Climate emotions, thoughts, and plans among US adolescents and young adults: a cross-sectional descriptive survey and analysis by political party identification and self-reported exposure to severe weather events

R Eric Lewandowski, Susan D Clayton, Lukas Olbrich, Joseph W Sakshaug, Britt Wray, Sarah E O Schwartz, Jura Augustinavicius, Peter D Howe, McKenna Parnes, Sacha Wright, Caitlyn Carpenter, Arkadiusz Wiśniowski, Diego Perez Ruiz, Lise Van Susteren

Summary

Background Climate change has adverse effects on youth mental health and wellbeing, but limited large-scale data exist globally or in the USA. Understanding the patterns and consequences of climate-related distress among US youth can inform necessary responses at the individual, community, and policy level.

Methods A cross-sectional descriptive online survey was done of US youth aged 16–25 years from all 50 states and Washington, DC, between July 20 and Nov 7, 2023, via the Cint digital survey marketplace. The survey assessed: climate-related emotions and thoughts, including indicators of mental health; relational aspects of climate-related emotions; beliefs about who or what has responsibility for causing and responding to climate change; desired and planned actions in response to climate change; and emotions and thoughts about the US Government response to climate change. Respondents were asked whether they had been affected by various severe weather events linked to climate change and for their political party identification. Sample percentages were weighted according to 2022 US census age, sex, and race estimates. To test the effects of political party identification and self-reported exposure to severe weather events on climate-related thoughts and beliefs we used linear and logistic regression models, which included terms for political party identification, the number of self-reported severe weather event types in respondents' area of residence in the past year, and demographic control variables.

Findings We evaluated survey responses from 15 793 individuals (weighted proportions: 80·5% aged 18–25 years and 19·5% aged 16–17 years; 48·8% female and 51·2% male). Overall, 85·0% of respondents endorsed being at least moderately worried, and 57·9% very or extremely worried, about climate change and its impacts on people and the planet. 42·8% indicated an impact of climate change on self-reported mental health, and 38·3% indicated that their feelings about climate change negatively affect their daily life. Respondents reported negative thoughts about the future due to climate change and actions planned in response, including being likely to vote for political candidates who support aggressive climate policy (72·8%). In regression models, self-reported exposure to more types of severe weather events was significantly associated with stronger endorsement of climate-related distress and desire and plans for action. Political party identification as Democrat or as Independent or Other (*vs* Republican) was also significantly associated with stronger endorsement of distress and desire and plans for action, although a majority of self-identified Republicans reported at least moderate distress. For all survey outcomes assessed in the models, the effect of experiencing more types of severe weather events did not significantly differ by political party identification.

Interpretation Climate change is causing widespread distress among US youth and affecting their beliefs and plans for the future. These effects may intensify, across the political spectrum, as exposure to climate-related severe weather events increases.

Funding Avaaz Foundation.

Lancet Planet Health 2024; 8: e879–93

Published Online October 17, 2024 https://doi.org/10.1016/S2542-5196(24)00229-8

Department of Child & Adolescent Psychiatry, NYU Grossman School of Medicine, New York, NY, USA (R E Lewandowski PhD); **The College of Wooster, Department of Psychology, Wooster, OH, USA** (S D Clayton PhD); **Institute for Employment Research, Nuremberg, Germany** (L Olbrich MSc, J W Sakshaug PhD); **Department of Statistics, LMU-Munich, Munich, Germany** (L Olbrich, J W Sakshaug); **Department of Psychiatry and Behavioral Sciences, Stanford University, Palo Alto, CA, USA** (B Wray PhD); **Department of Psychology, Suffolk University, Boston, MA, USA** (S E O Schwartz PhD); **Department of Equity, Ethics and Policy, School of Population and Global Health, McGill University, Montreal, QC, Canada** (J Augustinavicius PhD); **Department of Environment and Society, Utah State University, Logan, UT, USA** (P D Howe PhD); **Department of Psychiatry, University of Washington, Seattle, WA, USA** (M Parnes PhD); **Department of Public Health, Environments, and Society, London School of Hygiene & Tropical Medicine, London, UK** (S Wright BSc); **Institute at Brown for Environment and Society, Brown University, Providence, RI, USA** (C Carpenter); **Department of Social Statistics, School of Social Sciences, The University of Manchester, Manchester, UK** (A Wiśniowski PhD, D P Ruiz PhD); **Department of**

Introduction

As the impacts of climate change increase, emotional and psychological consequences are becoming apparent. A well established literature from countries around the world has described many adverse effects to mental health posed by climate change, including direct effects of weather-related disasters and extreme temperatures, and indirect effects associated with displacement, economic loss, and other environmental risks and changes.[1–3] Expanding global research has also reported mental distress in response to the awareness of climate change and its impacts.[4–8] In particular, climate anxiety has been identified as a type of emotional response to climate change that can impair functioning and might be linked to specific

Psychiatry and Behavioral Sciences, George Washington University School of Medicine and Health Sciences, Washington, DC, USA
(L Van Susteren MD)

Correspondence to:
Dr Eric Lewandowski, Department of Child & Adolescent Psychiatry, NYU Grossman School of Medicine, New York, NY, 10016, USA
eric.lewandowski@nyulangone.org

Research in context

Evidence before this study

We searched PsycINFO, Google Scholar, and Web of Science for relevant literature published in English between Jan 1, 2004, and July 1, 2024, using combinations of the following search terms as appropriate: "climate change" OR "global warming"; "mental health" OR "climate anxiety" OR "climate emotions"; "climate change opinions" OR "climate change beliefs"; "youth" OR "adolescent"; "political identification" OR "politics"; "weather" OR "weather perceptions" OR "climate change perception". Substantial evidence supports the direct and indirect mental health effects of weather-related disasters, and extreme temperatures, associated with climate change. Much less research has described the adverse effects of an awareness of climate change and its current or predicted future impacts. Some evidence indicates that young people are more worried about climate change than older generations, but few data describe climate-related distress among US youth. Research is needed to describe this distress and to establish the most appropriate responses. The current study is informed by past global research indicating high rates of distress about climate change in adolescents and young adults, though at lower rates in the USA than other countries. Previous research has shown differences in beliefs about climate change in the USA between people with different political identification, but has not focused on young populations or on emotional or psychological outcomes. Perceptions of exposure to climate-related severe weather events has shown mixed effects on beliefs about climate change.

Added value of this study

To our knowledge, this survey is the largest to assess climate emotions in adolescents and young adults (aged 16–25 years) in the USA. Additionally, it is the only study of which we are aware to consider the influence of perceived exposure to severe weather events linked to climate change, and of political identification, as a salient factor for climate beliefs, on climate-related distress. Results indicated widespread endorsement of distress about climate change, identifying responses of governments and corporations, and exposure to an array of severe weather events types, among the factors most frequently contributing to this distress. Results also indicated that respondents desire action from industries, corporations, and governments, including the US Government, and that respondents have plans for action, including a likelihood of voting for political candidates who support aggressive climate policy. This is the first study of which we are aware to show high frequencies of climate-related distress and desire and plans for action across the political spectrum. Distress increased incrementally as respondents reported exposure to more types of climate-related severe weather events.

Implications of all the available evidence

Our findings suggest widespread climate-related distress and desire and plans for action to address climate change in US adolescents and young adults, across the political spectrum, with stronger endorsement of these outcomes as exposure to more types of climate impacts was perceived. The findings highlight the view among US youth of the primary importance of responses aimed to address climate change led by governments and corporations and industries, and of making sustainable choices with regard to lifestyle and career. Support for climate-related distress in this population might involve providing opportunities to talk about climate-related emotions, with more emphasis on community, peer, family, and school settings, rather than primarily in clinical settings. The present results support the need to safeguard the wellbeing of young people via the actions of government and industry.

mental health problems, including depression and generalised anxiety, and in severe cases, substance use and suicidal thinking.[7,9–14] The term climate emotions has been used to describe the range of emotions related to the recognition of current and future risks from climate change, including distressing emotions such as anxiety, fear, sadness, grief, and anger.[15] Distressing climate emotions have been conceptualised generally as normal responses to climate change that do not necessarily reflect a mental health problem. However, considering the WHO definition of mental health as not only the absence of disorder, but as a general state of wellbeing, productivity, engagement, and resilience, these emotions can reflect a substantial challenge to an individual's mental health.[16–18]

Evidence suggests that adolescents and young adults feel more distress about climate change than older generations, are more likely to report that it impacts their functioning, and are at increased risk of related poor mental health outcomes.[9,19,20] A recent non-representative global survey of 10 000 young people (aged 16–25 years) from ten countries in the Global North and the Global South found high frequencies of negative emotions related to climate change in all countries surveyed.[8] This survey also identified negative views of government responses to climate change.

As the world's largest economy, second-largest current emitter of greenhouse gases, and largest-ever emitter historically, the USA has great significance globally for addressing climate change.[21] Patterns of distress among young people in the USA and their views about the response of their government are also of global significance, but limited data to date have described the presence and distribution of climate emotions among US youth. Among the 1000 US respondents in the aforementioned global survey, 75% (weighted data) reported at least moderate worry about climate change.[8] The majority of US respondents reported feeling sad (57%) and afraid (54%), nearly half reported feeling angry (48%), and large proportions endorsed a range of negative thoughts associated with climate change.

