-34 age group ($M=23.6$) and the oldest age group, 65-74 ($M=23.1$). The differences between the age groups were statistically significant ($p<0.001$), as was the analysis of age groups by gender (men vs. age $p=0.001$; women vs. age $p=0.012$). Among men, the highest score on the CCWS scale was observed in the 55-64 age group ($M=24.3$), followed by those aged 25-34 ($M=24.0$) and the youngest age group (18-24; $M=23.3$). Among women, the highest level of climate change worry was reported by those aged 65-74 ($M=24.2$), followed by the 55-64 ($M=23.8$) and 25-34 ($M=23.2$) age groups.

People who are struggling financially reported the highest levels of climate change worry ($M=25.2$), while those with a good or very good financial situation were the least worried ($p=0.001$). Individuals at risk of depression reported the highest climate change worry ($M=25.1$), followed by those with poor mental wellbeing ($M=24.6$) and those with excellent wellbeing ($M=21.9$), with statistically significant group differences ($p<0.001$). Climate change worry was also significantly higher among individuals with risky stress behaviour ($M=26.6$) compared to those without ($M=22.5$; $p=0.004$).

There were no significant differences with respect to gender, education, employment status, or living environment (Table 2).

4 DISCUSSION

4.1 General discussion

The Slovenian population has been increasingly confronted with climate change and its associated consequences, particularly given the recent increase in extreme weather events experienced domestically (23). Consequently, it is not unexpected that our respondents (aged 18-74 years) report experiencing a certain degree of climate change worry ($M=22.6$; $SD=8.48$). This result is comparable to the CCWS score in a Polish study ($M=23.02$; $SD=8.41$; $n=420$, age range=18-70 years, mean age=26.20) (13). Higher scores of climate change worry measured by CCWS were reported

Table 1. Demographic characteristics of the sample.

		n	%
Gender	Male	783	51.5
	Female	739	48.5
Age	18 - 24	139	9.1
	25 - 34	235	15.5
	35 - 44	302	19.8
	45 - 54	301	19.8
	55 - 64	293	19.3
	65 - 74	252	16.6
Education	Secondary education or less	740	48.6
	Post-secondary education or more	782	51.4
Employment status	Employed, self-employed	961	63.2
	Student	121	7.9
	Retired	353	23.2
	Unemployed	65	4.3
	Other	22	1.5
Mental wellbeing	Risk of depression	137	9.0
	Poor mental wellbeing	270	17.7
	Excellent mental wellbeing	1115	73.3
Risky stress behaviour	No	1472	96.7
	Yes	50	3.3

in a French study ($M=28.94$; $n=442$, age range=18-77 years, mean age=32.45, 82% women) (7). A 2022 Italian study ($n=130$, age range=18-77 years) reported a mean CCWS score of 17.84 (9). However, one year later, another Italian study reported a considerably higher mean score of 26.33 ($n=150$, age range=19-76 years) (14).

Available international data on the relationship between CCWS scores and socio-demographic variables remain limited. Contrary to our hypothesis, gender was not statistically significantly associated with CCWS scores. Similar findings were reported in several other studies (4, 7, 14, 24). However, Larionow et al. reported women having significantly higher average levels of climate change worry than men ($p=0.002$) (13). Additionally, the analysis of the European Social Survey (2020-22) data, involving 52,219 participants from 25 countries, revealed a notable gender difference in eco-anxiety, measured as worry about climate change. Women exhibited significantly higher levels of eco-anxiety than men (16). While a Polish study found no statistically significant association between age and CCWS scores (13), the results of our analysis of CCWS with respect to ten-year age groups revealed statistically significant differences between age groups ($p<0.001$). The results indicated that individuals in the 55-64 age group were the most burdened with climate change worry among adults. Respondents aged 65-74 years also showed more pronounced climate change worry. These findings are interesting, since the existing literature has mainly researched and reported on climate change worry in relation to younger individuals (15, 25). Furthermore, coping mechanisms for climate change worry were mostly researched among young people (6). Similar results were found in a study using data from

Table 2. Analysis of CCWS scores by sociodemographic variables, mental wellbeing and risky stress behaviour, analysis of variance (ANOVA).

