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Effects of Geography on Risk for Future Suicidal Ideation and Attempts Among Children and Youth

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Abstract

Objective: Geography may influence the relationships of predictors for suicidal ideation (SI) and suicide attempts (SA) in children and youth.

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Drs. Xi and Banerjee served as the statistical experts for this research.

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Method: This is a nationwide retrospective cohort study of 124,424 individuals less than 25 years of age using commercial claims data (2011–2015) from the Health Care Cost Institute. Outcomes were time to SI or SA within 3 months after the indexed mental health or substance use disorder (MH/SUD) outpatient visit. Predictors included sociodemographic and clinical characteristics up to 3 years before the index event.

Results: At each follow-up time period, rates of SI and SA varied by the US geographic division ($p < .001$), and the Mountain Division consistently had the highest rates for both SI and SA (5.44%−10.26% for SI; 0.70%−2.82% for SA). Having MH emergency department (ED) visits in the past year increased the risk of SI by 28% to 65% for individuals residing in the New England, Mid-Atlantic, East North Central, West North Central, and East South Central Divisions. The main effects of geographic divisions were significant for SA (p<0.001). Risk of SA was lower in New England, Mid-Atlantic, South Atlantic, and Pacific (hazard ratios = 0.57, 0.51, 0.67, and 0.79, respectively) and higher in the Mountain Division (hazard ratio = 1.46).

Conclusion: To understand the underlying mechanisms driving the high prevalence of SI and SA in the Mountain Division and the elevated risk of SI after having MH ED visits, future research examining regional differences in risks for SI and SA should include indicators of access to MH ED care and other social determinants of health.

Keywords

suicidal ideation; suicide attempts; geographic regions; youth mental health; insurance claims data

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Prevention of suicide among children and youth is a national priority,[1] as suicide is the second leading cause of death among US children and youth under the age of 25 years since 2013.[2] Suicides rose by 23.27% between 2013 and 2019,[2] with a disproportionate rise among female and Black children and youth.[3,4] In addition, suicide rates have stark geographic variations.[5–7] In 2018, 4 of the top 5 states with the highest age-adjusted suicide death rate were in the Mountain Division (Wyoming: 25.2, New Mexico: 25.0, Montana: 24.9, and Idaho: 23.9 per 100,000 standard population), whereas 4 of the top 5 states with the lowest age-adjusted suicide death rate were in the Northeast (New Jersey: 8.3, New York: 8.3, Rhode Island: 9.5, and Massachusetts: 9.9 per 100,000 standard population).[7]

Many young people experience suicidal ideation (SI) and attempt suicide,[8] both of which are among the strongest predictors for youth suicide.[5] Being female, racial/ethnic minority, and sexual minority, as well as having anxiety disorders, major depressive disorder, antidepressant prescriptions, and use of illicit drugs are associated with an elevated risk of SI or suicide attempt (SA) among children and youth.[9–11] Similar to suicide death, rates of SI and SA also vary by geography. For example, rural youth were more likely to report SI and SA than their urban counterparts, according to a study based on the California Health Interview Survey.[5] Another study using electronic health records (EHR) data from a large urban pediatric emergency department (ED) found that the risk for positive SI and SA screening among youth 11 to 19 years of age varied significantly by the ZIP code of their residence.[12] Some factors associated with suicidality, such as ambient temperature,[13] sunshine hours,[14] and prevalence of firearm ownership,[15] vary by US regions, potentially contributing to varying SI and SA rates across the country. At the national level, identifying regions that require the most help, and understanding the driving factors behind the high SI/SA risks, may be used by the federal government in allocating appropriate resources for suicide risk reduction. To this end, it is necessary to understand the additive effect of US regions on youth SI and SA after controlling for the known sociodemographic and clinical predictors, and whether the effects of these predictors vary by geographic regions.

This study used a national-level large commercial insurance claims data set and used demographic and clinical predictors identified by prior research in a psychiatric outpatient population[16] to achieve the following: (1) to examine the geographic variation of future SI and SA in the US among commercially insured children, adolescents, and transitional-aged youth[17] under 25 years; and (2) to explore how geographic divisions modify the effect of demographic and clinical predictors for SI and SA. The same data have been used to study the effects of social deprivation on risk factors for SI and SA in the youth and the adult populations.[18] To ensure that the predictors were valid in our study population, we adopted a study design similar to that in the previous study[16] by restricting the cohort to those individuals who had at least 1 outpatient care encounter for mental health or substance use disorder (MH/SUD). The "children and youth" population in the rest of this paper refers to commercially insured children and youth under 25 years of age with a prior MH/SUD-related outpatient visit. We hypothesized that (1) rates of SI and SA and (2) effects of demographic and clinical predictors for SI and SA both would vary by geographic regions across the US.

