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BRIEF REPORT

Suicide Attempt Trends in Central Texas Youth

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Introduction

Self-directed violence including suicide and suicide attempts are a serious public health issue (Crosby et al. 2011; Eaton et al. 2012; National Center for Injury Prevention and Control 2011; Shaffer et al. 2001; Texas Department of State Health Services 2011, 2012). One major concern is that suicide rates continue to increase in the United States. Age-adjusted suicide rates for individuals 10–74 years of age grew from 10.5 per 100,000 in 1999 to 13.0 per 100,000 in 2014, a 24% increase. Females aged 10–14 years old experienced the largest percent increase of 200% during the same time period. Males aged 10–14 years old experienced a 37% increase from 1999 to 2014 (Curtin et al. 2016).

Suicide was the second leading cause of death (18.6%) in youth aged 10–18 years in 2014 (Centers for Disease Control and Prevention). Suicide rates for females, age ranges 10–14 years and 15–24 years, were 1.5 per 100,000 and 4.6 per 100,000 respectively in 2014. Male suicide rates were higher at 2.6 per 100,000 for ages 10–14 and 18.2 per 100,000 for ages 15–24 years (Curtin et al. 2016). When focusing on Travis County, Texas, the population included in the analysis for this study, 6.3 per 100,000 youth ages 15–24 years died by suicide in 2012 (Texas Department of State Health Services Center for Health Statistics 2012).

While the rate of suicide is startling, the rate of suicide attempt is even more prevalent. Males died by suicide at a rate four times greater than females; however, females are three times more likely to attempt suicide then males (American Foundation of Suicide Prevention 2014; Molina and Duarte 2006). When considering the youth population sources suggests varying rates of youth suicide attempts to deaths by suicide all of which are significant, at 25:1 (American Foundation of Suicide Prevention 2014). Another source suggests a range of youth suicide attempts to deaths by suicide of 50:1 to 100:1 (Shain 2016).

Despite evidence showing suicide attempts being more prevalent than deaths by suicide, data on suicide attempts is underreported. In addition, differentiation of suicide attempts from other forms of self-directed violence without the intent to die is difficult due to data collection practices (American Foundation of Suicide Prevention 2014). The National Violent Death Report System is currently conducting surveillance on various forms of violent deaths including suicide in all fifty U.S. states; Washington, DC; and Puerto Rico. Texas was recently awarded funds to become part of this surveillance system that combines data from vital statistics, coroner, toxicology, law enforcement, and state and local medical examiner records (Center for Disease Control and Prevention 2018; National Center for Injury Prevention and Control Division of Violence Prevention 2017a, b). Given the focus of this surveillance system is on violent death, suicide attempts are not included and to the authors of this manuscript's knowledge, no comparable national system is being organized for suicide attempt surveillance. Currently, self-report and hospital data are the two primary methods utilized to conduct surveillance on suicide attempts.

Self-report data estimating suicide attempts in youth is collected with the high school Youth Risk Behavior Surveillance System (YRBSS), a nationwide survey of students in grades 9–12 that monitors priority health-risk behaviors in youth and young adults. According to the 2013 high school YRBSS, 8.0% of students had attempted suicide one or more times in the previous 12 months before the survey. When looking specifically at students residing in Texas, where this current study was conducted, 10.1% of the over 2700 students surveyed had attempted suicide one or more times in the previous 12 months before the survey (Centers for Disease Control and Prevention 2013). It is important to note that school district participation in the YRBSS is not mandated and therefore, not all school districts in Texas or other states participate. This limits the ability to do county comparisons to state and national rates of suicide attempts.

