



## Adolescent mental distress in the wake of climate disasters

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### ARTICLE INFO

#### Keywords:

Adolescent  
Schools  
Mental Health  
Mental Disorders  
Environment  
Disasters  
Weather  
Floods  
Wildfires

### ABSTRACT

**Objective:** Retrospective exposure to a higher number and prolonged duration of climate-related disasters could be positively associated with adolescent mental distress.

**Methods:** Person-level data came from 38,616 high-school students residing in 22 urban public-school districts in 14 states (U.S. Youth Risk Behavior Survey, 2019). Each district's federally declared climate-related catastrophes (severe storms, floods, wildfire, etc.) came from the Federal Emergency Management Agency. Logistic regression models estimated the adjusted odds ratios (aOR) of adolescent mental distress (MD, using survey responses feeling prolonged sadness/ hopelessness and short sleep duration) according to disaster events and days during three exposure periods (past 2-, 5-, 10-years); adjusted for age, gender, race/ethnicity, socio-economic disadvantage, feeling unsafe at school, district area size, district poverty, and region.

**Results:** Over 10 years, the median number of disaster events was 3 and total disaster days was 64. Adolescents experiencing the highest number of disaster days (top quartile vs. less) had 25% higher odds of MD when exposed within the past 2-years (aOR 1.25 [95% CI 1.14, 1.38]), and 20% higher odds of MD when exposed within the past 5-years (aOR 1.20 95% CI 1.07, 1.35). The odds of MD were not statistically associated with exposure periods that extended to 10 years, nor disaster events (instead of disaster days, all p-values > 0.1).

**Conclusions:** Severe weather will become more frequent and last longer with human-induced climate warming. More studies like this are needed to understand the broad range of adverse effects and enhance planning and preparedness including preparing for worsening mental health among adolescents.

### 1. Introduction

Climate related disasters such as severe storms, flooding, and drought are predicted to become more frequent due to human-induced climate change. These extreme weather events can have immediate and long-term catastrophic physical and social consequences for communities – including destruction of community infrastructure, destruction of roadways and businesses, closing of public services, and disruption of social support systems (SAMHSA, 2022).

There is growing interest in studying climate-related disasters on mental health. However, the extant literature is small, primarily focused on adults, and dominated by small case studies (for example (Boscarino et al., 2013; Vu et al., 2009)). Almost all studies have studied single disasters (Danielson et al., 2017; Ma et al., 2022) with most finding elevated levels of mental distress among residents living in areas that

had a catastrophic event (Lieberman-Cribbin et al., 2017). Few studies evaluated health effects due to multiple disasters but those that did suggested there may be a cumulative effect on worsening mental health. For example, one study found that adults who had a greater number of total exposures to four major hurricanes in the Gulf of Mexico area over a 10- to 13-year period, had higher prevalence of both PTSD and depression (Harville et al., 2018).

Overall, there has been very little research on climate disasters and mental health among children. Children may be traumatized in similar ways as adults, namely direct experiences such as physical injury during a disaster, evacuation and trauma due to loss/damages to their home. Even without direct experiences of injury or loss, trauma can occur due to disruptions in essential services and day-to-day living, such as inability to go to school or connect with extended family and other social supports. Among adolescents in particular, trauma could also occur due

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<https://doi.org/10.1016/j.pmedr.2024.102651>

Received 16 October 2023; Received in revised form 5 February 2024; Accepted 7 February 2024

Available online 10 February 2024

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to the disaster heightening awareness of the planetary climate emergency and feelings of severe alienation because the wider community/world fails to act on the emergency (Crandon et al., 2022; Li et al., 2022). Clinicians have dubbed this distress “climate anxiety” or “eco-anxiety” (Bhullar et al., 2022; Hickman et al., 2021; Li et al., 2022).

