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Health Diagnoses and Service Utilization in the Year Prior to Youth and Young Adult Suicide

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Abstract

Objective: Suicide rates among young people are on the rise. Health care visits provide opportunities for identification and intervention, yet studies have been limited by small or circumscribed samples.

Methods: A case-control study examining mental and physical health diagnoses and health care utilization in the 30 and 365 days prior to suicide death at nine health care systems across the United States. Data from 445 patients aged 10–24 who died by suicide were matched with 4,450 control group patients.

Results: Suicide decedents were more likely to have at least one mental health diagnosis (51% vs 16%; AOR: 5.74, 95% CI: 4.60–7.18) and had higher rates of nearly all mental health conditions. Epilepsy (AOR: 4.68, 1.86–11.76) and sleep disorders (AOR: 3.75, 2.30–6.12) were more likely among youth who died by suicide. Close to half (42%) and nearly all (88%) suicide decedents had a visit in the previous month and year, respectively.

Conclusions: Despite the high odds ratios associated with mental health diagnoses, such disorders were only present in 51% of suicide decedents. High utilization rates among suicide decedents indicate a need for improving identification of mental health conditions and suicide risk across the health care system. Increased substance use screening may yield a higher likelihood of high-risk youth, given its greater prevalence and odds.

Introduction

Adolescent and young adult suicide is a major public health concern as rates continue to rise despite increased awareness. Among adolescents and young adults (hereafter referred to as young people), suicide is the second highest cause of death (1). Since 2007, there has been a 56% increase in suicide deaths among young people age 10–24 (1). Concern over increasing suicide rates prompted the development of the National Strategy for Suicide Prevention (2), which focuses on suicide prevention as a core aspect of all health care services. Previous efforts to slow suicide rates have primarily focused on individuals with psychiatric diagnoses within behavioral health settings (3). The modifiable risk among this population, however, is low, given the relatively small volume of patients who have suicidal intent in these settings (2). Thus, general medical settings offer an opportunity to expand suicide prevention efforts and address this issue at scale, as the bulk of patients who are at risk of suicide are seen in these settings prior to their death (4, 5).

Understanding health diagnoses and health care utilization among young people prior to suicide can help with identification and intervention efforts. To date, however, most studies of suicide risk have focused on adult populations either exclusively (6, 7) or have combined young people with adults (4, 5, 8). The few that have examined health conditions and health care encounters among young suicide decedents have done so using subpopulations or specific settings, including Medicaid enrollees (9), youth in the child welfare system (10), and young people in the emergency department (11, 12). This study seeks to expand the knowledge base in this area by examining these associations among young people age 10–24 who died by suicide and a matched control group in nine large, geographically-diverse health care systems. Investigation of health diagnoses and health care

utilization across an array of health care interactions provides an opportunity to identify more avenues to effectively implement suicide prevention measures catered to young people. We hypothesized that mental health and substance use diagnoses would be associated with increased risk for suicide. Given that nearly half of adults who die by suicide have a mental health diagnosis, we expect that young people would show a similar prevalence rate. Finally, we anticipated that suicide decedents visited the health care system more often than control group patients in the month and year prior to death.

Methods

Study Sample

This case-control study was conducted within nine health care systems that are part of the Mental Health Research Network (MHRN), a consortium of 21 health systems providing care for over 30 million patients across the United States. Participating health systems were: Henry Ford Health System, Kaiser Permanente Washington, Kaiser Permanente Northwest (Oregon and Washington), Kaiser Permanente Georgia, Kaiser Permanente Colorado, Kaiser Permanente Hawaii, HealthPartners (Minnesota), Essentia Health (Minnesota), and Harvard Pilgrim (Massachusetts). These health systems serve patients living in urban, suburban, and rural areas. Each provides comprehensive health care, including primary and specialty care, behavioral health, and emergency/urgent care. Participating health systems are also health plan membership owners, allowing data capture on nearly all health care utilization within and outside of the health system via the combination of electronic health records (EHR) and insurance claims.

