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Risky Behaviors and Factors Associated with Suicide Attempt in Adolescents

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The objective of this study was to identify the behavior risk factors associated with suicide attempt in adolescents and to determine gender-specific patterns of risk factors. In 2001, Center for Disease Control and Prevention (CDC) conducted National Youth Risk Behavior Survey for 13,601 high school students in the U.S. Data were analyzed with logistic regressions to identify the risk behaviors. New significant risk factors (being offered illegal drugs at school, being abused by a boyfriend/girlfriend, gender, and ethnicity) were identified for suicidal attempt in adolescents. Patterns of risk behaviors differed among male and female groups. Several new risk behaviors associated with suicide attempt in adolescents were identified. There were notable differences in risk behaviors between two gender groups, especially in the area of depression. These findings could have potentially important implications for preventing adolescent suicide attempts.

Keywords ethnicity, suicide, gender differences, adolescent, risky behavior

Suicide is estimated to be the tenth leading cause of death in the world, and is as common as deaths from road-traffic accidents (Murray & Lopez, 1996). In the United States, suicide among adolescents is a growing health problem. The suicide rate for youth age 15 to 19 years has increased more than 300% since 1950 (CDC, 1994). In 1997, there were 4,186 suicides among people 15 to 24 years old, 1,802 suicides among those 15 to 19 years old, and 2,384 among those 20 to 24 years old in the United States (CDC, 1999). The actual number of deaths from suicide may be higher, because some of these deaths are recorded as ''accidental'' (Committee on Adolescence, 1996). In recent years, suicide has been the third leading cause of death for adolescents (CDC,

1999). According to a 2002 survey (CDC), 19% of high school students had seriously considered attempting suicide, 14.8% of students had made a specific plan to attempt suicide, and 8.8% of students had attempted suicide more than once during the 12 months preceding the survey.

The prevalence of adolescent suicide attempts in other research ranges from 1.9% to 17.7% (CDC, 1996; CDC, 2002; Garrison, Walter, Cuffe et al., 1993; Meehan et al., 1992; Vega et al., 1993). In 1999, the national survey found that males are four times more likely to die from suicide than are females (CDC, 2002; NCHS, 2003). However, females are three times more likely to attempt suicide than are males (Canetto & Sakinofsky, 1998; National Institute of Mental Health, 2002).

An increase in suicide has been shown to be associated with an increase in suicide attempts as observed in the WHO/EURO multi-center study conducted among youths age 15 to 24 years (Hawton, Arensman, Hultén et al., 1998). Husain (1990) estimated the ratio of attempted suicides to completed suicides among adolescents to be 50:1 to 100:1. Additionally, Andrus, Fleming, Heumann et al. (1991) found nearly 40% of adolescents who killed themselves had made a previous nonfatal attempt. Therefore, attempted suicide is a definite risk factor for later suicide.

Many school-based studies have shown that depression, negative life events, low social support, and a dysfunctional family, are associated with a higher rate of suicide attempts (De Man, Labreche, & Leduc, 1993; Fergusson, Lynskey, 1995; Rey, Warring, Feron et al., 1998; Roberts, Roberts, & Chen, 1998). Epidemiological and clinical studies have determined risk behaviors associated with adolescent suicide attempt such as alcohol use (Cornelius, Kelly, Bukstein et al., 2002), running away from home (Shaffer, Fisher, Dulcan et al., 1996), assaultive behavior (Walter, Vaughan, Armstrong et al., 1995), and carrying weapons and fighting (Woods, Lin, Middleman et al., 1997). These behavioral factors often were cited by youths as reasons for attempting suicide. Therefore, the behavior they choose to adopt is a critical link to attempted suicide.

Most studies examine each behavioral factor associated with suicide attempt in adolescents individually without adjusting for possible confounders. However, this study examined a number of possible risk factors simultaneously. The objectives of this study were to identify risk factors associated with suicide attempts in adolescents at the school-based national level, and to determine whether these differences were gender related.