	Variable	Mean CCWS	SD	Range	Comparisons between groups*
	Total sample	22.6	8.48	10-50	
	Gender (p=0.475; F=0.551; ES=<0.000)				
(A)	Male	22.5	8.63	10-50	
(B)	Female	22.8	8.33	10-47	
	Age (p=0<0001 F=5.932; ES=0.019)				
(A)	18-24	22.9	8.78	10-50	D
(B)	25-34	23.6	8.90	10-50	CD
(C)	35-44	21.6	8.41	10-47	BEF
(D)	45-54	21.0	8.06	10-42	ABEF
(E)	55-64	24.1	8.31	10-46	CD
(F)	65-74	23.1	8.30	10-46	CD
	Gender (men) x age (p=0.001 F=3.972; ES=0.026)				
(A)	Men 18-24	23.3	9.22	10-50	
(B)	Men 25-34	24.0	8.91	10-50	CD
(C)	Men 35-44	21.3	8.47	10-44	BE
(D)	Men 45-54	20.9	8.13	10-42	BE
(E)	Men 55-64	24.3	8.71	10-46	CDF
(F)	Men 65-74	21.9	8.14	10-42	E
	Gender (women) x age (p=0.012 F=3.058; ES=0.020)				
(A)	Women 18-24	22.6	8.32	10-39	
(B)	Women 25-34	23.2	8.91	10-47	D
(C)	Women 35-44	22.0	8.37	10-47	F
(D)	Women 45-54	21.0	8.01	10-41	BEF
(E)	Women 55-64	23.8	7.91	10-45	D
(F)	Women 65-74	24.2	8.31	10-46	CD
	Education (p=0.558 F=0.338; ES=<0.000)				
(A)	Secondary education or less	22.8	8.62	10-50	
(B)	Post-secondary education or more	22.5	8.36	10-50	
	Employment status (p=0.088 F=3.116; ES=0.006)				
(A)	Employed, self-employed	22.5	8.59	10-50	
(B)	Student	22.3	8.05	10-42	
(C)	Retired	23.5	8.23	10-46	
(D)	Unemployed	20.6	8.34	10-38	
(E)	Other	23.5	9.59	10-44	
	Living environment (p=0.991 F=0.011; ES<0.000)				
(A)	Rural	22.6	8.65	10-50	
(B)	Suburban	22.6	8.36	10-50	
(C)	Urban	22.7	8.40	10-47	
	Financial situation (p=0.001 F=5.589; ES=0.011)				
(A)	I'm struggling	25.2	9.50	10-41	CD
(B)	I manage, but I have to be careful	23.2	8.54	10-50	C
(C)	Financial situation is good	21.9	8.32	10-50	AB
(D)	Financial situation is very good	21.4	7.39	10-41	A
	Mental wellbeing (p=0<0001 F=17.778; ES=0.023)				
(A)	Risk of depression	25.1	9.73	10-50	C
(B)	Poor mental wellbeing	24.6	8.81	10-50	C
(C)	Excellent mental wellbeing	21.9	8.11	10-47	AB
	Risky stress behaviour (p=0.004 F=9.905; ES=0.006)				
(A)	No	22.5	8.42	10-50	B
(B)	Yes	26.6	9.57	10-50	A

Legend: SD=standard deviation; p=statistical significance value; ES=effect size *In the case of statistically significant differences between groups, letters are written indicating the groups with statistically significant differences. Otherwise, there are no statistically significant differences between groups

the European Social Survey (2020-2022, 52,219 participants aged 15 or more, from 25 countries), where those aged 60-69 years were most likely to be worried about climate change (measured with a one-item question: "How worried are you about climate change?") compared to those aged 15-19 years (16). However, our results suggest that climate change worry is also present among older adults. The older population may have been directly exposed to, or suffered substantial damage from, extreme weather events in Slovenia in recent years (e.g., the 2023 floods, severe storms and the 2022 Karst fire). Older individuals are often more emotionally and financially tied to their homes and property, which may make the consequences of these disasters more acute and traumatic for them.

