

Shared Predictors of Youthful Gambling, Substance Use, and Delinquency

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Given that gambling, alcohol misuse, other drug use, and delinquency are correlated, it is hypothesized that these problem behaviors have shared antecedents. Measures from 3 explanatory domains—socio-demographic factors (age, race, and socioeconomic status), individual factors (impulsivity and moral disengagement), and socialization factors (parental monitoring and peer delinquency)—were tested for links to problem behaviors in 2 longitudinal samples of adolescents. Black youth had lower levels of problem behaviors than Whites. Impulsivity was a significant predictor of alcohol misuse for females and delinquency for males. Moral disengagement predicted gambling for males. Parental monitoring showed a significant inverse relationship to alcohol misuse and other substance use for males. Peer delinquency showed numerous prospective paths to youth problem behaviors for both genders.

Theoretical and empirical research consistently show that various types of problem behaviors co-occur in adolescents. It has long been noted that substance use and delinquent behaviors occur together (Elliott, Huizinga, & Ageton, 1985; Welte & Barnes, 1985), constituting what Jessor and his associates have called a *problem behavior syndrome* (e.g., Donovan & Jessor, 1985; Jessor & Jessor, 1977). Youthful gambling has only recently been examined for its relationships with other problem behaviors, and studies show that adolescent gambling is positively related to alcohol use (Barnes, Welte, Hoffman, & Dintcheff, 1999, 2002) as well as to other substance use and delinquency (Vitaro, Brendgen, Ladouceur, & Tremblay, 2001; Winters & Anderson, 2000; Winters, Stinchfield, & Fulkerson, 1993). Given that gambling, substance use, and delinquency are correlated, it is plausible that all of the behaviors may be explained by shared antecedents or risk factors.

One of the most widely cited theories explaining the association between various types of problem behaviors is Hirschi and Gottfredson's (1994) *generality of deviance* perspective. Their argument is that all deviance is characterized by individuals who seek immediate pleasure at the risk of long-term consequences; thus, the property of individuals that explains variation in the likelihood of engaging in deviant acts is self-control. According to Hirschi and Gottfredson, this underlying trait, lack of self-control, is general, and it provides the explanation of why the same individuals tend to engage in various types of problem behaviors. Wilson and Herrnstein (1985) also offered a related key individual trait, impulsivity, as an explanation for deviance. They defined *impulsivity* as the extent to which individual behavior is influenced by immediate as opposed to delayed consequences. Another key individual characteristic related to general delinquency is lack of remorse or lack of

guilt for antisocial behaviors, termed *moral disengagement* by Elliott et al. (1985). Moral disengagement has been shown to be a significant precursor of juvenile offending (e.g., Hawkins, 1996) as well as alcohol consumption and frequency of gambling in youth (Barnes et al., 1999).

In the well-known prospective longitudinal Cambridge study of males aged 8 to 32, Farrington (e.g., 1996) also confirmed that delinquents are versatile rather than specialized in their offending. Farrington (1996), like Hirschi and Gottfredson (1994), viewed individual problem behaviors, such as heavy smoking, heavy drinking, and other drug use, as part of a larger syndrome of antisocial behavior that arises in childhood and persists into adulthood. However, scholars such as Farrington, Elliott et al. (1985), and Catalano and Hawkins (1996) have explained the wide variety of antisocial behaviors not with a single individual trait but with integrated theoretical perspectives involving multiple risk factors that encompass individual as well as social and environmental factors. Thus, most empirical researchers today find that it is important to consider factors from multiple domains to increase the explanatory power of influences on adolescent problem behaviors.

According to our conceptual model of the development of adolescent alcohol misuse and related problem behaviors (see Figure 1), individual–personality characteristics (e.g., impulsivity and moral disengagement) may also be shaped and acted on by socialization influences, in particular by parental monitoring and associations with problem-behaving peers (Barnes, 1990; Barnes et al., 1999). For instance, in a six-wave longitudinal study, parental monitoring was shown to significantly predict initial drinking levels of adolescents as well as their rates of increase in alcohol misuse over the course of adolescence (Barnes, Reifman, Farrell, & Dintcheff, 2000).

The other key socialization agent during adolescence is the peer group. Elliott and Menard (1996) showed empirically that exposure to delinquent peers preceded delinquent behavior, supporting social learning or socialization theory, which argues that young people learn problem behavior by associations with significant others who engage in the same problem behavior.

The present study was based on our conceptual framework (see Figure 1) for the development of adolescent alcohol misuse and related problem behaviors. This framework focuses on three pri-

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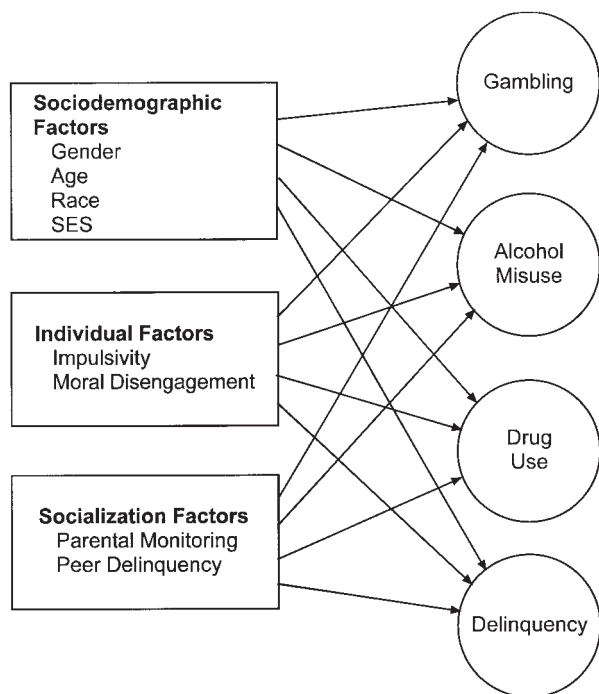