METHOD

Data Source

Data, public use, were obtained from the 2001 School-based Youth Risk Behavior Survey (YRBS), which was conducted by CDC. The YRBS focuses on priority health-risk behaviors established during youth that result in the most significant mortality, morbidity, disability, and social problems during both youth and adulthood. The study population consisted of 13,601 high school students in grades 9–12. The study was conducted in 38 states and 19 cities in the United States during February 2001 to December 2001. The UNTHSC

institutional review board (IRB) approved the study protocol.

Outcome Variable and Candidate Predictor Variables

Variables used to evaluate suicidal behavior included suicide attempt, suicide ideation (thoughts of suicide), number of suicide attempts, and the result of suicide attempt. We used suicide attempt (''During the past 12 months, did you make a plan about how you would attempt suicide?'') as the outcome of interest in our analysis. Considered predictor variables included: a) demographic information such as age, grade, gender, b) behaviors that contribute to unintentional injuries, c) behaviors that contribute to violence, d) tobacco use, e) alcohol consumption and other drug use, f) age at initiation of risk behaviors, g) tobacco, alcohol and other drug use on school property, h) sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases, including HIV infection, i) dietary behaviors, and j) physical activity.

The categorical variables were meaningfully recoded as dichotomous variables. For example, in the original survey data, the ''Had been in a physical fight'' variable has 8 answers (0 times, 1 time, 2–3 times, 4–5 times, 6–7 times, 8–9 times, 10–11 times, 12 or more times). We recoded this variable into 2 groups (''Yes'' or ''No'') for a better interpretation.

Data Analysis

We performed all statistical analysis with PC SAS®. First, we examined the univariate frequency for each variable in the original dataset since most of them were categorical data. Then we excluded the following types of variables: 1) variables with more than 50% of missing values, and 2) variables that did not make sense to predict the suicide attempt. The remaining variables were analyzed using multivariate logistic regressions. Backward stepwise regressions were used to determine which independent variables account for most of the variation in the dependent variable.

We used tolerance (TOL) $= 0.5$ or variance inflation factor (VIF) $= 2.0$ as a cut-point to investigate the collinearities. A final model was determined after fixing the collinearity problem. Goodness-of-fit of the model was assessed using the Hosmer-Lemeslow statistic ($p > 0.05$) (Hosmer & Lemeshow, 2000). Pearson χ^2 tests were used to compare differences in categorical results. Odds ratio (OR) and 95% confidence intervals (CI) were computed as estimates of the strength of association between behavioral risk factors and suicide attempts. Crude and adjusted (OR) were compared for assessing the confounding effects of the risk factors.

By repeating the same backward stepwise multiple logistic regression procedures, gender specific analyses were performed. Patterns of risk behaviors, predictors of difference between males and females were compared.

RESULTS

Among the 13,601 respondents, 3,963 respondents were eliminated due to missing values and the remaining 9,638 observations were used in this study. Of 9,638 students, 1,327 (13.8%) had reported that they had attempted suicide during the past 12

months. After a frequency check and exclusion of the variables that did not make sense, 78 variables remained and were entered in a multiple logistic regression model with backward stepwise selection.

The result of the overall (including both female and male) model indicated the following risk factors as significant predictors of suicide attempts: gender, Asian race/ethnicity, threatened or injured with a weapon, physical fights in the past 30 days, being abused by boyfriend/girlfriend, forced sexual intercourse, being depressed every day for more than two weeks, alcohol consumption, using hallucinogenic drugs or inhaling chemicals to get high, being offered an illegal drug at school, being obese or underweight, and anorexic/bulimic behavior. Table 1 shows the demographic characteristics for the risk factors and their corresponding adjusted OR and 95% CI. The positive difference between crude and adjusted OR indicates the positive confounding effect of most of the risk factors. The Hosmer-Lemeshow goodness-of-fit test showed ($p = 0.79$), which indicates a good fit of the model with the data.

Reported differences in significant risk behavior patterns among girls and boys are given in Table 2. The significant predictors for female suicide attempt were Asian race/ethnicity, threatened or injured with a weapon, physical fights in the past 30 days, forced sexual intercourse, being depressed every day for more than two weeks, smoking cigarettes, trying to quit smoking, alcohol consumption, inhaling chemicals to get high, being offered an illegal drug at school, being obese or underweight, and anorexic/bulimic behavior. The significant predictors for male suicide attempt were driving while intoxicated, carrying a weapon, being threatened or injured with a weapon, being abused by boyfriend/girlfriend, being depressed every day for more than two weeks, smoking cigarettes, alcohol consumption, using hallucinogenic drugs or inhaling chemicals to get high, being obese or underweight, excessive exercise to control weight, and fasting to control weight.

