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The Relationship between Substance Abuse and Suicide among Adolescents

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ABSTRACT

Suicide, prominent in adolescents, presents a major public health problem. This study examined the relationship between substance abuse and suicide among adolescents after adjusting for socio-demographic, interpersonal violence, and mental health variables. Data were drawn from the Youth Risk Behavior Survey. Suicidal measures included ideation, plan, attempts, and severe attempts. Substance abuse, depression, purging, and forced sex were the major predictors. Our findings may be of value to educators, providers, and policymakers in helping to target teens contemplating suicide. To curb incidence of suicidal thoughts and behavior among teens, routine screenings for substance abuse in schools is recommended.

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BACKGROUND

Suicide, the act of intentionally causing one's own death, is a major public health problem. It was the second leading cause of death (5,178 deaths) for ages 10 to 24 in 2012 (Sullivan et al., 2015). Each day in the United States (U.S.), there are approximately 5,400 attempts of suicide by youth in grades 7-12 (The Jason Foundation, 2016). In 2015, the Centers for Disease Control and Prevention (CDC) reported that suicide results in an estimated $51 billion in combined medical and work loss costs (Centers for Disease Control and prevention [CDC], 2015a). A few studies have examined the relationship between substance abuse and suicide among adolescents in America to foster an explanation for such extreme statistics. Researchers have found that substance abuse plays a large role in suicidality but conflicting views have varied.

There is no concrete etiology of suicide but there are a few theories regarding the association between substance abuse and suicidal thoughts and behaviors among adolescents. The first theory attributes suicidal behaviors and thoughts to the chronic abuse of alcohol among adolescents to the dis-inhibitory effects of acute alcohol intoxication, and depression (Wu et al., 2004). Another theory suggests that the type of substance may pose a greater risk of suicidality (Wong et al., 2013). Researchers further explain that this may be due to users of different substances having different risk profiles for suicide. Another interpretation could be due to the psychological and behavioral characteristics of individual drugs that increase suicide risk (Wong et al., 2013).

The Jason Foundation reports that four out of five teens who attempt suicide have given warning signs of suicidal behavior (The Jason Foundation, 2016). Risk factors for suicidality among adolescents have been identified and include mental disorders, such as depression, family environmental factors, financial loss, exposure to others who committed suicide, and major physical illness (Brent, 1995). One of the most common risk factors for suicidality is illegal substances such as heroin and cocaine, as well as alcohol, and tobacco (Girt & Kelly, 2015).

Using the National 2011 Youth Risk Behavior Survey, Gart and Kelly (2015) identified the role that illegal drug use, alcohol use, tobacco use and depressive symptoms play in suicide ideation and attempts. Researchers concluded that drug use was statistically significant but weakly correlated to suicidal behavioral. It was hypothesized that this may be due to the attempt to desensitize emotions through drug use, thereby not causing them to consider or even attempt suicide. There have been advancing strides to understand the relationship between substance abuse and suicide. To our knowledge, no other studies have been conducted in Florida to identify suicide risk factors, in particular substance abuse, among adolescents. In addition, what makes this study timely is that the Florida Department of Health reports that suicide rates have been steadily increasing since 2003 (Florida Charts, 2015).

Purpose

The purpose of this study was to identify data that could improve understanding of the substance abuse – suicidality connection among Florida adolescents after adjusting for socio-demographic, interpersonal violence, and mental health variables.

METHODS

The Youth Risk Behavior Survey (YRBS) is a school-based survey of high school students that estimates the six types of health-risk behaviors that contribute to the leading causes of death and disability among youth. It is conducted biennially (Centers for Disease Control and prevention [CDC], 2015b). YRBS data were drawn from the Florida Department of Health, Bureau of Epidemiology, from 2001-2013. The YRBS consists of a two-stage cluster probability sample design. First, a random sample of public high schools is selected for participation in the survey. Second, a random sample of classrooms is chosen within each selected high school, and all students in those classes are invited to participate in the survey. All students in grades 9-12 in public high schools are eligible to participate. The survey is anonymous with only a school and class code used for CDC reporting purposes. The responses of the survey were weighted to be representative of Florida public high school students to adjust for varying probabilities of selection and non- response.