Consistent with findings from the Polish study (13), the level of education ($p=0.558$) and living environment ($p=0.991$) were not significantly associated with climate change worry scores. Similarly, regarding employment status ($p=0.088$), respondents, surprisingly, with other forms of employment and retired respondents were the most worried about climate change. The absence of significant differences regarding gender, education, employment status, or living environment suggests that climate change worry is broadly distributed throughout the Slovenian population and is not confined to specific groups or areas. Extreme weather events (such as floods, sleet/ice storms and severe storms) affect both urban and rural areas equally, creating a universal experience of vulnerability across the entire country.

According to our results, respondents with the worst self-assessed financial situation expressed the highest levels of climate change worry. Although previous studies (16,26) did not find a link between income and climate change-related anxiety or worry, it can be speculated that the individuals with worse financial situation may experience greater levels of climate change worry, as climate change impact could result in an exacerbation of pre-existing socio-economic inequalities (27). This population is also more vulnerable to the economic consequences of natural disasters resulting from climate change (27).

With regard to mental wellbeing, there were significant differences in the average CCWS scores among individuals at risk of depression ($M=25.1$) and with poor mental wellbeing ($M=24.6$) compared to others. Similar findings were observed for risky stress behaviour, where respondents with such behaviour achieved an average CCWS score as high as 26.6 ($p=0.004$). The CCWS score was also positively associated with anxiety ($p<0.001$) and depressive symptoms ($p<0.01$) in the study by Larionow et al., however no statistically significant associations were found between climate change worry and mental wellbeing ($p>0.05$) (13). Moreover, in a study by Stewart, (sample of students, 85% women), an increase in scores on all three DASS sub-scales (stress, anxiety and depression) was associated with an increase in climate change worry (4). A Slovenian study, based on

a sample of young individuals, reported a moderate, but significant, correlation between CCWS score and stress ($p<0.001$) (20), while a recently published study conducted across 11 European countries found that climate change worry, measured with a one-item question, was associated with an increased risk of clinically significant anxiety, but not with depression (12). Furthermore, people living in Slovenia and Italy exhibited the strongest associations between climate change worry and anxiety (14). Given the cross-sectional nature of our study, it is not possible to determine exactly how much of this finding represents a risk factor for climate change worry and to what extent it is a consequence, but it can be assumed that people with pre-existing mental health problems are particularly vulnerable to experiencing climate change worry. In a Canadian study on adolescents and young adults, climate change worry was associated with concurrent anxiety, depression and self-harm symptoms, moreover adolescents with higher anxiety were more likely to worry about climate change later in early adulthood (17). Therefore, the authors suggested that prior mental health partially accounts for individual differences in climate change worry and concurrent adverse symptoms (17). On the other hand, a narrative review reported a negative impact of climate change worry on mental wellbeing (6).

The most common explanation – frequently highlighted in the international literature – is that climate change worry in this context may function as a symptom or manifestation of a pre-existing predisposition to anxiety and depression (4, 9). Alternatively, the threat of climate change presents an additional, uncontrollable external pressure, acting as an additional source of stress on individuals already facing mental health challenges (28).

Climate change worry being a reasonable response to environmental changes can also develop into a potential public health issue when it is related to adverse mental health outcomes (12). In this sense, preventive strategies addressing both psychological and environmental dimensions of climate change could be useful (12). To address climate change worry, some coping strategies were proposed in the literature, such as engaging in individual as well as collective pro-environmental activities (6, 29). Participatory approaches with intergenerational collaboration seem to be especially valuable (6). In this context particular attention should be given to vulnerable populations, not only children and adolescents but also individuals with pre-existing mental health conditions, risky stress behaviour, financial difficulties, and older adults, by developing tailored interventions. Collective and community-based climate action interventions have the potential to transform worry and anxiety into environmentally friendly behaviours, while also building social cohesion around a shared "challenge", which is itself a positive determinant of mental health (17).

