A 27-Year Retrospective Study of Pediatric Suicide Cases Referred to the Medical University of South Carolina (1988-2014)

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ABSTRACT

Suicide by individuals under 18 years of age is a tragic reality of society. To assess local trends and demographics, we retrospectively reviewed all pediatric cases referred to our institution from 1988-2014 (27 years). Pediatric cases were defined as individuals younger than 18 years of age. The incidence of reported suicides declined from 3.8 cases per year to 2.4 cases per year as compared to observations at our institution over a previous ten-year period (1988-1998). In concert with the overall decrease in cases were increases in the proportion of adolescents younger than 15 and the female demographic. Furthermore, a shift in suicidal methodology was noted, with an increase in suicide by hanging. Indeed, for females, hanging became the most common suicide modality, replacing firearms. Our findings are congruent with national trends and underline the need for global suicide preventive interventions targeted toward increasingly younger adolescents and females. *Acad Forensic Pathol.* 2016 6(3): 524-531

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INFORMATION

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INTRODUCTION

Suicide in children under the age of 18, or pediatric suicide, is a serious public health challenge and is often cited as the second or third leading manner of death, depending on the age range studied. Factors that reportedly place this age group at risk include psychiatric disorders, social stress, alcohol, drug use, and access to firearms (1, 2).

Pediatric suicide is preventable. It is surmised that better understanding of its root causes and increased accessibility to avenues of interventions should decrease the incidence. To these ends, multiple perspectives are needed to disentangle the complexities of pediatric suicidal ideation and completed suicide. The forensic pathologist perspective focuses on the cause of death and has the unique advantage of surveying many cases over time. Such a perspective may highlight areas amenable to intervention. For instance, studies implicating firearms as the leading suicide modality led to efforts to limit firearms access. Furthermore, this perspective promotes awareness of common trends associated with suicide among the forensic community, physicians and the general public.

A previous retrospective analysis of pediatric suicide cases presenting for autopsy to the Medical University of South Carolina from January 1988 to January 1998 has been published (3). The study analyzed pediatric suicide with respect to demographics, location, mechanism of death, alcohol and drug use, medical history, and factors preceding the suicide such as documented suicidal ideation, previous attempts, and presence of a suicide note. Now, we extend that analysis by 17 more years, until December 2014, encompassing a total period of 27 years. We further compare the findings from the initial study of ten years with the findings from the subsequent 17 years. We also compare our results to national trends.

METHODS

This study is a case series of 78 individuals under the age of 18 years whose manner of death was determined to be suicide after a complete autopsy. All

forensic pathology pediatric suicide autopsy cases referred to the Medical and Forensic Autopsy Section of the Department of Pathology and Laboratory Medicine at the Medical University of South Carolina by surrounding county coroner offices from January 1, 1988 to December 31, 2014 were reviewed.

Seventy-eight cases met age and manner of death criteria and were analyzed with respect to demographics, method of suicide, location of suicide, and documented psychiatric history. Thirty-one cases overlapped with the prior study of 1988-1998 (3); however, additional cases were located and included. Trends over time were assessed using all available data, from 1988-2014, and linear trend lines were generated using Microsoft Office Excel 2010 software by regression analysis: $y = mx + b$.

RESULTS

Thirty-eight (n=38) cases were identified from January 1, 1988 to January 1, 1998 and forty (n=40) cases were identified from January 1, 1998 to December 31, 2014. During 1988-1998, the average incidence was 3.8 pediatric suicide cases per year, while during 1998-2014 the average incidence was 2.4 cases per year. Overall average incidence during the 27-year period was 2.9 per year. The incidence of reported cases is demonstrated in **Figure 1**. Of note, 1993 demonstrated an unusual peak incidence of suicides. However, with this data point excluded, the trend continues to demonstrate a slight downward slope although the association is largely neutralized (current $R^2 = 5\%$ with 1993 ten cases of suicide; if 1993 = 0 suicides, $R^2 = 1\%$).

The majority of cases during both time periods were Caucasian males between 15 and 17 years of age. During the 1988-1998 period, 76% of suicide victims were of ages 15-17, 79% were male, and 71% were Caucasian. A relative decrease in this demographic group was noted in the 1998-2014 period: 65% were of ages 15-17, 70% were male and 62.5% were Caucasian. Therefore, over time, the proportion of children under 15 years of age and females increased. In the 1988-1998 period, 24% were under 15 and 21%

were female. However, during 1998-2014, 35% were younger than 15 and 30% were female (**Table 1**).

Firearm use and hanging persisted over time as the most common causes of pediatric suicide, responsible for a combined 92% of the 78 total deaths (**Table 2**). However, a demonstrable shift away from firearm use and toward hanging was noted. While firearm use resulted in 84% of the deaths and hanging resulted in 7.9% during the 1988-1998 period, only 45% of deaths resulted from firearms during 1998-2014 and the percentage of hanging deaths increased to 47.5%. Thus, hanging replaced firearms as the most common cause of death in the last 17 years studied (**Table 2**).