METHOD

Data Source and Study Design

The data source was commercial insurance claims data for 2011 to 2015 from the Health Care Cost Institute (HCCI), a non-profit, independent research institute that currently holds nationwide de-identified insurance claims data of beneficiaries covered by commercial or Medicare Advantage plans from 4 major health insurance payors in the US (ie, Aetna, Humana, Kaiser Permanente, and UnitedHealthcare) in a manner compliant with the Health Insurance Portability and Accountability Act (HIPAA).[19] Commercial health insurance, also known as private health insurance, is provided through an employer or union, direct purchase, or TRICARE.[20] It does not include public insurance such as Medicare or Medicaid. In 2021, 66% of the US population was covered by commercial health insurance and 54.3% was covered by an employment-based plan.[20] Compared with those who have no insurance or who are covered by public insurance plans, people covered by commercial insurance have higher income[20] and are more likely to reside in an urban area.[21] A detailed description of the HCCI database can be found elsewhere.[22]

This is a nationwide retrospective cohort study of patients less than 25 years of age who were enrolled in a commercial health care insurance plan with MH coverage and had at least 1 outpatient visit between January 1, 2014, and June 30, 2015, with an *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) code for an MH/SUD diagnosis[23] (index event). The index event window was chosen so that we could fully capture the health care use of all patients in the past 3 years (January 1, 2011 to January 1, 2014, for the earliest patients) and so that we could have at least 3 months of post-index event data in *ICD-9-CM* codes (*ICD-10-CM* became effective October 1, 2015) to construct outcome variables. For patients with multiple index events in the study window, the first one observed was used as the index event. To construct long-, mid-, and short-term clinical predictors for the analysis, we further restricted the cohort to patients with continuous enrollment in health insurance plans for 3 years prior to the index event (Figure 1). Therefore, those who changed their insurance plans or lost their insurance coverage because of job change or job loss may not be included in the study cohort.

Study Variable Construction

The independent variables were sociodemographic and clinical characteristics as well as US Census Bureau divisions. Administrative sex and age group (<18 and 18–24 years) were directly extracted from the membership enrollment table in the month of the index event. Patients' residential ZIP codes were extracted, and urbanicity (urban vs non-urban) was derived based on the metropolitan statistical areas defined by the US Census core-based statistical areas (CBSAs). Patients living in an area with a population of fewer than 50,000 were considered as living in a non-urban setting.

Patients' geographic regions were defined by assigning their state of residency to 1 of the 9 divisions defined by the US Census Bureau[24]: East North Central, East South Central, Mid-Atlantic, Mountain, New England, Pacific, South Atlantic, West North Central, and West South Central. A visual summary of divisions by states is presented in Figure 2, and the distribution of states within divisions is summarized in Table S1, available online.

Clinical predictors were risk factors identified by predictive modeling in prior research,[16] including previous MH or SUD diagnoses by type within the 3 years prior to the index visit, SA in the past 3 years, 1 year, and 3 months, and prior acute MH care (ie, MH inpatient stay/past year, MH ED visit/past year and 3 months) and prescriptions of antidepressants in the past 3 months.[16] Two important factors from prior research, namely having both an SA and a diagnosis of schizophrenia in the past 3 years as well as having benzodiazepine prescriptions in the past 3 months, were dropped from current analysis because of their low frequency. Hospitalizations were defined by having claims in the inpatient files. ED visits were identified via claims reporting Revenue Center Codes values for emergency room services: 0450 to 0459 (emergency room) or 0981 (professional fees, emergency room). Diseases diagnoses were defined by *ICD-9-CM* codes (details provided in Table S2, available online) and prescriptions were defined by the National Drug Code.

Two outcomes were considered for survival analyses: time from index event to the first diagnosis of SI (in days) and time from index event to the first diagnosis of SA (in days). SI and SA were defined by *ICD-9-CM* diagnosis codes V62.84[25,26] (suicidal ideation) and E950-E958[27,28] (suicide and self-inflicted injury), respectively. For SA, we also conducted a sensitivity analysis defining SA as E950-E958 and E980-E988 (injury undetermined whether accidentally or purposely inflicted), because previous research showed that using only E950 to E959 had low sensitivity in identifying suicide attempts and self-inflicted injury[29] and including E980 to E988 codes increased the sensitivity and positive predictive value.[16,30] In addition, the *ICD-9* to *ICD-10* conversion took effect on October 1, 2015.[31] To avoid the change in coding patterns due to this conversion,[31] we dropped the last 3 months of data (ie, October to December 2015) and censored patients who did not have an SI or SA diagnosis by September 30, 2015. The censoring date was defined by either the last day of the month of patients' insurance plan enrollment or September 30, 2015, whichever came first.

Data Analysis

The distributions of demographic characteristics, clinical predictors, and outcome variables (time to future SI and time to future SA) were summarized for the entire cohort as well as by division. χ^2 Tests were conducted to compare the distributions of variables across divisions.

