Relationship Between Substance Use, Bullying, and Other Delinquent Behaviors Among High School Students: a Secondary Analysis of the Florida Youth Substance Abuse Survey

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Abstract

Substance use and bullying during adolescence are two prevalent problem behaviors associated with a broad array of adverse developmental outcomes. This study conducted a secondary analysis of high school data from Hillsborough County's 2014 Florida Youth Substance Abuse Survey to examine the relationship between substance use, criminal activity, bullying, and other deviant behaviors. Results indicated that past-month alcohol and marijuana use were associated with driving under the influence of marijuana or alcohol, riding with a driver under the influence of marijuana or alcohol, carrying a hand gun, gambling, selling illegal drugs, and the perpetration of bullying. Implications for prevention and intervention efforts are discussed.

Introduction

Substance use among adolescents is an area of unremitting concern because of the amplified potential consequences on adolescent neurological and social development. Problems related to substance use are naturally compounded in adolescents due to the fact that the adolescent brain continues to develop until the mid-to-late 20s.[1] As a result, adolescent decision-making capabilities, already vulnerable, are weakened further by substance use and may result in harmful

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legal repercussions, safety and health concerns, and increased future exposure to or reliance on other substances.[2] Research demonstrates the developmental impacts of various types of adolescent substance use. One study associated more frequent and prolonged marijuana use in adolescents under the age of 18 years with neuropsychological decline affecting various levels of their functioning, including IQ decline, into their adult lives.[3] Other studies have found that binge drinking (i.e., four or more alcoholic drinks for females and five or more alcoholic drinks for males) during adolescence produces abnormalities in the development of the hippocampus and white matter, impairing brain functioning.[4,5] Scientific evidence tells us that substances hinder physical brain development for a lifetime, but decisions made under the influence can also irrevocably alter lives. These combined risk factors and heightened potential for long-term harm make the understanding of adolescent substance use imperative for informing prevention, harm reduction, and treatment strategies specific to this population.

In 1999, the Florida Legislature's Drug Control Summit recommended the establishment of a multi-agency-directed statewide substance abuse survey.[6] Based on that recommendation, the Florida Youth Substance Abuse Survey (FYSAS) has been undertaken annually since 2000. Across Florida, 407 middle schools and 343 high schools participated in the administration of the survey. The FYSAS was administered to 65,917 students in grades 6 through 12 in the Spring of 2014. The results of these efforts now supply a valuable source of information to help paint a detailed picture of adolescent substance use patterns and habits. The data is key to informing efforts for reduction, prevention, and treatment for the use of alcohol, tobacco, and other drugs by school-aged youth.

Findings from the 2014 FYSAS were illuminating, demonstrating some changing patterns and some that have remained steadfast. For instance, they revealed that alcohol and marijuana were the substances most commonly used among high school students for both lifetime and past 30-day use but that cigarette use in both categories has dropped from past years.[6] Perhaps surprising is that more than one in three high school students have used marijuana in their lifetime.[6] With the recent effort to legalize medical marijuana in Florida and other states, this statistic emboldens more direct efforts toward understanding and communicating the impact that legalization may have on this population. The director of the National Institute on Drug Abuse (NIDA) states that marijuana use can "alter the trajectory of a young person's life," a statement which has been proven accurate through scientific evidence associating adolescent marijuana use with various negative outcomes including school dropout, mental illness, other drug use, and a decrease in IQ points.[2]

Besides personal detriment, there are other societal costs associated with adolescent substance use that the FYSAS has helped to illuminate. For example, in 2007, a report estimated the total cost of underage drinking in Florida to be $3.073 billion.[7] These costs were attributed to automobile accidents as well as violence, property destruction, and other criminal acts. Hillsborough County, the county analyzed in this paper, has the highest cost of motor vehicle crashes in the state due to underage drinking and was listed as one of the six counties that accounted for "more than half of the total estimated cost" of underage drinking in Florida.[7] These statistics align with the high volume of reported underage drinking in these areas. Findings that, once more, assist public health workers and decision makers in making focused and concerted efforts to work on the adolescent substance use issues that have the greatest impacts.