A quarter (26%) reported that their feelings about climate change impaired their daily functioning, suggesting an effect on mental health.[12,22] In a nationally representative online US survey, which was not peer-reviewed, 57% (weighted) of 629 adolescents aged 13–17 years reported that climate change makes them feel afraid.[23] Late adolescence and young adulthood are also transitional periods when important decisions about the future are made, including about career and education, family and financial planning, and where to live.[24] Worry, uncertainty, and pessimism among young people about climate change might influence these decisions, with lasting consequences for their lives and wellbeing.[25–27]

Although emerging research highlights climate-related distress in US youth generally, previous evidence also indicates that beliefs about climate change in the USA are variable.[28,29] For example, political identification has a well established influence on beliefs about climate change in the USA, with Democrats generally expressing greater concern and support for action than Republicans.[29–31] Exposure to severe weather events, which reflect the heterogenous and advancing impact of climate change nationally, has been found to have mixed effects on climate change beliefs, with some studies in the USA and elsewhere reporting that increased exposure led to elevated perceptions of risk, concern, and support for action.[32,33] In the USA, these effects may also differ by political identification.[34,35] However, little research in US youth has focused on the influence of political identification or exposure to severe weather on climate beliefs, nor have emotional and psychological outcomes received thorough attention.

Considering these factors, in this study we aimed to describe the impact of climate change on adolescents and young adults in the USA, focusing on their related emotions and beliefs, including the perceived effects on mental health and daily functioning. We also investigated the choices and actions that young people plan in response to climate change and the responses they desire from others, as well as the influence of political identification and self-reported exposure to severe weather events. Young people in the USA will face increasing strain from climate change-related stressors in the future, compounding the already high mental health burden.[36,37] Understanding their distress and its consequences is an important aspect of a national response to climate change.[11,35,38]

Methods

Study design and sample

In this cross-sectional descriptive survey, data were collected between July 20 and Nov 7, 2023, from a non-representative online sample of individuals aged 16–25 years. Survey respondents were accessed via the Cint digital survey marketplace. All data were anonymised at the time of collection. No personally identifiable information was collected by or available to the research team. Cint distributed the survey via their sample supplier panels. The sample suppliers are responsible for enrolling their own respondents and invite participants to partake in research opportunities through emails, push notifications, in-app pop-ups, offerwalls, publishing networks, social media, and other online communities. Respondents indicated consent electronically on the survey information page. A waiver of documentation of consent and of parental permission for individuals younger than 18 years was obtained. Ethical approval was received from the Biomedical Research Alliance of New York (New York, NY, USA; reference number 22-040-1147).

A sample of 400 respondents was sought in each state, which was achieved or exceeded in 34 states. Based on estimates from Cint about the accessibility of survey respondents in different states, for some states it was known that, because of their small population, 400 respondents was not achievable; these states were grouped into six clusters based on geographical and political similarities based on past election results.[39] State clusters were composed as follows: Cluster A: Nebraska, North Dakota, and South Dakota; Cluster B: Maine, New Hampshire, and Vermont; Cluster C: Delaware, Maryland, and Washington, DC; Cluster D: Connecticut and Rhode Island; Cluster E: Colorado and New Mexico; Cluster F: Alaska, Idaho, Montana, and Wyoming. A sample of 400 individuals was gathered for each cluster, yielding a combined total of 40 state and state cluster units. Hawaii did not achieve 400 respondents but was included as a separate state and not within any state cluster because of geographical and political dissimilarity of Hawaii with other states.

Survey distribution in the marketplace was also guided to maintain balance based on age, sex, and race to enable calculation of statistical weights. This process was managed internally by Cint to selectively target different demographics based on our requests during field work. Quotas for age and state were set to prevent large imbalances. Other demographic variables were collected but were not used for weighting because there was no reliable reference data.

State and state cluster samples were weighted on age, sex, and race according to 2022 state-level population estimates from the US Census Bureau.[40,41] Weighting was done according to a generalised raking procedure.[42] It was not possible to weight the sample by ethnicity because there were insufficient numbers of Hispanic respondents in several small states. State clusters were weighted according to the relative population of component states. State and state cluster samples were then aggregated, preserving the proportion of state-level populations and demographic weighting, into a weighted national sample reflecting the national demographic composition and distribution of population by state.

At the time that individuals opted-in to take the survey (before survey initiation), individuals were aware only of the survey length and incentive and had no knowledge of the focus on climate change. The information provided

For **Cint** see https://www.cint.com

on survey length and incentive was governed entirely by Cint and the sample suppliers, with the incentive structure set by sample suppliers. There was 5% dropout after presentation of study information, and 1% or less drop-out per survey item for the remainder of the survey, totalling 14% of respondents who initiated the survey. Respondents were able to skip questions. Respondents missing data for specific survey items were omitted from calculations involving those items. Statistical cluster analysis employing timestamp data from individual survey items, as previously described in a preprint paper,[43] was used for the first 6002 respondents to identify and remove inattentive respondents and to validate three disqualification rules. During the remainder of data collection, respondents were excluded immediately if they violated one of the three rules: (1) incorrectly answering an embedded attention check; (2) giving straight-line responses on selected multi-item questions; (3) giving logically incompatible responses. Cluster analysis was applied regularly at intervals during the remainder of data collection and found no evidence of inattentiveness among respondents who did not violate the disqualification rules. Further information about the data quality rules is available in appendix 1 (pp 17–18). Respondents who endorsed that the area where they lived had experienced all seven types of assessed severe weather events within the past year were discarded because of geographical implausibility (<1% of those who completed the survey). These respondents also gave logically incompatible responses.

See Online for appendix 1

Survey design

The survey assessed five domains: (1) emotions and thoughts about climate change, including effect on self-reported daily functioning and mental health, and factors contributing to emotions and thoughts (six questions, 39 items); (2) perceived and desired responses to respondents' attempts to speak about climate change (four questions, 11 items); (3) perceptions of who or what is responsible for causing and addressing climate change (two questions, 13 items); (4) actions that respondents desire and are planning in response to climate change (two questions, 20 items); and (5) emotions and thoughts about the US Government response to climate change (two questions, 18 items). The survey also asked respondents to report whether the area they lived had been affected by seven different types of severe weather events (drought, extreme heat or heatwave, flooding, hurricane or tropical storm, smoke or air pollution, tornado, and wildfire or bushfire [direct]) in the past year and to report how sure they were that climate change was happening. The survey also collected sociodemographic information (age, sex [male or female], race, ethnicity, socioeconomic status, employment and educational status, and urban or rural location), and political party identification (Democrat; Independent or Other; or Republican). Emotional support helpline information was provided on the survey information page and at the bottom of every survey screen, directing respondents to resources in case they became distressed while completing the survey. The survey instrument is included in appendix 1 (pp 9–17).

The survey incorporated items from a recent ten-country survey of emotions and thoughts about climate change and government response to climate change in people of the same age range (16–25 years),[8] making slight adjustments to phrasing and replacing most binary outcomes with Likert scales to allow increased choice in responses. Questions about government response to climate change were adjusted to refer to the US Government. These outcomes retained the binary format used in the ten-country survey. The current survey also included additional domains drawing from ongoing research of the authors and perspectives of youth with lived experience of climate anxiety. A convenience sample of 34 young people representing different ages, race, sex, ethnicity, and geographical locations piloted the survey and participated in focus groups to ensure face validity and relevance of survey items. Appendix 1 provides further information about the focus groups (p 18).

Statistical analysis

To report item endorsement, ordinal categories were combined to create binary variables. For 5-point Likert scales, "moderate/moderately", "very/very much", and "extreme/extremely" were combined versus "none/not at all" and "a little". For these outcomes we report proportions representing moderate or stronger endorsement. For 7-point scales, "somewhat agree", "agree", and "strongly agree" were combined versus "neither agree nor disagree", "somewhat disagree", "disagree", and "strongly disagree". For these outcomes we report proportions representing somewhat to strong agreement. Reporting of proportions and statistical analyses for political party identification were restricted to the 18–25-years group due to voting age eligibility. Weighted proportions for each outcome were calculated using all available observations, excluding respondents who had missing data for the outcome. Regression models tested the effect of political party identification and the number of types of self-reported severe weather events in respondents' area of residence in the past year. Models also tested for an interaction between these variables to assess whether political party identification moderated the effect of self-reported exposure to severe weather events. Linear regression was used for survey items that used Likert scales, treating the scales as continuous (ie, strength of endorsement); and logistic regression was used for the item with a binary outcome (beliefs about US Government response to climate change), comparing the frequency of endorsement (ie, endorsed *vs* not endorsed). Models included terms for political party identification, number of severe weather event types, and their interaction, and also control variables (age, sex, race, ethnicity, educational attainment, and household education as a proxy for

	N*	Weighted proportion, %*
Age, years (N=15 793)		
16–17	1960	19·5%
18–25	13 833	80·5%
Sex (N=15 793)		
Female	9336	48·8%
Male	6457	51·2%
Race (N=15 793)†		
Black	2509	15·0%
Other	3500	12·1%
White	9784	72·9%
Ethnicity (N=15 793)		
Hispanic	2607	17·5%
Not Hispanic	13 186	82·5%
Political identification (N=11 920)‡		
Democrat	4388	39·0%
Independent or Other	5055	39·6%
Republican	2477	21·4%
Location (N=15 640)		
Urban	4649	31·1%
Suburban	7543	50·2%
Rural	3448	18·8%
Educational status (N=15 686)		
Student	8053	54·7%
Non-student	7633	45·3%
Completed high school (N=15 686)		
Yes	13 003	78·6%
No	2683	21·4%
Employment status (N=15 683)		
Full-time	5012	30·6%
Part-time	5206	31·7%
Not employed	5465	37·6%
Socioeconomic status of household of origin (N=15 671)		
Lower class	2952	16·8%
Working class	5173	32·0%
Middle class	5501	36·5%
Upper-middle class	1802	12·8%
Upper class	243	1·8%
(Table 1 continues in next column)		
(Continued from previous column)		
Highest education of parent or guardian in household of origin (N=15 674)		
Some high school or less	1200	7·8%
High school graduate	4254	25·8%
Some college, no degree	2035	12·8%
Vocational school	480	2·7%
Associate degree	1413	8·5%
Bachelor's degree	2882	19·5%
Advanced degree	2814	19·1%
Don't know	596	3·8%
Severe weather events in area of residence in the past year (self-reported)		
Flooding (N=14 958)	6225	40·3%
Extreme heat or heatwave (N=15 395)	11 259	74·1%
Wildfire or brushfire (direct; N=14 686)	3220	23·1%
Tornado (N=14 818)	4276	25·9%
Drought (N=14 684)	4103	31·0%
Hurricane or tropical storm (N=14 679)	3332	26·5%
Smoke or air pollution (N=15 176)	9605	63·8%
None (N=15 793)	1159	6·8%
Any (N=15 793)	14 634	93·2%
How sure climate change is happening (N=15 754)		
Very sure is it happening	7665	49·0%
Moderately sure it is happening	3107	19·8%
Slightly sure it is happening	2108	13·2%
Don't know	1293	7·7%
Slightly sure it is not happening	654	4·4%
Moderately sure it is not happening	533	3·3%
Very sure is it not happening	394	2·6%

*Respondent numbers (n) are unweighted; proportions are weighted according to census estimates for age, sex, and race, and represent the available data (N, as indicated). †Original survey categories were White alone, Black or African American alone, American Indian and Alaska Native alone, Asian alone, Native Hawaiian and other Pacific Islander alone, or two or more races; this variable was operationalised as three categories due to weighting considerations. ‡Numbers and proportions for political parties are restricted to the 18–25-year-old age group.

