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The Co-occurrence of Substance Use and Bullying Behaviors among U.S. Adolescents: Understanding Demographic Characteristics and Social Influences

Jeremy W. Luk, M.S.[1], **Jing Wang, Ph.D.**[2,3], and **Bruce G. Simons-Morton, Ed.D., M.P.H.**[2]
[1]Department of Psychology, University of Washington

[2]Prevention Research Branch, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development

[3]Glotech Inc.

Abstract

This study examined the co-occurrence of subtypes of substance use and bullying behaviors using latent class analysis and evaluated latent class differences in demographic characteristics, peer and parental influences. Self-reported questionnaire data were collected from a nationally representative sample (N = 7508) of 6–10th grade adolescents in the United States. Four latent classes were identified: the non-involved (57.7%), substance users (19.4%), bullies (17.5%), and substance-using bullies (5.4%). Older and Hispanic adolescents were more likely to be substance users and substance-using bullies, whereas younger and African American adolescents were more likely to be bullies. Females were more likely to be substance users, whereas males were more likely to be bullies and substance-using bullies. Spending more evenings with peers posed greater risks for substance use, bullying, and the co-occurrence of both problem behaviors. Paternal knowledge exerted protective effects over-and-above the effects of maternal knowledge. Implications for prevention and intervention efforts are discussed.

Keywords

Substance use; Bullying; Parental knowledge; Peer influence; Latent class analysis

Substance use and bullying are two problem behaviors that are prevalent in adolescence, and both of them are correlated with a broad array of adverse developmental outcomes (Feder, 2007; Nansel et al., 2001; Young, Corley, Stallings, Rhee, Crowley, & Hewitt, 2002). Prior research suggested that both adolescent substance use and bullying are associated with delinquency (Barker, Arseneault, Brendgen, Fontaine, & Maughan, 2008; D'Amico, Edelen,

Corresponding Author: Jeremy W. Luk, M.S., Department of Psychology, University of Washington, Box 351525, Seattle, WA 98195-1525, Phone: 206-543-2640; Fax: 206-685-3157, jwluk@uw.edu.
Jing Wang, Ph.D., Prevention Research Branch, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, 6100 Building Room 7B13 MSC 7510, Bethesda, MD 20892-7510, Phone: 301 435-6932, Fax : 301-402-2084, wangji2@mail.nih.gov, Bruce G. Simons-Morton, Ed.D., M.P.H., Prevention Research Branch, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, 6100 Building Room 7B13M MSC 7510, Bethesda, MD 20892-7510, Phone: 301-496-5674, Fax : 301-402-2084, mortonb@mail.nih.gov

Miles, & Morral, 2008), low academic attainment (Beran, Hughes, & Lupart, 2008; King, Meehan, Trim, & Chassin, 2006), school dropout (Townsend, Flisher, & King, 2007; Townsend, Flisher, Chikobvu, Lombard, & King, 2008), and mental health problems, such as depressive and psychosomatic symptoms (Chan, Dennis, & Funk, 2008; Copeland, Shanahan, Costello, & Angold, 2009; Gini & Pozzoli, 2009; Seals & Young, 2003). Yet, although both adolescent substance use and bullying share similar negative correlates and are widely recognized as critical public health problems, limited research has focused on modeling the co-occurrence of substance use and bullying behaviors in population-based samples. As a result, it remains unclear to what extent substance use and bullying behaviors co-occur on a population level, and whether its prevalence might justify the development of prevention programs that simultaneously address both problem behaviors. Moreover, there is little empirical data that indicate who are at the greatest risks for co-occurring substance use and bullying, and what contextual factors might underlie the co-occurrence of these two problem behaviors. The current study is designed to address these gaps in existing literature, which may in turn provide population level data to guide prevention efforts.

Co-occurrence of Substance Use and Bullying Behaviors

The Problem Behavior Theory (Jessor & Jessor, 1977) suggests that problem behaviors tend to correlate and co-occur among adolescents. A number of empirical studies have shown a positive correlation between substance use and bullying in adolescence (Bassarath, 2001; Luukkonen, Riala, Hakko, Räsänen, & Study-70 workgroup, 2010; Schnohr & Niclasen, 2006). For example, Carlyle and Steinman (2007) found that greater substance use was significantly associated with higher bullying aggression among a large sample of sixth to twelfth graders in metropolitan Ohio. Recent longitudinal studies have further shown that childhood bullying behaviors prospectively predicted substance use in late adolescence and emerging adulthood (Kim et al., 2011; Niemelä et al., 2011). However, these studies examined substance use and bullying in general and did not distinguish between different subtypes of substance use and bullying behaviors. Given previous studies showing different prevalence rates and correlates of subtypes of substance use and bullying (Kokkevi, Richardson, Florescu, Kuzman, & Stergar, 2007; Wang, Iannotti, & Nansel, 2009), it is of interest to test the degree to which different subtypes of bullying and substance use behaviors co-occur among adolescents.