The overall and gender specific predictors for suicide attempt and their corresponding adjusted Odds Ratio (OR) and 95% Confidence Intervals (CI) can be viewed in Table 2. The p-values of the Hosmer-Lemeshow goodness-of-fit tests for female and male were 0.46 and 0.72. Both of them indicated a good model fit.

DISCUSSION

In this study, the attempt suicide rate is 17.1% in female group and 10.2% in male group. This indicates that suicide attempt rate is higher in females than that in males in either adolescents or adults.

In our study, being depressed every day for two weeks or more was highly associated with suicide attempt for overall gender ($OR = 4.7$, 95% $CI = 4.1$–5.5). This result indicates that the odds of suicide attempts for whose who were depressed every day for more than two weeks were 4.7 times the corresponding odds for non depressed every day for more than two weeks after adjusting for other variables. Also, this risk factor was significant in both female and male groups. For females results were ($OR = 3.6$, 95% CI, 2.9–4.3), for males ($OR = 7.6$, 95% CI, 6.1–9.5). This data may give important information to identify adolescents at risk for suicide, especially males. However, this

TABLE 1. **Frequency and Percentage of Risk Behaviors and Their Association with Suicide Attempt in Adolescents (Multiple Logistic Regression Analysis)-YRBS 2001**

	Suicidal Attempt (n = 1,327)		No Suicidal Attempt (n = 8,311)				
(N = 9,638)	**n**	**(%)**	**n**	**(%)**	**OR**	**OR[a]**	**CI[a]**
Gender*							
Female (n = 4,959)	848	63.9	4,111	49.5	1.8	1.5	(1.3–1.7)
Male (n = 4,679)	479	36.1	4,200	50.5	1.0	Reference	
Race/Ethnicity*							
Asian (n = 306)	54	4.1	252	3.0	1.3	1.6	(1.1–2.2)
Black (n = 1,534)	149	11.2	1,385	16.7	0.6	0.6	(0.5–0.8)
Hispanic (n = 2,434)	329	24.8	2,105	25.3	0.9	0.8	(0.7–0.9)
Others[b] (n = 410)	74	5.6	336	4.0	1.3	1.0	(0.8–1.4)
White (n = 4,954)	721	54.3	4,233	50.9	1.0	Reference	
Being threatened or injured with a weapon*							
Yes (n = 788)	245	18.5	543	6.5	3.2	1.7	(1.4–2.1)
No (n = 8,850)	1,082	81.5	7,768	93.5	1.0	Reference	
Physical fights in the past 30 days*							
Yes (n = 3,264)	657	49.5	2,607	31.4	2.1	1.4	(1.2–1.6)
No (n = 6,374)	670	50.5	5,704	68.6	1.0	Reference	
Had been hit/slap/hurt by boyfriend/girlfriend*							
Yes (n = 931)	281	21.3	648	7.8	3.2	1.4	(1.1–1.7)
No (n = 8,707)	1,044	78.7	7,663	92.2	1.0	Reference	
Forced sexual intercourse							
Yes (n = 744)	269	20.3	475	5.7	4.2	1.7	(1.4–2.1)
No (n = 8,894)	1,058	79.7	7,836	94.3	1.0	Reference	
Felt sad/hopeless almost every day for > = 2 weeks*							
Yes (n = 2,831)	919	69.3	1,912	23.0	7.5	4.7	(4.1–5.5)
No (n = 6,807)	408	30.7	6,399	77.0	1.0	Reference	
Had at least one drink of alcohol*							
Yes (n = 7,690)	1,216	91.6	6,474	77.9	3.1	1.5	(1.2–1.9)
No (n = 1,948)	111	8.4	1,837	22.1	1.0	Reference	
Inhaled any chemical inhalant to get high*							
Yes (n = 1,299)	414	31.2	885	10.7	3.8	1.8	(1.5–2.1)
No (n = 8,339)	913	68.8	7,426	89.3	1.0	Reference	
Being offered an illegal drug at school*							
Yes (n = 2,705)	585	44.1	2,120	25.5	2.3	1.3	(1.1–1.5)
No (n = 6,933)	742	55.9	6,191	74.5	1.0	Reference	