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Hospital data is another avenue for conducting surveillance on suicide attempts. It has been estimated that 2 million adolescents in the United States attempt suicide each year and nearly 700,000 of those receive medical attention due to their attempt (Shaffer et al. 2001). Standardized hospital-based suicide attempt surveillance efforts are rare but do exist for adults in the Veteran Affairs healthcare setting (Brenner et al. 2011) and for youth in specific regions such as the State of Oregon which mandates hospital refer youth who have attempted suicide to appropriate services and report the attempt to the Department of Human Services (Oregon Department of Human Services Injury Prevention and Epidemiology Program 2009; Oregon Department of Human Services Public Health Division 2008). National efforts are lacking though unless one widens their focus from suicide attempt to self-harm. CDC reports generated from the WISQARS database suggest 469,096 hospital visits in 2014 were attributed to self-harm. When honing on the adolescent age ranges, 10–14, 15–19 and 20–24 years, reports show 36,782, 84,133 and 61,967 hospital visits for these age groups respectively. Ages 15–24 years reported the most visits and highest crude rates of all age groups (Centers for Disease Control and Prevention). Though accurate evaluation is critical in the emergency department, assessment of suicidality can be challenging given the barriers clinicians face to obtain sufficient information for informing treatment and emergency department disposition: multiple informants, mental illness stigma resulting in patients and caregivers being reluctant to divulge information, and characteristics inherent to the emergency department setting (e.g., lack of privacy, time constraint, etc.) (Berk and Asarnow 2015).

Given the lack of sufficient and consistent reporting mechanisms, research on trends of youth suicide attempt is limited and predominately focuses on specific populations of youth (Beauchamp et al. 2014; Jopling et al. 2016) or yearly trends of youth suicide attempt that do not include an investigation of seasonality (De Munck et al. 2009; Dieserud et al. 2010; Jansen et al. 2009; Larkin et al. 2008). A limited number of current research studies have observed seasonality with increased youth suicide attempts in the fall and spring (Beauchamp et al. 2014; Jopling et al. 2016). These studies have specifically focused on suicide attempts by poisoning (Beauchamp et al. 2014) and patients presenting to inpatient psychiatric units (Jopling et al. 2016). Limited research exists looking at trends of youth suicides in patients presenting to emergency departments for all mechanisms.

Existing literature on youth suicide trends has shown a distinct pattern among youth suicide when compared to adults, with significantly lower suicide rates during the months that students break from school (June, July, August and December). This observation could be attributed to intensified mental health issues students experience due to stressors students encountered when school is in session (Hansen and Lang 2011). A case-control study found serious suicide attempts in youth, aged 13–24 years, were triggered most commonly by relationship breakdowns (24%) or other interpersonal problems (26.4%) including conflict with family or friends. Financial difficulties (8.5%), legal issues (7.0%), and school (6.2%) or workplace (3.9%) difficulties were also significant (Beautrais et al. 1997). High-stakes standardized testing may also pose an increased risk with youth when performance outcome is worse than anticipated (Wang 2016).

The objective of this study was to examine trends of youth suicide attempts in patients presenting to two Central Texas civilian hospitals over a 20 month period. The authors have retrospectively utilized a standardized classification system to identify patients in an effort to increase the sensitivity and specificity of the sample.

Methods

Identifying Study Cohort

Given the lack of consistent classification of suicide attempts (Silverman and Leo 2016), a two-step screening process was conducted to accurately identify the study cohort of youth who attempted suicide: (1) self-directed violence cohort identification (2) rigorous surveillance using retrospective standardized classification. Given that common methods for querying suicide attempts using ICD-9 coding or medical record key word searches have shown to have low sensitivity (Barczyk et al. 2018). The rigorous surveillance method was developed by combining syndromic surveillance methods utilized in hospital systems (Oregon Public Health Division 2008) with the best practice of expert panels (Liljeqvist et al. 2014). A detailed comparison of common surveillance methods for querying suicide attempts to the rigorous surveillance method developed and utilized for this study are available in a previous manuscript (Barczyk et al. 2018).