Measures

The four measures of suicidality included: suicide ideation, suicide planning, suicide attempts, and severe suicide attempts that required medical attention. The independent variables were substance abuse, socio-demographics, interpersonal violence, and mental health risk factors. Lifetime use of three common substances of abuse (tobacco, alcohol, and marijuana) was assessed. The socio-demographic variables consisted of age, race/ethnicity and sex, while interpersonal violence included partner violence, forced sex intercourse, school violence and unsafe feelings. The mental health risk factors were depressive symptoms, restrictive symptoms and purging symptoms of eating disorders. All responses to the risk factors listed above as well as the measures of suicidality were dichotomized.

Data Analysis

Using data from all years 2001 through 2013, univariate analysis was first used to examine the association between each predictor variable (substance abuse, socio-demographic, interpersonal violence, and mental variables) and the four measures of suicidality. Multiple logistic regression analysis was then used to adjust for individual, interpersonal violence, and mental variables when associating substance abuse with suicidality. Analyses were performed using PROC FREQ and PROC SURVEYLOGISTIC in SAS Version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

The high school student population represented a weighed total of 2,635,095 (n=17,155). Boys were 51.3% of the population and most students (75.8%) were between the ages of 15 and 17 of the weighed sample. Whites (43.1%) were the largest racial group, followed by 29.7% Blacks, and 27.2% other race**.** Of these students, 10.5% (N=275,548) reported using tobacco compared to non-users, 58% (N=1,537,527) using alcohol compared to those who did not consume alcohol and 38.4% (N=1,012,498) using marijuana compared to those who did not use marijuana. Those who reported depression made up about 28.6% (N=753,471) of the population and those who experienced forced sex were 7.7% (N=203,638). Students who purged made up about 3.9% of the population whereas students who fasted were approximately 10.5% (Table 1).

Univariate comparisons of measures of suicidality and substance abuse are shown in Tables 2 through 5. For example, students who reported using tobacco were five times more likely to experience suicide attempts as compared to non-tobacco users. The odds ratios for suicide attempts for alcohol and marijuana are 2.936 and 2.918, respectively and multivariate odds ratios of 1.391 and 1.435 after adjusting for the other risk factors.

Multivariate analysis of substance abuse was statistically significant for the measures of suicidality except for marijuana, where it failed to reach statistical significance with the suicide ideation model (AOR=1.123; 95% CI 0.975-1.294; p=.1070), and alcohol with the severe suicide attempts model (AOR=1.323; 95% CI 0.926-1.888; p=.1237).

The association of each substance used with the four measures of suicidality is reported below. With respect to the suicide ideation model, the odds ratios were as follows: tobacco AOR=1.465, alcohol AOR=1.467, and marijuana AOR=1.123. The odds ratios to the suicide planning for the substance used were: tobacco AOR=1.419, alcohol AOR=1.464, and marijuana AOR=1.246. The third model used suicide attempts as the dependent variable and results were as follows: tobacco AOR=1.931, alcohol AOR=1.391, and marijuana AOR=1.435. The substances, excluding alcohol, had a stronger association with severe suicide attempts when compared to other measures of suicidality (tobacco AOR=2.378, alcohol AOR=1.232, and marijuana AOR=2.404).

Table 1
Population Characteristics during 2001-2013

	Weighted N[a] 2,635,095	Weighted (%)
Age		
≤14	255,072	9.7
15-17	1,998,028	75.8
≥18	381,995	14.5
Race		
Whites	1,113,517	43.1
Blacks	767,874	29.7
Other race	703,971	27.2
Sex		
Boys	1,284,428	51.3
Girls	1,350,666	48.7
Substance Use		
Tobacco		
Yes	275,548	10.5
Alcohol		
Yes	1,537,527	58.3
Marijuana		
Yes	1,012,498	38.4
Interpersonal Violence		
Partner Violence		
Yes	248,802	9.5
Forced Sexual Intercourse		
Yes	203,638	7.7
Unsafe		
Yes	200,428	7.6
School Violence		
Yes	186,622	7.1
Mental Health		
Depressed		
Yes	753,471	28.6
Fasting		
Yes	276,928	10.5
Purging		
Yes	102,112	3.9

[a]Total is estimated using sampling weights. Unweighted total is n=17,155.