Figure 1. Conceptual model of hypothesized predictors of youth problem behaviors. SES = socioeconomic status.

many explanatory domains: sociodemographic factors (e.g., gender, age, race, and socioeconomic status [SES]), individual factors (including impulsivity and moral disengagement), and socialization factors (especially parental monitoring and peer delinquency; Barnes, 1990; Barnes et al., 1999). Empirical research has shown links between selected factors from these three domains and selected problem behaviors (e.g., Barnes & Farrell, 1992; Barnes et al., 1999; Hawkins, 1996; Vitaro et al., 2001). However, most research to date involves cross-sectional studies and analytic procedures that do not take into account multiple influences on multiple problem behaviors. Winters, Stinchfield, Botzet, and Anderson (2002) carried out one of the few longitudinal studies of adolescent gambling and found that young adult gambling problems were predicted by the same risk factors associated with the problem behavior syndrome, particularly delinquency and substance use. The only longitudinal study that included adolescent gambling, substance use, and delinquency as multiple outcomes was carried out by Vitaro et al. (2001) among a select sample of boys in a disadvantaged neighborhood in Montreal, Quebec, Canada. They found that impulsivity, low parental supervision, and deviant friends were predictively related to gambling, substance use, and delinquency 2 years later (Vitaro et al., 2001). The present study extends previous research by including two independent general population longitudinal samples of young people, including both males and females. Derived from our conceptual framework (see Figure 1), we hypothesized that key factors from the three domains—sociodemographic, individual, and socialization—would predict gambling, alcohol misuse, other drug use, and delinquency. More specifically, we hypothesized that age would positively predict alcohol misuse and drug use but negatively predict gambling and delinquency, for each gender. Blacks were

expected to have lower levels of all problem behaviors compared with Whites, and SES was entered as a control variable. Both impulsivity and moral disengagement were expected to positively predict all problem behaviors. Parental monitoring was hypothesized to predict lower levels of all problem behaviors, whereas peer delinquency was hypothesized to predict higher levels of all problem behaviors over time.

The present study significantly extends our previous work (Barnes et al., 1999) in several ways. First, the present study involves longitudinal analysis, which is more sophisticated, is more comprehensive, and has stronger implications for causation than the analysis in our 1999 study (Barnes et al. 1999), which was primarily cross-sectional. We concluded the discussion in our 1999 article by pointing out the limitation of that cross-sectional analysis and the need for longitudinal analyses (Barnes et al., 1999, p. 765). Similarly, Winters and Anderson (2000) called for prospective studies to clarify factors that are unique and common to adolescent gambling and drug use. Second, the outcomes (dependent variables) are different in the two articles. The 1999 study used two single variables, alcohol consumption and times gambled as outcomes, whereas the present study uses four error-free constructs with multiple indicators, representing gambling behavior, alcohol misuse, other drug use, and delinquency. Many of the leading experts in structural equation modeling in the substance use field have also used latent constructs to represent involvement with substance use and delinquency (Duncan, Duncan, Biglan, & Ary, 1998; Newcomb, 1994; Windle, 1997, 2000; Windle & Barnes, 1988). Third, the predictors are different in the two studies. In earlier work, the predictors were primarily assessed at the same point in time as the outcomes, whereas in the present study all of the predictors in the two samples are from earlier waves than the outcomes. Fourth, in the present study we used structural equation modeling with latent variables as the analysis method. We used this method because it takes a confirmatory, rather than exploratory, approach (Byrne, 2001, p. 3); it explicitly accounts for errors of measurement, rather than assuming that error is negligible, as is done by regression models (Byrne, 2001, p. 4; MacCallum, 1995, p. 18); and it can model the complex, multiple independent and dependent variables from various domains (Newcomb, 1994, p. 157). In particular, this approach uses error-free constructs to represent the predictors such that the common and unique effects of each predictor are assessed while controlling for all other predictors and their errors of measurement (Windle, 2000, p. 100).

Method

Samples

The data for this study are taken from two general population household samples of youth from the metropolitan area of Buffalo, New York. These are the Family and Adolescent Study (Study 1) and Delinquency in Young Men (Study 2). These studies had comparable or similar measures on youthful problem behaviors and risk factors, and thus we reasoned that if analyses yielded similar results from two separate studies, then the generalizability of the findings would be strengthened. Summaries of the methods for the two studies are as follows.

Family and Adolescent Study (Study 1)

A six-wave longitudinal study of family influences on the development of adolescent alcohol misuse was begun in 1989, and respondents were

interviewed at yearly intervals. Adolescents were 13–16 years old ($M = 14.5$) at Wave 1 and 18–22 years old ($M = 19.9$) at Wave 6. At Wave 1, a representative household sample of 699 adolescents and their families was obtained by means of random-digit-dial sampling procedures. The criteria for inclusion in the sample were that the household have at least one adolescent between 13 and 16 years old and at least one parent. Black families were oversampled ($n = 210$) to allow sufficient numbers for meaningful analysis. Personal interviews were carried out with adolescent respondents and family members. Gambling measures were included only in Waves 5 and 6. The present analyses are based on data from those adolescents who were interviewed in Wave 5 ($N = 522$); this sample includes 226 males and 296 females, with a mean age of 19 years. The analysis sample consisted of 29% Blacks and 71% Whites and participants of other races. Additional details of the sampling and methods have been reported elsewhere (Barnes, Farrell, & Dintcheff, 1997; Barnes et al., 1999, 2000).