Table 1: **Self-reported sample characteristics (N=15 793)**

socioeconomic status). Household socioeconomic status was not included due to the subjectivity of this assessment and its potential confounding with age. The severe weather event variable was treated as continuous. To reduce risk from multiple comparisons, for multi-item outcomes regressions were done with only the most frequently endorsed subitem for each question. In total, ten regression models were tested. Confidence intervals for the regressions were based on model-robust standard errors. Regression analyses were done using all available observations, excluding respondents who had missing data on the selected outcomes. Regression plots were generated based on the interaction term in a linear regression.

All analyses were done with the R Core Team software (version 4.2.1). We report p values for the regression analyses with a p value of less than 0·05 as the threshold for significance.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Data were collected from a final sample of 15 793 respondents. Table 1 presents the demographic characteristics of the sample, showing the unweighted numbers and proportions weighted for age, sex, and race.

	Total sample (N=15 793)*		Democrat (N=4388)*†		Independent or Other (N=5055)*†		Republican (N=2477)*†	
	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %
How worried, if at all, are you about climate change and its impacts on people and the planet?	13 364/15 693	85·0%	4043/4362	92·6%	4337/5022	86·5%	1787/2453	73·5%
How much, if at all, does climate change make you feel the following?								
Anxious	10 580/15 732	65·8%	3421/4375	77·2%	3443/5038	67·2%	1332/2464	53·7%
Powerless	10 521/15 726	65·8%	3322/4373	75·5%	3429/5034	66·8%	1381/2465	55·3%
Afraid	10 402/15 724	65·1%	3398/4370	77·2%	3375/5034	65·3%	1302/2463	51·9%
Sad	9981/15 707	62·4%	3248/4362	73·5%	3274/5030	64·1%	1242/2464	51·1%
Angry	9773/15 721	61·3%	3248/4367	74·5%	3177/5036	61·6%	1199/2468	49·2%
Despair	8219/15 706	51·2%	2845/4372	64·8%	2707/5032	52·2%	968/2461	39·4%
Ashamed	7487/15 706	47·3%	2452/4358	56·8%	2395/5031	46·3%	958/2467	39·0%
Grief	7578/15 697	46·9%	2588/4364	58·5%	2504/5032	48·5%	926/2459	38·4%
Depressed	7338/15 727	45·5%	2541/4376	57·4%	2468/5034	48·2%	860/2464	33·8%
Guilty	7147/15 703	44·6%	2360/4366	52·4%	2317/5030	43·8%	843/2461	33·6%
Indifferent	5610/15 676	35·5%	1335/4359	30·9%	1872/5023	37·3%	1044/2462	41·5%
Optimistic	4392/15 707	29·2%	1144/4367	27·7%	1409/5029	29·6%	827/2465	35·6%
How much, if at all, does climate change make you think the following?								
People have failed to take care of the planet	13 919/15 752	88·0%	4021/4377	91·1%	4505/5046	89·0%	2016/2471	82·5%
The future is frightening	12 145/15 738	76·2%	3746/4371	84·7%	3932/5048	76·8%	1668/2465	67·0%
I don't want to participate in a social and economic system that harms the planet	11 453/15 731	71·9%	3510/4370	80·6%	3793/5038	74·6%	1510/2465	59·4%
Climate change will influence where I choose to live	10 908/15 741	69·4%	3431/4374	78·9%	3564/5039	70·1%	1392/2467	57·8%
Climate change will threaten my health	10 465/15 745	66·0%	3379/4371	77·0%	3419/5044	67·2%	1321/2470	53·8%
Climate change will make my life worse	10 403/15 740	65·5%	3449/4375	78·2%	3382/5038	67·6%	1287/2469	52·5%
Climate change will impact my plans for the future	10 178/15 739	63·5%	3306/4372	73·9%	3338/5042	65·1%	1274/2468	51·0%
I won't have access to the same opportunities my parents had	10 053/15 748	63·2%	3155/4369	71·8%	3339/5050	65·5%	1338/2470	53·6%
Humanity is doomed	10 063/15 747	62·9%	3149/4373	71·5%	3324/5037	65·5%	1271/2474	51·0%
I question whether the work I put into my education will matter	9450/15 734	59·5%	3011/4373	68·1%	3050/5041	59·7%	1244/2467	51·0%
My family should be doing more to combat climate change	9504/15 742	59·2%	3068/4381	68·9%	3089/5036	60·8%	1205/2470	48·8%
I question whether the work I put into my career, job, or vocation will matter	9308/15 744	57·9%	2950/4377	66·1%	3096/5034	60·9%	1196/2473	47·2%
Climate change will threaten my life	9272/15 725	57·7%	3061/4365	69·3%	3073/5036	59·9%	1151/2472	46·5%
The things I value most will be destroyed	9266/15 742	57·5%	3002/4374	66·8%	3046/5038	59·4%	1177/2471	47·7%
My or my family's security will be threatened	8946/15 731	55·8%	2944/4372	66·5%	2981/5038	58·9%	1148/2467	46·6%
I'm hesitant to have children	8382/15 744	52·3%	2773/4373	62·5%	2834/5043	55·1%	958/2469	37·9%
Climate change will make my life better	2788/15 740	17·9%	839/4377	20·5%	868/5044	18·1%	503/2466	19·5%

(Table 2 continues on next page)

See Online for appendix 2

For the **infographic** see https://www.us-climate-emotions-map.org/

19·5% (weighted proportion) of respondents were aged 16–17 years and 80·5% were aged 18–25 years; 48·8% were female and 51·2% were male. 82·0% respondents were slightly sure to very sure that climate change is happening and 93·2% reported living in an area affected by at least one type of severe weather event in the past year. The events reported by the largest proportions of individuals were extreme heat or heatwave (74·1%), smoke or air pollution exposure (63·8%), and flooding (40·3%). The state-level distributions of self-reported severe weather events are presented in appendix 1 (pp 2–8). Complete sample characteristics for each state or state cluster, including self-reported severe weather events, are provided in appendix 2.

Item endorsement results for all questions for the full sample, by political party identification, and for each state or state cluster are available in appendix 2 and in an online interactive infographic.

Table 2 shows endorsement of emotions and thoughts related to climate change. 85·0% (weighted proportion) of respondents endorsed being worried about climate change and its impacts on people and the planet (of

	Total sample (N=15 793)*		Democrat (N=4388)*†		Independent or Other (N=5055)*†		Republican (N=2477)*†	
	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %
(Continued from previous page)								
How much, if at all, do your feelings about climate change negatively affect your daily life? (Including, but not limited to, any of the following: your ability to focus on work or school, concentrate, sleep, eat, have fun, and enjoy friendships and other relationships)	6100/15 714	38·3%	1988/4371	45·7%	2019/5029	39·9%	839/2465	33·7%
How much, if at all, is climate change impacting your mental health?	6964/15 720	42·8%	2390/4375	54·4%	2350/5034	45·9%	864/2463	33·3%
How much, if at all, do these factors contribute to your feelings about climate change?								
Current actions of corporations and industries	12 850/15 684	82·0%	3861/4372	88·1%	4155/5028	82·8%	1837/2470	73·4%
Unseasonable or unusual weather in my area or region	12 284/15 690	78·2%	3690/4371	84·7%	3995/5035	79·2%	1743/2467	71·0%
Current response of the US Government	12 184/15 679	77·4%	3716/4368	84·3%	3946/5035	78·4%	1741/2466	71·7%
News about climate change or weather events on social media or in mainstream media	11 844/15 682	75·3%	3674/4373	84·6%	3814/5030	75·4%	1635/2471	67·2%
Severe weather events in my area or region	11 867/15 688	75·3%	3607/4378	82·5%	3863/5036	75·8%	1703/2467	70·5%
Current response of governments of other wealthy countries	11 719/15680	74·5%	3588/4368	82·1%	3832/5037	76·6%	1667/2469	68·2%
Current response of governments of poor countries	9409/15 665	60·1%	2759/4370	64·7%	3071/5026	61·2%	1439/2468	58·9%
Actions of my family and families like mine	9057/15 665	57·1%	2763/4368	63·9%	2932/5029	56·8%	1310/2463	52·0%

Numbers and proportions represent respondents who endorsed items at least moderately. *Respondent numbers (n) are unweighted; all proportion estimates are weighted according to census estimates for age, sex, and race, and represent the available data (n/N). †Numbers and proportions by political party are restricted to the 18–25-year-old age group.