Other impacts of substance use

Beyond financial, health, safety, and physical development concerns, adolescent substance use also has social repercussions. For instance, while it may be common knowledge that bullying is a problem that many youth experience, research is now revealing a link between bullying, substance use, and other externalizing problems.[8–12] Espelage and colleagues[9] broadly defined fighting and

bullying as "maladaptive social interactions…influenced, maintained, or mitigated by relationships in the school, peer and family contexts".[9(p. 344)] Just as substance use habits are influenced by relationships, social networks, and environmental circumstances, bullying is also a result of reactions to external factors. This relationship has stimulated behavioral health scientists to attempt a more intimate understanding of the nature of the connection, answering questions like: Who is affected? What causes the association? What are the effects?

Inconsistent with most prior research, Espelage and colleagues[9] found that the link between substance use and bullying only existed for *males*. Luk et al.[10] found that this gender difference could be explained by other research and base rates demonstrating that males are more inclined to bullying behaviors than females. Another study conducted by Peleg-Oren et al.[12] expanded upon this research by showing that students involved in any form of bullying were more likely to use alcohol than other students after accounting for gender, ethnicity, and age. Several explanations have been suggested for the link between bullying and substance use. First, bullying can be viewed as part of an antisocial disposition that will eventually be followed with substance use; the second viewpoint is that both bullying and substance use result from influences by the peer environment.[9] Other research by Radliff et al.[13] showed that a similar, but weaker, link exists between bullying victimization and substance use, whereby substance use can be seen as a coping mechanism for both victims and bullies.[13]

Aside from aggressiveness and bullying behavior, adolescent substance use has also been associated with other forms of delinquency such as arrests, crime severity, and cruelty to both animals and people.[14] According to Stice, Myers, and Brown,[15] delinquency moderates the relationship between level of consumption and problematic use. Some researchers have attributed the relationship between substance use and other problem behaviors to the adolescent brain that is inherently sensation seeking and egocentric, often manifesting itself in reckless behavior.[16]

Current study

This study sought to conduct a secondary analysis of high school data from Hillsborough County's 2014 Florida Youth Substance Abuse Survey (FYSAS). Many local organizations and community coalitions work with data to select and evaluate their prevention strategies and to determine new areas of concern. Additionally, schools are a choice location for educating youth about the harmful effects of alcohol and marijuana and for implementing targeted interventions to decrease the impacts of these effects. The analysis that follows is an effort to identify patterns of correlation between criminal and risky social behavior with alcohol and marijuana use among high school students to assist in community and school-based mitigation.

Method

This secondary data analysis is an adaptation of a similar study conducted with Florida middle school students by Peleg-Oren et al.[11] Hillsborough County FYSAS data from 2014 were obtained through the Florida Department of Children and Families (DCF). This county was selected because the authors were able to receive raw data of the FYSAS from our local community coalition, the Hillsborough County Anti-Drug Alliance (HCADA). Typically, FYSAS is presented to counties via tables and figures but our local community coalition had access to additional data that enabled us to conduct these secondary analyses. Detailed information on sampling procedures, survey administration, and survey validation has been provided for the entire state of Florida and can be found online at the DCF website.

Measure

Florida youth substance abuse survey   Derived from the Communities that Care Youth Survey (CTC), FYSAS is implemented annually in Florida as a tool to assess adolescent prevention needs by collecting data on the prevalence and frequency of substance use, the presence and frequency of antisocial behaviors, and the presence of risk and protective factors.[6] Similar to the CTC, the FYSAS provides multiple agencies with epidemiological and trend data that can help focus prevention efforts by targeting areas and demographic populations where risk factors are high and protective factors are low.[17–19]

Sampling

High schools were selected with a probability proportional to the number of students enrolled in the school, resulting in a higher probability of larger schools being selected.[6] Classrooms were selected at random, and all students in these classes were asked to participate. Of the 1719 Hillsborough County students participating, 904 were high school students (52.5%).

Administration of surveys   Passive consent procedures were used in which students were asked to give consent notification to their parents.[6] If parents did not want their child to participate, it was their responsibility to contact the school. Standardized procedures were used to administer surveys. Teachers received surveys and collection envelopes and were directed to review instructions with the students before asking them to complete the survey within a 50-min time period. Instructions provided by the teacher and written on the front of the survey informed students that their participation was voluntary and that answers would be kept anonymous and confidential. Students were asked to complete the survey but were given the option to skip questions that made them uncomfortable.