The data suggest that gender and age influences the modality of suicide selected by the victim. In the 1988-1998 period, 90% of males and 62.5% of females committed suicide by firearm use. During the same period, 3.3% of males and 25% of females were hanging deaths. In the subsequent 17-year period, the trend reversed for females, with firearms causing

25% of deaths and hanging causing 67%. For males, firearm use decreased to 54% and hanging also increased to 39% (**Figure 2**). A similar trend was noted for the most vulnerable age group of 15-17 years: in the 1988-1998 period, 86% of this group committed suicide through firearm use and 3.4% through hanging; in the 1998-2014 period, firearm use declined to 46.2% and hanging increased to 42.3% (**Figure 3**).

DISCUSSION

Investigation of pediatric suicide requires evidence-based interprofessional cooperation. Prevention with appropriate evaluation and treatment of suicidal ideation is key to reducing deaths while identification of demographic trends and changes over time in methods of suicide can assist primary care and mental health professionals to better identify children at risk. In addition, a comparison of our findings with national data may provide insight into our select population and identify areas of preventative success while uncovering areas requiring increased surveillance.

Figure 1: Decreasing trend of pediatric suicides.

We limited our study population to individuals under 18 years of age to compare findings with a previously published study which analyzed suicide victims of the same age range (3). However, national and state statistics frequently group individuals between 10-14 and 14-19 years of age together. This and the relatively

small size of the study, as well as the fact that not all suicide cases are referred for autopsy, are key limitations of our research. These limitations and the significant yearly fluctuations are highlighted by the weak R^2 values of the trend line.

Table 1: Pediatric Suicide Demographics

	Jan 1, 1988 – Jan 1, 1998		Jan 2, 1998 – Dec 31, 2014		Overall	
	Number of Cases	Percentage of Cases (%)	Number of Cases	Percentage of Cases (%)	Number of Cases	Percentage of Cases (%)
Total	38	100	40	100	78	100
Age						
≤11	0	0	2	5.0	2	2.6
12	2	5.3	1	2.5	3	3.8
13	3	7.9	5	12.5	8	10.3
14	4	10.5	6	15.0	10	12.8
Total Below 15	9	23.7	14	35.0	23	29.5
15	7	18.4	5	12.5	12	15.4
16	12	31.6	9	22.5	21	26.9
17	10	26.3	12	30.0	22	28.2
Total 15-17	29	76.3	26	65.0	55	70.5
Gender						
Male	30	78.9	28	70.0	58	74.4
Female	8	21.1	12	30.0	20	25.6
Race						
Caucasian	27	71.1	25	62.5	52	66.7
African American	10	26.3	10	25.0	20	25.6
Hispanic	0	0	4	10.0	4	5.1
Other	1	2.6	1	2.5	2	2.6

Table 2: Suicide Modalities

	Jan 1, 1988 – Jan 1, 1998		Jan 2, 1998 – Dec 31, 2014		Overall	
	Number of Cases (n = 38)	Percentage of Cases (%)	Number of Cases (n = 40)	Percentage of Cases (%)	Number of Cases (n = 78)	Percentage of Cases (%)
Firearm Use	32	84.2	18	45.0	50	64.0
Hanging	4	7.9	19	47.5	22	28.2
Drug Overdose	1	2.6	2	5.0	3	3.8
Thermal Injury	2	5.3	1	2.5	3	3.8

Figure 2: Impact of gender on mechanism of suicide.

Shifting Demographics

Relative success in curbing suicide is apparent in national and state trend data and is somewhat recapitulated by our experience. According to the Centers for Disease Control and Prevention (CDC) Web-Based Injury Statistics Query and Reporting System (WISQARS), national suicide rates for youths aged 15-19 declined steadily from 8 per 100 000 in 1999 to 7.2 in 2008 and since 2010 have begun to increase (4, 5). In South Carolina, a similar pattern was noted where rates declined from 9.8 in 1998 to as low as 3.7 in 2007. Specific to South Carolina, a Suicide Prevention Task Force was organized by Department of Health and Environmental Control in 2003 to promote suicide awareness and develop support for suicide prevention (6). Although we cannot directly gauge the impact of this program, the small decline in overall suicide rate noted in our study could potentially, in part, have been affected by this program. This is especially true given

that this program targeted males, and that we observed a decline in proportion of males.

The increase in proportion of suicides of those less than 15 years of age in our study is concerning and is consistent with nationwide statistics. For example, in 1999, the suicide rate nationally for 10- to 14-year-olds was 1.2 per 100 000. The rate has since fluctuated, but has been increasing since 2010, and in 2013 was 1.9 per 100 000 (4).

Also worrisome is an increased rate of suicide amongst females (7, 8). Suicide rates for all those aged 10-19 years of age was declining since the 1990s, but increased sharply between 2003 and 2005 (8). A Morbidity and Mortality Report by the CDC in 2007 attributed this increase in large part to a surge in female suicides, both in the 10-14 and 14-19 age groups (7). Nationally, for females aged 10-14, the rate increased steadily from 0.5 per 100 000 in 1999

Figure 3: Change in mechanism of suicide for the most vulnerable age group.

to 1.4 per 100 000 in 2013. Similarly, for females aged 14-19, the rate surged persistently from 2.75 to 3.86 per 100 000 from 1999 to 2013 (4). We weren't fully able to capture this national trend in our small study. However, we observed that females contributed to a larger proportion of total suicides over time.