Literature to date generally suggests adolescents have worse mental health after experiencing a disaster (Hansel et al., 2013; Meltzer et al., 2021). However, only a handful of studies exist, the studies have been mostly case-studies (Dass-Brailsford et al., 2022; Kar and Bastia, 2006) that enrolled disaster survivors from a single region in the U.S., and focused on exposure to a single disaster (Danielson et al., 2017; Hansel et al., 2013; Meltzer et al., 2021). Only one study (Meltzer et al., 2021) examined adolescent mental health to multiple disasters, finding that with each additional Gulf Coast hurricane there were higher odds that a parental/caregiver reported mental distress in their adolescent child. Our study adds to the literature by using a much larger sample of adolescents than has been used previously, and data come from urban areas across the U.S. where there were varying exposures to multiple climate related disasters over a 10-year period.

Children’s vulnerability to the effect of climate related disasters on mental distress and well-being may be worse for those living in lower-income families. Compared to higher-income families, lower-income families may have more acute and ongoing exposure to disaster (Chakraborty et al., 2019). Post-disaster, lower-income residents may disproportionately experience long-term financial insecurity due to not being able to replace housing, household items, and losing safety net services and networks they relied on (Morganstein and Ursano, 2020; Raker et al., 2020). All of these could make the short- and long-term association between climate related disasters and mental distress more severe for lower-income households compared to higher-income households (Morganstein and Ursano, 2020). However, little work has examined heterogeneity in effects; and in the few studies that exist the evidence is mixed, suggesting that results may be context specific (Brown et al., 2013; Meltzer et al., 2021).

This study examined the association between climate disaster timing, frequency, and duration on adolescents’ mental distress. We linked adolescent survey data from 22 urban public-school districts in the US to severe weather events that occurred in each school district in the prior 2-, 5- and 10-years before the survey. We hypothesized that higher number of disaster events and prolonged duration of climate disasters (disaster days) would be positively associated with worse mental health. We further hypothesized that the effects of disaster on mental health would be worse for socioeconomically disadvantaged adolescents.

## 2. Materials and methods

### 2.1. Study design & sample

#### 2.1.1. Overview

This cross-sectional study used person-level data from the high-school sample (grades 9–12) of the Youth Risk Behavior Survey (YRBS). The data were collected from large public-school districts that allowed CDC to make an anonymized dataset publicly available to qualified researchers. The survey is conducted biennially in odd-numbered years. The current manuscript used data collected in 2019 and 2017, representing 22 school districts, in 14 states. The school districts included in this study had jurisdiction over approximately 838,000 high school students, with over 46,000 students participating in the survey. See section on Analytic Sample below and see [Supplementary Material](#) for sample design details.

State and local institutional review boards approved YRBS data collection protocols for their respective districts and survey procedures were designed to protect students’ privacy by allowing for anonymous and voluntary participation (Underwood et al., 2020). Our manuscript used publicly available secondary data and thus did not meet the definition of human subjects and was exempt from institutional review.

### 2.1.2. Measures

**2.1.2.1. Outcome: Mental distress.** We constructed a binary variable to proxy symptoms of adolescent mental distress. Participants were classified as having mental distress if they responded affirmatively to two variables: reporting persistent feelings of sad/hopelessness and short sleep duration (SSD) which was used to proxy sleep problems. The following is the rationale to require both: 1. Feelings of sad/hopelessness and having sleep problems are both known to be strongly correlated with clinically diagnosed mental health disorders among adolescents (Franzen and Buysse, 2008; Liu et al., 2007). Sleep problems tend to accompany more severe symptoms of depression and have been reported by disaster survivors (SAMHSA, 2018). 2. The measures in our dataset, sad/hopelessness and SSD, were highly correlated within our sample (weighted Pearson correlation = 0.74). Including multiple correlated proxies of a single construct can improve specificity and measurement of a construct. Feelings of sad/hopelessness are known to be common among adolescents. Requiring students to report SSD was intended to improve the specificity of self-reported mental distress. See the [Supplementary Material](#) for how the questions asked, how the outcome measure was derived, and regression sensitivity analyses that operationalized the outcome only as a single variable ‘persistent feelings of sad/hopelessness’.