Validation of surveys   Five response validation procedures were utilized to remove unreliable surveys.[6] Two of them eliminated students who exaggerated their drug use and antisocial behaviors. Another strategy eliminated surveys of students who reported the use of the fabricated drug "Derbisol." The fourth strategy eliminated students who repeatedly reported inconsistent and illogical patterns of drug use. Finally, surveys were removed if they had less than 25% of the items completed.

Analyses

Four different types of statistical analyses were used for this study, including univariate descriptive statistics, cross tabulations, bivariate correlations, and binary logistic regression models. Univariate statistics described the sample demographics and prevalence rates for deviant behaviors and substance use. Cross tabulations and Pearson's chi square statistics were run to assess the relationships between deviant behaviors and past-month alcohol or marijuana use. Significant variables were then included in a correlation matrix to help determine which variables to exclude in the subsequent regression analyses. Stepwise logistic regression models were used to predict substance use from delinquent behaviors while controlling for grade, gender, and ethnicity, with control variables entered on the first step. Two separate regression models used the same set of predictive variables to predict past-month alcohol use and then past-month marijuana use. Driving

under the influence of alcohol was excluded as a predictor for past-month alcohol use and driving under the influence of marijuana was excluded as a predictor for past-month marijuana use due to their large intercorrelations that affected multicollinearity of the regression models. Variables that were not significant for predicting either past-month alcohol use or past-month marijuana use were removed as predictors. Variance inflation factors and tolerance statistics were also used to select each model's optimal set of predictors.

Results

Demographics

As can be seen in Table 1, there were 904 total high school male and female respondents (49.9% and 50.1% respectively). Respondents were able to select more than one race or ethnicity; however, most participants endorsed being White/Caucasian (44.5%). The remaining categories were reported as 37.8% Spanish/Hispanic/Latino, 20.7% Black/African-American, and 11.7% other. Students in 9th grade made up the largest portion of respondents (31.0%) followed by 11th grade (26.7%), 10th grade (22.1%), and 12th grade (20.2%). Because students were given the option to skip questions that they felt uncomfortable asking, and only those surveys with less than 25% of data were removed from the analysis, some categories in Table 1 do not add up to 904.

Approximately 1% of the sample (9 out of 904) was lost to the 25% exclusion rule. The remainder of the sample shrinkage due to skipped questions varied based on grade level and gender. For past 30-day marijuana use, 6.8% of females were missing and 10.6% of males were missing. The grade level with the most missing for past 30-day marijuana use was 11th grade, with 9.9% missing. The grade level with the least missing for past 30-day marijuana use was seniors, with 3.2% missing. For past 30-day alcohol use, 4.7% of females were missing and 8.5% of males were missing. The grade level with the most missing for past 30-day alcohol use was also the 11th grade, with 6.6% missing. The grade level with the least missing for past 30-day alcohol use was also seniors, with 3.2% missing.

Deviant behaviors

Deviant behaviors are also reported in Table 1. Past-month alcohol use was reported by 245 students (28.5%), and past-month marijuana use was reported by 158 students (18.9%). These rates were similar to the statewide rates of past-month high school alcohol and marijuana use (28.4% and 18.6% respectively).[6] Students reported driving after using marijuana (10.6%) and riding with a driver who was under the influence of marijuana (23.7%) more often than they reported driving after drinking alcohol (5.6%) or riding with a driver who had been drinking alcohol (18.2%). Verbal bullying was the most common type of bullying behavior reported by both perpetrators and victims (11.4% and 21.0% respectively). Aside from these bullying behaviors, which were collected for past-month only, the most commonly reported forms of deviant behavior reported for the prior year were gambling (50.1%), suspension (11.3%), attacking to hurt (8.1%), and selling illegal drugs (6.6%). Only seven students reported stealing a vehicle in the past year (0.9%), and one student reported bringing a hand gun to school in the past year (0.1%).

As can be seen in Table 2, past-month alcohol use among high school students was significantly associated with all forms of bullying perpetration (physical, verbal, and cyber) and some types of victimization (verbal and cyber bullying). Past-month alcohol use was also most notably associated with driving under the influence of marijuana or alcohol, riding with a driver under the influence of marijuana or alcohol, and selling drugs.