(*Contiuned*)

TABLE 1. **Continued**

(N = 9,638)	Suicidal Attempt (n = 1,327) n	(%)	No Suicidal Attempt (n = 8,311) n	(%)	OR	OR[a]	CI[a]
Used hallucinogenic drugs *							
Yes (n = 1,233)	359	27.1	874	10.5	3.2	1.5	(1.2–1.7)
No (n = 8,405)	968	72.9	7,437	89.5	1.0	Reference	
Describe your weight*							
Very overweight/underweight (n = 568)	153	11.5	415	5.0	2.5	1.8	(1.4–2.3)
About the right weight (n = 9,070)	1,174	88.5	7,896	95.0	1.0	Reference	
Fasting to control weight*							
Yes (n = 1,274)	389	29.3	885	10.7	3.5	1.5	(1.2–1.7)
No (n = 8,364)	938	70.7	7,426	89.3	1.0	Reference	
Vomited to control weight*							
Yes (n = 490)	184	13.9	306	3.7	4.2	1.5	(1.1–1.9)
No (n = 9,148)	1,143	86.1	8,005	96.3	1.0	Reference	

OR = odds ratios, CI = 95% confidence intervals for suicidal attempts vs. none.
[a] Adjusted.
[b] Others included American Indian, Alaska Native, and Multiple-Non-Hispanic.
*Significant at 0.05 level.

variable is not measured as a scale for depression or recognition of a psychiatric disorder as in other studies (Garrison, Waller, Cuffe et al., 1997; King, Schwab-Stone, Flisher et al., 2001; Reinherz, Gianconia, Siverman et al., 1995), or as measure of level of hopelessness (Asarnow, Carlson, Guthrie, 1987; Beck, Steer, Kovacs et al., 1985; Kazdin, French, Unis et al., 1983). This study suggests that perceived negative mental health plays an important role in an adolescent's decision to attempt suicide (Thatcher, Reininger, Drane et al., 2002).

Several studies have determined certain behaviors are associated with adolescent suicide attempt such as being threatened with a weapon and/or fighting (Orpinas, Basen, Grunbaum et al., 1995; Thatcher, Reininger, Drane et al., 2002; Woods, Lin, Middleman et al. 1997), sexual abuse (King, Schwab-Stone, Flisher et al., 2001; Patton, Harris, Carlin et al., 1997; Thatcher, Reininger, Drane et al., 2002; Walter, Vaughan, Armstrong et al., 1995), alcohol use (Addiction Research Foundation, 1996; Cornelius, Kelly, Bukstein et al., 2002; Mitic, Greschner et al. 2002; Thatcher, Reininger, Drane et al., 2002;), drug use (Shaffer, Fisher, Dulcan et al., 1996; Thatcher, Reininger, Drane, 2002), and self-perception of body type as well as being anorexic/ bulimic (Neumark-Sztainer, Story & French, 1996). Our study confirmed these community-based findings. However results of this study differ from findings of other studies (Brent, Perper, & Moritz, 1993; Dubow, Kausch, Blum et al., 1989;

TABLE 2. **YRBS, 2001-Multiple Logistic Regression Analysis of Predictors for Suicidal Attempt (Female vs. Male)**