Table 2: **Emotions and thoughts about climate change**

whom 57·9% endorsed being very or extremely worried; appendix 2). Figure 1 shows endorsement of this item by state. More than 75% of respondents in every state and state cluster endorsed this item, and in most states and state clusters, at least 50% reported being very or extremely worried (figure 1). In the full sample, up to two-thirds of respondents endorsed feeling powerless (65·8%), anxious (65·8%), afraid (65·1%), sad (62·4%), and angry (61·3%; table 2). Approximately a third of respondents endorsed feeling indifferent (35·5%), and three in ten optimistic (29·2%). Four in ten respondents (42·8%) indicated that climate change is impacting their self-reported mental health, and more than a third (38·3%) reported that their feelings about climate change negatively affect their daily life, including their ability to focus on work or school, eat and sleep, have fun, and enjoy friendships and other relationships. Multiple factors were reported at high frequencies as being contributors to feelings about climate change, including the current actions of corporations and industries (82·0%), unseasonable or unusual weather in the respondent's area or region (78·2%), and the current response of the US Government (77·4%). The least endorsed item was actions of their family and families like theirs (57·1%). Respondents also reported a range of negative thoughts about climate change, with three-quarters endorsing the belief that the future is frightening (76·2%). Approximately two-thirds of respondents reported that climate change will influence where they choose to live (69·4%) and believing that it will threaten their health (66·0%). More than half of respondents indicated that climate change is causing them to question whether the work they put into their education (59·5%) or their career, job, or vocation (57·9%) will matter, and to be hesitant to have children (52·3%). A minority of respondents reported that climate change will make their life better (17·9%). Responses by political party identification are shown in table 2.

9736 of 15 699 respondents (weighted proportion 61·5%) said that they have tried to talk to others about climate change. Of those respondents, 5735 of 9702 (57·6%) endorsed having felt ignored or dismissed by other people. More than 70% of respondents endorsed wanting people to talk openly about the dangers of climate change (71·1%) and about how climate change makes people feel (70·1%), and two-thirds reported wanting people in their parents' and grandparents' generations to try to understand their (the respondent's) feelings about climate change (66·4%). Appendix 2 and the online infographic include complete endorsement results for these items, including responses by political party identification and reasons why some respondents do not talk about climate change.

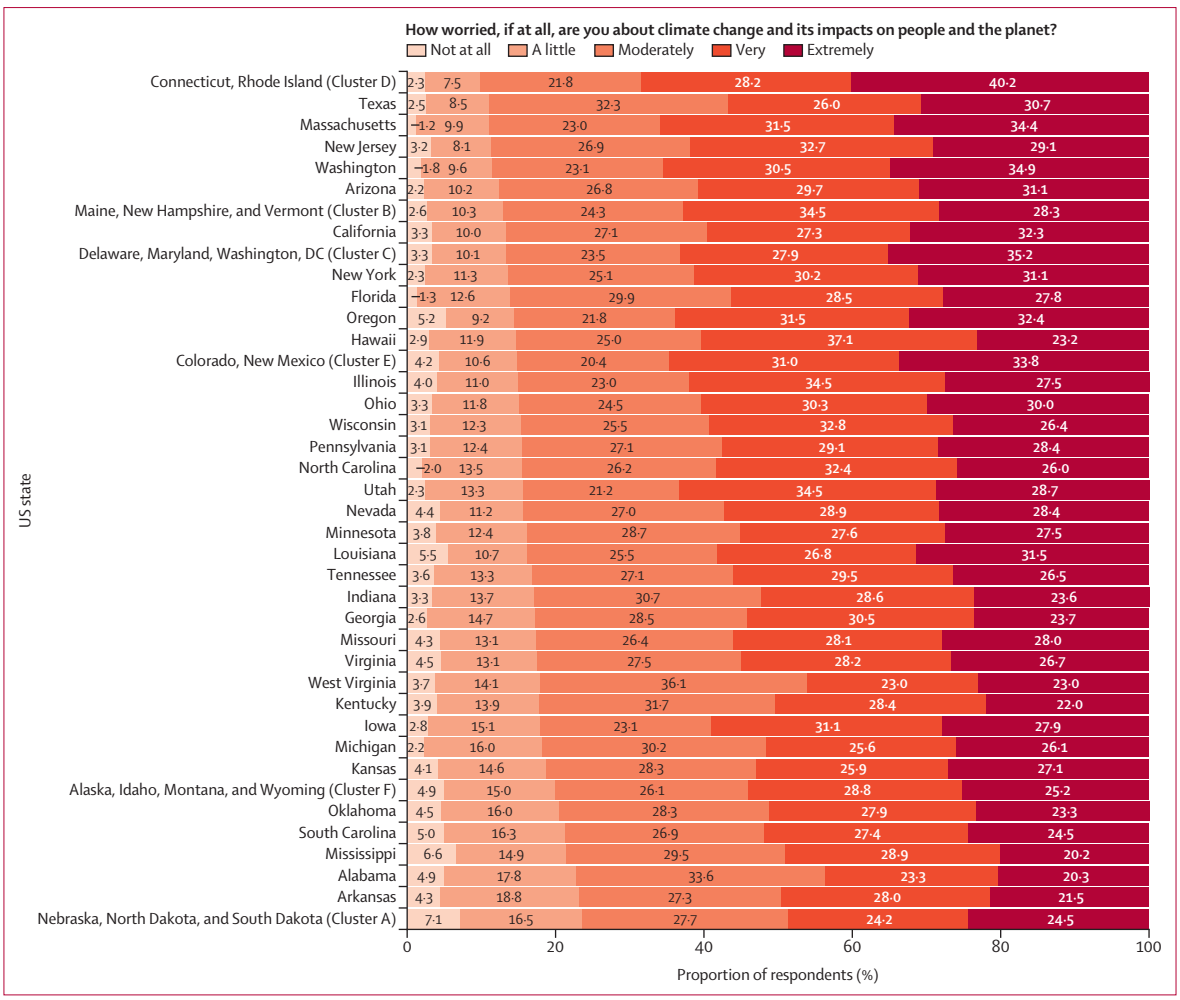

Figure 1: **State-level endorsement of worry about climate change**
All proportion estimates were weighted on age, sex, and race according to 2022 US Census state-level population estimates.

Respondents most frequently endorsed corporations and industries as having responsibility for causing climate change (weighted proportion 89·4%), followed by the US Government (86·0%), and governments of other wealthy countries (85·5%). Similarly, respondents most frequently endorsed that fixing or addressing climate change was the responsibility of corporations and industries (88·8%), the US Government (88·1%), and governments of other wealthy countries (86·9%). Appendix 2 and the online infographic include complete endorsement results for these items, including responses by political party identification.

Respondents endorsed a range of actions that they wish to see from multiple stakeholders (table 3). At least three-quarters endorsed wanting: governments around the world to collaborate to execute a plan to prevent the worst impacts of climate change (weighted proportion 77·4%); the US Government to carry out a plan to prevent the worst impacts of climate change (76·6%); corporations and industries to make major reductions in their contribution to climate change (76·5%); and for schools and universities to provide education about climate change and opportunities for discussion and support of students' concerns (74·7%). 10·4% of respondents reported that no further actions are necessary in response to climate change. Among potential actions that respondents plan to take themselves, almost three-quarters endorsed being likely to vote for political candidates who support aggressive policies to reduce climate change (72·8%). More than two-thirds endorsed being likely to decrease their own or their family's contribution to climate change (68·2%), to choose to work for employers who show commitment to sustainability and reducing their climate impact (67·4%), and to stop buying products and services that contribute to climate change (67·3%). 8·7% of respondents indicated that they did not plan to take any action or make any change. Responses by political party identification are shown in table 3.

Regarding emotions and thoughts about the US Government's response to climate change (table 4), more

	Total sample (n=15 793)*		Democrat (n=4388)*†		Independent or Other (n=5055)*†		Republican (n=2477)*†	
	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %
How much, if at all, do you want to see the following actions in response to climate change?								
Governments around the world collaborate to execute a plan to prevent the worst impacts of climate change	11 976/15 520	77·4%	3621/4338	83·0%	3899/4999	77·4%	1687/2436	70·2%
The US Government carries out a plan to prevent the worst impacts of climate change	11 846/15 528	76·6%	3585/4336	83·0%	3857/5002	76·1%	1686/2440	69·1%
Corporations and industries make major reductions in their contribution to climate change	11 870/15 568	76·5%	3607/4349	82·9%	3873/4997	76·9%	1670/2448	68·0%
Schools and universities provide education about climate change and opportunities for discussion and support of students' concerns	11 680/15 555	74·7%	3571/4343	81·7%	3820/4996	75·1%	1626/2449	67·8%
Individuals prioritise reducing their contribution to climate change	11 008/15 589	70·2%	3358/4361	77·2%	3537/4995	69·4%	1549/2453	63·0%
My community develops a plan to adjust to the impacts of climate change	10 711/15 578	68·8%	3335/4349	76·6%	3510/5005	68·8%	1452/2451	60·9%
Faith leaders and faith communities advocate action to reduce climate change and its impacts	10 712/15 564	68·5%	3297/4342	76·7%	3457/5002	67·8%	1496/2450	60·5%
Other action	10 025/14 683	68·0%	3137/4131	77·0%	3278/4715	67·5%	1323/2306	56·3%
People in my parents' and grandparents' generation take action to stop climate change	10 511/15 599	67·1%	3278/4346	75·2%	3416/5012	66·4%	1403/2462	58·0%
No actions are necessary‡	1683/15 793	10·4%	326/4388	6·7%	497/5055	10·4%	331/2477	13·1%
How likely, if at all, are you to do the following things in response to climate change?								
Vote for political candidates who support aggressive policies to reduce climate change (when eligible)	11 395/15 642	72·8%	3712/4369	85·5%	3738/5019	74·5%	1531/2461	62·3%
Decrease my own or my family's contribution to climate change	10 832/15 662	68·2%	3386/4368	76·8%	3570/5032	69·8%	1467/2470	59·8%
Choose to work for employers who show commitment to sustainability and reducing their climate impact	10 639/15 624	67·4%	3350/4358	77·1%	3493/5025	68·3%	1428/2459	57·2%
Stop buying products and services that contribute to climate change	10 642/15 647	67·3%	3371/4368	76·9%	3513/5026	69·2%	1429/2460	59·1%
Other action or change	9561/14 842	63·4%	3017/4166	72·1%	3186/4774	65·5%	1242/2331	53·1%
Join or support organisations whose mission is to combat climate change	9719/15 635	61·4%	3115/4365	70·5%	3205/5016	63·1%	1271/2459	52·6%
Join group actions or protests	8222/15 637	52·1%	2787/4361	64·0%	2734/5021	53·8%	1001/2463	40·9%
Talk to a doctor or mental health professional for emotional support	7219/15 643	45·4%	2324/4369	53·9%	2455/5021	49·0%	1013/2465	39·8%
Talk to your faith leader or a member of your faith community for emotional support	6396/15 622	40·3%	1848/4364	42·8%	2141/5012	42·3%	1096/2463	45·7%
Not planning to take any action or make any change§	1370/15 793	8·7%	204/4388	4·5%	387/5055	7·4%	296/2477	12·1%