Although all forms of bullying perpetration were associated with past-month marijuana use, the relationship was not as strong as that of past-month alcohol use. There was also no significant

relationship between past-month marijuana use and any form of bully victimization. Similar to past-month alcohol use, past-month marijuana use was associated with other forms of deviant behavior. The most notable associations were driving under the influence of marijuana or alcohol, riding with a driver under the influence of marijuana, carrying a hand gun, and selling illegal drugs.

Table 1
Demographics and prevalence of substance use, bullying, and other deviant activities

Categories	Sample ($N = 904$)	Valid (%)
Gender		
Female	444	50.1
Male	443	49.9
Race/ethnicity		
Spanish/Hispanic/Latino	342	37.8
Black/African-American	187	20.7
White/Caucasian	402	44.5
Other	119	11.7
Grade		
9	280	31.0
10	200	22.1
11	241	26.7
12	183	20.2
Alcohol use in the past 30 days	245	28.5
Marijuana use in the past 30 days	158	18.9
Physical bullying in the past 30 days		
Perpetrator	51	5.7
Victim	77	8.6
Verbal bullying in the past 30 days		
Perpetrator	102	11.4
Victim	189	21.0
Cyber bullying in the past 30 days		
Perpetrator	36	4.0
Victim	75	8.3
Other deviant activity		
Gambling—past year	445	50.1
Ride in car with marijuana user—past 30 days	208	23.7
Ride in car with drinking driver—past 30 days	160	18.2
Drive car while using marijuana—past 30 days	93	10.6
Been suspended—past year	92	11.3
Attacking to hurt—past year	66	8.1
Sold illegal drugs—past year	53	6.6
Drive car while drinking alcohol—past 30 days	49	5.6
Carried handgun—past year	46	5.7
Been arrested—past year	30	3.7
Current gang member	13	1.6
Stolen vehicle—past year	7	0.9
Handgun to school—past year	1	0.1

Table 2

Univariate associates between bullying, deviant behavior, and substance use

	Past 30-day alcohol use			Past 30-day marijuana use		
	No (N=616) (%)	Yes (N=245) (%)	χ^2 (1) =	No (N=678) (%)	Yes (N=158) (%)	χ^2 (1) =
Physical bullying	2.6	10.2	22.16, $p < .001$, N=0.16	3.6	8.9	8.32, $p < .01$, N=0.10
Physical victim	7.5	8.6	NS	7.6	8.3	NS
Verbal bullying	8.4	17.6	15.13, $p < .001$, N=0.13	9.4	17.3	8.14, $p < .01$, N=0.10
Verbal victim	17.8	26.1	7.57, $p < .05$, N=0.09	19.7	24.1	NS
Cyber bullying	1.8	8.2	20.45, $p < .001$, N=0.16	2.7	7.1	7.12, $p < .01$, N=0.09
Cyber victim	5.0	14.3	21.25, $p < .001$, N=0.16	7.1	10.8	NS
Ride in car with drinking driver	10.2	36.7	83.31, $p < .001$, N=0.31	14.5	32.1	26.42, $p < .001$, N=0.18
Drive car while drinking	0.5	18.4	104.36, $p < .001$, N=0.35	2.3	20.5	78.18, $p < .001$, N=0.31
Ride in car with marijuana driver	12.6	50.2	137.80, $p < .001$, N=0.40	12.0	72.4	257.29, $p < .001$, N=0.56
Drive car while using marijuana	4.1	26.5	92.41, $p < .001$, N=0.33	1.6	48.1	291.23, $p < .001$, N=0.60
Current gang member	0.7	3.8	10.44, $p < .01$, N=0.11	1.1	3.9	6.31, $p < .05$, N=0.09
Attacking to hurt—past year	5.6	13.4	13.73, $p < .001$, N=0.13	5.8	18	24.23, $p < .001$, N=0.18
Been arrested—past year	1.8	7.3	15.79, $p < .001$, N=0.14	1.6	12.7	42.21, $p < .001$, N=0.23

Table 2
(continued)