We used survival analysis to evaluate the effect of geographic differences on demographic and clinical predictors for SI and SA. We fitted a series of Cox proportional hazards models as follows: (1) a baseline model included main effects of clinical predictors and demographic variables; (2) a main effects model consisted of clinical predictors, demographic variables, and geographic divisions; and (3) a model with main effects of clinical predictors, demographic variables, geographic divisions, and 2-way interactions between geographic divisions and clinical predictors and demographic variables. Model 2 was compared to model 1 to test for the main effects of geographic divisions after controlling for clinical predictors and demographic variables. If the main effects of geographic divisions were significant, model 3 was compared to model 2 to test for the interaction effects between geographic divisions and clinical predictors and demographic variables. If model 3 was not significant, then model 2 was chosen as the final model. If model 3 was significant, then model 4 was fitted and chosen as the final model, using main effects of clinical predictors, demographic variables, geographic divisions, and only the interactions that were significant in model 3. A significance level of .05 was chosen for our analysis.

All data management and analyses were performed using R statistical software (version 3.6.3; R Foundation for Statistical Computing, Vienna, Austria). This study was reviewed and approved as exempt by the Institutional Review Board at Weill Cornell Medicine.

RESULTS

We identified 124,424 individuals less than 25 years old with an index encounter during the study period (Figure 2). Most children and youth in our cohort lived in urban areas (93.45%). The most common MH/SUD diagnoses in the past 3 years were anxiety (36.30%) and depression (31.70%). Prior SAs were relatively rare, with an overall 2.41% of individuals having an SA in the past 3 years and 0.53% in the past 3 months. Recent antidepressant treatment (11.69%) and past-year acute MH care (hospitalizations: 7.39%; ED visit: 6.85%) were relatively low. The distributions of these factors varied by geographic division (Table 1).

Suicidal Ideation

The overall post 7-, 30-, 90-, 180-, and 365-day SI rates among children and youth with an MH/SUD outpatient visit were 2.98%, 3.76%, 4.76%, 5.65%, and 6.66%, respectively, and varied significantly by geographic division ($p < .001$ for each rate). The Mountain division had the highest post 7-, 30-, 90-, 180-, and 365-day SI rates: 5.44%, 6.70%, 8.09%, 9.18%, and 10.26%, respectively. The post 7-, 30-, and 90-day SI rates were the lowest in the Mid-Atlantic division (1.88%, 2.47%, and 3.35%, respectively). The post 180- and 365-day SI rates were the lowest in the East South Central Division (4.05% and 4.90%, respectively). The by-division trajectories of post SI rates are summarized in Figure S1, available online.

For future SI, the Cox proportional hazards model showed significant interaction effects between geographic divisions and clinical and demographic predictors ($\chi^2(128) = 171{:}48$, $p < .01$). Geographic divisions interacted with anxiety disorder diagnosis in the past 3 years, eating disorder diagnosis in the past 3 years, and MH ED visits in the past year (Figure 3). Therefore, the final model included main effects of clinical predictors, demographic characteristics, geographic divisions, and the interactions between geographic divisions and anxiety disorder diagnosis in the past 3 years, eating disorder diagnosis in the past 3 years, and MH ED visits in the past year (model 4 described in the Data Analysis section). For children and youth from the Mid-Atlantic Division, having an eating disorder diagnosis in the past 3 years was negatively associated with future SI (hazard ratio [HR] = 0.65), whereas children and youth from other geographic divisions did not have such associations. For children and youth from the Mid-Atlantic, South Atlantic, West South Central, and Pacific Divisions, having an anxiety disorder diagnosis in the past 3 years was positively associated with future SI (HRs = 1.32, 1.30, 1.14, and 1.28, respectively), whereas children and youth from other geographic divisions did not have such associations. For children and youth from the New England, Mid-Atlantic, East North Central, West North Central, and East South Central Divisions, having an MH ED visit in the past year was positively associated with future SI (HRs = 1.42, 1.28, 1.33, 1.52, and 1.65, respectively), whereas children and youth from other geographic divisions did not have such associations.

In addition to the way in which geographic divisions interacted with anxiety disorder and eating disorder diagnoses and MH ED visits, being female, being less than 18 years of age, living in an urban setting, having a depression diagnosis in the past 3 years, an alcohol use disorder diagnosis in the past 3 years, a personality disorder diagnosis in the past 3 years, SA in the past 3 years, antidepressant prescription in the past 3 months, MH inpatient stay in the past year, and MH ED visit in the past 3 months were all associated with an elevated risk of future SI (Table 2).

Suicide Attempts

The overall post 7-, 30-, 90-, 180-, and 365-day SA rates among children and youth with an MH/SUD outpatient visit were 0.34%, 0.48%, 0.69%, 0.90%, and 1.16%, respectively, and varied significantly by geographic division ($p < .001$ for each rate). The Mountain Division had the highest post 7-, 30-, 90-, 180-, and 365-day SA rates: 0.57%, 0.93%, 1.39%, 1.73%, and 2.14%, respectively. The post 7-day SA rate was the lowest in the New England Division (0.16%), whereas the post 30-, 90-, 180-, and 365-day SA rates were the lowest in the Mid-Atlantic Division (0.24%, 0.34%, 0.48%, and 0.66%, respectively). The by-division trajectories of post SA rates are summarized in Figure S2, available online.