Prior research has attempted to examine and model the co-occurrence of adolescent problem behaviors, which often included substance use behaviors, sexual activity, and other externalizing behaviors such as aggression and delinquency (Racz, McMahon, & Luthar, 2011; Willoughby, Chalmers, & Busseri, 2004). For example, using a large sample of 739 15-year-old boys and girls in New Zealand, Fergusson, Horwood, and Lynskey (1994) applied a latent class analysis (LCA) model to examine the co-occurrence of alcohol abuse, cannabis use, sexual activity, conduct disorder and police contact among adolescents. A four-class model was found to best describe patterns of adolescents' engagement in these problem behaviors, including a class of well adjusted, a class with more early sexual activity and substance use, a class with more antisocial and lawbreaking activities, and a class with all problem behaviors. Gender differences were also observed in which females were more likely to be in the class with substance use, whereas males were more likely to be in the class with antisocial and lawbreaking activities.

In a more recent study, Weden and Zabin (2005) examined six adolescent problem behaviors using a LCA model, which included alcohol use, smoking, marijuana use, fighting, truancy, and early sexual initiation. Their results similarly indicated the existence of a subgroup with multiple problem behaviors and adolescents in this group were more likely to be European American and young male adolescents. Although previous research

has pointed to the existence of a group of adolescents who engage in multiple problem behaviors, little is known if this pattern can be generalized to subtypes of bullying such as physical, verbal, and relational bullying, as well as cyber bullying, a new form of bullying which can be defined as "a form of aggression that occurs through personal computers (e.g., email and instant messaging) or cell phones (e.g., text messaging)" (Wang et al., 2009, p. 369; Wang, Iannotti, & Luk, 2012). Moreover, the demographic characteristics of individuals with different levels of involvement in problem behaviors have not been well established in previous research, given the use of different samples that are not nationally representative. Thus, it is of interest to obtain an estimate of the national prevalence of co-occurring substance use and bullying, and the associated demographic characteristics of each latent class in a nationally-representative U.S. sample of adolescents.

Gender, Age, and Racial Differences in Substance Use and Bullying Behaviors

Early studies have typically reported that males were more likely to use substances than females (Chassin, Ritter, Trim, & King, 2003; Young et al., 2002), but recent evidence suggests that this gender gap is narrowing in younger cohorts (Pritchard & Cox, 2007), especially for smoking and drinking in the U.S. and other countries (Hammond, 2009; Keyes, Grant, & Hasin, 2008). As for bullying, research suggests that male adolescents are more likely to bully others physically, whereas female adolescents are more likely to bully others socially (Bjorkqvist, 1994; Owens, Shute, & Slee, 2000; Wang et al., 2009). Emerging evidence also suggests that males are more likely than females to engage in cyber bullying, a new form of bullying (Kiriakidis & Kavoura, 2010; Wang et al., 2009).

Substance use increases during adolescence and remains a significant threat to the wellbeing of adolescents (Chassin et al., 2003; Young et al., 2002). According to the 2009 *Monitoring the Future survey*, cigarette smoking, alcohol drinking, and marijuana use in the past 30 days almost doubled from grade 8 to 10 (Johnston, O'Malley, Bachman, & Schulenberg, 2010). In grade 8, the prevalence rates of cigarette smoking, alcohol drinking and marijuana use were 6.5%, 14.9% and 6.5% respectively. By grade 10, these prevalence rates correspondingly increased to 13.1%, 30.4% and 15.9%. In addition, the prevalence of drunkenness in the past 30 days almost tripled during this period from 5.4% in grade 8 to 15.5% in grade 10. In contrast, bullying behaviors decrease with age during middle and high school (Carlyle & Steinman, 2007). In a U.S. national sample, prevalence rates of weekly bullying behaviors in sixth, eighth and tenth grade adolescents were 10.4%, 9.8% and 6.9% respectively (Nansel et al., 2001). Because of these differential age trends, it is of interest to examine whether there are age-specific trends for co-occurring substance use and bullying behaviors.

With regard to racial differences, recent epidemiological data suggest that substance use is generally lower in African Americans when compared to non-Hispanic Caucasians, whereas the prevalence rates of substance use are increasing in Hispanic adolescents, with various substance use either approaching or exceeding those reported by non-Hispanic Caucasians (Johnston et al., 2010; Shih, Miles, Tucker, Zhou, & D'Amino, 2010). In contrast, racial differences in bullying behaviors have been more mixed. For example, higher rates of bullying were found in Hispanic than Caucasians in one national survey conducted in the United States (Nansel et al., 2001). In metropolitan Los Angeles, African Americans reported more bullying than Hispanics (Juvonen, Graham, & Schuster, 2003). Because the prevalence of each subtype of substance use or bullying behaviors may appear different, it is of interest to examine demographic differences across latent classes extracted in a national sample of adolescents.