Self-Directed Violence Cohort Identification

Four databases common to both institutions were queried to identify patients greater than four years of age and less than 19 years of age that were presenting due to self-directed violence (SDV) between 1/1/2011 and 8/31/2012. Database querying resulted in identifying 1903 encounters. Queried databases included the following: (1) trauma registries were queried for SDV related injuries (2) social work emergency department datasets were queried for patients flagged with "Psych" and/or "Behavioral" issues and comments fields were queried for SDV related terminology including: suicidal ideation (SI), suicide attempt (SA), and mechanisms of SDV (e.g., cutting, hanging/suffocation, overdose, etc.);

(3) the "Problem" field was queried in emergency department databases for key SDV related words including: suicidal ideation (SI), suicide attempt (SA), and mechanisms of SDV (e.g., cutting, hanging/suffocation, overdose, etc.); (4) financial databases' chief complaint fields were queried for key SDV terms including: suicide attempt, suicide ideation, SI, SA, and mechanisms of SDV. In addition, the financial database's diagnosis variable was queried for ICD-9 external cause of injury and supplemental classification codes between E950-E959.99 (Suicide and Self Inflicted Injury) and V62.84 (Suicidal Ideation).

Rigorous Surveillance Using Retrospective Standardized Classification

The 1903 encounters identified in the *Self-Directed Violence Cohort Identification* process were then screened to assess if classification requirements for suicide attempts were met. The screening resulted in 231 encounters identified as suicide attempts which will be the focus of this manuscript's analysis.

The screening was done by retrospectively implementing a standardized classification modeled from Oregon's Adolescent Suicide Attempt Data System (Oregon Public Health Division 2008). After a time-intensive medical record review, each encounter was assigned one of the three mutually exclusive SDV classifications by our research team members: (1) Suicide Attempt if the patient had self-harming thoughts, acted on these self-harming thoughts and had intent to die; (2) Self-Harm Act if the patient had self-harming thoughts, acted on these thoughts and did not have intent to die; (3) Self-Harm Ideation if the patient had self-harming thoughts and did not act on these thoughts. Cases were omitted if: (1) the patient did not present to the hospital with self-harming behavior; (2) it was a duplicate of an existing encounter; or (3) medical record documentation was insufficient to render a classification. Throughout the process, regular meetings were held to resolve researchers' questions. In addition, two clinical experts adjudicated eight complex cases for which the research team was unable to reach consensus. Finally, to enhance rigor of this process, interrater reliability was performed on 10% of encounters resulting in a substantial level of interrater reliability with a kappa of .79 ($p < .001$) and having 86% of the encounters coded in agreement (Landis and Koch 1977).

Variables Abstracted

Demographic variables abstracted from hospital medical records of patients identified in the study's cohort included age, gender (male and female), race/ethnicity (white non-Hispanic, Hispanic, black non-Hispanic, and other non-Hispanic), and insurance coverage (public, private, and uninsured). The mechanism of the suicide attempt was also abstracted from physician and social work notes (hanging/asphyxiation/choking/strangling, ingestion, MVC-related, cutting/stabbing, multiple methods, and other traumatic suicide attempt). Finally, the season which the suicide attempt occurred was abstracted based on the date the patient presented to the hospital (fall = September 1, 2011–November 30, 2011, winter = December 1, 2011-February 28, 2012, spring = March 1, 2012–May 31, 2012, and summer = June 1, 2012–August 31, 2012).

Analysis

Researchers used descriptive statistics to describe the sample. Graphs were used to examine trends in suicide attempt encounters by gender, race/ethnicity, and insurance over a 20 month period. Data for this retrospective cohort study were obtained from two hospitals in Central Texas each with a Level 1 Trauma Center upon approval by the Seton Institutional Review Board. In addition, the authors of this manuscript have no conflicts of interest to report relating to this research and are responsible for all content in this manuscript.

Results

Of the 231 patients who attempted suicide, the majority were female (n = 175, 76%) with only 24% of patients who attempted suicide being male (n = 56). Patients were predominately Non-Hispanic White (n = 111, 48%) with more than a third of patients who attempted suicide reporting Hispanic (n = 80, 35%), followed by patients reporting Black Non-Hispanic (n = 28, 12%) and Other Non-Hispanic (n = 12, 5%). The average age of patients was 14.74 years old (SD = 2.00). Over half of our sample was publicly insured (n = 127, 55%), with 40% having private insurance (n = 93) and 5% being uninsured (n = 11).