For future SA, the Cox proportional hazards model found no significant interaction effects between geographic divisions and clinical and demographic predictors ($\chi^2(128) = 121{:}57$,

$p = .64$). However, the main effects of geographic regions were still significant for SA, after controlling for the main effects of clinical and demographic predictors ($\chi^2(8)$ = 138:14, $p < .001$). Therefore, the final model included only the main effects of demographic characteristics, clinical predictors, and geographic divisions (model 2 described in the Data Analysis section). The risk of SA was lower in New England, Mid-Atlantic, South Atlantic, and Pacific (HRs = 0.57, 0.51, 0.67, and 0.79, respectively) and higher in the Mountain division (HR = 1.46). In addition, being female, being younger than 18 years old, having a depression diagnosis in the past 3 years, an alcohol use disorder diagnosis in the past 3 years, a personality disorder diagnosis in the past 3 years, SA in the past 3 years, antidepressant prescription in the past 3 months, MH inpatient stay in the past year, MH ED visit in the past year were all associated with an elevated risk of SA (Table 2).

Inclusion of *ICD-9-CM* codes E980 to E988 (injury undetermined whether accidentally or purposely inflicted) modestly increased the prevalence of SA at each post-index time period. Nevertheless, survival analysis led to the same conclusion, showing that the main effects of geographic divisions were significant after controlling for demographic and clinical predictors (χ^2 (8) = 171.58, $p < .001$), but the interaction effects between geographic divisions and predictors were not significant (χ^2 (128) = 145.87, $p = 0.13$) (Table S3, available online).

DISCUSSION

Our findings suggest that SI and SAs of children and youth had an unequal geographic distribution across the US. Among commercially insured children and youth with an MH/SUD outpatient encounter, those residing in the Mountain Division had the highest rates of future SI and SAs, with 10.26% of them experiencing SI and 2.14% having made an SA within 365 days after an MH/SUD encounter. Children and youth residing on the 2 coastlines (ie, New England, Mid-Atlantic, South Atlantic, and Pacific Divisions) had a lower risk of SI and SAs compared to children and youth living in central states (ie, East North Central, West North Central, East South Central, and West South Central Divisions).

Another important observation is that the relationships of demographic and clinical predictors for SI varied across geographic regions. Previous studies have mixed findings regarding the independent association between anxiety disorders and SI in youth.[32] Our study found that both the prevalence of anxiety disorder diagnosis and the association between anxiety disorders and SI varied by geographic regions. The geographic variation of anxiety disorder diagnosis might be because the prevalence was different, or because the diagnosis was inconsistent across regions. If it was the latter, then the severity of patients' anxiety disorder diagnoses might also vary across regions, which might be an explanation to the mixed findings in the literature regarding the association between anxiety and suicidality.[32] Having an MH ED visit in the past year increased the risk of SI by 28% to 65% in children and youth residing in the New England, East North Central, West North Central, and East South Central Divisions, despite the fact that these divisions, on average, had a lower prevalence of SI (Table 1). We speculate that this finding was due to the differences in access to MH emergency care and care-seeking patterns across divisions. In the above-mentioned divisions, more children and youth with the potential of developing

SI had been treated in the ED. Receiving an eating disorder diagnosis in the past 3 years appeared to be a protective factor for SI in children and youth in the Mid-Atlantic Division, but there was no such association in other geographic regions. Earlier studies reported a positive association between eating disorders and SI.[33–35] To explain our counterintuitive finding, we speculate that eating disorder treatment in the Mid-Atlantic Division might provide better care for patients' suicidal thoughts.

In addition, risk of SI increased if an individual had an MH ED visit in the past 3 months or an antidepressant prescription in the past 3 months. Compared to those who did not have an MH ED visit in the past 3 months, the risk of future SI almost doubled for those who had an MH ED visit. Similar observations can also be made for comparing those who had an antidepressant prescription vs those who did not (Table S4, available online). Having an MH ED visit or an antidepressant prescription in the past 3 months should be considered as a reflection of the severity of the patients' MH acute status. Therefore, our findings should not be interpreted as discouraging necessary visits to the MH ED or antidepressant prescription. Instead, health care providers and caregivers should pay closer attention to parents' suicidal thoughts if they had an MH ED visit or an antidepressant prescription.

Unlike SI, geographic regions did not influence the effects of predictors for SAs. History of depression, alcohol use disorder, personality disorder, SAs in the past 3 years, having an MH inpatient stay in the past year, having an MH ED visit in the past year, and receiving an antidepressant prescription in the past 3 months increased the risk of making an SA during the study period across all geographic regions. These findings are consistent with the literature.[36–39] After controlling for these factors that are available in the healthcare system, however, there are still unexplained geographic variations in the risk of future SA, which may be driven by socio-structural factors such as crime rates,[40] availability of acute MH specialists and facilities,[41] and firearm ownership rates (64% in Montana, the highest state in 2007–2016).[15] Several states in the Mountain Division also have a higher prevalence of Native American individuals, the racial group with the highest rates of SAs and with the lowest treatment use.[42] Whether, or to what extent, the social environment contributes to the high SA rates and low treatment rates in this ethno-racial group requires further investigation. Examining the association between these factors and SA in the Mountain Division in the future can help policy makers to better understand where to focus the improvement efforts to reduce the risk of SA among youth in the Mountain Division.