Changes in Suicide Modality

A drift away from firearm use and toward hanging occurred in our population. This trend was also seen across South Carolina and the United States. South Carolina reported that for adolescents aged 10-19, the suicide rate by firearm use declined from 3.4 to 1.8 per 100 000 from 1999 to 2010, while the rate by suffocation (the CDC category that includes hanging) increased from 1.64 to 2.2 per 100 000 from 2004 to 2010 (data prior to 2004 not available). Of note, most forensic pathologists would consider hanging to be a form of asphyxia, but not a subset of suffocation. In our population, hanging was the only cause of death that fit into the CDC suffocation category. The CDC National Vital Statistics System mortality data for periods 1990-2004 and then 1994-2012 demonstrated a continuing increase in suicides by suffocation for youth aged 10-14, 14-19 and 19-24 (4, 5, 7). This pattern was particularly noteworthy for young females, and in 2003-2004, a disastrous year for pediatric suicide in our region, the rate of suffocation more than doubled for females aged 10-14 (5).

This shift is concerning but may simultaneously point to success in interventions targeting prevention of suicide in males as well as prevention of access to firearms by youth. No significant changes in the gun sales laws occurred during the study period in South Carolina. Purchase of firearms through private vendors remains essentially unregulated aside from permits granted through the South Carolina Law Enforcement Division for concealable weapons. Several states in the United States do not require a permit for carrying a concealed weapon. Under United States federal law, individuals cannot lawfully purchase handguns if they are under age 18. Interestingly, long gun possession has no age limitation by U.S. federal law. Regardless, parent and guardian supervision of weapons in

the home remains paramount to limiting ready access. Theoretically, the relative ease of access to materials needed for hanging and instructions via the Internet may play a role in the trend away from firearm use.

Need for Interventions

Based on our findings and their congruence with national data, there are three key areas of pediatric suicide requiring attention: 1) burgeoning rates of suicides in adolescents younger than 15, 2) rising rates amongst females, and 3) the surging trend of hanging.

As depression plays a major role in pediatric suicide, these three areas cannot be addressed without improvement in recognition and treatment of depression. It is therefore not surprising that successful prevention programs have targeted increased awareness of depression. A notable example is the Garrett Lee Smith program, which trains teachers and physicians, among others, in recognizing warning signs of suicide ideation. It has resulted in significant reduction in suicide rates in individuals aged 10-18 years as well as those aged 19-24 years (9). Currently in draft form, The U.S. Preventive Services Task Force demonstrates grade B evidence (defined by as "*high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial*") for recommending that those from 12 to 18 years of age undergo "*screening for major depressive disorder (MDD) when adequate systems are in place for diagnosis, treatment, and monitoring*" during the course of each well child examination. However, they found insufficient evidence for a similar recommendation for those 11 years old and younger (10). Another study proposed increasing both access to mental health care and continuity of such care after a suicide attempt in an effort to enhance diagnosis and treatment of depression in youths (11). However, each suggestion requires significant community and healthcare infrastructure. Children should also be routinely informed about the dangers inherent in using choking in play. The "choking game" is not considered herein since the manner of death would not be classified as "Suicide," but rather "Accident" or "Undetermined."

Challenges of New Technology

The ease of access to the Internet, especially since the advent of smart phones and tablets, has created newer challenges. A growing number of children and adolescents have digital devices at their fingertips at younger ages, including cell phones, tablets, and laptops. This allows unlimited access unless parental controls are in place. One consequence is ready availability of countless suicide methods. Another is cyberbullying, an intentional and repetitive form of virtual violence causing psychological distress in the victim. Studies analyzing the effects of cyberbullying have demonstrated an increase in depression, suicidal ideation, and suicide attempts in victims (12, 13). Cyberbullying is both more difficult to monitor and is able to reach more victims than its conventional counterpart. In our state, it is troubling that a search of “cyberbullying” at the South Carolina Department of Education website returns no matches. Children in this state are protected from “harassment, intimidation, or bullying” by the Safe School Climate Act, which was signed into law in 2006. The law does not specifically address cyberbullying nor does the amended 2012 version. Cyberbullying allows the perpetrator to hide behind a computer identity and such anonymity has led to unbridled misuse of these systems. In fact, blogs exist for the sole purpose of posting insulting commentary (14).

CONCLUSION

Trends are apparent in the pediatric suicide population served by the forensic pathologists at the Medical University of South Carolina. Between 1988 and 2015, there has been an increase in suicides amongst younger adolescents and females. Concurrently, there has been an increase in suicides by hanging. These changes over time are similar to those seen statewide and nationwide. However, our small population size and the large fluctuations from year to year make generalizations regarding the trends difficult. Interventions targeted at increasing timely recognition and treatment of depression and improvement in children’s access to well child and mental health care facilities may further enhance pediatric suicide prevention.

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