Table 2
Logistic Multiple Models Predicting Suicide Ideation

Model: Suicide Ideation		
	Univariate OR (95% CI)	Multivariate OR (95% CI)
Depression	9.875 (8.922, 10.930)	6.714 (5.959, 7.564)
Dieting	4.445 (4.088, 4.834)	1.792 (1.591, 2.020)
Purging	7.011 (6.046, 8.130)	2.344 (1.919, 2.863)
Tobacco	3.361 (2.960, 3.816)	1.465 (1.232, 1.741)
Alcohol	2.514 (2.255, 2.802)	1.467 (1.300, 1.655)
Marijuana	2.035 (1.857, 2.229)	1.123 (0.975, 1.294) **NS**
Physical violence	3.232 (2.829, 3.692)	1.355 (1.134, 1.618)
Forced sex	4.981 (4.373, 5.673)	1.916 (1.631, 2.250)
Unsafe	2.914 (2.507, 3.387)	1.100 (0.932, 1.299) **NS**
School violence	3.651 (3.141, 4.245)	1.470 (1.260, 1.714)
Age	0.953 (0.911, 0.997)	0.926 (0.875, 0.981)
Male	0.501 (0.455, 0.552)	0.736 (0.648, 0.836**)**
Black	0.749 (0.665, 0.845)	0.846 (0.736, 0.972)
Other race	0.882 (0.802, 0.969)	0.827 (0.745, 0.918

Table 3
Logistic Multiple Models Predicting Suicide Planning

Model: Suicide Planning		
	Univariate OR (95% CI)	Multivariate OR (95% CI)
Depression	8.830 (7.823, 9.966)	5.830 (5.094, 6.671)
Dieting	4.150 (3.787, 4.547)	1.693 (1.464, 1.958)
Purging	6.476 (5.521, 7.596)	2.015 (1.676, 2.422)
Tobacco	3.561 (3.105, 4.083)	1.419 (1.190, 1.691)
Alcohol	2.621 (2.312, 2.971)	1.464 (1.264, 1.694)
Marijuana	2.302 (2.073, 2.556)	1.246 (1.068, 1.454)
Physical violence	3.725 (3.168, 4.381)	1.463 (1.198, 1.786)
Forced sex	5.455 (4.699, 6.332)	2.033 (1.711, 2.417)
Unsafe	3.318 (2.828, 3.893)	1.236 (1.050, 1.456)
School violence	4.359 (3.776, 5.031)	1.599 (1.326, 1.927)
Age	0.944 (0.902, 0.989)	0.911 (0.861, 0.964)
Male	0.617 (0.557, 0.683)	0.923 (0.805, 1.058)
Black	0.784 (0.692, 0.890)	0.933 (0.804, 1.083) **NS**
Other race	0.981 (0.846, 1.137) **NS**	0.961 (0.816, 1.132) **NS**

Table 4
Logistic Multiple Models Predicting Suicide Attempts

Model: Suicide Attempts		
	Univariate OR (95% CI)	Multivariate OR (95% CI)
Depression	11.358 (9.700, 13.300)	6.201 (5.247, 7.328)
Dieting	5.242 (4.568, 6.014)	1.902 (1.565, 2.312)
Purging	8.193 (7.032, 9.544)	2.036 (1.625, 2.552)
Tobacco	5.078 (4.362, 5.911)	1.931 (1.575, 2.369)
Alcohol	2.963 (2.556, 3.436)	1.391 (1.156, 1.673)
Marijuana	2.918 (2.581, 3.300)	1.435 (1.180, 1.746)
Physical violence	4.883 (4.151, 5.745)	1.562 (1.269, 1.922)
Forced sex	7.876 (6.811, 9.107)	2.477 (2.079, 2.951)
Unsafe	4.502 (3.827, 5.296)	1.427 (1.161, 1.754)
School violence	5.884 (4.942, 7.006)	1.939 (1.570, 2.395)
Age	0.926 (0.877, 0.977)	0.883 (0.831, 0.938)
Male	0.494 (0.436, 0.560)	0.709 (0.597, 0.841)
Black	0.938 (0.829, 1.062) **NS**	1.279 (1.104, 1.481)
Other race	1.136 (0.982, 1.315) **NS**	1.178 (0.986, 1.407) NS