Children and youth less than 18 years of age had a higher risk of both SI and SA compared to those in the 18- to 24-year age bracket. Female patients had a higher risk of developing SI and SA than their male counterparts. These findings are consistent with patterns reported in the US.[38,43,44] Children and youth living in an urban setting had higher risk of developing SI, whereas the risk for SA did not vary between urban and rural populations after controlling for demographic and clinical predictors and geographic regions. An earlier study found an increased risk for SA in rural compared to urban youth,[45] whereas another study reported no significant difference in SI between urban and rural adolescents.[46] Also, higher risk of suicide has been reported in rural relative to urban areas.[6,45] The discrepancy between our findings and the existing literature may be due in part to the fact that we studied only patients with commercial insurance plans, which systematically underrepresents rural beneficiaries and their dependents with lower household income, a risk factor for SI and SA among children and youth.[47]

Our study has several limitations. First, the Health Care Cost Institute does not provide detailed age information for patients under the age of 18 years. Therefore, we were unable to differentiate pre-adolescents from youth between the ages of 12 and 18 years. Suicide and predictors for suicide are rather rare among very young children and become prevalent only in late pre-adolescence.[38] Therefore, only a small percentage of young children were likely to experience SI or SAs in our cohort. Second, although we analyzed a sample of children and youth across the nation, we included those with commercial insurance plans from 4 major insurance companies in the US and not patients covered by public health insurance programs or those who were uninsured. As a result, our study sample was 93.45% urban, whereas the Medicaid program covers a higher proportion of youth in rural areas.[48] Although the majority of children and youth in the US are covered by private insurance plans,[49] the results of our study cannot, and should not, be generalized to all US children and youth. A parallel study on the Medicaid-insured youth population can be a future direction of this research. In addition, this study was based on data from large commercial insurance companies and did not include data from small commercial health insurance companies that offer different sets of options to the insured that may influence health services use. Furthermore, the inclusion of patients with continuous insurance enrollment for 3 years may have introduced a selection bias, leading to disproportional inclusion of patients with more stable socioeconomic status. However, this inclusion criterion enabled us to fully capture the patients' prior health care encounters and to assess the effect of predictors for SI and SAs. Third, our study has the limitations of claims-based analyses, including inaccurate diagnostic coding, variation in coding patterns, and lack of ability to capture encounters not documented by the insurance plan. As a result, the prevalence of the outcome variables might not reflect the true rates of SI and SA in the population. Fourth, access to MH care services[41,50–53] and MH treatment-seeking patterns[54] may vary by geography. Therefore, in our study sample of children and youth with an MH/SUD outpatient diagnosis, the severity of patients' illness might be different across regions, potentially explaining some differences in the prevalence of SI and SA that we observed across geographic regions. However, the difference in mental illness severity should not affect the modeling results, because we controlled for patients' historical diagnosis in the models. If patients in one region had lower rates of SI/SA because of lack of access to MH care, then they should also have lower rates of having other MH/SUD diagnoses; the association between previous MH/SUD diagnoses and future SI/SA should not be affected by the access to care. Finally, we focused only on children and youth already with an MH/SUD outpatient visit, and we studied demographic and clinical predictors that were captured in our data set. Therefore, our findings should not be generalized to all commercially insured children and youth. There are also other predictors for SI and SA that we were unable to control for, including race/ethnicity, sexual orientation, being bullied, history of being sexually abused, low parental income, and family history of suicide,[9,10,38,39,47] which might affect SI and SAs across the various geographic regions.

Despite its limitations, this study's findings can inform both the allocation and the targeting of federal, regional, and local resources aimed to reduce suicide in youth. Interventions aiming to reduce youth suicide are critical, as suicides continue to increase and as the prevalence of suicide risk factors remains high.[55] In 2019, the prevalence of SI in high school students was 15.8% and the prevalence of SAs was 8.9%, an increase of 22% since 1991.[56] Both SI and SA among children and youth not only heighten the risk of suicide but have a negative impact on their development, disrupt their families, and tax the health care system.[57,58] In addition, although the goal of this study was to inform US policy makers, the conceptual idea that there might be geographic variations in suicidality beyond factors captured by the health care systems, or that the effects of clinical factors can vary by geography, advises the global clinical audience to consider factors beyond what the health care systems can capture when studying suicidality.