Social Influences on Adolescent Substance Use and Bullying Behaviors

Substantial research has emphasized the importance of peer influence as a risk factor for adolescent problem behaviors (Dishion & Dodge, 2005; Kuntsche et al., 2009; Simons-Morton & Chen, 2006). Conversely, parental knowledge, defined as parental awareness of their adolescents' friends, activities, and whereabouts, has been shown to protect adolescents from problem behaviors (Kerr & Stattin, 2000; Stattin & Kerr, 2000). Numerous studies on substance use and conduct problems have separately demonstrated the detrimental and often bi-directional effects between affiliation with problem behaving friends and adolescent problem behaviors through both socialization and selection processes (Bray, Adams, Getz, & McQueen, 2003; Dishion, Nelson, & Bullock, 2004; Simons-Morton, 2007; Simons-Morton & Farhat, 2010). While most prior research has focused on affiliation with deviant peers as a measure of negative peer influence, the number of evenings spent with friends may serve as a proxy measure of peer affiliation outside of school time. In a national sample, Gage and colleagues (Gage, Overpeck, Nansel, & Kogan, 2005) found that increased peer activity in the evening was correlated with higher odds of substance use, bullying, and weapon carrying, even after controlling for covariates such as parental communication and parental involvement with schools. Thus, it is of interest to examine whether parental knowledge and number of evenings spent with friends would independently increase risks for substance use, bullying behaviors, and the co-occurrence of both problem behaviors.

Finally, there is a paucity of research that examines paternal and maternal knowledge separately. Existing research suggests that parenting by fathers and mothers may have different effects on adolescent substance use (Luk, Farhat, Iannotti, & Simons-Morton, 2010). Yet it remains unclear in the literature whether paternal knowledge buffers against substance use over-and-above the effects of maternal knowledge. Emerging research indicates that the effect of paternal knowledge on adolescent deviance or substance use may be mediated by maternal knowledge (Waizenhofer, Buchanan, & Jackson-Newsom, 2004; Wang, Simons-Morton, Farhat, & Luk, 2009). However, conflicting evidence suggests that parental knowledge from either parent may have a similar magnitude of protective effects on adolescent substance use (Coley, Votruba-Drzal, & Schindler, 2008).

The Purpose of the Present Study

Using LCA, the present study examined the co-occurrence of four types of substance use behaviors (cigarette smoking, alcohol drinking, drunkenness, marijuana use) and five types of bullying behaviors (physical attack, verbal teasing, social exclusion, spreading rumors and cyber bullying) in a nationally representative sample of U.S. adolescents from grade 6 to 10. Three research questions were addressed: (1) To what extent do different subtypes of bullying and substance use behaviors co-occur among U.S. adolescents? (2) What are the demographic differences between classes of adolescents with varying levels of involvement in bullying and substance use behaviors? (3) How do spending more evenings with peers, paternal and maternal knowledge relate to adolescents' susceptibility to risks for substance use, bullying behaviors, and the co-occurrence of both?

Methods

Sample and Procedures

Data were obtained from the Health Behavior in School-aged Children (HBSC) 2005/2006 study conducted in the United States. A nationally representative sample of 6^{th}–10^{th} graders in the U.S. was collected through a multiple stage, stratified design, with clustering by school districts and stratification by census regions and grades. In particular, a 3-stage

sampling procedure was employed to provide a representative sample of U.S. students in grades 6–10. In stage 1, school districts within census regions were stratified by grade 6–10 enrollment and sampled. In stage 2, schools were sampled in proportion to the total enrollment in grades 6 through 10. In Stage 3, classes in grades 6–10 were sampled. Sample size was determined by considering estimation margin of error to be within 3% for students in each grade. The final student response rate was 87%. Racial minority groups (African-American and Hispanic students) were oversampled for more accurate estimates in these groups. Accordingly, we used an appropriate weighting procedure to control for this oversampling in our analyses. Youth assent and parental consent were obtained as required by the participating school districts. Data were collected through anonymous self-report questionnaires distributed in the classroom. Additional details about the HBSC study design and methodology have been reported elsewhere (Roberts et al., 2007; Wang, Iannotti, & Nansel, 2009). The study protocol was reviewed and approved by the Institutional Review Board of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development.

Measures

Demographic Variables—Demographic variables included gender, age, and race/ethnicity (Caucasian, African-American, Hispanic, and others).

Substance Use Behaviors—Adolescent substance use was measured by number of occasions in the past 30 days they had (1) smoked cigarettes; (2) drunk alcohol; and (3) been drunk; and (4) taken marijuana. For each item, a dichotomous variable was created with two categories: “never” and “for once or more frequently.” Similar items have been used in large-scale survey research, such as the *European School Survey Project on Alcohol and Other Drugs* (Hibell et al., 2004) and the *Monitoring the Future Study* (Johnston, O’Malley, Bachman, & Schulenberg, 2010).