The current study examined the data of 445 young people age 10–24 who died by suicide between January 1, 2000 and September 30, 2015. Data from these youth were matched in a 1:10 ratio with data from 4,450 youth who did not die by suicide chosen randomly, based on health system and time period of membership. Data were extracted from the year leading up to the date of death by suicide (index date; or matched index date for control group patients). Participants were continuously enrolled in the health system insurance plan for at least 10 months of that year-long examination period.

Data Source

All MHRN sites maintain a Virtual Data Warehouse (VDW), which has EHR and health insurance claims data, allowing for the capture of nearly all internal and external health care utilization (~99%) (13, 14). VDW data on demographics, encounters, pharmacy fills, diagnoses, procedures, enrollment, and costs are organized into uniform datasets using standardized variables and definitions across sites. The VDW also contains mortality data, including date and cause(s) of death, which are derived from official, government mortality records.

Individuals in the current study who died by suicide were identified using International Classification of Diseases (10th version; ICD-10) codes X60 to X84 and Y87.0. Health system encounters in the year prior to the index date were extracted, including the number of days prior to the index date. Encounters (categorized as ED/urgent care, inpatient care,

primary care, or specialty care) were categorized as being associated with a mental health diagnosis, a substance use diagnosis, or neither. Diagnoses were captured using ICD-9-CM codes. Mental health and substance use diagnoses included codes 290–319. Physical health conditions were chosen based on their association with suicide (9, 10, 15) and their prevalence among youth both generally and in our sample, which included asthma (493), back pain (720.0–724.9), epilepsy (345), and sleep disorder (291.82, 307.4, 327, 780.5). Demographics included age, binary sex as recorded in EHR (representing legal sex/sex assigned at birth), and insurance type. Neighborhood income and education were calculated using geocoded addresses and Census block data. High poverty was defined as living in a Census block in which more than 20% of the households were below the poverty line for income. Low education was defined as living in a Census block in which fewer than 25% of the residents have a college degree. Race/ethnicity data were not available for several sites prior to 2008 and were, therefore, not included in the study. Given possible confounding, we eliminated any diagnosis or encounter that occurred on the index date. The study was approved by the Institutional Review Boards at each study site.

Statistical Analyses

We used chi-square statistics to examine differences on demographic variables. We then used conditional logistic regression to examine whether various mental and physical health diagnoses were associated with the odds of suicide death. These models were run both unadjusted for any confounding variables and adjusted for both age and sex assigned at birth. We examined each individual diagnosis, as well as the odds of suicide death among individuals with any mental health diagnosis and any substance use diagnosis. We calculated the proportion of individuals engaging in the subtypes of encounters (i.e., outpatient specialty, inpatient, emergency/urgent care, and primary care by mental health diagnosis, substance use diagnosis, or neither) 30 and 365 days prior to the index date. Conditional logistic regression was used to test the odds of suicide death among those encounter subtypes at the two time points. Finally, we examined the odds of suicide death given past year health system encounter frequency for each of the identified visit subtypes. Analyses of encounters were adjusted for age and sex assigned at birth. SAS Version 9.4 (16) was used for all analyses.

Results

The overall study population consisted of 4,895 individuals (case group: 445, control group: 4,450); 53% (N= 2,588) were males and the average age was 16.9 ± 4.1 years old. As noted in Table 1, the proportion of males in the case group was significantly greater than among the control group. Age was also associated with suicide death, with a greater proportion of young adults (18+ years old) among suicide decedents. Although insurance type and living in a higher poverty Census block were not associated with suicide death, patients living in Census blocks with fewer than 25% of the residents having a college degree were less likely to be suicide decedents. Data on insurance type were missing for 202 patients, while the poverty and education variables were missing for 156 and 1,430, respectively; groups did not significantly differ on missingness for these variables.

Table 2 provides information on unadjusted conditional regression results examining the association of mental and physical health diagnoses on the odds of suicide death. Just over half (51%) of suicide decedents had at least one mental health diagnosis; depression (33%), anxiety (20%), substance use disorder (12%), and attention deficit/hyperactivity disorder (ADHD; 11%) were the most common. Nearly all diagnoses were associated with greater odds of suicide death. Those with the largest odds ratios included suicidal ideation, psychotic disorders, alcohol use disorder, and substance use disorder. After adjusting for age and sex assigned at birth, nearly all results remained the same, with back pain becoming non-significant in the adjusted model.