Numbers and proportions represent respondents who endorsed items at least moderately. *Respondent numbers (n) are unweighted; all proportion estimates are weighted according to census estimates for age, sex, and race, and represent the available data (n/N). †Numbers and proportions by political party are restricted to the 18–25-year-old age group. ‡Check box item that read "Check this box if you think no actions are necessary in response to climate change". §Check box item that read "Check this box if you do not plan to take any action or make any change in response to climate change".

Table 3: **Desired and planned actions in response to climate change**

than three-quarters of respondents endorsed negative views of the US Government's response to climate change, with 81·8% (weighted proportion) endorsing that the Government is failing young Americans. Positive views were reported by a quarter of respondents or less, with 14·4% endorsing that the US Government is trustworthy in relation to climate change. Negative emotions were also endorsed more frequently than positive ones. Almost three-quarters of respondents indicated that the US Government response to climate change made them feel ignored (73·5%), and two-thirds felt angry (66·0%); less than a third endorsed feeling hopeful (29·1%), protected (24·1%), reassured (21·0%), or proud (20·1%). Responses by political party identification are shown in table 4.

Table 5 presents regression results of the effect of political party identification and self-reported exposure to more types of severe weather events on climate-related emotions and beliefs for ten selected outcome variables. For eight outcome variables, exposure to more types of severe weather events was significantly associated with stronger endorsement, after controlling for political party identification and demographic variables. The greatest effect was observed for the model predicting the impact of climate change on self-reported mental health (β=0·14, 95% CI 0·09 to 0·18; p<0·0001). Political party identification as a Democrat or as Independent or Other was associated with significantly stronger endorsement of each item than identification as Republican in eight models, after controlling for self-reported

	Total sample (N=15 793)*		Democrat (N=4388)*†		Independent or Other (N=5055)*†		Republican (N=2477)*†	
	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %	n/N	Weighted proportion, %
In relation to climate change, do you believe that the US Government is:‡								
Failing young Americans	12 928/15 479	81·8%	3730/4323	84·1%	4255/4979	84·5%	1881/2432	76·0%
Betraying you and/or future generations	12 018/15 471	76·0%	3489/4319	78·8%	3964/4978	77·3%	1724/2435	70·1%
Dismissing people's distress	11 986/15 486	75·3%	3512/4320	79·2%	3979/4991	77·7%	1686/2429	67·6%
Lying about the effectiveness of the actions they're taking	11 861/15 480	74·7%	3283/4332	73·7%	3939/4977	77·2%	1750/2428	70·6%
Acting in line with climate science	3676/15 443	25·3%	1011/4329	24·9%	1072/4960	23·2%	699/2419	31·4%
Protecting you, the planet, and/or future generations	3071/15 499	21·4%	823/4341	21·9%	884/4978	18·7%	644/2436	28·3%
Doing enough to avoid a climate catastrophe	2955/15 482	20·4%	740/4321	18·5%	906/4975	19·4%	614/2439	27·1%
Taking your concerns seriously enough	2808/15 484	19·2%	745/4321	18·6%	862/4979	18·1%	561/2436	24·1%
Trustworthy	1931/15 423	14·4%	576/4311	15·7%	565/4968	12·8%	348/2424	16·2%
When you think about how the US Government is responding to climate change, how much, if at all, do you feel the following?§								
Ignored	11 724/15 677	73·5%	3494/4376	79·1%	3851/5035	75·4%	1667/2473	67·1%
Angry	10 546/15 643	66·0%	3283/4369	74·3%	3478/5023	68·4%	1440/2468	57·8%
Afraid	10 117/15 656	63·1%	3232/4372	73·0%	3323/5033	63·9%	1321/2467	52·0%
Abandoned	10 027/15 669	62·1%	3086/4373	69·1%	3333/5040	64·8%	1384/2468	55·1%
Ashamed	9528/15 636	59·5%	2959/4361	66·7%	3149/5030	61·1%	1291/2461	52·4%
Hopeful	4254/15 667	29·1%	1200/4371	30·4%	1282/5036	26·7%	780/2472	33·3%
Protected	3459/15 645	24·1%	1015/4365	25·3%	1044/5037	23·6%	651/2463	28·9%
Reassured	3136/15 633	21·0%	925/4367	22·6%	977/5017	20·8%	576/2467	23·7%
Proud	2988/15 656	20·1%	860/4371	21·6%	930/5033	19·7%	594/2469	24·6%

*Respondent numbers (n) are unweighted; all proportion estimates are weighted according to census estimates for age, sex, and race, and represent the available data (n/N). †Numbers and proportions by political party are restricted to the 18–25-year-old age group. ‡Numbers and proportions represent respondents who answered "yes" to a binary "yes/no" answer format. §Numbers and proportions represent respondents who endorsed items at least moderately.

Table 4: **Emotions and thoughts about the US Government's response to climate change**

experience of severe weather events and demographic variables. Democrats and Republicans differed significantly in the reported effect of climate-related feelings on their daily functioning (β=0·34, 0·16 to 0·51; p=0·0001), whereas those who identified as Independent or Other did not differ significantly from Republicans (β=0·14, –0·02 to 0·29; p=0·085). Democrats and Republicans did not differ significantly in their endorsement of the belief that the US Government is failing young Americans in relation to climate change (odds ratio [OR]=1·31, 0·87 to 1·96; p=0·19), whereas individuals who identified as Independent or Other did differ significantly from Republicans (OR=1·48, 1·02 to 2·16; p=0·039). There were no significant interactions between political party identification and self-reported severe weather event exposure for any item assessed in the models. Figure 2 illustrates the effects of self-reported exposure to severe weather events and political party identification on worry about climate change and its impacts on people and the planet, and self-reported impact on mental health.

Discussion

This is the largest survey of which we are aware that has focused on climate emotions and related thoughts and plans among US adolescents and young adults. High proportions of respondents endorsed distress about climate change, and that climate change is impacting how they think about and plan for their future. Approximately four in ten respondents indicated that their feelings about climate change impact their self-reported mental health and their self-reported ability to function daily. Although people who self-identified as Democrats or as Independent or Other were more likely than Republicans to report negative emotions and thoughts, and desire and plans for action, a majority of Republicans also endorsed these items. Previous research has established political party identification as

	Severe weather event types	Republican	Democrat*	Independent or Other*	Democrat × severe weather event types*	Independent or Other × severe weather event types*
How worried, if at all, are you about climate change and its impacts on people and the planet?†	0·11 (0·06 to 0·15); p<0·0001	Ref	0·80 (0·64 to 0·97); p<0·0001	0·56 (0·40 to 0·73); p<0·0001	0·01 (–0·04 to 0·07); p=0·60	–0·02 (–0·07 to 0·03); p=0·47
How much, if at all, does climate change make you feel: Anxious†	0·11 (0·06 to 0·16); p<0·0001	Ref	0·62 (0·42 to 0·82); p<0·0001	0·44 (0·25 to 0·63); p<0·0001	0·04 (–0·02 to 0·11); p=0·19	–0·01 (–0·07 to 0·06); p=0·87
How much, if at all, does climate change make you think: People have failed to take care of the planet†	0·10 (0·04 to 0·15); p=0·0004	Ref	0·45 (0·26 to 0·64); p<0·0001	0·36 (0·17 to 0·54); p=0·0002	0·00 (–0·06 to 0·06); p=0·94	0·00 (–0·06 to 0·06); p=0·95
How much, if at all, do your feelings about climate change negatively affect your daily life?†	0·12 (0·07 to 0·16); p<0·0001	Ref	0·34 (0·16 to 0·51); p=0·0001	0·14 (–0·02 to 0·29); p=0·085	0·00 (–0·06 to 0·05); p=0·90	–0·01 (–0·06 to 0·04); p=0·77
How much, if at all, is climate change impacting your mental health?†	0·14 (0·09 to 0·18); p<0·0001	Ref	0·62 (0·45 to 0·80); p<0·0001	0·34 (0·18 to 0·49); p<0·0001	–0·02 (–0·07 to 0·04); p=0·61	0·00 (–0·05 to 0·06); p=0·87
How much, if at all, do these factors contribute to your feelings about climate change: Current actions of corporations and industries†	0·10 (0·05 to 0·14); p<0·0001	Ref	0·67 (0·49 to 0·84); p<0·0001	0·45 (0·28 to 0·62); p<0·0001	0·00 (–0·05 to 0·06); p=0·86	0·01 (–0·05 to 0·07); p=0·72
How much, if at all, do you want to see the following actions in response to climate change: Governments around the world collaborate to execute a plan to prevent the worst impacts of climate change†	0·05 (–0·01 to 0·11); p=0·12	Ref	0·62 (0·41 to 0·84); p<0·0001	0·40 (0·18 to 0·62); p=0·0003	0·02 (–0·05 to 0·10); p=0·52	0·01 (–0·07 to 0·08); p=0·80
How likely, if at all, are you to do the following things in response to climate change: Vote for political candidates who support aggressive policies to reduce climate change (when eligible)†	0·07 (0·02 to 0·13); p=0·0060	Ref	0·84 (0·65 to 1·04); p<0·0001	0·35 (0·16 to 0·55); p=0·0003	0·02 (–0·04 to 0·09); p=0·50	0·03 (–0·03 to 0·10); p=0·30
In relation to climate change, do you believe that the US Government is: Failing young Americans‡	1·10 (1·00 to 1·22); p=0·052	Ref	1·31 (0·87 to 1·96); p=0·19	1·48 (1·02 to 2·16); p=0·039	1·12 (0·97 to 1·29); p=0·13	1·08 (0·94 to 1·23); p=0·28
When you think about how the US Government is responding to climate change, how much, if at all, do you feel the following: Ignored†	0·13 (0·07 to 0·18); p<0·0001	Ref	0·43 (0·22 to 0·64); p<0·0001	0·31 (0·11 to 0·51); p=0·0029	–0·01 (–0·07 to 0·06); p=0·85	–0·01 (–0·07 to 0·06); p=0·85

