Adolescent Predictors of Generalized Health Risk in Young Adulthood: A 10-Year Longitudinal Assessment

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We conducted a prospective examination of multiple adolescent predictors of generalized health risk in early adulthood. Data were used from 3,392 members of a longitudinal cohort surveyed at ages 13 and 23. A measure of generalized risk was constructed using confirmatory factor analysis to represent shared variance among substance use, sexual risk, and victimization. Multiple regression analysis indicated several robust sociodemographic, behavioral, and environmental early predictors of generalized adult risk, including gender, age, race, not coming from a nuclear family, engaging in smoking and deviant behavior as an adolescent, having poor grades in high school, alcohol and cigarette use by an adult important to the adolescent, and being offered substances as an adolescent. Results support the existence of an underlying risk construct in early adulthood, the importance of early adolescent deviance and substance use exposure in predicting risk, and the use of early comprehensive interventions that prevent several risks simultaneously.

Introduction

Sexual risk behavior, substance use, and victimization are public health problems that appear to co-occur in some individuals. Robust relationships among these psychosocial health risks have been observed in studies of both adolescents and young adults (e.g., Ellickson, Collins, Bogart, Klein, & Taylor, 2005; Jessor

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& Jessor, 1977; Zweig, Lindberg, & McGinley, 2001). Research on adolescents and young adults also suggests that these risks are predicted by similar personal, behavioral, and environmental factors, including sociodemographic characteristics such as gender, antisocial behaviors, and the attitudes and behaviors of parents and peers (e.g., Capaldi, Stoolmiller, Clark, & Owen, 2002; Chassin, Pitts, & Prost, 2002; Ellickson, Collins, & Bell, 1999; Feigelman, Gorman, & Lee, 1998; French & Dishion, 2003; Jessor & Jessor, 1977; Reinherz, Giaconia, Hauf, Wasserman, & Paradis, 2000; Windle, 1990, 1994; Wu et al., 2005). Nevertheless, there is a lack of comprehensive research that, within the same study, examines the conjunction of psychosocial health risks among young adults and prospectively predicts them from sociodemographic, behavioral, and environmental factors. As a result, our understanding of the reasons for the close relations among these behaviors is limited. Understanding the etiology of risk across these three domains would facilitate the identification of early prevention targets among adolescents that might be successful routes to stemming diverse psychosocial problems in young adulthood.

In the present study, we undertook a longitudinal investigation to examine whether sociodemographic characteristics, behavioral problems, and family and social environment in adolescence are predictive of overall psychosocial health risk 10 years later, in early adulthood. Consistent with this framework, a number of theories and empirical examinations of adolescent risk suggest that behavioral risks in adolescence share similar etiologies and can in turn lead to multiple future behavioral risks (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Cooper, Wood, Orcutt, & Albino, 2003; Donovan & Jessor, 1985; Donovan, Jessor, & Costa, 1988; Hirschi & Gottfredson, 1983; Jessor & Jessor, 1977; Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998; McGee & Newcomb, 1992; Patterson, Reid, & Dishion, 1992). In particular, problem behavior theory (PBT) (Jessor & Jessor, 1977) argues that risk behaviors are interconnected manifestations of an underlying disposition toward deviance, reflecting an oppositional stance toward societal and parental controls among adolescents and emerging young adults.

Because social and economic disadvantage may set the conditions for risky health behaviors (Wyatt, 1994), sociodemographic factors may be especially important in predicting later health risk. Low socioeconomic status (SES) has been associated with higher levels of alcohol and illicit substance use, higher HIV risk, and unsafe environments, each of which can lead to greater opportunities for victimization (Centers for Disease Control [CDC], 2003; Reinherz, et al., 2000). Gender socialization processes and differing environs and norms among members of diverse racial/ethnic groups may also contribute to risk. Boys are more likely to use substances than are girls (Feigelman et al., 1998; Magdol et al., 1997; Windle, 1990). Males experience similar or higher levels of victimization than do females

(Coleman & Byrd, 2003; Foshee, 1996; Halpern, Oslak, Young, Martin, & Kupper, 2001; Kasian & Painter, 1992; O'Keefe, 1997; Stets & Henderson, 1991), although females are more likely to sustain serious injury from these experiences (Gray & Foshee, 1997; Magdol et al., 1997; Malik, Sorenson, & Aneshensel, 1997). The relationships of race/ethnicity to risk are complex, with Whites more likely to use alcohol and illicit substances, and African Americans and Hispanics at disproportionate risk for heterosexual-related HIV transmission (CDC, 2002, 2003; Kandel & Yamaguchi, 2002) and victimization (Pallone & Hennessy, 2000; Uehara, Chalmers, Jenkins, & Shakoor, 1996). Research also suggests that predictors of substance use in adolescence differ by race/ethnicity (Wells et al., 1992).