**2.1.2.2. Disaster exposure.** Disasters were identified via the U.S. Federal Emergency Management Agency’s (FEMA), federal disaster declaration database (National Emergency Management Information System (FEMA, 2023)). Disasters are declared by the US government in situations of catastrophic events that overwhelm the resources of local and state authorities. The governor of the state in which the disaster occurs declares a state of emergency, then formally requests assistance from the U.S. President and FEMA, then the federal government makes a determination regarding the course of action and responds to the disaster.

The FEMA database lists all federally declared disasters for states and counties, the incident type, and begin- and end- dates. We retained disaster types that were related to climate: severe storms, hurricanes, floods, coastal storms, tornadoes, severe ice storms, freezing, snowstorms, droughts, and wildfire. Heat waves were not included because heat waves were not included in the Stafford Act, the federal law that gave FEMA power to declare and respond to emergencies (Selig, 2023). (See [Supplementary Material](#) for details on processing the FEMA database).

**2.1.2.3. Linkage of participants and disaster exposure.** The YRBS data used in this manuscript were collected from high-school students around May 2019. One district, Miami-Dade, did not collect data in 2019 and thus May 2017 data were used. Each of the 22 YRBS school districts were spatially and temporally linked to declared disasters that occurred within the county. To assess timing, frequency, and duration of climate disaster exposure we separately summed the number of events that occurred within 2-, 5-, and 10-years prior to the participant’s survey to proxy near- and long-term exposure to the total number of disasters. Two-, 5- and 10-year exposure periods were selected because they roughly aligned with time lags examined by others (Meltzer et al., 2021; Morganstein and Ursano, 2020) and conformed to the distribution of disasters in our study dataset (see [Supplementary Table 1](#)). We did not include disasters that occurred more than 10-years prior.

Additionally, we summed the number of days that the district was subject to a disaster declaration (AKA ‘Days’) by subtracting the end-date of the declaration from the first declaration start-date. ‘Days’ was used to proxy the intensity/severity of a disaster with longer disaster days indicating that the disaster was highly disruptive.

**2.1.2.4. Sociodemographic characteristics and covariates.** We selected confounders *a priori* based on literature and directed acyclic graphs.

Participant survey responses used for adjustment were age, gender, self-reported racial and ethnic group (classification shown in Table 1), experience of being bullied and/or had concerns about safety at school, and very low family socio-economic position (SEP). See Supplementary Material for student variables used to proxy family SEP.)

Area-level covariates came from the U.S. Census American Community Survey 2015–2019. The following area-level variables were included due to being linked to more climate-related disasters, and the possibility of area-level variability in community-level mental distress (Hallegatte et al., 2020; Nicolaus, 2022): district-level area poverty, school district’s census region and geographic size.

2.1.3. Analytic sample

The dataset encompassed 22 urban public school districts in 14 states (Supplement Table 1), with the largest share of the districts located in the southern and western regions of the U.S.. The survey dataset had

46,204 high school students; 7588 and (16%) were removed due to missing a key YRBS variable. The final analytic sample was 38,616 students. Details on the missing are in the Supplementary Materials.

2.2. Statistical Analysis

Table 1 shows operationalizations used in the analysis. Decisions regarding variable operationalizations were made to aid interpretability and to align with the variable distribution in the sample. Exposure number and duration were examined as continuous and binary variables. The number of disasters days differed widely across disaster timing (past 2-, 5-, 10-years) but generally were high. To aid interpretation of regression coefficients across models, we standardized by dividing the number of disaster days by 14 days (2 weeks), thus coefficients can be interpreted as differences in outcomes per two weeks of disaster days. Because there may be nonlinear or threshold effects

**Table 1**  
Distribution of sample characteristics (number and percent) for total and stratified by mental distress, adolescents from the U.S. Youth Risk Behavior Survey, 2017 and 2019.