The most common mechanism of the suicide attempt was ingestion (n = 151, 65%) followed by multiple methods (n = 31, 14%), hanging/asphyxiation/choking/strangling (n = 18, 8%), cutting/stabbing (n = 14, 6%), MVC-related (n = 10, 4%), and other traumatic suicide attempt (n = 7, 3%). Spring was the most common season in which youth presented to the participating hospitals having attempted suicide (n = 49, 31%) followed closely by Fall (n = 30, 30%), then Winter (n = 34 20%) and Summer (n = 27, 17%).

There was a visually significant increase in suicide attempts that occurred near the spring (March–May) and fall (September–November) seasons. The months with the highest number of suicide attempts included April 2011 (n = 13), November 2011 (n = 18), and April 2012 (n = 21). The months with the lowest number of suicide attempts

included June 2011 (n = 6) and June 2012 (n = 7). These patterns were visually significant for both males and females, though the peak month differed slightly. For females, the months with the highest number of suicide attempts included May (n = 9), April (n = 9), November (n = 14) of 2011, February 2012 (13), and April 2012 (n = 18). The months with the lowest numbers of suicide attempts in females included January 2011 (n = 5), June 2011 (n = 5), January 2012 (n = 5), and June 2012 (n = 5). For males, the months with the highest number of suicides included January (n = 4), April (n = 4), August (n = 4), November (n = 4) of 2011 and March 2012 (n = 7). The months with the lowest number of suicide attempts in males included March (n = 1), June (n = 1), December (n = 1) of 2011, May 2012 (n = 1), and August 2012 (n = 1). Overall, there was less variability in the treads for males possibly due to the lower number of suicide attempts in the male youth.

In addition, nearly all ethnicities showed increases in the number of suicide attempts near the spring and fall. Specifically, for white Non-Hispanic patients, April (n = 10) and November 2011 (n = 10) and April 2012 (n = 7) were the months with the highest number of suicide attempts. June 2011 (n = 3), August 2011 (n = 3), and June 2012 (n = 2) were the months with the lowest number of white Non-Hispanic youth attempting suicide. The months with the highest number of suicide attempts in Hispanic youth was September 2011 (n = 6) and April 2012 (n = 10). The months with the lowest number of suicide attempts in Hispanic youth were January 2011 (n = 1), June 2011 (n = 1), May 2012 (n = 2), and July 2012 (n = 2). Children reporting as Non-Hispanic black or other Non-Hispanic races had less variability in treads likely due to the lower number of suicide attempts in these populations presenting to the hospital. Among Non-Hispanic black children, August 2011 (n = 4) and May 2012 (n = 5) were the months with highest number of suicide attempts. Several months had zero suicide attempts including: January, March, April, July, October, December of 2011, June 2012, and August 2012. Among children reporting race as other Non-Hispanic, January 2011 (n = 2) was the month with the highest number of suicides and several months had zero suicide attempts reported: February, May, June, August, September, November of 2011, and February, March, and August of 2012. When looking at patterns based on insurance coverage, our proxy for income, all insurance coverages (public, private, and uninsured) showed increases in the spring and fall; however, there were also additional peaks in suicide attempts. There were very low numbers of uninsured patients, and therefore, less variability. Months with the highest number of suicide attempts for uninsured patients were May 2011 (2), November 2011 (2), and April 2012. Several other months had zero suicides occurring including: January, February, March, April, June, August, September of 2011 and January, May, June, July, and August of 2012. Among patients with public insurance, November 2011 (10), February 2012 (12), and April 2012 (14) had the highest number of suicide attempts. January 2011 (4), April 2011 (2), July 2011 (3), December 2011 (4), and July 2012 were the months with the least about of suicide attempts for publicly insured patients. Patients with private insurance had the highest number of suicide attempts in April 2011 (11) and March 2012 (8). February 2011 (1), June 2011 (1), and June 2012 (2) were the months with the fewest number of suicide attempts in patients with private insurance. More research is needed to understand if these findings are an anomaly or if there are in fact differences between the time one attempts suicide based on socioeconomic factors such as insurance coverage.