Table 3 shows the results of conditional logistic regressions that examine encounter subtypes, adjusting for age and sex assigned at birth. Nearly half (42%) of youth in the case group made a health care visit in the month prior to suicide and almost all (88%) made a visit within the past year. Outpatient specialty and primary care visits were the most and second most common visit type, respectively, in both groups. As expected, visits associated with a mental health diagnosis were also common in the case group, with 23% having such a visit in the previous month and almost half (48%) in the prior year. Significant group differences were observed for every visit subtype, with suicide decedents being more likely to have a specific encounter than control group patients. Inpatient and emergency visits showed the greatest discrepancy between groups with odds ratios ranging from 9.40 to 94.57.

The prevalence of all visit subtypes was significantly more common among suicide decedents (Table 4). Young people who died by suicide made an average of 11.39 ± 15.94 total visits in the previous year, compared to the control group ($M = 6.53 \pm 9.87$). Outpatient specialty visits were most common among both the case ($M = 8.07 \pm 12.65$) and control ($M = 4.73 \pm 7.38$) groups. Primary care visits were second most common with suicide decedents averaging 2.97 ± 4.06 and the control group averaging 2.46 ± 3.70 . The average number of visits with a mental health diagnosis was 4.02 ± 8.38 and 0.86 ± 3.95 for the case and control group, respectively.

Discussion

In this large, geographically-diverse sample of young people, mental health, substance use, and physical health comorbidities were common among suicide decedents. Among those with a mental health diagnosis, depression, anxiety, ADHD, and substance use were the most common and highlight prevention targets. Nearly half (49%) of suicide decedents lacked a recorded mental health diagnosis in the year prior to death, which is consistent with recent national reports of U.S. adults (17, 18). Health care visits were also common; close to half (42%) and nearly all (88%) young people who died by suicide had a health care visit in the month and year prior to their death, respectively, highlighting missed opportunities to intervene.

Results indicated that nearly all mental health disorders distinguish young people who died by suicide, which is largely consistent with case-control (9–12) and other studies of psychiatric risk factors for suicide-related behavior among youth (19–21). Alcohol and other

substance use disorders stand out as unique, in that they were among the most prevalent disorders among the case group and had the highest odds ratios. Previous studies have found similar results (9, 10), demonstrating that increased substance use screening may have a substantial impact on suicide prevention. A notable exception among mental health disorders in this study was autism, where the groups did not significantly differ. However, there is a wide range of cognitive and adaptive abilities among youth meeting ICD-9 diagnostic criteria, from individuals who are unable to verbally communicate to those who are extremely gifted and live independently. The inability to control for this variation may explain the lack of group differences.

With regard to physical health conditions, epilepsy and sleep disorders were associated with death by suicide. Previous research has noted relationships between suicide-related behavior and chronic physical health diagnoses (9, 10), with mixed findings for asthma (9, 10, 22). Epilepsy, however, has a long-standing association with suicide-related behaviors (23, 24), including among young people (9, 10, 22). Previous investigations have also noted that sleep disturbances and insomnia have resulted in increased ideation (25), attempts (26), and deaths (15) among young people. While more evidence exists linking sleep and both suicidal ideation and attempts, the literature on suicide deaths among those with sleep disorders is limited to psychological autopsy (15); thus, our study advances the field by reporting on documented sleep disorders among young suicide decedents.

Health care utilization findings indicated that young people who died by suicide were more likely than control group patients to make visits in the year prior to index date. Our results are similar to a recent study of young Medicaid enrollees (9) where 45% had an encounter in the month prior to death (current study: 49%). The studies were also similar in that outpatient visits were the most utilized, while also being associated with the smallest relative odds of suicide. As noted elsewhere (5), such findings underscore the challenge in providing suicide prevention across all areas of care that include high volume, lower odds settings (i.e., in outpatient settings) and lower volume, high risk settings (i.e., inpatient/ED).