Values are β (95% CI) unless otherwise indicated. Effect estimates for severe weather event types represent the association for every increase by one event type. Self-reported severe weather events were for the past year. *Effect estimates are compared with Republican party identification as the reference category. †Linear regressions used Likert scaled scores as continuous variables (ie, intensity of endorsement). ‡Binary outcome with odds ratios (95% CI) for a "yes" response calculated by logistic regression (ie, frequency of endorsement).

Table 5: **Association of self-reported exposure to increasing types of severe weather events and political party identification with endorsement of climate emotions, thoughts, and desired and planned actions**

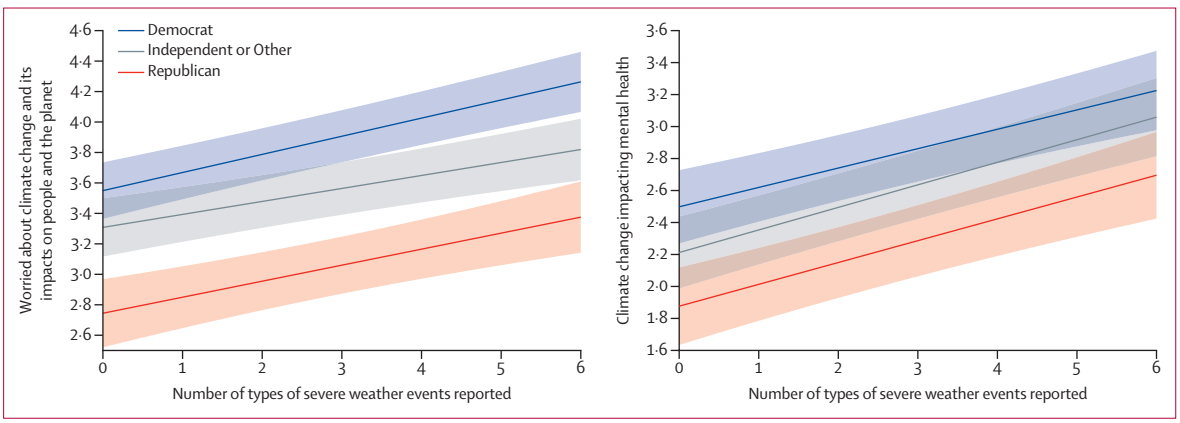

Figure 2: **Effect of number of types of self-reported severe weather events on worry about climate change and on self-reported mental health impact of climate change by political party identification**

The y axes represent Likert scale scores on a continuous scale; the full scale ranged from "not at all" (1) to "extremely" (5). Self-reported severe weather events were for the past year. Shaded regions represent 95% CIs. Note that scales on y axes differ between plots.

one of the strongest predictors of attitudes about climate change in the USA, with Democrats showing more support for climate-related policies and more dissatisfaction with the US Government response to climate change than Republicans.[29,44] Differences might vary by age, with Gen Z and Millennial Republicans endorsing more concern about climate change and support for climate action than Republicans of older age.[44,45] Compared with these past reports, greater proportions of Republicans in this survey endorsed negative emotions and thoughts

about climate change and the response of the US Government, and plans to vote for political candidates who support aggressive climate policies.

Reflecting existing evidence,[32,33] we found that self-reported exposure to more types of severe weather events was associated with a greater intensity of negative emotions and thoughts about climate change, and stronger endorsement of desire and plans for action. This effect was not significantly different between respondents identifying as Republican, Independent or Other, and Democrat. Thus, despite baseline differences by political party, as respondents across the political spectrum perceived the impact of a greater array of severe weather events in their area, their distress related to climate change and their desire and plans for action increased. These findings are consistent with other US research showing that, after controlling for political ideology, people who experience the impacts of climate change are more willing to take action.[34]

The current results are congruent with previous research on the emotional and psychological effects of climate change. This survey shared several items with a comparable global survey of young people by Hickman and colleagues,[8] including the primary outcome of the previous survey, which asked how much respondents were "worried about the impact of climate change on people and the planet". In the current survey, 85% (weighted proportion) of respondents endorsed at least moderate worry about climate change, and 58% endorsed being very or extremely worried, compared with 75% and 46% (weighted for age group, gender, and region), respectively, among 1000 US respondents in Hickman et al. Feeling anxious, powerless, afraid, sad, and angry were the most frequently endorsed emotions in both surveys, although they were endorsed in greater proportions in the current survey. Other items used in both surveys were also endorsed more frequently in the current survey, including self-reported negative effect on daily functioning and hesitancy to have children. Of all countries in the global survey, US respondents had the lowest endorsement rates of moderate or greater worry about climate change (75%) and for effect on self-reported daily functioning (26%).[8] Differences between the current survey and the global survey might suggest an increase in distress in the USA over time but should be interpreted cautiously given the different approach to sampling, weighting, and outcome scales, and minor phrasing adjustments to survey items in the present study.

Climate emotions and related thoughts may be understood as normal reactions to climate change. However, the widespread distress documented in this survey raises a substantial mental health concern and questions about the most appropriate response. Frameworks based on ecological systems theory have categorised responses to the mental health effects of climate change at the level of the individual, peer, family, and social group, and more broadly in communities and policy.[46] The current results emphasise a common desire among US youth for decisive action by governments, including the US Government, and corporations and industries to address climate change. Respondents connected their distress about climate change to the current responses of corporations, industries, and governments, which they most frequently viewed as being responsible for causing and addressing climate change. These findings reflect previous correlational evidence linking climate anxiety to beliefs about government inaction on climate change.[8] The results show that a response to climate change, and therefore to respondents' distress about climate change, requires structural intervention for systems-level change. Consistent with emerging research,[47,48] respondents also frequently endorsed planning individual responses to address climate change including through their household practices, purchases, and career plans. However, the most endorsed individual response was to vote for political candidates who support aggressive climate policies, again reflecting respondents' emphasis on government action as the most important response.

Young people should be engaged as partners in the development of climate policy;[26] however, policy processes move slowly and without frequent opportunity for individual participation. Even dramatic policy changes will not prevent near-term environmental impacts. Thus, there is also an immediate need to support youth who are feeling distress related to current and unavoidable future impacts and losses. Although climate literacy is important for mental health professionals who might have contact with affected youth, seeking support from a mental health professional was among the least endorsed responses to climate change in this study. Most fundamentally, simply providing opportunities for young people to communicate their distress about climate change may be beneficial.[49,50] More than half of survey respondents reported either feeling, or worrying about being, dismissed or ignored when they talk about climate change. Two-thirds of respondents wanted their parents' or grandparents' generations to try to understand their feelings, and more than 70% wanted others to talk about climate-related feelings. A central focus of many interventions and programmes for climate change-related distress is to provide opportunities to share climate emotions and strengthen relationships among peers and within families and communities, and in many cases to empower individuals to take action.[46,51,52] Having negative climate emotions has been linked to increased civic engagement and pro-environmental behaviour,[4,53,54] and indeed engagement in collective action might have a protective effect against the development of clinically significant mental health problems.[55] Our survey findings highlight schools and universities as promising venues for such interventions, with three-quarters of respondents endorsing climate education and opportunities for discussion and support in these settings.

This study has several limitations. Although the sample was weighted to the latest US census population estimates

to reflect the demographic composition of the USA, the non-probability sampling method limits generalisability of the findings. Given the urgency of the topic and the scant existing research, the non-probability sample offered advantages of feasibility and efficiency.[56] The most substantial possible bias would be if the survey preferentially enrolled respondents who are concerned about climate change. To protect against this possibility, the invitation to the survey made no mention of climate change. Therefore, the choice to opt-in to the survey could not be influenced by a concern or interest in climate change. There was 5% attrition at the presentation of the survey information screen where the focus on climate change was first described, suggesting only a small possible bias even if all dropouts were attributable to a lack of concern about climate change. Weighting for political party was not possible because no adequate source data are available, therefore individual state and cluster samples might differ from the actual political composition. Given the logistical and financial challenges of obtaining large national probability samples, especially in this age group, future research could aim to gather smaller state-level probability samples using common methods and measures to facilitate comparison and synthesis. Such efforts would benefit from engaging youth as partners in the co-design of research aims and questions.[26,57] The survey was limited to self-report assessment of exposure to different types of severe weather events. Therefore, results should be interpreted as reflecting the perception of having been exposed to different types of weather events rather than as an objectively verified exposure to those events. However, as observed in the severe weather event maps in appendix 1 (pp 2–8), self-reported exposure to severe weather events was consistent with general patterns of these events over the reporting period,[58–60] suggesting correspondence between self-reported exposure in this survey and actual events. The current approach does not capture variability in the experience and impact of severe weather events by the type, magnitude, and duration of the event and contextual factors related to community and individual vulnerability and adaptive capacity. Future research might seek to replicate the current findings with use of objective assessment methods that are sensitive to variability in the experiences and negative effects of severe weather events. Similarly, indications of mental health and effect on daily functioning in this survey were also limited to single self-report items. In future research, mental health assessment could be enhanced with validated mental health questionnaires and with in-person mental health assessment, which might help to clarify the clinical implications of self-report indicators. A further limitation of the self-report format of this survey, as with all survey research, is the possibility of responding based on perceived social desirability, specifically related to questions of planned and intended actions. Subsequent research using observational or experimental methods might aim to connect reports of intended behaviour with completed actions.