Bullying Behaviors—The Olweus’ Revised Bully/Victim Questionnaire (Olweus, 1996) was used to measure the four types of traditional bullying: physical (1 item, i.e., *hitting, kicking, pushing, shoving around, and locking indoors*), verbal (3 items, i.e., *teasing in a hurtful way*, *calling mean names about race,* and *calling mean names about religion, Cronbach’s alpha = .75*), social exclusion (1 item, i.e., *leaving others out of things on purpose*, *excluding others from their group of friends, and completely ignoring others* as a single item), and rumor spreading (1 item, i.e., *telling lies and spreading false rumors about others*. Cyber bullying was measured with two items: *bullying others using computers, e-mail messages, pictures,* and *bullying others using cell phones, Cronbach’s alpha = .83*). Five dichotomous variables (physical, verbal, social exclusion, rumor spreading, and cyber bullying) were created with two categories: “never” and “for once or more frequently” in the past couple of months.

Evenings Spent with Friends—Students were asked “how many evenings per week do you usually spend out with friends?” The response options ranged from “0 evenings” to “7 evenings”. This measure has been used in previous study as an indicator for peer influence (Gage, Overpeck, Nansel, & Kogan, 2005). For easier interpretation, a dichotomous variable was created: “0–2 evenings” and “3–7 evenings”.

Maternal and Paternal Knowledge—Maternal and paternal knowledge were measured separately with five items for each (Fletcher, Steinberg, & Williams-Wheeler, 2004; Kerr & Stattin, 2000). Adolescents were asked how much their mothers (or female guardians) really knew about: 1) who their friends were; 2) how they spent their money; 3) where they were after school; 4) where they went at night; and 5) what they did with their free time. The

same five questions were asked about their fathers (or male guardians) on paternal knowledge. The four-point scale are 0 (*don't have/see mother (or father)/guardian*), 1 (doesn't know anything), 2 (knows a little), and 3 (*knows a lot*). Both measures had desirable reliability (Cronbach's alpha = .82 for maternal knowledge and .93 for paternal knowledge). Median splits (2.6 for maternal knowledge and 2.2 for paternal knowledge) were used for both variables for easier interpretation.

Data Analysis

Data analysis consisted of three steps. The first step was to choose the optimal number of classes by specifying separate LCA models with various numbers of classes. Model solutions on choosing the appropriate number of classes were evaluated based on a comparison between several statistical criteria including Akaike's Information Criteria (AIC), Bayesian Information Criteria (BIC), Adjusted BIC, entropy, Vuong-Lo-Mendell-Rubin (VLMR) Likelihood Ratio Test, and Lo-Mendell-Rubin (LMR) adjusted LRT test (Nylund, Asparouhou, & Muthén, 2007). After the optimal number of classes was chosen, the second step was to examine socio-demographic differences on latent class membership by adding predictors including gender, age, and race/ethnicity. The third step was to include the three variables on spending evening time with friends, maternal and paternal knowledge, with socio-demographic variables as covariates.

We used the statistical software package Mplus 5.1 (Muthén & Muthén, 1998–2008) for model-fitting. To account for the complex sampling structure of the HBSC data, LCA models were examined by specifying stratification, cluster and sampling weights, a complex survey feature that exists within Mplus. Full Information Maximum Likelihood, FIML Schafer (Schafer & Graham, 2002), was applied to make use of all available data, including cases with some missing responses on bullying items.

Results

Sample Characteristic

The current analytic sample included 7,508 adolescents who participated in the HBSC 2005/06 survey and completed the survey with the bully/victim items. For generalization purpose, analyses for choosing optimal number of classes were conducted on all of the 7508 adolescents. Adolescents in the analytic sample reported a mean age of 14.2 (SD = 1.42). The demographic characteristics of this sample were 48.5% males, 42.2% Caucasian Americans, 18.7% African-Americans, and 26.4% Hispanic.

Step1: Optimal Number of Classes—Co-occurrence of Substance Use and Bullying Behaviors—The prevalence rates of substance use and bullying are reported in Table 1. Cigarette smoking, alcohol use, drunkenness and marijuana use were 14.5%, 34.4%, 19.4%, and 9.6% respectively. The prevalence rates of the five types of bullying were 13.8% physical, 37.9% verbal, 24.4% social exclusion, 11.9% rumor spreading, and 8.9% cyber.

The model fit statistics are reported in Table 2, which includes AIC, BIC, ABIC, entropy, VLMR LRT test and LMR adjusted LRT test. Because VLMR LRT test and the LMR adjusted LRT test provide *p* values of model comparison, they were used as the main criteria. Both tests suggested that the 2-class model represented the data better than a model without multiple latent classes. Then, the 3-class, 4-class, and 5-class models were tested until evidence showed no significant better model fit for a 5-class model than 4-class model. Thus, a 4-class model was considered to be the best model. Other model fit statistics, including AIC, BIC, ABIC and entropy values for the 4-class models were all acceptable.