Characteristic		Total		Mental distress <sup>a</sup>			
		N	col% <sup>a</sup>	No N	col% <sup>a</sup>	Yes N	col% <sup>a</sup>
		38,616	100%	29,630	77.0%	8986	23.0%
Age	12 to 14	6165	15.6	4901	16.1	1264	14.0
	15	9783	24.7	7692	25.2	2091	23.1
	16	10,036	24.8	7583	24.6	2453	25.4
	17 or older	12,632	34.9	9454	34.1	3178	37.5
Gender	Male	18,051	48.8	15,014	52.8	3037	35.3
	Female	20,565	51.2	14,616	47.2	5949	64.7
Race / ethnicity <sup>b</sup>	AI, AN, NHI, PI	731	1.5	552	1.5	179	1.5
	Asian	3589	7.9	2854	8.1	735	7.4
	Black	8464	25.1	6497	25.3	1967	24.6
	Hispanic	16,061	43.4	12,175	43.0	3886	44.7
	Multiple	1842	3.1	1331	2.9	511	3.8
	White	7929	18.9	6221	19.2	1708	18.1
Grade in school	10th	10,025	26.1	7947	26.8	2078	23.8
	11th	10,083	25.4	7790	25.7	2293	24.4
	12th	9835	24.3	7456	24.1	2379	24.7
	9th	8673	24.2	6437	23.3	2236	27.1
Bullied / safety concerns at school	No	28,258	72.8	23,209	77.9	5049	55.8
	Yes	10,358	27.2	6421	22.1	3937	44.2
Very low SEP <sup>c</sup>	No	26,555	69.0	20,659	69.9	5896	65.9
	Yes	8530	23.1	6094	21.9	2436	27.0
	Missing	3531	7.9	2877	8.2	654	7.1
Census region	Northeast	8658	25.8	6527	25.5	2131	27.2
	Midwest	3324	8.7	2459	8.5	865	9.6
	South	15,707	43.6	11,855	43.3	3852	44.8
	West	10,927	21.8	8789	22.8	2138	18.4
District land area (sq. km)	Smaller (63 - <784)	12,915	20.1	10,098	20.0	2817	20.2
	Larger (784 - <2340)	17,241	44.6	13,076	44.9	4165	43.6
	Largest (2340 to 5102)	8460	35.3	6456	35.1	2004	36.2
District poverty (%)	Lower (10.3 - <14.9)	14,562	34.7	11,496	34.8	3066	34.5
	High (14.9 - <18.0)	16,379	39.2	12,392	39.2	3987	39.1
	Highest (18.0 to 32.7)	7675	26.1	5742	26.0	1933	26.3

a Col% = column percent. N are unweighted. Percentages are weighted.

b Label AI, AN, NHI, PI refers to American Indian, Alaska Native, Native Hawaiian, or Pacific Islander. Label Hispanic refers to Hispanic or Latino. Label Multiple refers to Multiple races, non-Hispanic (NH). Label Black refers to Black or African American NH. Asian refers to NH. White refers to white NH.

c SEP refers to family socio-economic position.

between disasters and mental health, we also derived binary variables to complement the continuous measure. Binary variables proxied exposure to high volume of disasters, defined for each of the exposures as top quartile versus the lower three quartiles.

We derived descriptive statistics (survey-weighted means and percentages) for the overall sample and by presence of mental distress. Logistic regression was used to estimate the odds of mental distress according to disaster timing (within the past 2-, 5-, 10-years), frequency (number of distinct events in the period), and duration (total number of days under declared disasters in the period). Models were adjusted for age, gender, race/ethnicity, very low family SEP, feeling unsafe at school, census region, district geographic area (to account for the higher probability of disasters occurring within geographically larger districts), and district poverty.