In this study, we explored how the relationship between clinical and demographic predictors with SI and SA varied across geographic regions of the US among commercially insured children and youth with outpatient MH/SUD visits. Children and youth residing in the Mountain Division had consistently higher rates of SI and SA compared to those from other divisions. Among states in the Mountain Division, 4 of 5 have the highest age-adjusted suicide death rates in the US.[7] More focused studies are needed in the future to understand the underlying mechanism driving the high rates of SI and SA in the Mountain Division. The consistently higher rates of SI and SA in the Mountain Division may inform the federal government's plans for resource allocation intended to reduce suicide risk in children and youth. Local governments in the Mountain Division may use this information to make MH resources available for the continuum of care (prevention, early detection, and treatment) and to educate youth and their caregivers to utilize the available MH services.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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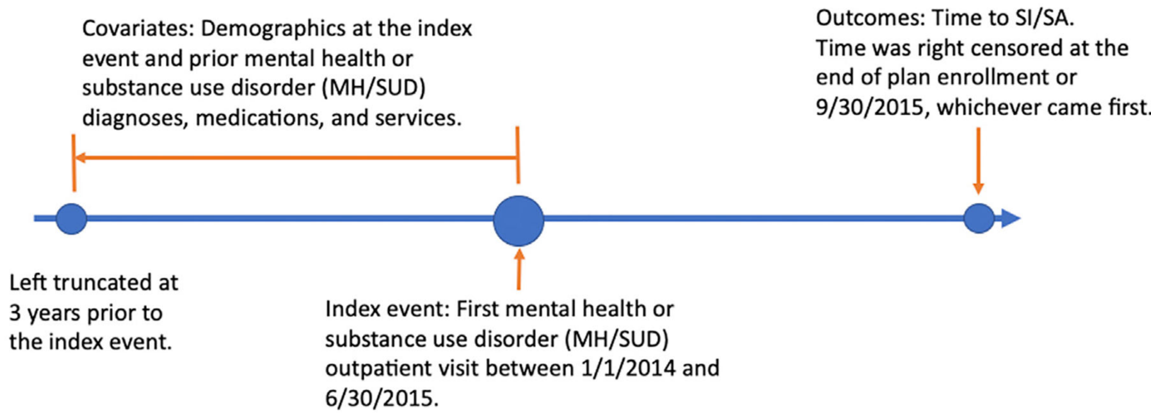

FIGURE 1.

Study Design

Note: MH/SUD = mental health or substance use disorder; SA = suicide attempt; SI = suicidal ideation.

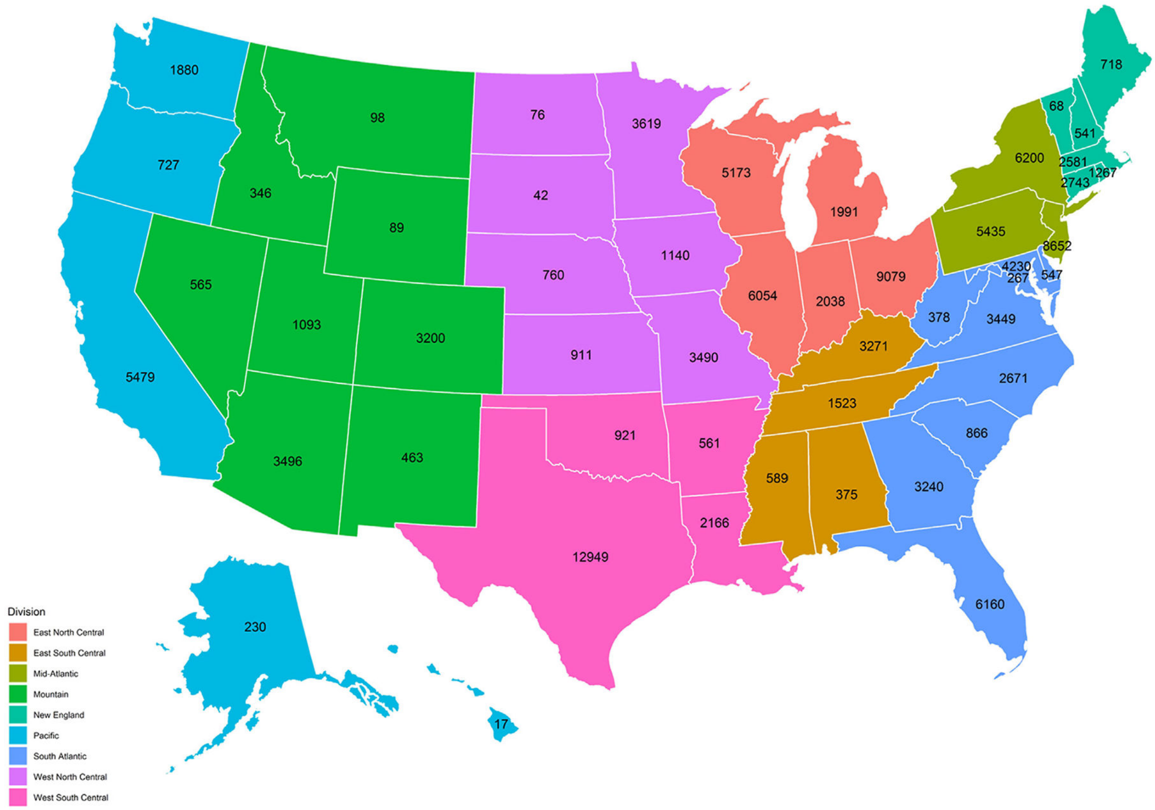

FIGURE 2.

Distribution of Cohort Enrollment by State

Note: The color indicates the 9 divisions defined by the US Census Bureau. The number indicates the number of enrollments from each state.