For the 4-class LCA model, the item probabilities are shown in Figure 1, which indicates the probability of an individual endorsing each of the substance use and bulling items. This figure shows the overall pattern of the four latent classes: Class 1 is a class of non-involved, marked by minimal or low probabilities of conducting any of substance use and bullying behaviors; Class 2 is a class of substance users, characterized by much higher probabilities of using substances and low probabilities of bullying others; Class 3 is a class of bullies, marked by higher probabilities of bullying behaviors and low probabilities of using substances; Class 4 is a class of substance-using bullies, characterized by the highest probabilities of conducting all problem behaviors across the four latent classes.

Step 2: Socio-demographic Differences in Latent Class of Substance Use and Bullying Behaviors—The results of the 4-class LCA with socio-demographic variables as predictors are reported in Table 3 (Model 1). Socio-demographic variables included gender (male as referent), age, and race/ethnicity (Caucasian-American as referent). As there were a total of four classes, the model was analogous to a multinomial logistic regression of latent classes on socio-demographic variables. Class 1, the category of noninvolved, was set as the reference group.

Gender: Compared to males, females were more likely to be substance users (OR = 1.35), less likely to be bullies (OR = 0.75) and less likely to be substance-using bullies (OR = 0.58).

Age: Compared to younger adolescents, older adolescents were more likely to be substance users (OR = 1.90), less likely to be bullies (OR = 0.90) and more likely to be substance-using bullies (OR = 1.42).

Race/ethnicity: Compared to Caucasian adolescents, African-American adolescents were more likely to be bullies (OR = 1.86) and Hispanic adolescents were more likely to be substance users (OR = 1.36) and substance-using bullies (OR = 1.76).

Step 3: Social Influences on Latent Class of Adolescent Substance Use and Bullying Behaviors—The results of the 4-class LCA, with maternal knowledge, paternal knowledge and spending evening time with friends as predictors and socio-demographic variables as predictors, are also reported in Table 3 (Model 2).

Maternal Knowledge: Compared to those who reported higher level of maternal knowledge, adolescents with lower level of maternal knowledge were more likely to be substance users (OR = 2.81), bullies (OR = 1.87) and substance-using bullies (OR = 5.38).

Paternal Knowledge: Compared to those who reported higher level of paternal knowledge, adolescents with lower level of paternal knowledge were more likely to be substance users (OR = 2.39), bullies (OR = 1.61) and substance-using bullies (OR = 2.05).

Evenings Spent with Friends: Compared to those who spent less evening time with friends (0–2 evenings/week), those who spent more evening time (3–7 evenings/week) with friends were more likely to be substance users (OR = 2.62), bullies (OR = 1.41), and substance-using bullies (OR = 3.00).

As shown in Table 3 (Model 2), when the parental and peer variables were included, the gender and age differences remained significant. Compared to Caucasian adolescents, African-Americans were less likely to be substance users but more likely to be bullies.

Hispanic adolescents were more likely to be substance-using bullies, and other race/ethnicity adolescents were less likely to be bullies.

Discussion

The current study is, to our knowledge, the first to examine the co-occurrence of adolescent subtypes of substance use and bullying behaviors using LCA models. In a nationally representative U.S. sample, we found that subtypes of substance use and bullying behaviors co-occurred among 5.4% of adolescents in the United States, whereas the percentages of substance use only and bullying only adolescents were 19.4% and 17.5%, respectively. A four-class latent class model was found to best describe patterns of co-occurrence of different types of substance use and bullying behaviors, with one class of adolescents who had minimal involvement in substance use and bullying behaviors (Class 1), a second class of adolescents who were primarily involved in substance use (Class 2), a third class of adolescents who were primarily involved in bullying (Class 3), and a final class of adolescents who were involved in both substance use and bullying behaviors (Class 4).

Demographic differences across the four latent classes were evaluated using LCA with covariates, an approach that is analogous to the use of multinomial logistic regressions. Results indicated gender differences across the four latent classes. We found that female adolescents were more likely to be substance users whereas male adolescents were more likely to be substance-using bullies. While this may reflect the closing gender gap in substance use as reported in recent studies (Hammond, 2009; Keyes et al., 2008), this may also be explained by the fact that male substance users were more likely to be grouped into the class of substance-using bullies in the current study. In addition, male adolescents were more likely to be bullies than female adolescents. This is consistent with previous studies showing that males are overall more likely than females to bully others and especially so in physical bullying (Bjorkqvist, 1994; Seals & Young, 2003) and cyber bullying (Kiriakidis & Kavoura, 2010; Wang et al., 2009). As no previous study that we are aware of has examined gender differences in the co-occurrence of substance use and bullying behaviors, our study uniquely shows that substance use and bullying behaviors are more likely to co-occur among male than female adolescents.