	Past 30-day alcohol use			Past 30-day marijuana use		
	No (N=616) (%)	Yes (N=245) (%)	χ^2 (1) =	No (N=678) (%)	Yes (N=158) (%)	χ^2 (1) =
Been suspended—past year	9.1	15.1	6.23, $p<.05$, N=0.09	8.1	22.7	26.57, $p<.001$, N=0.18
Carried handgun—past year	3.7	9.9	12.39, $p<.001$, N=0.12	3.3	14.7	30.46, $p<.001$, N=0.20
Handgun to school—past year	0.0	0.4	NS	0.0	0.7	4.25, $p<.05$, N=0.07
Sold illegal drugs—past year	2.3	16.6	55.51, $p<.001$, N=0.26	1.1	30.2	163.95, $p<.001$, N=0.46
Stolen vehicle—past year	0.9	0.4	NS	0.3	2.7	8.88, $p<.01$, N=0.11
Gambling—past year	43.3	63.3	27.87, $p<.001$, N=0.18	46.3	63.7	15.42, $p<.001$, N=0.14

Time periods refer to past 30 days unless otherwise specified

Table 3
Intercorrelations of substance use, bullying, and deviant behaviors

Variable	1	2	3	4	5	6	7	8	9
1. Past month alcohol use	—								
2. Past month marijuana use	0.42***	—							
3. Grade	0.14***	0.15***	—						
4. Gender	0.04	0.07*	−0.05	—					
5. Spanish/Hispanic/Latino	−0.05	−0.04	0.01	0.01	—				
6. Black/African-American	−0.07*	0.04	0.06	0.01	−0.28***	—			
7. White/Caucasian	0.11**	0.01	−0.03	0.02	−0.48***	−0.31***	—		
8. Other ethnicity	−0.04	−0.05	−0.05	−0.03	−0.23***	−0.03	−0.08*	—	
9. Physical bullying—past month	0.16***	0.10**	−0.06	0.11***	−0.022	0.05	−0.01	0.05	—
10. Cyber victim—past month	0.16***	0.05	0.02	−0.12***	−0.08*	−0.03	0.05	0.05	0.19***
11. Ride with drinking driver—past month	0.31***	0.18***	0.00	−0.05	−0.01	−0.01	0.06	−0.05	0.12***
12. Driving while drinking—past month	N/A	0.31***	0.15***	0.02	0.02	0.00	0.04	−0.01	0.12***
13. Ride with marijuana user—past month	0.40***	0.56***	0.15***	0.04	−0.10**	0.08*	0.01	−0.02	0.11**
14. Sold illegal drugs—past year	0.26***	0.46***	0.00	0.13***	−0.01	−0.06	0.05	0.00	0.06
15. Stolen vehicle—past year	−0.02	0.11**	−0.04	0.07	0.04	−0.01	−0.03	0.01	0.10**
16. Gambling—past year	0.18***	0.14***	−0.06	0.29***	−0.06	0.05	0.03	−0.01	0.13***

Variable	10	11	12	13	14	15	16
1. Past month alcohol use							
2. Past month marijuana use							
3. Grade							
4. Gender							
5. Spanish/Hispanic/Latino							
6. Black/African-American							
7. White/Caucasian							
8. Other ethnicity							
9. Physical bullying—past month							

Table 3
(continued)

Variable	10	11	12	13	14	15	16
10. Cyber victim—past month	–						
11. Ride with drinking driver—past month	0.20***	–					
12. Driving while drinking—past month	0.13***	0.32***	–				
13. Ride with marijuana user—past month	0.10**	0.29***	0.30***	–			
14. Sold illegal drugs—past year	0.10**	0.14***	0.19***	0.38***	–		
15. Stolen vehicle—past year	−0.03	−0.04	0.04	0.09*	0.25***	–	
16. Gambling—past year	0.02	0.13	0.09*	0.11**	0.18***	0.068	–