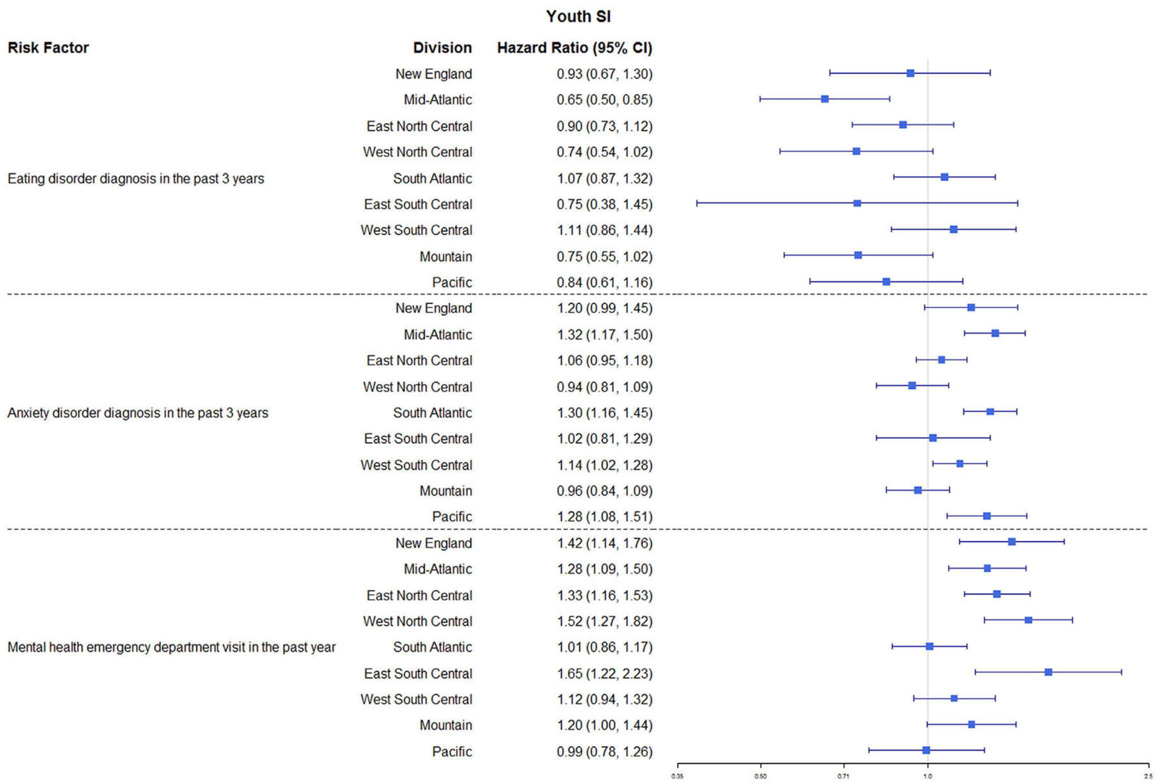

FIGURE 3.

Hazard Ratios of Predictors Having Significant Interaction With Divisions for Future Suicidal Ideation (SI)

TABLE 1

Distributions of Demographic and Clinical Predictors by Division Among Commercially Insured Children and Youth With an Outpatient Mental Health or Substance Use Disorder–Related Visit

		Northeast		Midwest		South			West		
	All, % (N = 124,424)	**New England, % (n = 7,918)**	**Mid-Atlantic, % (n = 20,287)**	**East North Central, % (n = 24,335)**	**West North Central, % (n = 10,038)**	**South Atlantic, % (n = 21,808)**	**East South Central, % (n = 5,758)**	**West South Central, % (n = 16,597)**	**Mountain, % (n = 9,350)**	**Pacific, % (n = 8,333)**	**p (χ^2)**
Demographics											
Sex											<.001
Male	52.67	49.85	54.73	51.98	51.80	53.02	54.20	52.35	51.83	53.03	
Female	47.33	50.15	45.28	48.02	48.20	46.98	45.80	47.65	48.17	46.97	
Age, y											<.001
<18	52.24	48.81	51.91	53.44	54.71	52.39	54.29	50.19	52.39	51.93	
18–24	47.76	51.19	48.11	46.56	45.29	47.61	45.71	49.81	47.62	48.07	
Region type											<.001
Urban	93.45	93.24	98.70	90.57	89.77	96.42	77.91	93.42	92.76	97.58	
Non-urban	6.55	6.76	1.30	9.44	10.23	3.58	22.09	6.59	7.24	2.42	
Mental health diagnoses											
Anxiety disorder diagnosis in the past 3 years	36.30	44.46	35.46	37.67	40.21	35.07	33.45	31.77	36.76	35.62	<.001
Depression diagnosis in the past 3 years	31.70	34.67	30.26	32.99	35.70	29.45	29.44	29.68	34.54	32.15	<.001
Alcohol use disorder diagnosis in the past 3 years	6.95	7.75	8.89	6.03	8.19	6.70	5.61	5.69	6.73	7.06	<.001
Drug use disorder diagnosis in the past 3 years	9.80	9.70	11.55	8.77	9.29	9.85	9.43	8.72	11.02	10.15	<.001
Eating disorder diagnosis in the past 3 years	3.30	4.64	3.80	3.18	3.79	3.21	2.40	2.19	2.94	4.08	<.001
Personality disorder diagnosis in the past 3 years	2.35	2.73	2.64	2.49	2.82	2.22	1.65	1.69	2.74	2.00	<.001
Suicide attempt in the past 3 years	2.41	2.20	1.75	3.04	2.52	1.69	2.61	2.61	3.57	2.33	<.001
Suicide attempt in the past year	1.13	0.97	0.82	1.42	1.34	0.71	1.39	1.26	1.60	1.13	<.001
Suicide attempt in the past 3 months	0.53	0.46	0.40	0.68	0.72	0.34	0.61	0.57	0.64	0.54	<.001