Age differences in substance use, bullying and the co-occurrence of these two problem behaviors were also examined. Consistent with previous research, our results indicate that substance use increased with age (Johnston et al., 2010). On the other hand, we found that younger adolescents were more likely to be bullies, which is similar to findings reported in previous studies (Carlyle & Steinman, 2007; Nansel et al., 2001). More importantly, a distinctive finding of this study is that older adolescents were more likely to be substance-using bullies. This indicates that engagement in multiple problem behaviors is more prominent among older adolescents, highlighting the need for prevention efforts during the transition into middle or high school, particularly among high risk adolescents (i.e., substance-using bullies).

Racial differences across the latent classes extracted were likewise evaluated using LCA with covariates. Results suggest that Hispanics were more likely to be substance users when compared to Caucasians, which is consistent with national data during the same period of time among adolescents of similar age (Johnston, O'Malley, Bachman, & Schulenberg, 2006). In contrast, we found that African Americans were more likely to be bullies than Caucasians, replicating the findings reported in a regional study (Juvonen et al., 2003) and a national study (Wang et al., 2009). Our findings on race and bullying did not replicate results from previous national studies conducted in the United States (Nansel et al., 2001; Spriggs, Iannotti, Nansel, & Haynie, 2007), which may reflect a change in racial differences

in bullying over time. Importantly, our findings add to the literature by showing that Hispanics were more likely to be substance-using bullies than Caucasians. Significant racial differences highlight the possible advantage of developing culturally appropriate interventions for African American and Hispanic adolescents who are at elevated risks for engagement in different problem behaviors.

Previous research demonstrated that affiliation with deviant peers is correlated with a wide array of adolescent problem behaviors including substance use and bullying behaviors (Bray et al., 2003; Dishion et al., 2004; Simons-Morton, 2007), whereas increased parental knowledge served as a buffer against engagement in problem behaviors (Kerr & Stattin, 2000; Waizenhofer et al., 2004; Simons-Morton & Chen, 2005). Consistent with the findings by Gage and colleagues (2005), we found that the number of evenings spent with peers, which may serve as a proxy measure for peer affiliation and opportunities for unsupervised social activities, also posed greater risks for substance use, bullying and the co-occurrence of both problem behaviors. The present study also demonstrates that paternal knowledge had a significant protective effect on engagement in problem behaviors, over-and-above the effects of maternal knowledge. Results from the present study are similar to those reported by Coley and colleagues (2008), in which the importance of paternal knowledge is emphasized along with maternal knowledge. This suggests that prevention effects may yield greater impact by involving both parents than only one parent. Together with the direct and positive association between peer activity in the evening and problem behaviors, the present study indicates that one important way of preventing adolescent problem behaviors is to increase parental supervision of peer activities, which may buffer against the risks posed by deviant peers.

It is important to note that gender and age differences remained significant when parental and peer variables were added into the model, indicating that parental knowledge and evenings spent with friends did not mediate these effects on latent class membership. Similarly, elevated risks for African American adolescents to be bullies and for Hispanic adolescents to be substance-using bullies remained significant after parental and peer variables were taken into account. By contrast, Hispanic adolescents were no longer more likely to be substance users after parent knowledge and evenings spent with friends were included in the model, suggesting higher rates of substance use in Hispanic adolescents could be partially explained by social influences on substance use (Frauenglass, Routh, Pantin, & Mason, 1997; Myers et al., 2009). In addition, after controlling the parental and peer variables, African American adolescents were less likely to be substance users, adolescents with other race/ethnicity were less likely to be bullies, and adolescents with higher family affluence were more likely to be substance users. It may reflect racial/ethnic and economic differences in the social influences (Wang, Simons-Morton, Farhat, & Luk, 2009), and deserve further investigation.

Contributions to the Literature

The present study adds to the literature in at least three distinct ways. First, our study extends previous studies which focused on the co-occurrence of adolescent substance use, sexual behaviors and externalizing symptoms (Fergusson et al., 1994; Weden & Zabin, 2005) by testing the extent to which co-occurrence of problem behaviors can be generalized to bullying behaviors. Second, our study included multiple indicators of adolescents' involvement in substance use and bullying, providing a unique opportunity to examine the degree to which subtypes of substance use and bullying behaviors overlap using LCA. Third, the large and nationally representative U.S. sample provided us with sufficient representation from different age and racial/ethnic groups. Consequently, this dataset enabled us to examine gender, age and racial differences across different latent classes and the results of this study may be generalized to different demographic groups.

