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Spatial Clustering of Adolescent Bereavement in the United States During the COVID-19 Pandemic

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A B S T R A C T

Purpose: Few studies have examined grief and bereavement in the context of a pandemic, particularly among young people during the ongoing COVID-19 pandemic.
Methods: The objective of this study is to examine spatiotemporal clustering of bereavement using data from Crisis Text Line, an SMS-based intervention with widespread usage among youth and adolescents in the United States from January 2017 to September 2020.
Results: Results found significant spatial clustering of bereavement during the pandemic period in the late summer months compared with the onset of the pandemic.
Conclusion: Our study provides the first evidence of elevated bereavement in adolescents using a technique for rapidly identifying clusters of bereavement risk among this vulnerable subgroup. Findings can be leveraged for targeted interventions and supportive counseling in geographic hotspots.

IMPLICATIONS AND CONTRIBUTION

Using a text-based platform, Crisis Text Line, this study documented statistically significant increases in population-level bereavement during the COVID-19 pandemic. Relative risk was highest for bereavement in the Western US and the Southern US, which highlights locations where targeted interventions for adolescents and youth may be needed.

Bereavement—grief associated with the loss of a loved one—has surged during the COVID-19 pandemic. Among adolescents, bereavement has been associated with an increased risk of depression, substance abuse, and suicidal ideation [1–4]. New research indicates that these sudden and traumatic COVID-19–related deaths in the United States (US) will leave roughly nine bereaved relatives for every COVID-19 death, as many are left behind grieving the loss of a loved one [5]. This trend is particularly concerning in the context of severe isolation, loss of normal routine and support networks, and the disappearance of traditional mourning rituals [6]. Few studies have examined geographic patterns of bereavement burden over the course of the pandemic to understand the burden of loss from COVID-19 in young people, particularly as we try to understand the downstream and lasting effects on mental, emotional, and social health.

Crisis Text Line (CTL) is a not-for-profit organization which offers a free text-message support service targeted at young people in the US with near real-time data available since 2013. CTL is funded through individual donations and corporate

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partnerships. CTL offers free, nationally available, and 24/7 support for people in crisis. The service is made possible by trained crisis counselors who respond to texts and help counsel texters in crisis through a variety of strategies including active listening, problem-solving, and safety planning. Research using CTL has examined the effects of celebrity suicides [7], Hurricane Florence [8], and temperature on adolescent mental distress [9]. Yet, no study has examined the spatial clustering of bereavement in young at-risk populations during the COVID-19 pandemic. Spatial epidemiological techniques such as clustering have only recently been applied to mental health research for syndromic surveillance of population health risks [10].

This study used anonymized CTL texter data to identify and map spatiotemporal clusters of excess risk in bereavement among young people across the US. Results will shed light on the magnitude of bereavement in this age group and can inform location-based support interventions. Our methodology can be readily applied to data such as CTL to mitigate the mental consequences of bereavement during the pandemic by targeting specific locations that require bereavement counseling.

Methods

Data

At the close of the crisis conversation, a crisis counselor adds issue tags (e.g., bereavement, suicidal thoughts) for topics covered. Daily anonymized CTL data on crisis response conversations flagged for bereavement were obtained between January 1, 2017, and October 27, 2020. Only individuals younger than 24 years with available demographic data and a US-based area code were included in the study, resulting in a total of 11,891 unique individuals who contributed to 15,208 crisis conversations for bereavement.

Cluster analysis

SaTScan software spatially and temporally analyzes the spread of a health outcome using Kulldorff's spatial scan statistic. A discrete Poisson model was used to locate high-risk clusters of bereavement concern. This model is preferable to other models as it produces more conservative p values [11,12]. Clustering analysis detected space-time clusters using a circular spatial window size set to a maximum of 10% of the total at-risk population and a temporal cluster maximum of three months. The covariates of gender, sexual orientation, race, and ethnicity were adjusted for individually in models and then combined in the final SaTScan model to determine the mediating role of these factors in the strength and spatial distribution of clusters for bereavement.

Results

Space-time analysis

Nearly 84% of CTL users with bereavement-related conversations were more likely to be older than 14 years, consistent with other CTL users, and 80.6% were female which was slightly higher than all CTL conversations. However, CTL users with bereavement were more likely to identify as American Indians (5.9%) and African American (11.5%) and less likely to identify as Hispanic (15.8%) or Asian (4.8%) than other CTL users (4.6%, 11.3%, 16.3%, or 6.4%, respectively) (Table 1). Figure 1 shows the location and temporal period for five high-risk clusters of bereavement-related conversations ($p < .05$). The highest unadjusted bereavement risk clusters occurred during the Summer of 2020 primarily in the Southern US. Other significant hotspots of bereavement risk were located in the Southwest, Mid-Atlantic, Midwest, and Great Lakes. Accounting for race and ethnicity did not alter the location or size of clusters but lowered the log-likelihood ratio of the primary high-risk bereavement cluster from log likelihood ratio = 33.4 ($p < .01$) to log likelihood ratio = 31.8 ($p < .01$). Covariate adjustment for sexuality expanded the size of the Northeast cluster and caused it to spatially move farther north (Figure 1). The relative risk for the Northeast cluster decreased upon adjustment for sexuality from relative risk (RR) = 3.59 ($p < .05$) to RR = 2.36 ($p < .01$). In the final model after adjustment for all covariates, the Northeast cluster expanded, and the relative risk decreased from RR = 1.78 to RR = 1.62 ($p < .05$).