N/A not applicable
*$p < .05$; **$p < .01$; ***$p < .001$

Table 4
Logistic regression model—past month alcohol use

Variable	B	SE	OR	95% CI	WALD statistic	p
Grade[a]	0.313	0.086	1.368	[1.16, 1.62]	13.391	.000
Gender[a]	0.113	.199	1.120	[0.76, 1.66]	0.323	.570
Spanish/Hispanic/Latino[a]	−0.274	0.305	0.760	[0.42, 1.38]	0.805	.370
Black/African-American[a]	−0.970	0.342	0.379	[0.19, 0.74]	8.073	.004
White/Caucasian [a]	−0.003	0.293	0.997	[0.56, 1.77]	0.000	.993
Other ethnicity[a]	−0.340	0.334	0.712	[0.37, 1.37]	1.037	.309
Physical bullying	1.090	0.440	2.974	[1.26, 7.04]	6.148	.013
Cyber victim	0.665	0.331	1.944	[1.02, 3.72]	4.038	.044
Ride In car with drinking driver	1.187	0.231	3.277	[2.08, 5.15]	26.343	.000
Drive car while drinking[b]	N/A	N/A	N/A	N/A	N/A	N/A
Ride in car with marijuana driver	1.488	0.219	4.428	[2.88, 6.61]	45.977	.000
Sold illegal drugs	1.071	0.415	2.920	[1.29, 6.59]	6.655	.010
Stolen a vehicle	−2.451	1.231	0.086	[0.01, 0.96]	3.968	.046
Gambling	0.660	0.198	1.823	[1.24, 2.69]	9.202	.002
Constant	−3.200	0.511	0.041		39.237	.000

Step 1 overall model χ^2 (6) = 30.569, p < .001, Nagelkerke R^2 = 0.056. Step 2 overall model χ^2 (13) = 210.455, N = 748, p < .001, Nagelkerke R^2 = .344

N/A not applicable

[a]These were control variables entered on step one

[b]Not included in model due to high correlation with variable being predicted

Additionally, there was a difference in the deviant behavior exhibited between the substances used. Although only 18% of students who had reported using alcohol in the past month drove a car while drinking, nearly 50% of the students who used marijuana in the past month drove a car while under the influence of marijuana. The same pattern was reported with a willingness to ride in a car while drivers were under the influence. While 36.7% of students who drank in the past month rode in a car with a driver under the influence of alcohol, 72% of the students who smoked marijuana in the past month rode in a car with a driver under the influence of marijuana. In addition to these risky behaviors, nearly twice as many students who smoked marijuana in the past month sold illegal drugs (30.2%) compared to students who drank alcohol in the past month (16.6%).

Correlational analyses (see Table 3) were conducted to examine the interrelationships of predictors considered for inclusion in the regression models. Tolerance and variance inflation statistics were also examined to determine the optimal set of predictors for each regression equation. Table 4 shows multiple deviant behaviors that were significant predictors of past-month alcohol use. The controlling variables (grade, gender, race, and ethnicity) were entered in the first step χ^2 (6) = 30.569, p < .001, Nagelkerke R^2 = 0.056. Step 2 of the overall model, which included both controlling variables and predictors, showed that predictors significantly explained past-month alcohol use well beyond the controlling variables alone with χ^2 (13) = 210.455, p < .001, Nagelkerke R^2 = 0.344. Students involved in physical bullying and students who sold drugs were more than twice as likely to have used alcohol in the past month. Odds ratios indicated that high school students who rode with drivers under the influence of marijuana were four times as likely to have used alcohol in the past month, while students who rode with drinking drivers were three times as likely to have used alcohol in the past month. Additionally,

Table 5

Logistic regression model—past month marijuana use

Variable	B	SE	OR	95% CI	WALD statistic	p
Grade[a]	0.240	0.114	1.271	[1.02, 1.59]	4.435	.035
Gender[a]	0.105	0.259	1.110	[0.67, 1.84]	0.164	.686
Spanish/Hispanic/Latino[a]	−0.212	0.392	0.809	[0.38, 1.75]	0.293	.589
Black/African-American[a]	−0.178	0.424	0.837	[0.36, 1.92]	0.177	.674
White/Caucasian[a]	−0.198	0.384	0.820	[0.39, 1.74]	0.265	.607
Other ethnicity[a]	−0.734	0.458	0.480	[0.20, 1.18]	2.566	.109
Physical bullying	−0.069	0.619	0.993	[0.28, 3.14]	0.012	.991
Cyber victim	−0.575	0.471	0.563	[0.22, 1.42]	1.489	.222
Ride in car with drinking driver	−0.132	0.331	0.876	[0.46, 1.68]	0.160	.690
Drive car while drinking	1.245	0.456	3.472	[1.42, 8.49]	7.436	.006
Ride in car with marijuana driver	2.450	0.258	11.584	[6.98, 19.22]	89.863	.000
Sold illegal drugs	2.682	0.504	14.619	[5.44, 39.26]	28.329	000
Stolen a vehicle	−0.136	1.224	0.872	[0.08, 9.62]	0.012	.911
Gambling	0.186	0.261	1.204	[0.72, 2.01]	0.504	.478
Constant	−3.642	0.669	0.026		29.638	.000

Step 1 overall model χ^2 (6) = 22.574, $p < .001$, Nagelkerke $R^2 = .048$. Step 2 overall model χ^2 (14) = 269.455, $N = 763$, $p < .001$, Nagelkerke $R^2 = 0.484$

[a]These were control variables entered on step 1

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high school students who were victims of cyber bullying or involved in gambling were nearly two times more likely to have used alcohol in the past month when compared to students not engaging in these behaviors.