Delinquency in Young Men (Study 2)

This was a three-wave longitudinal study of the relationships between substance abuse and criminal offending in young men. Respondents were 625 males aged 16–19 at the first wave. Wave 1 interviewing was begun in 1992, and respondents were reinterviewed for Waves 2 and 3 at approximately 18-month intervals. Households were selected by random-digit-dialing procedures, and telephone districts with high crime rates were oversampled. For a household to be eligible for the study, it had to contain both a male aged 16–19 and an adult family respondent who could answer questions about the young male's upbringing and family background. Screening was done by telephone to oversample young males at risk for delinquency. Personal interviews were conducted by trained interviewers. Additional details of the sampling and methods have been reported elsewhere (Welte, Zhang, & Wieczorek, 2001; Zhang, Welte, & Wieczorek, 1997; Zhang, Wieczorek, & Welte, 1997a, 1997b). Gambling measures, as well as substance use and delinquency measures, were included in all three waves. The present analyses are based on data from those youth (males) who were interviewed in Wave 2 ($N = 597$), to provide a sample of male youth having the same mean age (19 years) as males in Wave 5 of Study 1. The sample was nearly equally divided by race: 49% Black and 51% White–other.

Measures

Dependent Variables

Latent variables were used to represent four categories of youth problem behaviors: (a) gambling, (b) alcohol misuse, (c) other drug use, and (d) delinquency. These dependent variables were assessed in Wave 5 in Study 1 and in Wave 2 in Study 2. Each latent factor had three composite indicators, as described below. Because problem behaviors are not normally distributed, log transformations were applied to the respective indicators to reduce skewness.

Gambling. Three composite indicators were used for the latent variable representing youth gambling in both studies. These indicators were derived from identical questions on gambling in both studies asking about the frequency of nine types of gambling (Lesieur & Blume, 1987). To develop the three indicators for the latent variable representing youth gambling, we conducted preliminary analyses to identify the factor structure. First, the frequencies of gambling on each of nine types of gambling in the past year were examined. Because the distributions were skewed, we applied log transformations to make the distributions more nearly normal. Then, confirmatory factor analysis (CFA) models were run, specifying each of these nine log-transformed frequencies of gambling as indicators for a single latent gambling factor. Separate models using these same indicators were run for males and females in Study 1 and for males in Study 2. The standardized loadings of these gambling types were then examined in each of the study–gender models, and the five types of gambling that had the

highest loadings were identified in each case. Using these types of gambling as a starting point, the other types of gambling that seemed to be similar in nature or venue were then grouped with these initial types, to form three groups of items. These groups of items were then used to form scales, which could be used as composite indicators for the gambling construct. Three indicators were constructed because three is a rule of thumb for the number of indicators to use for a latent variable in order for the model to be identified (Kenny, Kashy, & Bolger, 1998, p. 253; Kline, 1998, p. 206). The items in the three resulting groups were (a) sports, games of skill, and horses–dogs; (b) cards and dice; and (c) lottery, bingo, slots, and casino games. To form the composite indicators, we first summed items for each group, and then we applied a log transformation to the sum to make the distributions more nearly normal.

Alcohol misuse. Three composite indicators were used for the latent variable representing youth alcohol misuse in both studies: (a) alcohol consumption, (b) number of times drunk in the past year, and (c) frequency of drinking five or more drinks at one time in the past year (Barnes et al., 2000). The measure of total daily average alcohol consumption was derived from beverage-specific questions on the youth's typical quantity and frequency of alcohol consumption during the last 12 months in both studies. Total alcohol consumption was calculated by multiplying frequency of drinking by typical quantity by percentage alcohol content. This calculation was done for each class of beverage, and the products were summed over beverages (Barnes, Welte, Hoffman, & Dintcheff, 1997). Both studies also included questions on the frequency of drinking five or more drinks at a time in the past year and a question asking for the number of times the respondent had gotten drunk in the past year.

Drug use (other than alcohol). Three composite indicators were used for the latent variable representing drug use in both studies: (a) frequency of marijuana use in the past year, (b) frequency of use of other illicit drugs besides marijuana in the past year, and (c) average number of cigarettes per day. These were derived from similar questions about the frequency of illicit drug use during the past year in both studies and from questions about frequency of cigarette use in the past month (Study 1) or in the past year (Study 2). In Study 1, youth were asked how many times they had used on their own without a physician's order each of seven illicit drugs, including (a) marijuana or hashish, (b) LSD or other hallucinogens, (c) cocaine or crack, (d) glue or inhalants, (e) tranquilizers, (f) "ups," and (g) "downs" (e.g., barbiturates or sedatives or sleeping pills). Response options ranged from *never used* to *40 or more times* on a 7-point frequency scale. These responses were recoded to the midpoints of each frequency class interval and the results summed over drugs to give a measure of total frequency of past-year illicit drug use. In Study 2, the questions about number of times youth had used each drug in the last 12 months had eight response categories, ranging from *0 to 2–3 times a day*; four of the response categories corresponded to frequencies of use greater than once a week. We asked about a wider range of drugs than in Study 1, including 12 illicit drugs and up to 4 prescription drugs used without a physician's order. Responses were recoded to the midpoint of each frequency interval and summed over drugs (Zhang, Welte, & Wieczorek, 1997; Zhang, Wieczorek, & Welte, 1997b). Both studies also included questions about the youth's average number of cigarettes smoked per day. In Study 1, the question asked youth about their smoking cigarettes in the past 30 days, with six responses, ranging from *no smoking in the last 30 days* to *2 or more packs per day*. Responses were recoded to the equivalent number of cigarettes per day, for example, *2 or more packs per day* was assumed to correspond to 50 cigarettes per day. In Study 2, the question asked youth who had smoked in the past 12 months for the number of cigarettes smoked on a typical smoking day.