All analyses used appropriate complex sample design variables provided in the YRBS dataset: sampling stratum, sampling weight (to correct for sample design and school and student nonresponse), and cluster variables that accounted for correlated errors between records within the same PSU. Because we used multiple district datasets, we additionally accounted for correlated errors between records that were in the same school district (AKA nesting by primary sampling unit [PSU], and school district ID). Descriptive and regression analyses were conducted in SAS sample survey statistical package which assumed a with-replacement sampling design, variance estimation was Taylor Series linearization (SAS 9.4. SAS Institute Inc., Cary, NC).

**Heterogeneity and sensitivity.** We tested whether the association between disasters and mental health were stronger for adolescents living in households with very low family SEP compared to others. When testing this interaction hypothesis, we used the fully-adjusted model, included the product terms between exposure and SEP, and obtained the p-for-interaction. Sensitivity analyses are reported in the [Supplementary Materials](#).

### 3. Results

#### 3.1. Descriptive results

Within the past 10 years, the school districts were affected by 83 federally declared climate-related disasters. FEMA classified most of the disasters as storms, hurricanes, and floods; 28% of the disasters were wildfire ([Supplement Table 1](#)). Across the districts during the past 10 years, there was wide variability in the number of disasters and their duration. There was a median of 3 climate disasters (min–max 0 to 14) and 64 days that districts were under a disaster declaration (min–max 0 to 211, [Supplement Table 1](#), columns on the far right). On average, districts were approximately 1800 sq km and 16.8% of district residents lived in poverty (district poverty min–max 10.3% to 32.6%); for context, 2019 U.S. poverty rate in was 10.5%.

[Table 1](#) reports characteristics for the total sample and stratified by this outcome. Overall, 23% of adolescents reported mental distress. The largest race/ethnic group was Hispanic/Latino (43.4%) followed by Black/African American (25.1%); 23.1% of the students were classified as living in families with very low SEP. Mental distress was higher among older female students, those living in families with very low SEP, and having experienced bullying and/or safety concerns at school.

#### 3.2. Primary adjusted analysis

The adjusted odds of having mental distress were higher for adolescents exposed to the highest number of disaster days (top quartile) during the past 2 years and the past 5 years ([Table 2](#)). For example, mental distress was 25% higher and was 20% higher when exposed to upwards of 44 days over the 2-year period and 62 days over the past 5 years (respectively) compared to fewer days. (Odds ratio [OR] and 95% confidence intervals [CI]: for 2 years OR 1.25 [CI 1.14, 1.38]; for 5 years OR 1.20 [CI 1.07, 1.35].) This relationship followed a dose–response pattern with stronger effects for more recent timepoints. When

**Table 2**

Adjusted odds of reporting mental distress according to climate disaster events and days (past 2-, 5-, 10-years); adolescents from the U.S. Youth Risk Behavior Survey, 2017 and 2019. N = 38616.

Effects for each exposure (modeled separately) <sup>a</sup>	Odds Ratio	Lower	95% Confidence Intervals			
			Upper	P value		
Events	a)	Per event (continuous)	0.92	0.84	1.01	0.068
	b)	High number of events vs. less (binary) <sup>b</sup>	0.93	0.80	1.08	0.329
Duration (days)	a)	Per 14 days (continuous) <sup>c</sup>	1.03	0.99	1.06	0.112
	b)	High number of days vs. less (binary) <sup>b</sup>	1.25	1.14	1.38	<0.0001
Events	a)	Per event (continuous)	0.99	0.96	1.02	0.580
	b)	High number of events vs. less (binary) <sup>b</sup>	0.92	0.81	1.05	0.220
Duration (days)	a)	Per 14 days (continuous) <sup>c</sup>	1.02	0.99	1.04	0.175
	b)	High number of days vs. less (binary) <sup>b</sup>	1.20	1.07	1.35	0.0024
Events	a)	Per event (continuous)	0.97	0.94	1.01	0.112
	b)	High number of events vs. less (binary) <sup>b</sup>	1.04	0.86	1.25	0.682
Duration (days)	a)	Per 14 days (continuous) <sup>c</sup>	1.01	0.99	1.03	0.601
	b)	High number of days vs. less (binary) <sup>b</sup>	1.06	0.96	1.16	0.230

CI: confidence interval.

a. All results shown were adjusted for age (categorical), gender, very low family socio-economic position, bullied and/or safety concerns at school, census region, district area size, and district poverty.

b. The binary variables representing high exposure were defined as follows:

Top quartile cut-points for disaster events was as follows: 2 yrs was ≥2 events, 5 years was ≥3 events, 10 years was ≥6 events.