After inpatient settings, ED use was associated with the greatest relative risk for suicide death, particularly when accompanied by a mental health or substance use diagnosis. Emergency visits are common in the year prior to death among young people (27); fortunately, studies indicate that suicide risk screening is feasible in this setting (28) and newly identified patients could be linked to further services. A substantial proportion of youth have the ED as their only point of health care contact (29) making it an essential setting to enact prevention efforts. Young people who died by suicide had roughly four specialty care visits in the year prior to death that were not associated with a mental health diagnosis. Specialty outpatient visits were the most common of all visits, with youth in the case group averaging over eight in the last year. Brief screeners are feasible to implement in this setting (30, 31) and may strike the balance between risk status and visit frequency.

Sentinel Event Alert #56 (32) and the more recent Patient Safety Goals (33) recommend suicide risk screening in all health care settings. Patients, however, require follow-up connection to evidence-based services to bend the curve on increasing suicide rates. The Zero Suicide initiative (34) provides a range of evidence-based approaches that are

specific to addressing suicide and can be implemented in a variety of settings. Integrated systems can leverage the continuum of Zero Suicide elements, with screening, transition across care settings, and treatment approaches such as Dialectical Behavior Therapy and Collaborative Assessment and Management of Suicidality (35). Specialty care, primary care, and emergency rooms – settings that may have less capacity for comprehensive service packages – can utilize Zero Suicide strategies that are effective and less resource-intensive like safety planning (36), caring contacts (37), and reduction of lethal means (38).

Given the strong association between mental health/substance use disorders and suicide death, it is important to recognize the lack of such diagnoses in half of suicide decedents. While suicide can be the result of acute stressors that are not precipitated by psychiatric diagnosis, many of these young people may have had unrecognized conditions that increased risk. Suicide decedents without a documented mental health condition were more likely to be male (53% vs. 33%; $p < 0.001$), mirroring population-level data (39), but were similar to those with a mental health diagnosis on other demographics. The rise in persistent feelings of sadness/hopelessness among young people (40) necessitates identification of mental health difficulties at all care pathways, such that youth can receive appropriate services before suicide attempts are made. Many of the mental health conditions linked to increased suicide risk have associated screening instruments which are brief (41, 42) and, perhaps, more easily implemented across settings.

While these findings move the field forward by providing information on health care visits and diagnoses among a large and geographically-diverse sample of young people, limitations should be noted. The EHR data available for this study did not include information on race and ethnicity. Given the recent escalation of suicidal ideation, attempts, and death among African-American youth and other racial and ethnic minorities (43, 44), examination of subgroup patterns is essential. We do not have information for this sample on gender identity or sexual orientation, which are associated with increased suicide risk (45). Indeed, more recent work by our group highlighted the association between suicide attempts and transgender/gender diverse individuals (50). We did not have adequate representation of those who were uninsured or on Medicaid compared to national rates who may have different patterns of health diagnoses and care utilization than those found in this study. Although our sample was diverse in myriad ways, our results may not generalize to other states or insurance types. The age range included in our study is broad and may represent different biological, social, or medical risks for suicide; however, this age range is practically important given the eligible age range for several national youth suicide prevention efforts. Funding for this study ended prior to recent increases in suicide-related behaviors among youth (40, 46), which are of critical concern. Finally, we do not have information on previous suicide attempts or trauma, known risk factors for future suicide-related behavior.

Conclusions

This study suggests that young people are frequent utilizers of health care services in the year prior to death by suicide. Physical and mental health diagnoses are strongly associated with suicide death and warrant frequent screening, especially given the unknown proportion of youth who may have undiagnosed conditions that increase suicide risk. Pre-visit mental

health screening in ambulatory settings may be feasible and catch the largest sample of youth with unrecognized disorders. Reliable, brief suicide risk screeners also make identification of those without a mental health condition possible in myriad settings (31, 47). Data indicate that technology-based approaches (48) and improved clinical pathways (49) may limit the impact of such screening and intervention on clinical workflow and promote widespread suicide prevention. This comprehensive approach casts the widest net to triage youth into appropriate mental health and/or suicide-specific intervention services.