Delinquency. Three scale-level indicators were used for the delinquency factor in both studies: (a) frequency of remunerative delinquency, that is, delinquent acts committed for monetary gain; (b) frequency of violent delinquent acts; and (c) frequency of general delinquent acts, not classified as remunerative or violent, consisting of minor, property, or nonviolent acts. All delinquency items measured the frequency with which

the youth had committed each act in the past year. Somewhat different items were included in these composite indicators in the two studies. In Study 1, the delinquency items were developed on the basis of previous work in this area (Bachman, 1970; Gold & Mann, 1972) and were supplemented on the basis of the National Youth Survey delinquency scales (Elliott et al., 1985). The 18 items included delinquent acts covering a range of seriousness, from relatively minor offenses—for example, stayed out later than parents said, argued or fought with mother, skipped a day of school without a real excuse, or argued or fought with father—to major delinquent acts—for example, ran away from home, taken something of value that did not belong to you, beaten up someone on purpose, used a credit card or check without the owner's permission, and broken into a house. Response options ranged from *never* to *once a week or more* along a 7-point frequency scale. Sample items for the Remunerative Delinquency Scale (four items) include "taken something of value which did not belong to you," and "broken into a house, business or car to take something or look around." Sample items for the Violent Delinquency Scale (six items) include "argued or fought with your mother"; "beaten up someone on purpose"; and "pushed, shoved, or hit a parent or another adult in your family." Sample items for the General Delinquency Scale in Study 1 (eight items) include "stayed out later than you should have" and "skipped a day of school without a real excuse."

In Study 2, respondents were asked similar questions based on the National Youth Survey about the number of times they had engaged in each of 31 delinquent acts during the past year (Elliott et al., 1985; Zhang, Wieczorek, & Welte, 1997b). The delinquent acts included both relatively minor offenses, such as unauthorized credit card use, disorderly conduct, and theft of money or other things from someone you live with or from the place you work, as well as more serious offenses, such as stealing a motor vehicle, stealing something worth more than \$100, arson, using force or strong-arm tactics to get money or things from people, attacking someone with the idea of seriously hurting or killing them, gang fighting, rape, and assault. For each item there were eight response categories of frequency, ranging from 0 to 2–3 times a day; four of the response categories corresponded to frequencies greater than once a week. Sample items in the Remunerative Delinquency Scale (17 items) include "stolen something worth more than \$100," "stolen a motor vehicle such as a car or motorcycle," and "sold marijuana." Sample items for the Violent Delinquency Scale (6 items) include "attacked someone with the idea of seriously hurting or killing that person" and "used force or strong-arm tactics to get money or things from people." Sample items in the General Delinquency Scale (8 items) include "purposely damaged or destroyed property" and "been very loud, rowdy, or unruly in a public place—disorderly conduct."

Independent Variables

Independent variables included sociodemographic factors, individual-psychological factors, and parental and peer socialization factors. Measures of independent variables were taken from earlier waves of the respective study than the dependent variables.

Sociodemographic Factors

In Study 1, both males and females were included, whereas Study 2, by design, had all male primary respondents. In both studies, race was dichotomized as Black (coded 1) and White (coded 0). (There were only a few cases in both studies of races other than White or Black.) Youth age, measured in years, was taken from Wave 5 in Study 1 and from Wave 2 in Study 2. The number of years of mother's education, taken from Wave 1 in both studies, was used as a measure of family SES in both studies (Barnes, Farrell, & Dintcheff, 1997). The mean of this measure was 13.4 years for youth in Study 1 and 12.3 years in Study 2. This difference is a reflection of the different sampling areas; Study 1 included ring suburban areas with higher average education than in the predominantly urban areas included in Study 2.

Individual–Psychological Factors

Impulsivity

In Study 1, seven items were used to assess impulsivity in Wave 3. Sample items were "I throw myself too quickly into things" "I frequently talk before I think" "I usually spend my money as soon as I get it" and "If something seems like fun to do, I'm willing to do it right away and think about the consequences later on." Response choices ranged on a 4-point scale from 1 (*usually false*) to 4 (*usually true*). To form three indicators for the latent construct, we initially grouped these items into three groups based on related content, corresponding to spending money too quickly (two items), forgetting to check the consequences (three items), and forgetting to think (two items). However, in initial CFA models the loadings for the spending money too quickly indicator were low. To improve the low loadings, we therefore combined these two items with the two items for forgetting to think, resulting in two indicators with acceptable loadings. Although having three indicators assures the identification of a single latent variable model, two indicators are sufficient for a latent variable when there are other correlated latent variables in the model to aid in model identification, as in the present model (Kline, 1998, pp. 203 and 205).

In Study 2, 15 items from the Psychopathic State Inventory were used to measure youth impulsivity in Wave 1 (Haertzen, Martin, Ross, & Neidert, 1980; Zhang, Wieczorek, & Welte, 1997b). To form three indicators for the latent construct, we initially grouped these items into three groups based on similar content, loosely described as thrill seeking (four items), impatience (seven items), and boredom (four items). However, in an initial CFA model the loading for thrill seeking was low, so these items were combined with the four items for boredom, again resulting in two indicators with acceptably high loadings.

Moral Disengagement

Moral disengagement was measured in both studies by the same questions reflecting youth attitudes toward deviance, adapted from the National Youth Survey (Elliott et al., 1985). These questions were from Wave 4 in Study 1 and from Wave 1 in Study 2. The 14 items asked youth respondents how much guilt or remorse they would feel if they engaged in each of 14 delinquent acts, including exceeded the speed limit by 10 to 20 mph; stole something worth more than \$50; broke into a vehicle or building to steal something; used force—strong-arm methods or physical force—to get money or things from other people; physically hurt your spouse or partner; and attacked someone with the idea of seriously hurting or killing him or her. The response options were also the same in both studies and ranged from 5 (*a great deal*) to 1 (*very little*). A subset of 7 of these items was used to make an index of deviant attitudes in Zhang, Wieczorek, and Welte (1997b) and was used as a measure of approval of antisocial or deviant acts. To make three indicators for a latent construct, we first recoded the items so that higher scores meant greater approval of deviant acts. An initial approach to combining the items based on type of deviant act or crime involved did not produce indicators with high loadings in CFA models. The 2 items involving exceeding the speed limit were dropped because they did not seem to load well with the other items in initial CFA models. The remaining 12 items were then grouped at random into three groups of 4 items, combining 2 items for property crimes with 2 items for violent crimes in each group. The resulting three indicators, which thus represent three measures of tolerance of stealing or violence, had acceptably high loadings in the CFA models in both data sets.