As hypothesized by problem behavior theory (Jessor & Jessor, 1977), an underlying deviance syndrome in adolescence may manifest itself as a constellation of behavioral problems that reciprocally influence each other, including substance use, antisocial behavior, and low academic achievement. Personality and individual difference factors may be an underlying stable cause of problem behaviors, by either facilitating or inhibiting their expression (Jessor & Jessor, 1977). For example, adolescents who have high expectations for achievement may engage in behaviors that further their educational goals, whereas those who are positively predisposed toward personal autonomy may engage in behaviors to assert their independence from authority figures.

Behavioral problems in adolescence may in turn foreshadow or influence the extent to which health risks are experienced in young adulthood by acting as facilitators of continued risk. Accordingly, early use of drugs and alcohol predicts later substance use (Chassin et al., 2002; Ellickson & Hays, 1991; Feigelman et al., 1998; Kandel, Simcha-Fagan, & Davies, 1986; Windle, 1990), sexual risk behavior (Capaldi et al., 2002; Li, Stanton, Cottrell, Burns, Pack, & Kaljee, 2001), and victimization (Windle, 1994). Similarly, delinquency, antisocial behavior, and aggression in adolescence and childhood have been shown to predict later substance use (Chassin et al., 2002; Reinhertz et al., 2000; Windle, 1990), and victimization (Boyd, Cooley, Lambert, & Ialongo, 2003). Adolescents who are not committed to school and who have weak academic records are more likely to use alcohol and drugs, both concurrently and prospectively (Bryant, Schulenberg, O'Malley, Bachman, & Johnston, 2003; Ellickson, Hays, & Bell, 1992). In addition, low expectations for academic success have been prospectively associated with earlier initiation of sexual intercourse (Costa, Jessor, Donovan, & Fortenberry, 1995).

In addition to the influences of individual difference factors, sociodemographic characteristics, and adolescent behavioral problems, adolescents' family and social environments may create contexts that enable risk behaviors to develop and that impede positive behavioral changes, leading to psychosocial health risk at a later point in time. In general, adolescents who form weak ties with family, school, and church may be more susceptible to the development of long-term problem behavior patterns (Hirschi & Stark, 1969). Adolescents may model the risk behavior (e.g., substance use) of important others, such as their parents and peers (Denton & Kampfe, 1994), and these behaviors may continue into adulthood. Adolescents from families that are accepting of alcohol use are more likely to engage in polydrug use during college (Feigelman et al., 1998), and adolescents whose parents and peers use substances are more likely to use these substances themselves, both concurrently and in later years (Chassin et al., 2002; Clapper, Martin, & Clifford, 1994; Ellickson et al., 1999; Kaplow et al., 2002; Martinez et al., 1998; Newcomb, Huba, & Bentler, 1983; Windle, 1990). In addition, adolescents from single-parent homes report more substance use (e.g., Turner, Irwin, Tschann, & Millstein, 1993) and a greater likelihood of problematic sexual activity (see Miller, 2002). Although fewer studies have been conducted on the early etiology of sexual risk and victimization, the available research shows that low levels of parental supervision in adolescence are predictive of greater sexual risk in young adulthood (Capaldi et al., 2002) and that adolescents with nontraditional family structures (e.g., single parent homes) experience higher levels of victimization (Halpern et al., 2001; Stermac, Reist, Addison, & Millar, 2002).