Top quartile cut-points for disaster days was as follows: 2 yrs was ≥44 days, 5 years was ≥62 days, 10 years was ≥89 days.

c. Most of the disasters had lengthy duration so to aide interpretation, continuous days represent per 14 days (2 weeks, approximately the median for past 2 years disasters in the sample).

examining exposures over the past 10 years the association was positive but not statistically significant (OR 1.06 [CI 0.96, 1.16]). There was no evidence of an association with mental distress when disaster days were operationalized as a continuous variable for any time point (all p-values > 0.1).

There was no evidence of an association with mental distress for number of past **disaster events** (continuous or binary operationalization) for any time window (most p-values > 0.07).

### 3.3. Heterogeneity of effects

There was no evidence of statistical heterogeneity by the binary variable that proxied very low family SEP (interaction p > 0.2) for any of the operationalizations of the exposure.

## 4. Discussion

### 4.1. Summary and interpretation

In this cross-sectional study among racially/ethnically diverse adolescents, 23% reported symptoms consistent with having mental distress. Results suggested that adolescents with exposure to prolonged disasters had higher odds of mental distress. For example, the odds of mental distress were approximately 20% higher for adolescents exposed to upwards of 44 disaster days over a 2-year period and 62 disaster days over a 5-year period. There was no indication that adolescent mental health was higher with more disaster events or when assessing past 10-year disaster exposure.

While this study did not assess mechanisms for how a high number of disaster days might impact mental distress among adolescents, literature supports several mechanisms (Nicolaus, 2022). Adolescents' day-to-day lives could be disrupted for extended periods, including interruption of school, and social and physical support services (Ruskin et al., 2018). Their family's material circumstances could worsen and declines in mental health among adults could transfer to adolescents. Additionally adolescents have the cognitive and emotional maturity to recognize that climate-related events they are currently experiencing are likely to become more severe and more frequent and could upend their future (Hickman et al., 2021; Lawson et al., 2019). As uncertainty grows in adolescents' future, a sense of hopelessness and anxiety can occur (Hurley et al., 2022).

The relationship between years since a disaster and mental distress roughly followed a dose–response pattern with stronger effects for more recent timepoints (2 years and 5 years) as opposed to 10 years. The literature on long lags in adolescent disaster exposure is largely non-existent except for one study of Hurricane Katrina survivors. That study found adolescents sustained symptoms of psychological distress 13 years after the initial disaster event (Meltzer et al., 2021) and each additional hurricane experienced by the family was associated with 40% greater odds of their adolescent's distress. We conjecture that differences in long-term results found in that study and ours may be due to differences in the sample context and measurement of the outcome. Most of the Hurricane Katrina study families were forced to relocate whereas our data likely captured students who remained or returned to their homes post-disaster as well as students unexposed to disasters. Further, the prior study used parental/caregiver report of their child's mental distress (Meltzer et al., 2021) whereas our study solicited the answers directly from the adolescent.

Our bivariate results showed the proportion with mental distress was higher for adolescents living in families with very low SEP (Cao et al., 2021). However, we found no evidence that effects of disasters on mental distress were heterogeneous by whether the adolescent lived in a family with very low SEP (Bours, 2021; Pearce and Greenland, 2005). While a number of studies have adjusted for socioeconomic disadvantage as a confounder (Bours, 2020; Hahn et al., 2022), very few studies examined heterogeneity of effects by SEP thus there is limited work with

which to compare our study. One of the only studies comparable to our study reported similar findings to ours, namely no evidence that the effects of disaster on mental health of adolescents was worse for those living in families with very low SEP (Meltzer et al., 2021). That study and our study had high proportions of adolescents from lower-income families (IES-NCES, 2018) which may have limited examination of heterogeneity by SEP. More work on this topic is needed using data that has robust measures of family SEP and participation from adolescents living in families with a wide range of SEP.