Socialization Variables

Parental Monitoring

Both studies included five comparable questions about parental monitoring of the adolescents' whereabouts and peer associations. Items for monitoring from Waves 1–4 in Study 1, and from Wave 1 in Study 2, were

used. These items were developed by Barnes and her colleagues on the basis of previous theory and empirical research on adolescent socialization processes (Barnes, 1990; Barnes & Farrell, 1992; Barnes, Farrell, & Dintcheff, 1997; Rollins & Thomas, 1979). The item wording was “How often do you tell your parents where you are going to be after school?” “How often do you tell your parents where you are really going when you go out evenings and weekends?” “How often do you talk with your parent(s) about the plans you have made with your friends?” “When you are going out, how often do your parents ask you where you are going?” and “If you are going to be home late or change your plans, are you expected to call your parents to let them know?” Study 2 included an additional item, “How often did you tell your parents who you were going out with?” Response choices ranged from *never* to *always* along a 5-point scale. To model monitoring as a latent construct, we created three indicators by grouping items based on similar content. The resulting three indicators were (a) how often do you tell your parents where you are going; (b) how often do you tell your parents who you are going out with or talk to them about your plans with friends; and (c) how often do your parents ask you where you are going or you are expected to call home when plans change. To capture the cumulative effect of early monitoring in Study 1, we combined the same items in Waves 1 through 4 to make each indicator. In Study 2, all items were from Wave 1. The resulting indicators had acceptably high loadings in the CFA measurement models.

Peer Delinquency

In both studies, measures of peer delinquency were based on the youth reports of their friends’ delinquent acts during the past year. These questions were in Wave 3 in Study 1 and in Wave 1 in Study 2. In Study 1, adolescents were asked “During the past year, about how often has your closest friend [done each act]?” The 21 items included a range of relatively minor acts to major delinquent acts, for example, stayed out later than parents said, argued or fought with mother, skipped a day of school without a real excuse, argued or fought with father, ran away from home, taken something of value that did not belong to you, beaten up someone on purpose, used a credit card or check without the owner’s permission, broken into a house, and so forth. Items for using drugs (either marijuana or other drugs) or alcohol (“drank five or more cans of beer, drinks of wine or drinks with liquor”), as well as having sex, were included. Response options were on an ordinal 4-point frequency scale: 3 (*frequently*), 2 (*sometimes*), 1 (*seldom*), and 0 (*never*). To model peer delinquency as a latent construct, we grouped the items into three groups by type of delinquency, parallel to the types used for the adolescent’s own delinquency. Thus, the three indicators represented, respectively, the frequency of remunerative delinquency (4 items), violent delinquency (6 items), and general delinquency (11 items).

In Study 2, peer delinquency was measured by asking respondents 14 items about how many of their friends had engaged in each of a set of delinquent behaviors in the past year (Elliott et al., 1985; Zhang, Wieczorek, & Welte, 1997b). The items included such acts as cheated on income tax, purposely damaged or destroyed others’ property, used marijuana or hashish, used alcohol, stole something worth more than \$50, and hit or threatened to hit someone without any reason. Responses were made on a 5-point scale that ranged from 1 (*none of them*) to 5 (*all of them*). To form three indicators for a latent construct, we also grouped these items by type of delinquency into remunerative (4 items), violent (2 items), and general (8 items) delinquency. In the CFA measurement models, these indicators all had acceptably high loadings.

Analysis

We used structural equation modeling analyses to test the hypothesized model in Figure 1 in both studies. To permit comparisons of the results for males across the two study samples, we ran the model separately by gender in Study 1. The model was estimated using the maximum likelihood

method, using Amos Version 4.0 graphics software (Arbuckle & Wothke, 1999). Model specification and testing followed the general approach described by Byrne (2001). We conducted the analyses using unweighted data to take advantage of the true sample sizes. In each study, the variable most related to the oversampling was also included as a variable in the analyses (race in Study 1, and delinquency in Study 2). Initial CFA models were run to evaluate the measurement of the latent variables. These CFA models included only the eight latent factors representing the four youth problem behaviors, and four antecedent factors—that is, impulsivity, moral disengagement, parental monitoring, and peer delinquency—and their intercorrelations. No sociodemographics or regression paths were included in these measurement models. The standard model specifications, necessary for the structural model estimation, included correlations among all the predictor (exogenous) variables and correlations among the disturbance terms for each of the dependent (endogenous) factors representing youth problem behaviors. Each of the latent variables (except impulsivity) had three scale-level measured variables as indicators, each with a unique or residual variance term. To identify each of the latent variables, we fixed the factor loading for one of the three indicators to 1.0 for each latent variable. The path from each of the disturbance terms to the corresponding latent variable was also fixed to 1.0, and the variance of the disturbance term was estimated.

A sequential model-building process was also followed, as recommended by Byrne (2001). The modification indices (MIs) from the initial runs were examined to suggest possible parameters to be added to improve model fit in subsequent post hoc model modifications. The MIs indicate parameters not in the model that, if added to the model, would result in a significant decrease in chi-square, that is, a statistically significant improvement in model fit. Parameters were added only if the statistically implied modification was also substantively plausible.

For the females in Study 1 and for the males in Study 2, the MIs provided by the initial structural model runs suggested theoretically plausible parameters to add to the models. For the females in Study 1, three MIs in the initial run suggested plausible parameters to add the following: paths from race to the indicators for violent delinquency and cigarette use, indicating that Black females had lower frequencies of violence and cigarette use than White females, and a path from moral disengagement to the indicator for remunerative delinquency, suggesting that females who had a greater approval of antisocial acts committed remunerative delinquent acts, such as stealing, more often. Therefore, these three paths were added to the model for females, resulting in an improved model fit in that sample.