Limitations and Implications

The results of this study should be interpreted with caution because of its limitations. First, the cross-sectional data collected in this study limited our ability to draw causal conclusions. For example, it remains unclear whether substance use and bullying were caused by stronger peer influences or if adolescents who engage in substance use and bullying behaviors were more likely to hang out with friends in the evening. Additionally, we cannot rule out the possibility that these problem behaviors co-occur due to other common determinants that were not examined in the current study (Chun & Mobley, 2010). Second, we only used one survey item, number of evenings spent with friends, to assess peer influence, which may not fully capture the complex dynamics within the peer context. Future research should use a comprehensive set of items to assess for peer influence. Third, although it is possible that parental knowledge interacted with or predicted evenings spent with peers, our study only examined independent effects and did not test moderated or mediated effects of maternal and paternal knowledge on the association between evenings spent with peers and adolescent problem behaviors.

Nevertheless, the current study has important implications for prevention of substance use and bullying behaviors in U.S. adolescents. Our results suggest that substance use and bullying behaviors co-occur among a subpopulation of U.S. adolescents (5.4%) who are more likely to be males, older adolescents, Hispanics, and tend to spend greater number of evenings with friends. Understanding the demographic characteristics of substance users, bullies and substance-using bullies may facilitate the development of prevention and intervention programs through effective identification of adolescents who are likely to engage in multiple problem behaviors. Moreover, parental knowledge and evenings spent with peer were found to associate with class membership, suggesting that they may serve as points of intervention as far as the prevention of substance use and bullying are considered.

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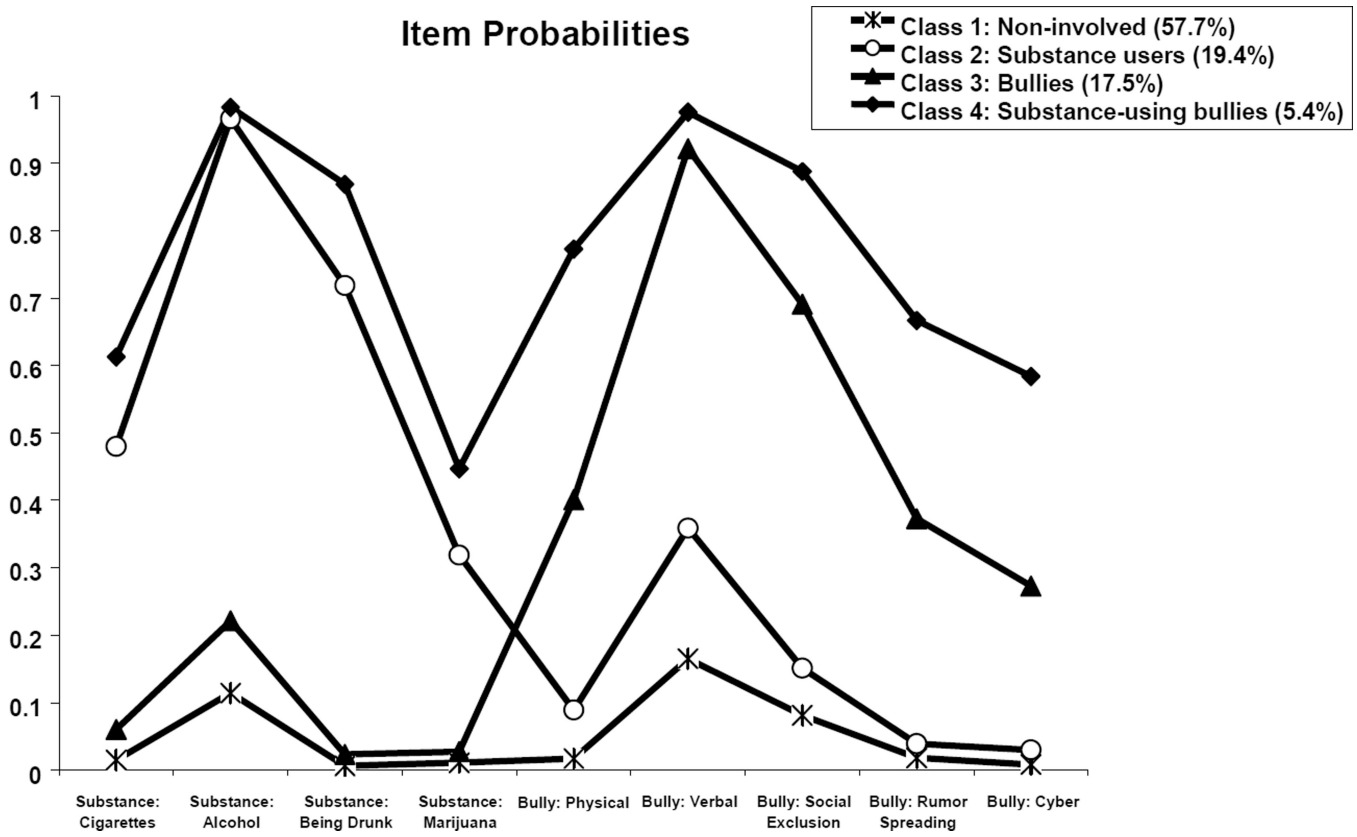