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Highlights

- Mental health diagnoses were only present among 51% of young people who died by suicide.
- Nearly all mental health and physical health diagnoses significantly differentiated those who did or did not die by suicide.
- Alcohol and other substance use disorders were among the most prevalent diagnoses among suicide decedents, as well as produced the largest odds ratios.
- Increased screening and subsequent evidence-based strategies across all areas of the health care system may improve prevention rates.

Table 1.Demographic comparisons between case (n = 445) and control (n = 4,450) patients.^a

Characteristic	Case Group		Control Group		p-value
	N	%	N	%	
Male	349	78	2,239	50	<0.001
Age				27	<0.001
10–13	18	4	1,197	27	
14–17	117	26	1,376	31	
18–20	135	30	930	21	
21+	175	39	947	21	
Insurance type					0.146
Commercial	390	88	3,902	88	
Public	23	5	214	5	
Other (self-pay)	15	3	149	3	
Unknown	17	4	185	4	
Lower Education ^b	139	32	1,602	37	0.030
Higher Poverty ^c	24	8	303	10	0.233

^aMissing data include insurance type (n = 202), education (n = 1,430), and poverty (n = 156)^bLiving in a Census block in which fewer than 25% of the residents have a college degree^cLiving in a Census block in which more than 20% of the households were below the poverty line for income

Prevalence, unadjusted odds ratios (OR), and adjusted odds ratios (AOR) for mental and physical health conditions using conditional logistic regression.

Table 2.

Characteristic	Case Group (n = 445)		Control Group (n = 4,450)		OR	95% CI	AOR ^a	95% CI
	N	%	N	%				
Any Mental Health diagnosis	227	51	701	16	5.63	4.58, 6.92	5.74	4.60, 7.18
Type of Mental Health diagnosis								
ADHD	51	11	202	5	2.71	1.96, 3.75	2.85	2.01, 4.05
Anxiety	90	20	234	5	4.74	3.60, 6.23	5.22	3.86, 7.06
Autism	6	1	30	1	2.03	0.84, 4.95	1.65	0.64, 4.26
Bipolar Disorder	22	5	29	1	8.05	4.55, 14.25	8.65	4.68, 15.97
Conduct Disorder	21	5	54	1	4.14	2.45, 6.98	5.72	3.25, 10.06
Depression	147	33	300	7	6.81	5.39, 8.61	7.58	5.84, 9.83
Eating Disorder	12	3	13	0	9.23	4.21, 20.23	16.11	6.93, 37.46
Psychotic Disorders	24	5	16	0	16.52	8.53, 32.00	14.28	6.89, 29.59
Suicidal Ideation	17	4	7	0	24.29	10.07, 58.56	27.33	10.21, 73.79
Tobacco Use Disorder	54	12	115	3	5.57	3.92, 7.93	4.15	2.85, 6.05
Alcohol Use Disorder	46	10	40	1	13.64	8.62, 21.57	8.52	5.21, 13.93
Any Substance Use Disorder	55	12	52	1	11.78	7.91, 17.54	8.50	5.53, 13.06
Physical health conditions								
Asthma	31	7	271	6	1.16	0.78, 1.70	1.43	0.95, 2.15
Back pain	42	9	285	6	1.53	1.09, 2.15	1.33	0.93, 1.91
Epilepsy	7	2	21	1	3.33	1.42, 7.84	4.68	1.86, 11.76
Sleep disorders	28	6	93	2	3.30	2.11, 5.16	3.75	2.30, 6.12

^a Adjusted for age and sex assigned at birth.

Table 3.

Adjusted odds ratios (AOR) for health care visit type incidence at 30 and 365 days prior to index date using conditional logistic regression.