For the males in Study 2, two MIs in the initial run suggested two parameters to be added to the model: a path from race to the indicator for frequency of using marijuana, indicating that Black males had a higher frequency of marijuana use than White males, and a path from race to the indicator for frequency of drinking five or more drinks, indicating that Black males had a lower frequency of drinking five or more drinks than White males. Because these two paths seemed substantively reasonable, on the basis of previous research, these two parameters were added to the initial model specifications, and the model was rerun, resulting in a better fit. The added paths correspond to specific effects of an independent variable on a measured indicator of one of the latent dependent measures (Bentler, 1990). For males in Study 1, none of the MIs in the initial model were large enough to suggest additional parameters to add to the model.

We evaluated the fit of the models using several recommended fit indices in addition to the chi-square statistic (Hu & Bentler, 1999). These included a measure of absolute fit, which assesses how well the model reproduces the sample data: the root-mean-square error of approximation. Two measures of incremental fit, which measure the proportionate improvement in fit of the target model compared with a more restricted, nested baseline model, also were used: the Tucker–Lewis Index, also called the *nonnormed fit index*, and Hu and Bentler’s (1999) comparative fit index. The baseline model used for comparison in these indices was the null model in which all the observed variables are uncorrelated. Criteria

used for good fit between the hypothesized models and the observed data were as follows: cutoff values close to .06 for the root-mean-square error of approximation and cutoff values close to .95 for the Tucker–Lewis Index and comparative fit index (Hu & Bentler, 1999).

Results

The measurement (CFA) models (without any predictors) for each of the two studies and the gender groups showed adequate fit, and the estimated loadings for all the indicators of the latent factors were all significant at $p < .001$ and were generally large in magnitude, indicating adequate measurement of the latent constructs. Most of the correlations among the four problem behavior constructs as given by these measurement (CFA) models were statistically significant (see Table 1); thus, the four youthful problem behaviors covary. However, the strength of the bivariate correlations varies. The highest correlations were consistently between alcohol and other drug use (.63–.75). The weakest correlations ($< .20$) were between gambling and the two substance use constructs for females.

The hypothesized model is shown in Figure 1. Age, race, and SES constitute the predictors from the sociocultural domain, with gender taken into account by separate models. Impulsivity and moral disengagement represent dimensions identified from theory and research as important individual factors influencing adolescent problem behaviors. Parental monitoring and peer delinquency are the two indicators from the adolescent socialization domain. Each

of these seven predictors has hypothesized paths to each of the four problem behavior constructs.

The three final structural models showed an adequate fit to the data, indicating that the parameter estimates were reasonable. The fit indices and estimated standardized path parameters for the prospective effects of the predictor variables on the four latent variables for youth problem behaviors, which are the key model results of interest, are presented for males and females in the Family and Adolescent Study in Table 2 and for males in the Delinquency in Young Men Study in Table 3. To simplify the presentation, we do not show the correlations among the predictors and among the disturbance terms of the dependent variables. The major findings are summarized below.

Sociodemographic Factors

Age was included primarily as a control variable because it has been consistently shown to be related to increased levels of alcohol use, for example, and lowered levels of delinquency in later adolescence. Socioeconomic status, as measured by mother's education, was entered as a control variable. It shows no relationship to any of the four problem behaviors for both samples of males. For females, lower SES was weakly associated with higher levels of gambling, and lower SES was associated with less delinquency.

Race is a strong sociodemographic predictor of the various problem indicators. For females, gambling is the only problem behavior that does not show a significant association with race. All three groups of youth show the same relationship between race and the two substance use constructs; that is, Blacks had less alcohol misuse and less overall other drug use than their White counterparts. In the family study, both Black females and males had less delinquency than their White counterparts. There is no observed association between race and delinquency among males in the delinquency study.

Table 1
Correlations Among Youth Problem Behavior Constructs From the Measurement Models by Gender Subgroups in the Two Studies

Subgroup	Problem behavior construct			
	1	2	3	4
Study 1: Family and adolescent study				
Females ($n = 296$)				
1. Gambling	—			
2. Alcohol misuse	.18*	—		
3. Drug use	.18	.63***	—	
4. Delinquency	.35**	.51***	.43***	—
Males ($n = 226$)				
1. Gambling	—			
2. Alcohol misuse	.33***	—		
3. Drug use	.24**	.75***	—	
4. Delinquency	.33**	.28**	.38**	—
Study 2: Delinquency in young men				
Males ($n = 597$)				
1. Gambling	—			
2. Alcohol misuse	.30***	—		
3. Drug use	.44***	.73***	—	
4. Delinquency	.57***	.40***	.57***	—

Note. Correlations are estimates from confirmatory factor analysis measurement models including only the eight latent factors representing the four youth problem behaviors and four antecedent factors (i.e., impulsivity, moral disengagement, parental monitoring, and peer delinquency) and covariances among these factors.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Individual Factors

For females (see Table 2), impulsivity, measured 2 years earlier than the outcomes, was a weak predictor of alcohol misuse. For males, the relationships were less clear. For males in the family study (see Table 2), impulsivity was not a significant prospective predictor for any of the outcomes, whereas for males in the delinquency study (see Table 3), impulsivity had a significant positive path to later delinquency.

In the family study, there are no significant paths from moral disengagement to any problem behaviors for males or for females. There is, however, a specific path for females from moral disengagement to remunerative delinquency. For males in the delinquency study, moral disengagement, measured approximately 18 months earlier, significantly predicted gambling and other drug use.