Past-month marijuana use (shown in Table 5) had fewer predictors than past-month alcohol use, however, this model explained a greater proportion of variance. The controlling variables (gender, grade, race, and ethnicity) were again entered on the first step, χ^2 (6) = 22.574, $p < .001$, Nagelkerke $R^2 = 0.048$. Once the additional predictors were added on the second step, the overall model was significant χ^2 (14) = 269.455, $p < .001$, Nagelkerke $R^2 = 0.484$. High school students who drove while drinking in the past year were more than three times as likely to have used marijuana in the past month when compared to high school students who did not drive while drinking. Students who rode in the car with someone under the influence of marijuana in the past year were more than 11 times more likely to have used marijuana in the past month than other students. Students who sold drugs in the past year were over 14 times more likely to engage in past-month marijuana use than students who did not sell drugs.

Discussion

This study was conducted to determine whether various criminal, risky, and deviant behaviors would be correlated with adolescent alcohol and marijuana use. Results confirmed that certain criminal and risky behaviors are associated with an increased likelihood of having engaged in alcohol and/or marijuana use. Previous research had already suggested a link between substance use, delinquency, and bullying,[10,14] a finding which this study confirmed. However, this study

further expanded on this relationship, demonstrating that the link between substance use, delinquency, and bullying appears to vary by substances, with physical bullying being more strongly related to the occurrence of past-month alcohol use than it was to past-month marijuana use.

Although Peleg-Oren et al.[11] found that perpetrators of all bullying forms were more than twice as likely to engage in alcohol use, this study found that only perpetrators of *physical* bullying were more likely to have engaged in alcohol use. Students involved in physical bullying were nearly three times more likely to have reported alcohol use, but no more likely to have used marijuana. This suggests a stronger association between alcohol and aggression than marijuana and aggression. These associations only partially support the conclusions of Gordon et al.[14] who reported that early substance use is associated with bullying and cruelty.

The high prevalence of reported marijuana use among youth may at least in part be explained by decreased perceptions of harm stemming from marijuana's increased media presence and the focus on medical marijuana.[20] Changing attitudes toward substance use, such as perceptions of harm, often precede changes in reported use. This connection between perceptions of harm and harmful behavior is supported by health behavior theories like the Theory of Planned Behaviors[21] and the Health Belief Model;[22] conceptualizing that a high-risk perception is associated with decreased likelihood for risky behavior and a low-risk perception is associated with an increased likelihood of partaking in that same risky behavior. Subsequently, after marijuana was decriminalized in California, 12th graders reported significantly lower perception of harm, reduced disapproval of regular use, and a 60% increase in expectancy to use marijuana in the next 5 years.[23]

Marijuana's increased overall prevalence among all teens rather than just deviant groups may also explain recent studies' weaker associations found between the drug and deviant behaviors. The perceived risk of harm associated with smoking marijuana once or twice a week has continued to decrease since 2004 for both middle school and high school Florida students (from 60.9 to 37.7%).[6] Further evidence supporting a decreasing perception of harm can be seen in the higher percentage of students willing to ride in a car with a driver under the influence of marijuana than alcohol (23.7% and 18.2% respectively). In addition, nearly twice as many students reported driving a car after using marijuana (10.6%) than after drinking alcohol (5.6%). Focusing interventions on informing risk perceptions with accurate and reliable information should be prioritized.