	All, % (N = 124,424)	Northeast: New England, % (n = 7,918)	Northeast: Mid-Atlantic, % (n = 20,287)	Midwest: East North Central, % (n = 24,335)	Midwest: West North Central, % (n = 10,038)	South: South Atlantic, % (n = 21,808)	South: East South Central, % (n = 5,758)	South: West South Central, % (n = 16,597)	West: Mountain, % (n = 9,350)	West: Pacific, % (n = 8,333)	p (χ^2)
Psychotropic medications											
Antidepressant prescription in the past 3 months	11.69	11.62	8.38	12.82	15.90	11.35	9.54	12.03	12.74	11.90	<.001
Mental health services											
Mental health inpatient stay in the past year	7.39	6.25	7.182	7.28	8.34	7.25	7.59	8.37	7.44	6.38	<.001
Mental health emergency department visit in the past year	6.85	7.86	7.33	7.29	8.17	6.69	5.80	5.53	6.71	5.80	<.001
Mental health emergency department visit in the past 3 months	2.27	2.61	2.38	2.39	3.19	2.34	2.03	1.56	1.96	1.94	<.001

TABLE 2

Main Effects From the Cox Model for Suicidal Ideation (SI) and Results of Cox Models for Suicide Attempt (SA)

	SI HR (95% CI)	SA HR (95% CI)
Demographics		
Sex		
Male	Reference	Reference
Female	1.35 (1.29, 1.41)*	2.01 (1.80, 2.25)*
Age, y		
<18	1.54 (1.47, 1.61)*	1.73 (1.55, 1.92)*
18–24	Reference	Reference
Region type		
Urban	Reference	Reference
Non-urban	0.85 (0.78, 0.94)*	0.84 (0.68, 1.05)
Mental health diagnoses		
Anxiety disorder diagnosis in the past 3 years	Sig interaction	1.06 (0.94, 1.20)
Depression diagnosis in the past 3 years	2.94 (2.79, 3.10)*	2.93 (2.57, 3.33)*
Alcohol use disorder diagnosis in the past 3 years	1.11 (1.03, 1.20)*	1.29 (1.09, 1.54)*
Drug use disorder diagnosis in the past 3 years	1.06 (0.99, 1.14)	1.02 (0.87, 1.19)
Eating disorder diagnosis in the past 3 years	Sig interaction	1.01 (0.84, 1.23)
Personality disorder diagnosis in the past 3 years	1.38 (1.26, 1.51)*	1.45 (1.19, 1.76)*
Suicide attempt in the past 3 years	1.33 (1.17, 1.50)*	2.00 (1.58, 2.54)*
Suicide attempt in the past year	0.91 (0.74, 1.11)	1.28 (0.91, 1.79)
Suicide attempt in the past 3 months	0.92 (0.73, 1.16)	1.15 (0.81, 1.64)
Psychotropic medications		
Antidepressant prescription in the past 3 months	1.19 (1.13, 1.26)*	1.30 (1.15, 1.46)*
Mental health services		
Mental health inpatient stay in the past year	1.49 (1.39, 1.59)*	1.35 (1.16, 1.58)*
Mental health emergency department visit in the past year	Sig interaction	1.20 (1.01, 1.44)*
Mental health emergency department visit in the past 3 months	1.17 (1.06, 1.30)*	1.20 (0.96, 1.50)
Geographic divisions		

	SI HR (95% CI)	SA HR (95% CI)
New England	Sig interaction	0.57 (0.44, 0.73) *
Mid-Atlantic	Sig interaction	0.51 (0.42, 0.62) *
East North Central	Sig interaction	Reference
West North Central	Sig interaction	0.97 (0.80, 1.16)
South Atlantic	Sig interaction	0.67 (0.57, 0.79) *
East South Central	Sig interaction	0.90 (0.70, 1.17)
West South Central	Sig interaction	0.88 (0.74, 1.04)
Mountain	Sig interaction	1.46 (1.24, 1.73) *
Pacific	Sig interaction	0.79 (0.63, 0.98) *

Note: Significant interactions of the SI model are summarized in Figure 3. HR = hazard ratio; Sig = significant

* $p < .05$.