Socialization Factors

After taking into account all of the other sociodemographic and individual factors previously noted, parental monitoring had a significant inverse relationship to later alcohol misuse and other drug use for males in both studies; that is, higher levels of parental monitoring resulted in less alcohol misuse and less other drug use

Table 2
Standardized Path Coefficients for the Final Model of Predictors of Youth Problem Behaviors (Study 1, Family and Adolescent Study)

Predictor	Dependent variable (Wave 5)			
	Gambling	Alcohol misuse	Drug use	Delinquency
Males				
Age (Wave 5)	-.15	.04	-.10	-.19*
Race (0 = W, 1 = B; Wave 1)	-.13	-.42***	-.27***	-.32***
Mother's education (Wave 1)	.02	.04	.00	.13
Impulsivity (Wave 3)	.06	.03	.15	.06
Moral disengagement (Wave 4)	.17	.05	.09	.07
Parental monitoring (Waves 1-4)	-.12	-.24***	-.22*	-.16
Peer delinquency (Wave 3)	-.08	.18*	.24*	.15
Females				
Age (Wave 5)	.07	.15**	-.02	-.20*
Race (0 = W, 1 = B; Wave 1)	.02	-.45***	-.19**	-.27***
Mother's education (Wave 1)	-.19*	.04	.01	.27***
Impulsivity (Wave 3)	.11	.17*	.16	.20
Moral disengagement (Wave 4)	-.04	.01	.06	.08
Parental monitoring (Waves 1-4)	.04	-.10	-.17	-.08
Peer delinquency (Wave 3)	.28**	.15*	.22**	.20*

Note. Fit indices for the final structural models are as follows: Males: $\chi^2(247, N = 226) = 413.35, p = .000$, comparative fit index (CFI) = .939, Tucker-Lewis Index (TLI) = .920, root-mean-square error of approximation (RMSEA) = .055; Females: $\chi^2(244, N = 296) = 437.38, p = .000$, CFI = .930, TLI = .907, RMSEA = .052. W = White; B = Black.
* $p < .05$. ** $p < .01$. *** $p < .001$.

for males. More parental monitoring also negatively predicted delinquency among the males in the delinquency study. Surprisingly, monitoring does not significantly predict any of the later outcomes for females when all other factors are taken into account.

Peer delinquency is the other socialization measure that shows numerous significant paths to later youthful problem behaviors, with increased levels of peer delinquency being related to increased levels of adolescent problem behaviors. Again, note that the peer delinquency measures were taken from earlier waves of data (2 years earlier for the family study and 18 months earlier for the delinquency study). For females in the family study, all four paths to later outcomes are significant holding constant all other factors in the models. For males in the family study, increased peer

delinquency predicted later alcohol misuse and drug use. For males in the delinquency study, peer delinquency predicted later substance use and delinquency, but not gambling.

The squared multiple correlations (R^2) from the final models provide estimates of the variance explained in each of the dependent variables in each sample. For example, for males in Study 1, the R^2 value for the gambling construct is .08, corresponding to an unexplained proportion of variance of $1.00 - .08 = .92$. The R^2 estimates range from .08 to .49, with most in the range of .19 to .35. Of the youth problem behaviors examined, gambling had the lowest R^2 values (.16 or less for each gender and in each study), whereas those for alcohol misuse (.28-.35), drug use (.21-.49), and delinquency (.23-.44) were higher.

Table 3
Standardized Path Coefficients for the Final Model of Predictors of Youth Problem Behaviors (Study 2, Delinquency in Young Men)

Predictor	Dependent variable (Wave 2)			
	Gambling	Alcohol misuse	Drug use	Delinquency
Age (Wave 2)	-.19***	.23***	.07	-.10*
Race (0 = W, 1 = B; Wave 1)	.03	-.28***	-.57***	.02
Mother's education (Wave 1)	-.04	-.06	.03	-.03
Impulsivity (Wave 1)	.07	.11	.01	.22**
Moral disengagement (Wave 1)	.18**	.07	.13*	.11
Parental monitoring (Wave 1)	-.06	-.11*	-.17**	-.12*
Peer delinquency (Wave 1)	.12	.20***	.25***	.38***

Note. Fit indices for the final structural model are as follows: Males: $\chi^2(245, N = 597) = 627.32, p = .000$, comparative fit index = .943, Tucker-Lewis Index = .924, root-mean-square error of approximation = .051. W = White; B = Black.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

Consistent with theory and empirical research, problem behaviors did covary among adolescents in these two general population samples. This study adds to the relatively small literature on adolescent gambling by showing that gambling is linked with substance use and delinquency, yet gambling does not share the same strength of association as do alcohol misuse, other drug use, and delinquency. A possible explanation of the present finding that alcohol misuse and other illicit drug use have the strongest association is that they both constitute substance misuse, and alcohol and other substances are often used together (Hoffman, Barnes, Welte, & Dintcheff, 2000). Youthful gambling correlates less well with other problem behaviors, especially among females, and gambling has fewer common predictors with other problem behaviors than might be anticipated by problem behavior theory. This finding suggests that youth gambling might not be viewed as being as deviant as other problem behaviors, despite the fact that it is illegal for young people. Perhaps adults view certain types of gambling, such as lotteries, bingo, and cards, as acceptable activities for young people, whereas substance misuse and delinquency are viewed as more deviant behavior (e.g., Felsner, Derevensky, & Gupta, 2003, pp. 362–363). The squared multiple correlations, reflecting these variations in association, suggest that other variables not included in these models are needed to account for youth gambling—that is, that youth gambling may have some unique predictors, such as availability of gambling opportunities, in addition to the common predictors of the other problem behaviors. We did not measure problem gambling as have some other studies that have found associations among problem gambling, substance use, and other risk behaviors (Proimos, DuRant, Pierce, & Goodman, 1998; Vitaro et al., 2001; Winters et al., 2002).

With regard to sociodemographic influences on multiple problem behaviors, the findings regarding age are consistent with other studies. For example, it has been shown that alcohol misuse increases throughout adolescence and into young adulthood (e.g., Johnston, O'Malley, & Bachman, 2002), whereas delinquency peaks in adolescence and then declines in young adulthood (e.g., Elliott, Huizinga, & Menard, 1989). Our finding that SES showed no relationship to problem behaviors for males may indicate that substance use, gambling, and delinquent behaviors are prevalent among adolescent males and are not restricted to any particular socioeconomic class. On the other hand, race (Black and White in these studies) shows the most numerous relationships to various problem behaviors. Consistent with the present findings, U.S. national surveys have shown that Black high school students have lower prevalence rates of alcohol and cigarette use as well as other illicit substance use compared with their White counterparts (Wallace et al., 2002). Race was not related to gambling in any of the three subgroups.