Discussion

In this sample of Central Texas youth, females and non-Hispanic white patients had the highest frequency of presentation to the hospital due to a suicide attempt. It should be noted that when comparing the racial/ethnic breakdown of our sample to that of Travis County, Texas where this study occurred, our sample was fairly consistent. Specifically, the percentage of Non-Hispanic White (48%), Hispanic (35%), and Black Non-Hispanic (12%) patients in our sample were comparative to the percentage of Non-Hispanic White (50.5%), Hispanic (33.5%), and Black Non-Hispanic (8.5%) persons in Travis County, Texas (United States Census Bureau 2010).

When looking for trends across the calendar year, fall and spring showed the highest frequency of suicide attempts for all genders and races/ethnicities. These patterns are consistent with existing literature on youth suicide attempts by poisoning (Beauchamp et al. 2014) and patients presenting to inpatient psychiatric units (Jopling et al. 2016).

While this study did not examine causality or reasons why suicide attempts occurred, it is important to note that fall and spring are periods with the potential stressors of transitioning back to or beginning a new school, and often a time of standardized testing. For the timeframe of this study, standardized testing occurred in April 2011 and March 2012 but, more research is needed to assess if any relationship exists between standardized testing and youth suicide attempts. Risk factors for suicide attempt associated with school and issues during school have been reported in the literature. For example, in a national longitudinal survey of 7th through 12th graders, previous suicide attempt, alcohol use, marijuana use, violence perpetration, victimization, and problems in school including having trouble paying attention or getting homework done were found to be risk factors of suicide attempts for each gender and racial/ethnic group in the study (Borowsky et al. 2001). There is also evidence

linking bullying to risk for adolescent suicide attempt (Kaminski and Fang 2009; Klomek et al. 2009). According to data from The Finnish Hospital Discharge Register, even when controlling for conduct disorders and depression, having been bullied at age 8 was a significant risk factor for suicide attempt by age 25 among girls (Klomek et al. 2009). It is our hope that as more knowledge is gained about when suicides are occurring, more targeted prevention strategies can be implemented.

Data is crucial to improve suicide prevention efforts (Reidenberg and Berman 2016) and develop effective interventions with suicidal patients in emergency departments (Larkin and Beautrais 2010). More efforts are needed to increase the use of standardized nomenclature and classifications systems to continue to enhance the study of youth suicide attempts. In addition, more research is needed to continue to understand the differences between youth who attempt suicide and those utilizing other forms of self-directed violence such suicidal ideations and suicide.

Despite efforts to ensure rigor in our study, limitations do exist. First, the study sample includes youth who presented to the emergency department due to a suicide attempt. Literature shows that many youth attempt suicide without seeking medical treatment (Shaffer et al. 2001); therefore, this study cannot be generalized to all youth who attempt suicide. Second, despite the rigorous method for identifying the cohort in this study, the hospitals this study occurred in lacked a uniform nomenclature or classification system. Due to this, the authors were unable to determine if all SDV encounters during the study time period were identified for initial screening.

Despite these limitations, the authors believe the results support the need to target suicide prevention efforts at the beginning and end of the school year in order to increase the effectiveness of reaching high-risk youth. This may mean a continuous prevention strategy or one that has multiple points of contact to ensure long term effectiveness. Various factors may be impacting the behavioral health of students including testing in school and transitioning in and out of school. Future research is needed to examine reasons for the increase in suicide attempts during these time periods.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed for this study where in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was retrospective in nature and therefore formal consent was not required.

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