At the time of study planning, there was no published validated measure that incorporated all domains of interest for this study. Although the findings pertain to mental health and wellbeing, our aim was to describe a broad spectrum of emotional, perceptual, and behavioural responses to climate change rather than to assess for clinically relevant symptoms. As mentioned, many survey items were based on a battery used previously by Hickman and colleagues with this age group.[8] Future studies aiming to further explore the clinical significance of climate anxiety specifically would benefit from the use of a validated measure, such as the Climate Change Anxiety Scale, which during the completion of this survey has been validated for youth in short form.[9,61] Subsequent analyses with the current data might also inform ongoing dialogue about conceptual definitions and psychometric properties of climate emotions in young people.

Although a range of current societal stressors may affect youth mental health, evidence indicates that climate change is among the most important.[36] Representative survey data in the USA has identified climate change as a top concern among youth along with gun violence and economic concerns.[62] Polling further suggests that across the political spectrum, youth prioritise addressing climate change even at the expense of economic growth.[63] Despite the overlap of many of these stressors, international research suggests that youth feel distress related to climate change more intensely than older age groups and as distinct from other crises, such as the COVID-19 pandemic.[64] Few, if any, other areas of societal concern have such visible and widespread youth engagement. This engagement can be seen in the proliferation of youth climate activism and the numerous examples of youth climate litigation in the USA and elsewhere.[65,66] These indicators suggest that climate change is a paramount concern for young people, but also one that may be intertwined with and aggravate other stressors and causes of concern for the future.

To conclude, the current survey provides evidence that climate change is causing widespread distress among adolescents and young adults in the USA, across the political spectrum, and is affecting multiple aspects of their planning for the future. Results also suggest that as the effects of climate change become more evident, the emotional, psychological, and behavioural consequences might also intensify. This emotional response represents a substantial burden on wellbeing and might also increase the risk of mental health problems. Youth can benefit from opportunities to share their distress and to act in response to climate change, including in their families, schools and universities, and communities, and through participation in policy development. The findings indicated that the young people in our sample were dissatisfied with the current actions of those in positions of power, in government and in business, and wanted these stakeholders to

act to address climate change. In addition, individuals endorsed plans to respond to climate change with their votes and choices about their purchases, lifestyle, and career. These findings reinforce a theme identified in other research that climate change-related distress will continue to increase while climate change remains insufficiently addressed.[67] Accordingly, the response to address this distress must be for industries, governments, and policy makers to act at the necessary scale.

Contributors

All authors had access to the data. LO and JWS accessed and verified the raw data. All authors read and approved the final version of the manuscript and had final responsibility for the decision to submit for publication. REL led the conceptualisation and design of the study and analysis, design of the survey instrument, interpretation of results, and writing and revising of the manuscript. SDC contributed to the conceptualisation and design of the study and analysis, design of the survey instrument, interpretation of results, and writing and revising of the manuscript. LO led the design and execution of the statistical analysis and contributed to the conceptualisation and design of sampling and data collection, design of the survey instrument, interpretation of results, and writing and revising of the manuscript. JWS contributed to the design and execution of the statistical analysis, conceptualisation and design of sampling and data collection, design of the survey instrument, interpretation of results, and writing and revising of the manuscript. REL, LO, and JWS were responsible for collating and managing data. BW contributed to the design of the study and survey instrument, interpretation of results, and writing and revising of the manuscript. SEOS contributed to the design of the survey instrument, interpretation of results, and writing and revising of the manuscript. JA contributed to the design of the study and survey instrument, interpretation of results, and writing and revising of the manuscript. PDH contributed to the design of the study and survey instrument, interpretation of results, and writing and revising of the manuscript. MP contributed to the interpretation of results and writing and revising of the manuscript. SW contributed to the design of the survey instrument, interpretation of results, and writing and revising of the manuscript. CC contributed to the design of the survey instrument, interpretation of results, and writing and revising of the manuscript. AW contributed to the design of the survey instrument, to the sampling approach and statistical analysis, and to the writing and revising of the manuscript. DPR contributed to the design and execution of the statistical analysis and to the writing and revising of the manuscript. LVS contributed to study conceptualisation, to the design of the survey instrument, and to the writing and revising of the manuscript.

Declaration of interests

We declare no competing interests.

Data sharing

The anonymised data collected for this study will be made available on request to the corresponding author beginning 6 months after the publication of this manuscript and ending 5 years after publication to researchers who provide a methodologically sound proposal to achieve the aims specified therein. Proposals will be reviewed by a small team of authors. Requests should be directed to eric.lewandowski@nyulangone.org. A data sharing agreement is required.

Acknowledgments

Funding for direct costs of this research was obtained from Avaaz Foundation. We would like to thank Bella Struminskaya and Camilla Salvatore at the Department of Methodology and Statistics, Utrecht University, for comments on the design of the survey instrument and for input on the statistical weighting of the sample, respectively, and Emma Lawrance of Climate Cares, Imperial College London, for comments on the survey design. The authors would also like to acknowledge and thank members of the ORIGAMI Research Group (Jean-Baptiste Poline [principal investigator], Alyssa Dai, Sebastian Urchs, Nikhil Bhagwat, Kendra Oudyk, Michelle Wang, Rémi Gau, Arman Jahanpour, and Brent McPherson) at the Department of Neurology, McGill University, for the construction of the online infographic for this manuscript.

Editorial note: The Lancet Group takes a neutral position with respect to territorial claims in published maps.

References

1 Burrows K, Denckla CA, Hahn J, et al. A systematic review of the effects of chronic, slow-onset climate change on mental health. *Nat Ment Health* 2024; **2:** 228–243.
2 Charlson F, Ali S, Benmarhnia T, et al. Climate change and mental health: a scoping review. *Int J Environ Res Public Health* 2021; **18:** 4486.
3 Sharpe I, Davison CM. Climate change, climate-related disasters and mental disorder in low- and middle-income countries: a scoping review. *BMJ Open* 2021; **11:** e051908.
4 Ogunbode CA, Doran R, Hanss D, et al. Climate anxiety, wellbeing and pro-environmental action: correlates of negative emotional responses to climate change in 32 countries. *J Environ Psychol* 2022; **84:** 101887.
5 Gianfredi V, Mazziotta F, Clerici G, et al. Climate change perception and mental health. Results from a systematic review of the literature. *Eur J Investig Health Psychol Educ* 2024; **14:** 215–29.
6 Aylward B, Cunsolo A, Vriezen R, Harper SL. Climate change is impacting mental health in North America: a systematic scoping review of the hazards, exposures, vulnerabilities, risks and responses. *Int Rev Psychiatry* 2022; **34:** 34–50.
7 Boluda-Verdú I, Senent-Valero M, Casas-Escolano M, Matijasevich A, Pastor-Valero M. Fear for the future: eco-anxiety and health implications, a systematic review. *J Environ Psychol* 2022; **84:** 101904.
8 Hickman C, Marks E, Pihkala P, et al. Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *Lancet Planet Health* 2021; **5:** e863–73.
9 Clayton S, Karazsia BT. Development and validation of a measure of climate change anxiety. *J Environ Psychol* 2020; **69:** 101434.
10 Ma T, Moore J, Cleary A. Climate change impacts on the mental health and wellbeing of young people: a scoping review of risk and protective factors. *Soc Sci Med* 2022; **301:** 114888.
11 Ramadan R, Randell A, Lavoie S, et al. Empirical evidence for climate concerns, negative emotions and climate-related mental ill-health in young people: a scoping review. *Early Interv Psychiatry* 2023; **17:** 537–63.
12 Hepp J, Klein SA, Horsten LK, Urbild J, Lane SP. Introduction and behavioral validation of the climate change distress and impairment scale. *Sci Rep* 2023; **13:** 11272.
13 Ndetei DM, Wasserman D, Mutiso V, et al. The perceived impact of climate change on mental health and suicidality in Kenyan high school students. *BMC Psychiatry* 2024; **24:** 117.
14 Vergunst F, Berry HL, Minor K, Chadi N. Climate change and substance-use behaviors: a risk-pathways framework. *Perspect Psychol Sci* 2023; **18:** 936–54.
15 Pihkala P. Toward a taxonomy of climate emotions. *Front Clim* 2022; **3:** 738154.
16 WHO. World mental health report: transforming mental health for all. Geneva: World Health Organization, 2022.
17 Marks E, Hickman C. Eco-distress is not a pathology, but it still hurts. *Nat Ment Health* 2023; **1:** 379–80.
18 Lawrance EL, Thompson R, Newberry Le Vay J, Page L, Jennings N. The impact of climate change on mental health and emotional wellbeing: a narrative review of current evidence, and its implications. *Int Rev Psychiatry* 2022; **34:** 443–98.
19 American Psychological Association. Stress in America: generation Z. October, 2018. https://www.apa.org/news/press/releases/stress/2018/stress-gen-z.pdf (accessed April 15, 2024).
20 Teo SM, Gao CX, Brennan N, et al. Climate change concerns impact on young Australians' psychological distress and outlook for the future. *J Environ Psychol* 2024; **93:** 102209.
21 Tiseo I. Global cumulative CO_2 emissions from fossil fuel combustion 1750–2022, by country. Dec 12, 2023. https://www.statista.com/statistics/1007454/cumulative-co2-emissions-worldwide-by-country/#:~:text=Global%20cumulative%20CO (accessed July 16, 2024).
22 Clayton S. Climate anxiety: psychological responses to climate change. *J Anxiety Disord* 2020; **74:** 102263.