Limitations

This study had several limitations. One notable limitation was an exclusion of private schools from the sample pool. Since public and private schools differ in many ways including size, dynamic, education strategies, and economic status, the results may have been affected by extraneous variables that could not be controlled. In addition, youth who dropped out of school were not included. These youths are likely to have higher amounts of reported delinquent behaviors. Few reports of certain delinquent activities are a further limitation. Some of the delinquent activities such as being a current gang member and stealing a vehicle only had a few responses. Low reported numbers may be due to the self-report measures used, as some students may have underreported delinquent acts for fear of punishment. However, responses were collected anonymously, and research has suggested that adolescents' self-reported substance use is valid and even more reliable when confidentiality is emphasized.[24]

Another limitation of this study involved question formatting. The survey developers grouped the number of times a student could report use into inconsistent ranges of numbers. Therefore, this study used the prevalence of any past 30-day use as dichotomous dependent variables rather than the continuous number of times students reported using. Similarly, the survey collected data only

on past-year occurrence for some behaviors without specifying past 30-day behaviors. This may have resulted in some recollection bias and limited the authors' abilities to extrapolate meaning from behaviors within consistent timeframes.

Additionally, by design, this study is correlational with data only collected at one point in time making it impossible to infer accurate directional causation. Although relationships and associations have been demonstrated with this data, further research would need to be done to assess whether certain behaviors influenced the occurrence of others. Lastly, the analyses were conducted for only one county within the state of Florida in which the raw data was available. Issues of generalizability to Florida statewide are noted; however, substance use rates for Hillsborough County were similar to the statewide rates of past-month high school alcohol and marijuana use.

Conclusions

This study suggests that addressing deviant behaviors (such as bullying, gambling, and selling illegal drugs) as a part of substance use interventions and education in primary and secondary education classes would contribute to improved treatment and prevention outcomes. Many prevention services such as *Project D.A.R.E*™ (Drug Abuse Resistance Education) and *Too Good for Drugs*™ are universally targeted at the whole grade or school as an educational activity. While numerous studies have found *ProjectD.A.R.E.*™ to be generally ineffective, *Too Good for Drugs*™ produced positive effects that remained 6 months after the program for high risk middle school students.[25,26] Similarly, the *Too Good for Drugs and Violence*™ program, implemented in 9th–12th grade classrooms, was found to result in statistically significant improvements to students' protective factors such as positive attitudes toward nonviolence, perceptions of emotional competency skills, perceptions of social and peer resistance skills, and perceptions of assertiveness and self-efficacy.[27,28] Programs that offer tailored and evidence-based services to school-aged populations may improve prevention efforts congruent with this study's findings.

The results of this study suggest that certain illegal behaviors like selling drugs and gambling may be associated with substance use; in turn, prevention efforts should target youth with a history of these behaviors. Early identification of risk factors and behaviors are critical in linking youth with needed mental health and substance use interventions, skill building groups, and academic support. One example of a recently established program addressing these key points of youth development is the Project Prevent grant program.[29] Programs supported under this federal funding award aim to improve access to counseling services, emotional supports, conflict resolution strategies, and safer school environments. These study results offer further evidence to support that the expansion of behavioral based interventions for youth may be crucial for deterring deviant behaviors and substance use among adolescents.

Many past studies have found additional correlations between adolescent substance use and deviant behaviors that were not explicitly explored here. Most notably, mental health status, peer networks, and household stressors seem to each impact the likelihood that an adolescent will partake in substance use and deviant behaviors. One study specifically found a correlation between psychosocial maladjustment and substance use within youth who were experiencing depression, stigmatization, and victimization.[30] Other research has shown that adolescents who associate with peers who partake in deviant behavior or substance use are more likely to participate in these behaviors themselves.[31–33] Similarly, children with stressful home environments (non-two-parent households, permissive parenting patterns, or a parent who misuses substances) are also more likely to demonstrate delinquent behaviors and substance use.[34]

Implications for Behavioral Health

The findings of this current study and the existing body of evidence not only indicate that there are associations between substance use and delinquent behaviors but also highlight that they are both probable indicators for other psychosocial and mental health disparities. This conclusion points to a broad gap in existing services and further promotes the prioritization of mental health services, the teaching of healthy coping strategies, and the promotion of healthy peer-to-peer relationships. As the understanding of correlations and causations of substance use and delinquent behaviors expands, the ability to tailor intervention strategies to the specific needs of adolescents most at-risk will improve. Furthermore, continuing to follow and analyze patterns of substance use, perception, and coordinating behaviors will reveal the complexities of substance use and misuse, hopefully contributing to a decrease in stigma and an increase in dynamic treatment options.

Compliance with Ethical Standards

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