	Female (adjusted)		Male (adjusted)	
	OR	**95% CI**	**OR**	**95% CI**
Race/Ethnicity				
Asian vs. White	2.0	(1.3–3.2)	–	–
Black vs. White	0.7	(0.5–0.9)	–	–
Hispanic vs. White	0.8	(0.7–1.0)	–	–
Others vs. White	0.9	(0.6–1.3)	–	–
Physical fight in the past 30 days	1.5	(1.3–1.9)	–	–
Forced sexual intercourse	1.8	(1.4–2.3)	–	–
Try to quit smoking cigarettes				
No vs. did not smoke	1.5	(1.1–2.0)	–	–
Yes vs. did not smoke	1.5	(1.2–2.0)	–	–
Being offered an illegal drug at school	1.4	(1.1–1.7)	–	–
Vomited to control weight	1.7	(1.2–2.2)	–	–
Being threatened or injured with a weapon	1.7	(1.2–2.3)	1.9	(1.4–2.5)
Felt sad/hopeless for $>=2$ weeks	3.6	(2.9–4.3)	7.6	(6.1–9.5)
Smoked cigarettes $>=1$ per day	0.6	(0.5–0.9)	1.5	(1.1–1.9)
Had at least one drink of alcohol	1.5	(1.1–2.1)	1.5	(1.0–2.2)
Inhaled any chemical inhalant to get high	1.9	(1.5–2.4)	1.8	(1.4–2.4)
Very overweight/underweight	1.6	(1.1–2.2)	2.1	(1.4–3.1)
Fasting to control weight	1.4	(1.1–1.8)	1.4	(1.0–2.1)
Rode in a car while drinking alcohol	–	–	0.7	(0.5–1.0)
Carried a weapon such as a gun, knife, or club	–	–	1.3	(1.0–1.7)
Had been hit/slap/hurt by boyfriend/girlfriend	–	–	1.7	(1.2–2.2)
Used hallucinogenic drugs	–	–	1.7	(1.3–2.3)
Exercised to control weight	–	–	0.8	(0.6–1.0)

OR = odds ratios
CI = confidence interval

King, Schwab-Stone, Flisher et al., 2001; Shaffer et al., 1996) in that low grades, running away from home, marijuana use, and early onset of sexual intercourse were not significantly associated with suicide attempt in this study.

Notable gender-specific differences occurred. Race/ethnicity was a predictor factor in the female group but not in the male group, and the odds of suicide attempt for Asian girls were two times the corresponding odds for White girls after adjusting by other factors. To better interpret this result, other factors should be considered, such as cultural and socio-economical background, immigrant history, and other family factors, which were not provided in this

survey. Future research should examine these factors.

However, some behaviors were selected as predictors only in the female model, such as being in a physical fight, forced sexual intercourse, trying to quit smoking cigarettes, being offered an illegal drug at school, and bulimic behavior. Carrying a weapon, being abused by boyfriend/girlfriend, using hallucinogenic drugs, and exercising to control weight (the only positive protective behavior factor) were selected as predictors only in the male model. These results indicate that there are some interactions between gender and other variables in this population. Consequently, intervention and prevention programs are likely to be most effective if the interventions consider different characteristics of risk behavior factors between females and males in adolescents.

In this study, many adolescents reported one or more risk behaviors. The combination of these risk behaviors was predictive of suicide attempts in this population. However, adolescents who reported suicide attempts may not fully represent youth who complete suicides. Further studies are needed to follow cohorts of adolescents who report suicide attempts to assess predictors of suicide completion (Woods, Lin, Middleman et al., 1997).

The other important limitation of this study is that the models and the analyses presented were derived from cross-sectional data. The results represent associations and prohibit firm conclusions as to causation. To examine the developmental continuities to suicide attempt, longitudinal data are needed.

Another limitation of this study was that school-based data can apply only to adolescents who attend school, therefore it might not be representative of those who did not attend schools in this age group. Furthermore, this study only assessed the health behavior factors without considering the psychosocial, familial and socioeconomic factors that have been documented to be associated with suicide attempt in adolescents in several previous studies. To obtain a better estimation, multivariate analyses based on a large number of individuals, family, and socioeconomic variables are needed.

The ultimate goal of suicide interventions should be to prevent risk factors and to bolster protective factors. Therefore, identifying risk and protective behavior factors associated with suicide attempt in adolescents are meaningful. This study may enrich our understanding of suicidal behavior in adolescents. In addition, the findings could potentially have important preventive implications. It may help to create awareness of the extent of risk behaviors in adolescents, to provide basic information to set up an efficient preventive strategy for identifying and intervening with adolescents at risk for suicide (Shaffer & Craft, 1999), and to promote the suicide education curricula and coordinated school health programs.

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