With regard to the individual–psychological factors measured in the current studies, it is noteworthy that the importance of these factors is lessened or no longer significant in the longitudinal analyses as compared with earlier cross-sectional analyses. In the current analyses, there was no relationship between impulsivity and gambling for males after taking into account the other factors in the model. Previous studies by Vitaro and his associates (Vitaro, Arseneault, & Tremblay, 1997; Vitaro et al., 2001) have found that impulsivity predicts youthful gambling. However, unlike the present study, Vitaro and his colleagues assessed problem–

pathological gambling. In our own earlier cross-sectional analyses (Barnes et al., 1999), impulsivity was a significant predictor of alcohol consumption and times gambled in both data sets. In the present longitudinal analyses, impulsivity was not significant for gambling, was a weak predictor of alcohol misuse only for females, and was a predictor of delinquency for males in one sample (the delinquency study). In our earlier cross-sectional analyses of the same data sets (Barnes et al., 1999), moral disengagement was a significant predictor of alcohol consumption and times gambled in both data sets. In the present analyses, moral disengagement manifested significant positive associations with only gambling and drug use in one sample of males (the delinquency study) and was also related to remunerative delinquency, in particular, among girls in the family study. These findings lend support to theories that antisocial beliefs are precursors of juvenile offending (e.g., Elliott et al., 1985; Hawkins, 1996).

Decades of research confirm the importance of parental and peer socialization influences on adolescent development. A substantial body of research shows the strong effects of parenting on the development of youthful alcohol misuse and related problem behaviors (Barnes et al., 2000; Brook, Whiteman, Finch, & Cohen, 2000; Farrell & Barnes, 2000; Kandel, 1996; Patterson & Dishion, 1985). In our earlier cross-sectional analyses of the same data sets (Barnes et al., 1999), parental monitoring was a significant predictor of alcohol consumption but was not a significant predictor of gambling frequency in either of the two data sets. In the present study, parental monitoring was a significant longitudinal predictor of alcohol misuse and other substance use for males in both data sets, whereas it was not a significant predictor for any of the four problem behaviors for females, after all other sociodemographic, individual, and socialization variables were controlled. This is similar to previous findings from a six-wave longitudinal analysis of the family study, which showed that monitoring negatively predicted baseline alcohol misuse as well as the rate of increase in alcohol misuse (Barnes et al., 2000).

The present findings on the influence of peer delinquency also extend our previous work in this area. In our earlier cross-sectional analyses of the same data sets (Barnes et al., 1999), peer delinquency was not found to be a significant predictor of gambling frequency in the Family Study (Study 1). In the present analyses, earlier peer delinquency was found to be the strongest predictor of later gambling for females but not for males in the family study. In the present analyses, peer delinquency remains a significant predictor of alcohol misuse and other substance use for females and males in both data sets.

The strong influence of peer delinquency on problem outcomes observed in the present study is also consistent with previous research findings that show a strong positive correlation between adolescent drinking and drinking by the adolescent's closest friends (Reifman, Barnes, Dintcheff, Farrell, & Uhteg, 1998). Although it has been convincingly documented that peer effects are overestimated, in part because of cross-sectional designs and projection on the part of adolescents (Kandel, 1996), most researchers nonetheless acknowledge the importance of the peer culture in providing contexts for substance use and other problem behaviors. The relative contribution of peers and parents in developing alcohol misuse remains a topic of some controversy (see Bogenschneider, Wu, Raffaelli, & Tsay, 1998, and Farrell & Barnes, 2000, for reviews of this issue). It may well be that the relative influence of parents and peers may vary at different stages

of adolescence such that parents exert more influence on adolescent behavior during childhood and early adolescence, whereas peers and older siblings exert relatively more influence on behavior during mid- to later adolescence (Windle, 2000). A sequence for which there is strong empirical support is that parental support and monitoring, early in adolescence, insulate the adolescent from deviant peers, which in turn reduces the risk of alcohol and other substance misuse in later adolescence (Bogenschneider et al., 1998; Fletcher, Darling, & Steinberg, 1995; Patterson & Dishion, 1985) and even into adulthood (Brook et al., 2000). In this study, the effects of both parental monitoring and peer delinquency remain significant in predicting alcohol misuse, other drug use, and delinquency in older male adolescents. This has added significance given that males have higher levels of these problems during later adolescence. The fact that many findings were replicated across two independent, high-quality, longitudinal, general population samples provides additional confidence in these results.

This study has several limitations that should be acknowledged. First, earlier problem behaviors were not controlled for, either by selection of participants or by including earlier measures of the outcome behaviors in the models. We did not control for the earlier outcomes by selecting only those individuals who did not have the problem behaviors at the earlier times, because that strategy would deplete our sample size for analysis, leaving us with insufficient power. We could not include measures of gambling at an earlier wave in Study 1 (the family study), because gambling was not measured earlier in that study. A more stringent causal analysis would include controls for the outcomes measured at earlier waves, in a recursive model (e.g., Finkel, 1995, pp. 6–7). There were some differences in the measures between the two data sets, and not all measures were available at each wave in each data set. Also, neither of our studies included measures of problem gambling, which may be expected to relate more strongly to other problem behaviors.

Despite these limitations, this study significantly extends our own previous work and that of other investigators by confirming that problem behaviors are intertwined and that there are shared antecedent factors from various domains that prospectively predict these outcomes among adolescents in the general population. Prevention strategies, such as improved parenting, may have the benefit of successfully reducing multiple problem behaviors in adolescence.

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