



Adolescent health brief

Spatio-Temporal Clustering of Adolescent Bereavement in the United States During the Extended Response to COVID-19: A Follow-Up Study

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A B S T R A C T

Purpose: This follow-up study investigated the spatio-temporal clustering of adolescent bereavement during the extended response to COVID-19 from October 2020–January 2022 in the continental United States.**Methods:** Deidentified and anonymized bereavement data from Crisis Text Line (CTL), a text-based crisis intervention service, and SaTScan cluster analysis were used to identify space-time clustering of bereavement among adolescents, aged 24 years and less, during the COVID-19 pandemic.**Results:** Clustering of bereavement conversations occurred during waves of high COVID-19 case and death counts, with the highest risk occurring in the Southeastern United States during the fall of 2020 (relative risk: 5.86, confidence interval: 3.48–8.24). Of the CTL texters who shared their demographic information, Indigenous American, Black, male, and female adolescents were more likely to seek help for bereavement when compared to the other CTL users.**Discussion:** Findings show an increased need for bereavement counseling resources during periods of high COVID-19 cases and deaths.

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IMPLICATIONS AND
CONTRIBUTION

This follow-up study identified statistically significant spatio-temporal clustering of adolescent bereavement during the later phase of the COVID-19 pandemic. Most clusters occurred during the winter of 2020–2021, aligning with the deadliest wave of the pandemic to date. These findings suggest that periods of high COVID-19 case counts and deaths corresponded with an increased risk of geographic clustering of adolescent bereavement.

The COVID-19 pandemic has increased bereavement (defined as grief experienced following loss) [1,2]. Adolescents are vulnerable to bereavement due to the unprecedented nature of the COVID-19 pandemic, complicated by a

developing and oftentimes limited capacity for emotional regulation [3]. This is especially true for adolescents from marginalized communities who are at a higher risk of bereavement due to disproportionately high death rates and historic lack of social services [3–5]. Adolescent bereavement increases the risk of anxiety, depression, substance abuse, and prolonged grief disorder [3]. Prolonged grief disorder is severe, persistent grief that interferes with daily life [6].

Conflicts of interest: The authors have no conflicts of interest to declare.

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Table 1

Demographic table of CTL-texters for the (1) pre-COVID-19 time period (2017–2019), (2) early phase of the pandemic (January–September 2020) (Harden et al., 2020), and (3) later phase of the pandemic, October 2020–January 2022. A total of 4,988 individuals and 6,151 total conversations relating to bereavement, of 68,316 individuals and 149,195 total CTL texts footnotes

Total bereavement conversations (% of bereavement related to total CTL)	Pre COVID-19 January 1, 2017–December 31, 2019		Harden et al. January 1–October 1, 2020+		Current analysis October 1, 2020–Jan 11, 2022	
	n = 5,111 12,516 (3.1)		n = 3,886 (4.1)		n = 6,151 (4.1)	
	Bereavement	All Texts	Bereavement	All Texts	Bereavement	All Texts
Race and Ethnicity (%)						
Asian	437 (3.5)*	19,178 (4.8)	158 (4.1)*	5,320 (5.6)	196 (3.2)*	7,103 (4.7)
Black	924 (7.4)	29,664 (7.4)	308 (7.9)	7,662 (8.1)	616 (10.0)*	13,947 (9.3)
Hispanic	2,173 (17.3)	70,231 (17.5)	814 (20.9)*	18,083 (19.1)	1,108 (18.0)	27,372 (18.3)
Indigenous American	437 (3.5)*	10,103 (2.5)	107 (2.7)*	1,945 (2.1)	182 (3.0)*	3,095 (2.1)
Middle Eastern	91 (0.7)	2,671 (0.7)	28 (0.7)	820 (0.9)	28 (0.5)	1,059 (0.7)
Mixed Race	1,410 (11.3)	45,133 (11.3)	459 (11.8)	10,998 (11.6)	791 (12.8)	18,631 (12.5)
Pacific Islander	37 (0.3)	1,173 (0.3)	14 (0.4)	295 (0.3)	14 (0.2)	375 (0.3)
White	7,024 (56.0)	222,823 (55.6)	2,010 (51.6)*	49,733 (52.4)	3,227 (52.4)	77,986 (52.1)
Gender (%)						
Female	10,023 (80.0)*	309,642 (77.2)	3,165 (81.2)*	73,566 (77.6)	4,678 (75.9)*	108,893 (72.8)
Male	1,409 (11.2)	44,640 (11.1)	374 (9.6)	9,433 (9.9)	707 (11.5)*	15,825 (10.6)
Diverse	1,101 (8.8)	46,694 (11.6)	359 (9.2)*	1,857 (12.5)	777 (12.6)*	24,850 (16.6)
Age (%)						
13 or younger	1,735 (13.8)	57,050 (14.2)	712 (18.3)*	15,869 (16.7)	1,015 (16.5)*	26,316 (17.6)
14–17	5,912 (47.2)*	198,060 (49.4)	1,771 (45.4)*	44,149 (46.5)	2,770 (45.0)*	68,353 (45.7)
18–24	4,886 (39.0)*	145,866 (36.4)	1,415 (36.3)	34,838 (36.7)	2,377 (38.6)*	54,899 (36.7)

Harden et al. analysis spanned January 1, 2017–October 27, 2020. This current analysis begins on October 1, 2020 to ensure all of October 2020 is captured. To avoid repeats in this table, all users for October 2020 are included in the far right column 'Current Analysis'.