The findings are likely to have significant implications for Slovenia's public health strategy, particularly when integrated with existing national or EU-level climate adaptation frameworks. The observed high levels of worry, especially among vulnerable groups (individuals with pre-existing mental health issues or financial struggles), underscore the necessity of moving beyond viewing climate change solely as an environmental or economic threat but as a public mental health determinant.

4.2 Strengths and limitations of the study

The study presents data on climate change worry for a sample of adult residents of Slovenia, aged 18-74 years, for the first time. So far, to our knowledge, only data for a sample of young individuals (18-24 years, 75.8% women) have been published in the validation study (20). Also, the results of the Climate Change Worry Scale are analysed in relation to basic socio-demographic groups, mental wellbeing and stress, which is also an added value, as there is a scarcity of such data in the foreign literature. In addition, the study was conducted on a large sample ($n=1522$) that was weighted by gender, age groups and statistical regions, enhancing the representativeness and generalisability of the findings. A limitation of this study is the validation of the measurement instrument (Climate Change Worry Scale), which was originally conducted solely on a sample of young individuals in Slovenia, while our research covered a broader adult age range.

However, the study also has several other limitations. First, its cross-sectional design prevents drawing any conclusions regarding causality. Second, the use of an online panel introduces additional constraints. Because of self-selection, respondents may differ in characteristics that also influence mental well-being or environmental concern. Moreover, the sample was not selected using a probability-based method; therefore, the results cannot be generalised from the sample to the entire target population. The analyses used are therefore applied descriptively - to examine associations within the sample rather than to make inferences about the population. In addition, participation requires internet access, which may lead to an over-representation of more educated individuals and the potential exclusion of vulnerable groups. Finally, when analysing ten-year age groups, the youngest group (18-24) includes fewer respondents, as it covers only seven years.

4.3 Future recommendations

Future research should further examine the correlation between climate change worry and dependent variables (socio-demographic and mental wellbeing) with regression models to more clearly identify vulnerable populations for experiencing climate change worry. Furthermore, longitudinal studies could be useful to examine causality,

especially regarding mental wellbeing. Future research could also obtain data on climate change worry from minors or schoolchildren and compare them with results on a sample of adults. It is important to prioritise detailed investigation (qualitative and quantitative) into the specific concerns of the most worried older adults (55-74 years). Understanding their drivers of worry (e.g., property attachment, legacy concerns, disaster trauma) and identify resilience mechanisms (e.g., social cohesion, effective coping) that transform passive worry into constructive engagement and adaptive behaviour is essential for effective intervention development.

5 CONCLUSIONS

The study showed medium levels of climate change worry in a sample of adult residents of Slovenia. The main finding of our study is that climate change is perceived as a threat not only by young people, but also by the older age groups. Our findings suggest that individuals at risk of depression, those with poor mental wellbeing, or those showing risky stress behaviour represent more vulnerable groups, as they reported particularly high levels of climate change worry. Further research is needed to thoroughly identify risk factors and the needs of people experiencing climate change worry. Strengthening climate literacy, promoting environmental self-efficacy and tailoring climate change communication to different groups are necessary measures in order to reduce climate change worry and feelings of anxiety, and encourage constructive responses while fostering resilience.

CONFLICTS OF INTEREST

The authors declare that no competing interests or conflicts of interest exist.

FUNDING

The study received no external funding.

ETHICAL APPROVAL

Ethical approval to conduct the SI-PANDA 2024/2025 study was obtained from the National Medical Ethics Committee of the Republic of Slovenia (NMEC), No. 0120-561/2020-2711-15 of 5 April 2024.

INFORMED CONSENT

All study participants were voluntary members of the online access panel and an informed consent was obtained electronically prior to participation. Participants confirmed their voluntary involvement by selecting the option 'I agree to participate in the research' after confirming they were at least 18 years old and had read the study information. The study was conducted in accordance with the Declaration of Helsinki.

AVAILABILITY OF DATA AND MATERIALS

The data used for this study are freely available upon request from the statistical office of National Institute of Public Health or can be obtained upon request from the corresponding author.

LLM STATEMENT

The authors used the GPT language model in order to refine translation of certain parts of written text. After using this model, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

PREPRINT STATEMENT

There is no preprint of this study.

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