Visit type	30 days prior to index date						365 days prior to index date					
	Case Group (n = 445)			Control Group (n = 4,450)			Case Group (n = 445)			Control Group (n = 4,450)		
	N	%	AOR ^a	N	%	95% CI	N	%	AOR ^a	N	%	95% CI
Any encounter	188	42	2.65	1,125	25	2.13, 3.29	391	88	1.9	3,755	84	1.40, 2.59
Outpatient specialty	149	33	2.16	977	22	1.72, 2.71	377	85	17.1	3,643	82	1.29, 2.27
Inpatient stay	48	11	35.17	18	0	18.84, 65.66	97	22	12.05	125	3	8.53, 17.03
ER/Urgent	34	8	6.86	58	1	4.21, 11.18	142	32	3.54	566	13	2.79, 4.51
Primary care	84	19	1.78	602	14	1.35, 2.34	310	70	1.36	3,084	69	1.08, 1.71
Any visit with MH dx	102	23	8.77	173	4	6.46, 11.91	213	48	6.13	671	15	4.87, 7.71
Outpatient specialty with MH dx	82	18	7.59	158	4	5.48, 10.53	194	44	5.59	633	14	4.44, 7.04
Inpatient with MH dx	29	7	94.57	4	0	31.67, 282.44	71	16	29.08	39	1	17.81, 47.49
ER/Urgent with MH dx	16	4	60.21	3	0	16.34, 221.92	59	13	16.18	47	1	10.20, 25.66
Primary care with MH dx	35	8	8.53	52	1	5.24, 13.88	109	24	4.29	358	8	3.29, 5.60
Any visit with SUD dx	35	8	10.5	26	1	6.05, 18.25	97	22	6.24	142	3	4.55, 8.55
Outpatient specialty with SUD dx	16	4	6.29	21	1	3.16, 12.53	65	15	4.55	117	3	3.20, 6.46
Inpatient with MH dx	14	3	47.15	2	0	9.90, 224.60	40	9	17.7	18	0	9.46, 33.14
ER/Urgent with SUD dx	7	2	9.40	5	0	2.76, 32.03	36	8	5.81	44	1	3.54, 9.53
Primary care with MH dx	6	1	5.56	9	0	1.84, 16.77	29	7	3.42	69	2	2.11, 5.55

^a Adjusted for age and sex assigned at birth

Abbreviations: MH, mental health; dx, diagnosis; SUD, substance use disorder

Adjusted odds ratios (AOR) for health care visit type frequency 365 days prior to index date using conditional logistic regression.

Table 4.

Visit type	Case Group (n = 445)			Control Group (n = 4,450)			AOR ^a	95% CI
	M	SD	Med	M	SD	Med		
Any encounter	11.39	15.94	7	6.53	9.87	4	1.04	1.03, 1.04
Outpatient specialty	8.07	12.65	4	4.73	7.38	3	1.04	1.03, 1.05
Inpatient stay	0.37	1.05	0	0.04	0.33	0	3.46	2.74, 4.37
ER/Urgent	0.62	1.20	0	0.20	0.70	0	1.60	1.43, 1.79
Primary care	2.97	4.06	2	2.46	3.70	1	1.06	1.03, 1.08
Any encounter with MH dx	4.02	8.38	0	0.86	3.95	0	1.10	1.08, 1.12
Outpatient specialty with MH dx	3.20	7.28	0	0.78	3.69	0	1.10	1.08, 1.12
Inpatient with MH dx	0.27	0.81	0	0.01	0.15	0	8.14	5.54, 11.96
ER/Urgent with MH dx	0.23	0.72	0	0.01	0.14	0	6.43	4.46, 9.26
Primary care with MH dx	0.56	1.45	0	0.15	0.62	0	1.67	1.51, 1.85
Any encounter with SUD dx	1.47	8.59	0	0.14	1.75	0	1.10	1.06, 1.14
Outpatient specialty with SUD dx	1.11	7.65	0	0.11	1.64	0	1.08	1.04, 1.12
Inpatient with SUD dx	0.14	0.50	0	0.00	0.08	0	8.13	4.66, 14.18
ER/Urgent with SUD dx	0.13	0.60	0	0.01	0.14	0	3.18	2.18, 4.63
Primary care with SUD dx	0.10	0.46	0	0.03	0.33	0	1.29	1.08, 1.55

^a Adjusted for age and sex assigned at birth.

Abbreviations: MH, mental health; dx, diagnosis; SUD, substance use disorder