CTL data for January 2017–October 2020 are slightly different than that in Harden et al. due to changes in coding of Hispanic individuals and inclusion of texters who gave demographic information on age, race, and gender but not sexual orientation, resulting in 1,194 additional texts from January 2017–September 2020.

* Indicates p value $< .05$.

With more than 970,000 COVID-19–related deaths in the United States as of March 2022 [5], nearly nine million people have potentially grieved or are grieving the loss of a loved one due to the pandemic [6]. Therefore, understanding the spatial and temporal distribution of where and when grief-related mental healthcare resources are most needed is of increased importance. This study, building on prior bereavement research by Harden et al. [7], identified spatio-temporal cluster locations of adolescent bereavement during the COVID-19 pandemic from October 2020–January 2022 in the continental United States.

Methods

Data

Crisis Text Line (CTL) is a not-for-profit organization with trained Crisis Counselors who provide real-time, free, 24/7, confidential, text-based crisis intervention services [8]. CTL's anonymized and deidentified data have been used to characterize the mental health concerns of frontline workers, their children [9], and young people in response to the COVID-19 pandemic [10,11]. Crisis issue data are coded post-conversation by trained volunteer Crisis Counselors and tagged for specific crisis concerns (e.g., depression, bereavement); the crisis concern of interest for this analysis was bereavement. Geographic location is derived from the texter area code and was the spatial unit of analysis for this study. Anonymized CTL data were restricted to those aged 24 years and less, who provided demographic information in the continental United States (n : 6,151), representing 12% of bereavement-related conversations. Adolescence was defined as individuals aged 24 years and less [12], a definition

which encompasses youth, adolescents, and young adults and corresponds to our previous analysis [7]. Data were exempt under human subjects' category #4 for secondary data (IRB#19–0270).

Spatial analysis

Spatio-temporal clusters were identified using Kulldorff's spatial scan statistic in SaTScan [13]. SaTScan identifies if cases are randomly distributed or clustered [7,14]. To identify high-risk clusters, we used a discrete Poisson space-time model with a 10% at-risk window and aggregated time to monthly [7]. We evaluated clusters with 999 Monte Carlo replications and rejected the null hypothesis (no clusters) at $p < .05$. The maximum cluster length was limited to 3 months [7].

Results

From October 2020–January 2022, there were 6,151 bereavement-related conversations among adolescents, which were highest among texters who were White (52.4%), female (75.9%), or aged more than 13 years (38.6%–45.0%), which is consistent with all CTL users (Table 1). More Black (10.0%) and male adolescents (11.5%) used CTL for bereavement-related texts. Across all time periods, female (75.9%–80%) and Indigenous American (2.7%–3.5%) adolescents were more likely to use CTL for bereavement-related conversations compared to all conversations.

The Eastern United States had the highest density of bereavement clustering and the Southwest had no clustering (Figure 1). The highest risk cluster was in the Southeast from