Table 5
Logistic Multiple Models Predicting Severe Suicide Attempts

Model: Severe Suicide Attempts		
	Univariate OR (95% CI)	Multivariate OR (95% CI)
Depression	19.562 (14.793, 25.869)	8.770 (6.290, 12.228)
Dieting	5.288 (4.234, 6.604)	1.463 (1.035, 2.067)
Purging	12.290 (9.932, 15.207)	2.485 (1.670, 3.697)
Tobacco	9.353 (7.680, 11.391)	2.378 (1.835, 3.080)
Alcohol	4.610 (3.308, 6.424)	1.323 (0.926, 1.888) NS
Marijuana	6.508 (5.079, 08.339)	2.404 (1.758, 3.287)
Physical violence	8.871 (7.348, 10.711)	1.782 (1.366, 2.324)
Forced sex	14.105 (11.568, 17.199)	3.031 (2.418, 3.800)
Unsafe	6.968 (5.493, 8.840)	1.707 (1.262, 2.310)
School violence	8.533 (6.719, 10.836)	1.557 (1.165, 2.082)
Age	0.932 (0.857, 1.012) NS	0.904 (0.833, 0.983)
Male	0.680 (0.555, 0.833)	1.050 (0.783, 1.408) NS
Black	1.047 (0.808, 1.356) NS	1.846 (1.318, 2.585)
Other race	1.380 (1.091, 1.746)	1.486 (1.136, 1.944)

Table 6
Variable Measures

Variable	Question
Suicide thoughts and behaviors	
Suicide ideation	During the past 12 months, did you ever seriously consider attempting suicide?
Suicide planning	During the past 12 months, did you make a plan about how you would attempt suicide?
Suicide attempt	During the past 12 months, how many times did you actually attempt suicide?
Severe suicide attempt	If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?
Substance Use	
Tobacco	Have you ever smoked cigarettes regularly, that is, at least one cigarette every day for 30 days?
Alcohol	During your lifetime, on how many days have you had at least one drink of alcohol?
Marijuana	During your lifetime, how many times have you used marijuana?
Interpersonal Violence	
Forced sexual intercourse	Have you ever been forced to have sexual intercourse when you did not want to?
Partner violence	During the past 12 months, did your boyfriend or girlfriend ever hit, slap, or physically hurt you on purpose?
School violence	During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club on school property?
Unsafe feelings	During the past 30 days, how many days did you not go to school because you felt you would be unsafe at school or on your way to or from school?
Mental Health	
Depression	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?
Dieting	During the past 30 days, did you go without eating for 24 h or more (also called fasting) to lose weight or to keep from gaining weight?
Purging	During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?

With respect to the mental health variables, depression consistently held the highest odds ratio among all four measures of suicidality (AOR=5.830-8.770). Purging (AOR=2.015 – 2.485) and dieting (AOR=1.463-1.902) were also strong predictors of suicidality. Forced sex had a strong association with suicidality (AOR=1.916 – 3.031) along with school violence (AOR=1.470-1.939). Race was strongly associated with the severe suicide attempts models for Blacks, and other races as compared to Whites (AOR=1.846; 1.486) respectively.

DISCUSSION

We examined the relationship between substance abuse and suicidality among teens aged 15-19 in Florida schools after adjusting for socio-demographic, interpersonal violence, and mental health variables. Alcohol was the substance most strongly associated with suicide ideation and suicide planning; tobacco was the substance most strongly associated with suicide attempts, and marijuana was the substance most strongly associated with severe suicide attempts. Our findings are consistent with ones from a previous study that reported the positive association of alcohol with suicide ideation and planning (Wong et al., 2013). However, alcohol and marijuana were not significantly associated with severe attempts of suicide, and in suicide ideation, respectively. This may be explained by the serotonergic abnormalities of alcohol and depression pathologies (Wu et al., 2004).