### 4.2. Strengths and Limitations

The literature on the mental health effects from climate disasters is sparse and we are not aware of another large-scale study that examined exposure to a range of climate disasters and adolescent psychological distress (Hwong et al., 2022). Major strengths of this study were the use of a large racially and ethnically diverse sample that was representative of adolescents in 22 urban public school districts across the U.S.. Additional strengths were inclusion of a range of climate related types of disasters, and multiple measures of disaster over time.

Despite these strengths, a few limitations remain. 1. The data used in the current study are cross-sectional, thus, causation cannot be inferred from our results. Nevertheless, temporal inference is strengthened by the fact that our exposure was a retrospective measure of disasters. 2. We linked county climate disasters to each school district survey based on location and date, a practice commonly used in the literature (Morganstein and Ursano, 2020; Newnham et al., 2022) under the rationale that major disasters are generally felt by all. Nevertheless, the long-term consequences could differ depending on proximity to the disaster zone (Schwartz et al., 2017). Additionally, it is unknown whether surveyed students lived in the school district during the full study period (10 years prior to the survey). 3. We used available survey variables from the YRBS that proxied mental distress. Confidence in our proxy measure was bolstered by seeing that they aligned with expected sociodemographic patterns of mental distress (higher for older adolescents, females, more socioeconomically disadvantaged (Merikangas et al., 2010)). 4. As with any observational study, we cannot rule out residual confounding's influence on results. We mitigated this threat by statistical adjustment for student characteristics and district characteristics (region, poverty, geographic size) and specified 'district' as a clustering unit.

### 4.3. Conclusion

Extreme weather events will become more frequent and more intense with human-induced climate change (IPCC, 2023). Experts have called for expansion of research on the effects of the climate emergency on all aspects of health, including mental health (Hwong et al., 2022). Our study is among the very few that has assessed adolescent mental health impacts from multiple disasters and considered varying duration of climate related disasters. Results from this study suggest that many adolescents in urban areas are already experiencing multiple climate-related disasters that last for many days. Our study adds urgency to ensuring that adolescent-specific mental health resources are appropriately placed in diverse urban communities to mitigate/respond to future disasters. Future work should explore additional adolescent mental health outcomes and explore the many mechanisms by which climate-related disaster could worsen mental health.

### CRedit authorship contribution statement

**Amy H. Auchincloss:** Writing – original draft, Formal analysis, Data curation, Conceptualization. **Dominic A. Ruggiero:** Writing – original draft, Formal analysis, Data curation. **Meghan T. Donnelly:** Writing – review & editing, Data curation, Conceptualization. **Esther D. Chernak:** Writing – review & editing. **Josiah L. Kephart:** Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data are public and cited in the paper.

## Acknowledgements

The authors thank Saima Niamatullah for assisting with data compilation. The authors thank the high school participants and local/federal data teams for their valuable contributions to the Youth Risk Behavior Survey. The authors take sole responsibility for all data analyses, interpretation, and views expressed in this paper. The views expressed in this paper do not necessarily reflect the official policies of the institutions where the authors work, funding entities, the U.S. Government, or any other entities.

## Funding

JLK's effort on this work was supported by the U.S. National Institutes of Health (NIH) National Institute on Minority Health and Health Disparities (grant P20MD019221) and NIH National Cancer Institute (grant U54CA267735).

## AI and ai-assisted technologies

None. Generative artificial intelligence (AI) and AI-assisted technologies were not used in the writing process nor in data coding/compilation.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2024.102651>

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