Figure 1.
Item Probability for Each Latent Class

Table 1

Percentage of Involvement in Bullying and Substance Use

Items	Total *N* = 7508	Male *N* = 3585	Female *N* = 3916
Bullying [a]			
Physical	13.8%	18.8%	9.2 %
Verbal	37.9%	40.9%	35.0%
Social Exclusion	24.4%	25.0%	23.9%
Rumor Spreading	11.9%	13.3%	10.8%
Cyber	8.9%	10.6%	7.3%
Substance use [b]			
Cigarettes	14.5%	13.9%	15.0%
Alcohol	34.4%	33.0%	35.6%
Being Drunk	19.4%	19.3%	19.4%
Marijuana	9.6%	10.5%	8.8%

Note.

[a]Percentage of having bullied others for at least once in the past a couple of months.

[b]Percentages of having used substances for at least once in the past 30 days.

Table 2

Model Fit Statistics by Number of Classes (N = 7508)

Fit Statistics	No. of classes			
	2	3	4	5
Degree of freedom	19	29	39	49
Log likelihood	−27250.6	−25497.5	−24856.1	−24675.2
Akaike (AIC)	54539.2	51052.9	49790.2	49448.4
Bayesian (BIC)	54670.8	51253.7	50060.3	49787.6
Sample-Size				
Adjusted BIC	54610.4	51161.5	49936.3	49631.9
Entropy	.789	.862	.844	.810
VLMR LRT	< .0001	< .0001	.0003	0.145 [a]
LMR adjusted LRT	< .0001	< .0001	.0004	0.148 [a]

Note.

AIC = Akaike's Information Criteria; BIC = Bayesian Information Criteria; VLMR LRT = Vuong-Lo-Mendell-Rubin Likelihood Ratio Test; LMR adjusted LRT: Lo-Mendell-Rubin Adjusted Likelihood Ratio Test.

[a]The tests compares the 4-class model and the 5-class model. As the 5-class model didn't significantly increase the model fit, the 4-class model was selected as the optimal model.

Table 3

The Results of LCA with Covariates [a]

	Model 1 (N = 7350) [b]			Model 2 (N = 7315) [b]		
	Substance Users [c]	Bullies [c]	Substance-using bullies [c]	Substance Users [c]	Bullies [c]	Substance-using bullies [c]
	OR [95% CI]	OR [95% CI]	OR [95% CI]	OR [95% CI]	OR [95% CI]	OR [95% CI]
Gender						
Female	**1.35 [1.07–1.70]**	**0.75 [0.60–0.92]**	**0.58 [0.43–0.79]**	**1.49 [1.14–1.94]**	**0.77 [0.62–0.94]**	**0.68 [0.48–0.95]**
Male (ref)						
Age	**1.90 [1.72–2.10]**	**0.90 [0.82–0.98]**	**1.42 [1.30–1.55]**	**1.87 [1.69–2.08]**	**0.88 [0.81–0.96]**	**1.38 [1.27–1.50]**
Race/Ethnicity						
African-American	0.79 [0.53–1.17]	**1.86 [1.28–2.71]**	1.40 [0.99–1.97]	**0.53 [0.34–0.83]**	**1.50 [1.02–2.20]**	0.84 [0.58–1.20]
Hispanic	**1.36 [1.07–1.72]**	1.00 [0.74–1.42]	**1.76 [1.25–2.48]**	1.10 [0.84–1.43]	0.90 [0.64–1.26]	1.30 [0.91–1.85]
Other race/ethnicity Caucasian (ref)	1.00 [0.67–1.49]	0.76 [0.53–1.09]	0.92 [0.61–1.37]	0.79 [0.54–1.16]	**0.66 [0.45–0.98]**	0.69 [0.43–1.21]
Maternal knowledge (lower vs. higher)				**2.81 [2.32–3.41]**	**1.87 [1.36–2.56]**	**5.38 [3.73–7.74]**
Paternal knowledge (lower vs. higher)				**2.39 [1.90–3.00]**	**1.61 [1.33–1.94]**	**2.05 [1.47–2.88]**
Spending evenings with friends (3–7 vs 0–2 evenings/week)				**2.62 [2.12–3.26]**	**1.41 [1.13–1.76]**	**3.00 [2.19–4.43]**

Note.

[a]The analysis is analogous to a multinomial logistic regression, with the four-category latent class membership as the outcome variable. Due to missing data on the covariate variables, 230 adolescents (3.0%) were excluded in the analysis of Model 1 and 265 adolescents (3.5%) were excluded in the analysis of Model 2.

[b]The purpose of Model 1 was to examine socio-demographic differences, whereas the main purpose of Model 2 was to examine the influence of peer affiliation with socio-demographic variables as covariates.

[c]Class 1 (the noninvolved) was the referent for the latent class membership.