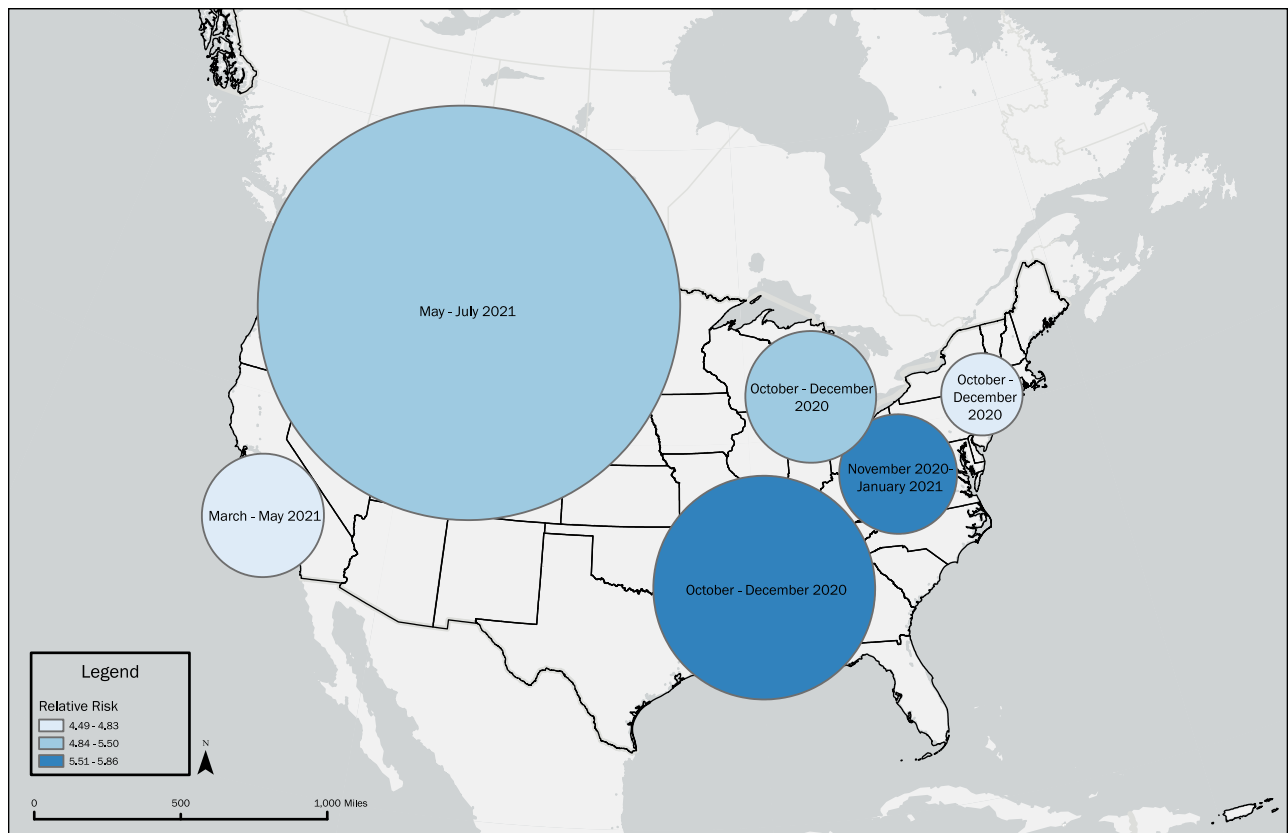


Figure 1. Significant spatial and temporal adolescent bereavement clustering for the continental United States from October 2020 through January 2022. Clusters are adjusted for age, race, and gender. Relative risk (RR) values > 1 = higher risk, $RR < 1$ = lower risk. Note: * indicates p value $< .05$.

October–December, 2020 (relative risk: 5.86, confidence interval: 3.48–8.24). Additional clustering during the fall of 2020 and winter of 2020–2021 occurred in the Northeast, upper Midwest, and mid-Atlantic.

Discussion

This spatio-temporal analysis, building on work by Harden et al. [7], illustrates that adolescent bereavement remains a pressing mental health issue in the United States. Adolescent bereavement clustering was rare in the years leading up to the pandemic (2017–2019) [7], suggesting these clusters may be attributed to the loss of normal life (e.g., school closures, physical isolation) caused by the COVID-19 pandemic, which exacerbated poor mental health among adolescents [15]. The continuation of bereavement clustering in the Rocky Mountain West, upper Midwest, and South/Southeast [7] may indicate under addressed grief among adolescents.

Most bereavement clustering occurred during the fall of 2020 and winter of 2020–2021. These clusters align with the deadliest waves of COVID-19 and with increased restrictions during the holidays, a time when people typically prioritize seeing loved ones and family [5]. Clustering in southern California during the spring and summer of 2021 may illustrate grief corresponding to deaths in February of 2021, when the death count was high in California [16]. Clustering in the Rocky Mountain West also aligns with periods of relatively high death

counts [5], during the summer of 2021. Clustering during the spring and summer of 2021 could also be explained by mass vaccination efforts [5], which largely excluded youth and adolescents, with only 44% of adolescents having been vaccinated by August 2020 [17], potentially prolonging poor mental health among this vulnerable group related to the continued social isolation.

More Indigenous American, Black, male, and female adolescents sought help for bereavement compared to all CTL conversations, suggesting these subpopulations may be at an increased risk of bereavement. This may further be explained by the comparably high COVID-19 death rates among Black and Indigenous Americans [5].

This study may not be representative of all CTL texters or the larger adolescent population in the United States in general and may be subject to nonrandom selection bias for texters who answered the demographic survey. Adolescent bereavement from the pandemic disproportionately affected marginalized and disadvantaged communities due to a historic lack of access to and availability of social support services [3,4]. Our analysis did not examine clustering based on subgroups; therefore, we cannot draw conclusions about spatio-temporal differences in bereavement vulnerability based on age, race/ethnicity, or gender identity. Future research at local scales should consider clustering based on vulnerable subgroups, developmental stages within adolescence, incorporate additional mental health indicators, and the availability of mental health resources.

Our study identified spatio-temporal clusters of adolescent bereavement, most of which occurred in the winter of 2020–2021, suggesting adolescents are at an increased risk of bereavement during and immediately following deadly COVID-19 surges. As bereavement increases the risk of poor mental health, resources for adolescents experiencing grief and grief-related symptoms are, and will continue to be needed. These findings can guide future mental health resource mobilization following extreme events causing loss of life and disruption to normal life.

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