Table 1
Demographic information for all Crisis Text Line conversations and for bereavement conversations, U.S. 2017-2020

	Bereavement conversations	All conversations
Race & ethnicity		
African American	1,754 (11.5)	54,942 (11.3)
American Indian/Alaska Native	904 (5.9)	22,342 (4.6)
Asian	728 (4.8)	31,231 (6.4)
Hispanic	2,405 (15.8)	79,074 (16.3)
Mixed race	411 (2.7)	13,663 (2.8)
Other	127 (.8)	4,597 (.9)
White	8,879 (58.4)	279,576 (57.6)
Gender		
Female	12,265 (80.6)	377,518 (77.8)
Male	1,685 (11.1)	54,039 (11.1)
Non-binary	95 (.6)	4,299 (.9)
Other	708 (4.7)	30,471 (6.3)
Transgender	455 (3.0)	19,098 (3.9)

Discussion

COVID-19 is an ongoing public health crisis that may yield a second wave of mental health concerns tied to bereavement, social isolation, financial instability, and social support reductions [6]. Projections suggest that over 1.7 million Americans will experience the death of a close relative resulting in high bereavement burden over the course of the pandemic [5]. And these projections have already been outstripped given the large and growing COVID-19 death toll among Americans. By applying a popular syndromic surveillance approach, our results highlight that bereavement is a significant stressor shouldered by adolescents during the pandemic and requires further study to understand the contextual factors driving excess risk in young people.

We noted high-risk clusters of bereavement in the Northeastern US (e.g., New York) and in the Western US (e.g., Utah) corresponding to high case counts. We observed no significant clusters of bereavement from 2017 to 2019, with the exception of the August 2019 cluster in Utah of unknown origin, suggesting that the

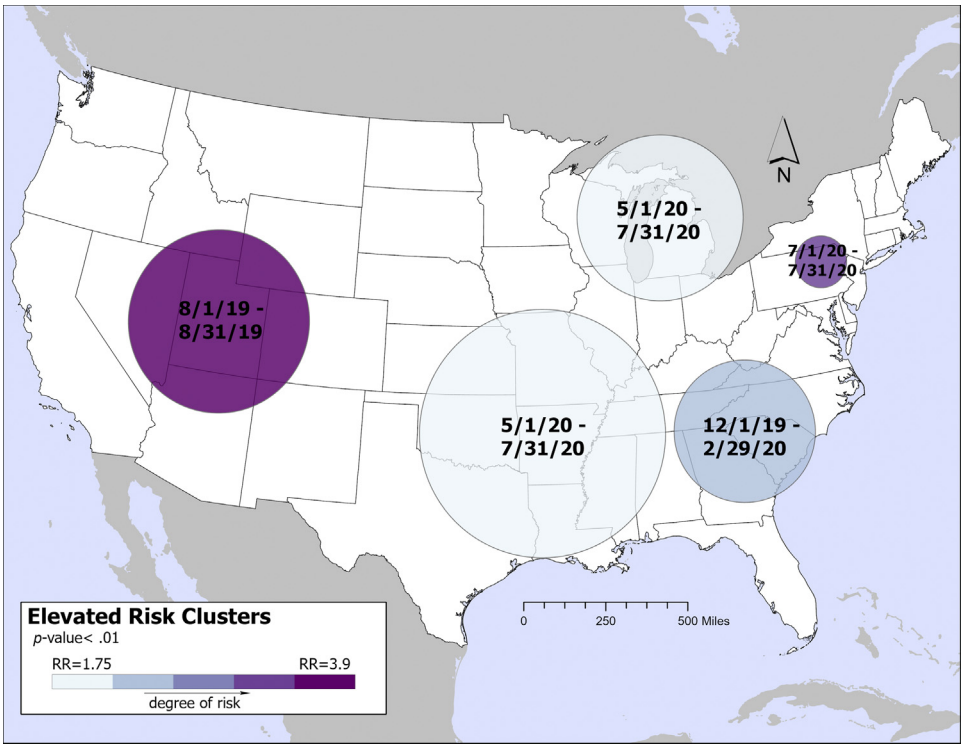

Figure 1. Space-time clusters of elevated bereavement concern among CTL users (unadjusted), U.S. 2017-2020. Clusters where the underlying population was less than 20 were excluded from analysis because of their relatively small sample size.

COVID-19 pandemic is contributing to the increase in bereavement among adolescents in select regions of the US.

The high-risk bereavement cluster in the Northeast changed in size and location after adjustment for sexual orientation. The spatial shift indicates that sexual orientation partially explained the clustering of bereavement concern in northeast Pennsylvania. Our findings suggest that a disproportionate number of texters who identified as LGBTQ+ were experiencing bereavement in this region and may be in need of additional support outside existing social networks. This reflects the higher proportion of COVID-19 deaths in the Northeast than the national average [13]. One limitation of our approach is that we did not adjust for repeated measures of crisis conversations among the same individual, and this may in part explain the observed clustering of bereavement in northeast Pennsylvania. However, the lack of spatial change for clusters in other US regions emphasizes the persistence of bereavement as a significant concern among adolescents across the nation regardless of individual factors.

Our study was subject to a few limitations. Because we only included data on texters with demographic characteristics, the results may not be representative of the entire US, particularly because our sample of young people were inclined to seek help for bereavement during this difficult time and the demographic characteristics of participants may not reflect the national population as a whole. However, results from our study shed light on important at-risk groups, including gender nonconforming youth, that may benefit from additional support, including targeted crisis response using free and nationally available digital platforms, such as CTL, or call helplines. Future validation studies should be conducted with emergency department records using billable codes for bereavement to confirm our findings.

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