23 Washington Post and Kaiser Family Foundation. Washington Post–Kaiser Family Foundation Climate Change Survey, July 9–Aug 5, 2019. 2019. https://www.washingtonpost.com/context/washington-post-kaiser-family-foundation-climate-change-survey-july-9-aug-5-2019/601ed8ff-a7c6-4839-b57e-3f5eaa8ed09f/ (accessed Sept 18, 2024).

24 Wood D, Crapnell T, Lau L, et al. Emerging adulthood as a critical stage in the life course. In: Halfon N, Forrest C, Lerner R, Faustman E, eds. Handbook of life course health development. Springer, Cham, 2018: 123–43.

25 Dillarstone H, Brown LJ, Flores EC. Climate change, mental health, and reproductive decision-making: a systematic review. *PLOS Clim* 2023; **2:** e0000236.

26 Diffey J, Wright S, Uchendu JO, et al. "Not about us without us"—the feelings and hopes of climate-concerned young people around the world. *Int Rev Psychiatry* 2022; **34:** 499–509.

27 Jones CA. Life in the shadows: young people's experiences of climate change futures. *Futures* 2023; **154:** 103264.

28 Howe PD, Mildenberger M, Marlon JR, Leiserowitz A. Geographic variation in opinions on climate change at state and local scales in the USA. *Nat Clim Chang* 2015; **5:** 596–603.

29 Leiserowitz A, Maibach E, Rosenthal S, et al. Climate change in the American mind: politics and policy, fall 2023. New Haven, CT: Yale University and George Mason University, 2023.

30 Lee S, Goldberg MH, Rosenthal SA, Maibach EW, Kotcher JE, Leiserowitz A. Climate change belief systems across political groups in the United States. *PLoS One* 2024; **19:** e0300048.

31 McCright AM, Dunlap RE. The politicization of climate change and polarization in the American public's views of global warming, 2001–10. *Sociol Q* 2011; **52:** 155–94.

32 Howe PD, Marlon JR, Mildenberger M, Shield BS. How will climate change shape climate opinion? *Environ Res Lett* 2019; **14:** 113001.

33 Xia Z, Ye J, Zhou Y, et al. A meta-analysis of the relationship between climate change experience and climate change perception. *Environ Res Commun* 2022; **4:** 105005.

34 Gould RK, Shrum TR, Ramirez Harrington D, Iglesias V. Experience with extreme weather events increases willingness-to-pay for climate mitigation policy. *Glob Environ Change* 2024; **85:** 102795.

35 Constantino SM, Cooperman AD, Keohane RO, Weber EU. Personal hardship narrows the partisan gap in COVID-19 and climate change responses. *Proc Natl Acad Sci USA* 2022; **119:** e2120653119.

36 Office of the Surgeon General. Publications and reports of the Surgeon General. Protecting youth mental health: The US Surgeon General's advisory. Washington, DC: US Department of Health and Human Services, 2021.

37 Thiery W, Lange S, Rogelj J, et al. Intergenerational inequities in exposure to climate extremes. *Science* 2021; **374:** 158–60.

38 WHO. Mental health and climate change: policy brief. Geneva, Switzerland: World Health Organization, 2022.

39 Federal Election Commission. Federal Elections 2020. October, 2022. https://www.fec.gov/introduction-campaign-finance/election-results-and-voting-information/federal-elections-2020/ (accessed Sept 17, 2024).

40 US Census Bureau. State population by characteristics: 2020–2023. https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-detail.html (accessed Sept 17, 2024).

41 US Census Bureau. Annual state resident population estimates for 6 race groups (5 race alone groups and two or more races) by age, sex, and Hispanic origin: April 1, 2020 to July 1, 2022. June, 2023. https://www2.census.gov/programs-surveys/popest/technical-documentation/file-layouts/2020-2022/sc-est2022-alldata6.pdf (accessed Sept 17, 2024).

42 Deville JC, Särndal CE, Sautory O. Generalized raking procedures in survey sampling. *J Am Stat Assoc* 2021; **88:** 1013–20.

43 Olbrich L, Sakshaug W, Lewandowski E. Evaluating methods to prevent and detect inattentive respondents in web surveys. *SocArXiv* 2024; published online July 22. https://doi.org/10.31235/osf.io/py9gz (preprint).

44 Pew Research Center. Two-thirds of Americans think government should do more on climate. June 23, 2020. https://www.pewresearch.org/science/2020/06/23/two-thirds-of-americans-think-government-should-do-more-on-climate/ (accessed Sept 17, 2024).

45 Brenan M. Republicans' environmental worry varies by age. July 25, 2022. https://news.gallup.com/poll/394955/republicans-environmental-worry-varies-age.aspx (accessed July 16, 2024).

46 Xue S, Massazza A, Akhter-Khan SC, Wray B, Husain MI, Lawrance EL. Mental health and psychosocial interventions in the context of climate change: a scoping review. *Npj Mental Health Res* 2024; **3:** 10.

47 Andre P, Boneva T, Chopra F, Falk A. Globally representative evidence on the actual and perceived support for climate action. *Nat Clim Chang* 2024; **14:** 253–59.

48 UNICEF USA. From eco-anxiety to eco-optimism: listening to a generation of resilient youth. New York, NY: UNICEF USA, 2023.

49 Lehtonen A, Pihkala P. Encounters with climate change and its psychosocial aspects through performance making among young people. *Environ Educ Res* 2021; **27:** 743–61.

50 Spitzer J, Grapsas S, Poorthuis AM, Thomaes S. Supporting youth emotionally when communicating about climate change: a self-determination theory approach. *Int J Behav Dev* 2024; **48:** 113–24.

51 Büchs M, Hinton E, Smith G. 'It helped me sort of face the end of the world': the role of emotions for third sector climate change engagement initiatives. *Environ Values* 2015; **24:** 621–40.

52 Jarrett J, Gauthier S, Baden D, Ainsworth B, Dorey L. Eco-anxiety and climate-anxiety linked to indirect exposure: a scoping review of empirical research. *J Environ Psychol* 2024; **96:** 102326.

53 Myers TA, Roser-Renouf C, Leiserowitz A, Maibach E. Emotional signatures of climate policy support. *PLOS Clim* 2024; **3:** e0000381.

54 Anneser E, Levine P, Lane KJ, Corlin L. Climate stress and anxiety, environmental context, and civic engagement: a nationally representative study. *J Environ Psychol* 2024; **93:** 102220.

55 Schwartz SEO, Benoit L, Clayton S, Parnes MF, Swenson L, Lowe SR. Climate change anxiety and mental health: environmental activism as buffer. *Curr Psychol* 2022; **42:** 16708–21.

56 Jager J, Putnick DL, Bornstein MH. II. More than just convenient: the scientific merits of homogeneous convenience samples. *Monogr Soc Res Child Dev* 2017; **82:** 13–30.

57 Yamaguchi S, Tuong J, Tisdall EKM, et al. "Youth as accessories": stakeholder perspectives on youth participation in mental health policymaking [part II]. *Adm Policy Ment Health* 2023; **50:** 84–99.

58 National Centers for Environmental Information, National Oceanic and Atmospheric Administration. Assessing the US climate in 2023. Jan 9, 2024. https://ncei.noaa.gov/news/national-climate-202312 (accessed Oct 3, 2024).

59 National Centers for Environmental Information, National Oceanic and Atmospheric Administration. Assessing the US climate in 2022. Jan 10, 2023. https://ncei.noaa.gov/news/national-climate-202212 (accessed Oct 3, 2024).

60 US Environmental Protection Agency. Interactive map of air quality. https://gispub.epa.gov/airnow/index.html?tab=3 (accessed Oct 3, 2024).

61 Wu J, Long D, Hafez N, Maloney J, Lim Y, Samji H. Development and validation of a youth climate anxiety scale for the Youth Development Instrument survey. *Int J Ment Health Nurs* 2023; **32:** 1473–83.

62 de Guzman P, Medina A. Youth and the 2024 election: likely to vote and ready to drive action on key political issues. Nov 29, 2023. https://circle.tufts.edu/index.php/2024-election-youth-poll (accessed July 15, 2024).

63 Marist Poll. Views on climate change getting more partisan. Aug 3, 2023. https://maristpoll.marist.edu/polls/views-on-climate-change-getting-more-partisan/ (accessed Sept 19, 2024).

64 Lawrance EL, Jennings N, Kioupi V, Thompson R, Diffey J, Vercammen A. Psychological responses, mental health, and sense of agency for the dual challenges of climate change and the COVID-19 pandemic in young people in the UK: an online survey study. *Lancet Planet Health* 2022; **6:** e726–38.

65 ClimaTalk. Youth climate lawsuits database. https://climatalk.org/youth-climate-lawsuit-database-ycld/ (accessed July 15, 2024).

66 Rashid S. Rising up: how youth are leading the charge for climate justice. Dec 7, 2023. https://www.undp.org/blog/rising-how-youth-are-leading-charge-climate-justice (accessed July 15, 2024).

67 Pitt C, Norris K, Pecl G. Informing future directions for climate anxiety interventions: a mixed-method study of professional perspectives. *J Outdoor Environ Educ* 2024: **27:** 209–34.