Depression had the strongest association among all measures of suicidality in univariate as well as in multivariate analysis. This is consistent with previous studies that have shown a strong association between depression and all measures of suicidality (Wong et al., 2013; Schilling et al., 2009; Kaley et al., 2014). Our findings show that forced sex is a major predictor in all measures of suicidality with it being the second highest predictor in suicide planning, attempts and severe attempts. This is of great concern because researchers have demonstrated that severe sexual, physical, and emotional childhood abuse can result in substantial risk of repeated suicidal behavior in adulthood (Marshall et al., 2013). Purging was also a major predictor and was the second highest predictor in suicide ideation.

Among all the interpersonal violence variables, school violence was the strongest predictor of the suicide ideation, planning, and attempts models. However, in the severe suicide attempts model, the odds ratios of all interpersonal violence variables increased significantly after adjusting for all the other variables. Previous research has found that dating violence perpetration and victimization are linked to suicide attempts (Swahn et al., 2008). Moreover, with regards to school safety, our findings are consistent with past research that has determined that "feeling unsafe at school" leads to an increased risk of depression and suicide (Kindrick et al., 2013).

Socio-demographic variables including age and sex were protective in the suicide ideation and planning models. Race was also protective in the ideation model but failed to reach statistical significance in the suicide planning model. Racial disparities were evident in suicide attempts with 28% higher odds for Blacks as compared to Whites, and more profound in severe suicide attempts for both minorities where the odds increased to 84% and 49% for Blacks and other races, respectively. This is consistent with findings from another study that showed African Americans and Hispanics were at higher odds of attempting suicide when compared to Whites (Swahn et al., 2012). The novel finding of this study is the adjustment of those three common substances with each measure of suicidality. A previous study has indicated that is not uncommon for adolescents to use multiple substances at any given time (Rowan, 2001). Therefore, to be able to assess the impact of these common substances at the same time on suicidality is critical for targeting adolescents who use multiple substances.

Our analysis was limited because our data set is not nationally representative. Another limitation to the study is that the data set relies on self-reported measures. Respondents' burden could be another limitation because the YRBS survey has a large volume of questions (N=116) contributing to recall bias. The way the data were collected could result in under-reporting or over-reporting of answers due to social norms. Additionally, because we used secondary data, we were limited to using only the questions given by the survey. It would have been beneficial if the survey had some information about students' available resources for suicidality when they experience a crisis. Our data set lacked information on family structure which we believe could be an important factor in influencing substance abuse and suicide thoughts and behaviors. Furthermore, YRBS data are cross-sectional and cannot be used for causality. Finally, students cannot be followed up to identify any behavioral changes over time.

Implications for Public Health Practice

Suicide is a preventable event and happens too often in the adolescent population. With our results and those of previous studies conducted, risk factors have been identified. Because there is no true defined etiology of suicide, prevention measures may be the

most effective solution. Oftentimes, getting to the root of the problem produces a successful treatment outcome. Substance abuse has been identified by the American Psychiatric Association and the American Academy of Child and Adolescent Psychiatry as a leading risk factor for suicide (American Academy of Child and Adolescent Psychiatry, American Psychiatric Association 2004). Both organizations recommend that assessment of all adolescents exhibiting suicidal ideation and behaviors due to substance abuse, be used to profile those at risk. We also recommend that educators, providers, and policymakers are educated on risk assessment and profiling of students that exhibit suicidal risk factors. Some researchers suggest that school nurses be at the forefront of this public health issue in schools. Gart and Kelly (2015) suggest that nurses act as trained "gatekeepers" through programs such as Question, Persuade, Refer (QPR). Finally, we believe that involving all stakeholders including youth, parents, teachers, school nurses, administrators, and teen mental health researchers will provide a cohesive team to conquer suicide among adolescents.

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