In sum, in accordance with theories of generalized risk among adolescents and young adults (e.g., Jessor & Jessor, 1977), prior research shows that substance abuse, victimization, and sexual risk are interlinked public health problems with similar correlates and predictors. However, the majority of research in this area has been cross-sectional, making causal conclusions difficult. Research that has investigated risk prospectively, in the context of early sociodemographic, behavioral, and environmental predictors, has tended to focus on only one psychosocial risk problem, not generalized predictors across problems (e.g., Capaldi et al., 2002; Chassin et al., 2002). Moreover, empirical work on generalized risk has tended to examine generalized risk during adolescence (Jessor & Jessor, 1977), or has tested the longitudinal relationships of deviant behaviors with each other, without placing the adolescent in his or her sociodemographic and environmental context (Donovan & Jessor, 1985; Donovan et al., 1988; McGee & Newcomb, 1992; Osgood, Johnston, O'Malley, & Bachman, 1988; Willoughby, Chalmers, & Busseri, 2004; Wu et al., 2005). No research to date has provided an integrated evaluation of whether early risk factors related to sociodemographic characteristics, behavioral problems, and family and social environment predict overall psychosocial health risk in young adulthood.

This paper seeks to establish whether or not a generalized psychosocial health risk factor comprised of substance use, victimization, and sexual risk exists during young adulthood and, if so, to identify specific adolescent predictors at the individual, family, and social levels. We focused on young adults because the developmental period of emerging adulthood, characterized by role exploration and new independence from adult supervision (Arnett, 2000), is typically marked by the highest levels of risky behavior and experiences that can jeopardize health, particularly substance use, victimization, and sexual risk (Bachman et al., 1997; Newcomb & Bentler, 1988, Brener et al., 1999, Laumann, Gagnon, Michael, & Michaels, 2000; see CDC, 1997). Using confirmatory factor analysis techniques, we constructed a latent measure of generalized psychosocial health risk in early adulthood to represent the shared variance among substance use, sexual risk behavior, and victimization and tested the fit of such a factor with the observed data. We then used multiple regression analysis to identify the common predictors, measured 10 years earlier, of this generalized risk construct. Based on prior research, we hypothesized that three classes of variables, sociodemographic characteristics, behavioral problems, and family and social environment during adolescence, would be strongly associated with generalized risk. By identifying a generalized health risk factor and its early predictors, we hope to lay the groundwork for designing and implementing interventions for adolescents that effectively reduce multiple risk behaviors during young adulthood.

METHOD

PARTICIPANTS

The RAND Adolescent/Young Adult Panel is a longitudinal cohort first surveyed during grade 7 (age 13) and followed for 10 years. The sample was originally recruited from 30 California and Oregon middle schools that were selected to represent a wide range of community environments with regard to urbanicity (urban, suburban, rural), ethnic composition, and SES. Nine schools had minority populations of 50% or more, and 18 schools drew from neighborhoods with household incomes below the median for their state (Ellickson & Bell, 1990).

The original (grade 7) sample consisted of 6,527 males and females. This study uses data from the 3,392 participants who responded to that survey in 1985 and to a follow-up survey in 1995 (age 23) and who provided complete information on sex-related risk, victimization, and alcohol and drug use in 1995. Participants who could not be located or who had dropped out of the study by the 1995 survey were more likely to be male, African American, or to have exhibited high risk behavior at an early age than those who were retained. To reduce bias associated with sample attrition, we developed nonresponse weights to provide estimates consistent with the original 1985 sample. We used logistic regression to create the weights, obtaining predicted probabilities of responding to the 1995 survey based on information collected in the 1985 survey, including race, gender, family structure, deviance, substance use, and grades. As Table 1 shows, these weights remove 90% or more of the bias exhibited in the obtained young adult sample. On average, respondents in the final sample were 12.8 years old (*SD*=0.6) in the first wave of data collection and 23.5 (*SD*=0.6) in the second wave of data collection.

Table 1
How Sample Weights Reduce Attrition Bias: Weighted and Unweighted Percentages of Baseline Demographics, Substance Use, and Behavioral Variables

	Full Sample (N=6,527)	Young Adults (Retained Sample) (N=3,466)	
	Unweighted %	Unweighted %	Weighted %
Sociodemographics			
Gender			
Male	52.0	46.0	52.0
Female	48.0	54.0	48.0
Race/ethnicity			
White	67.3	70.9	67.1
Black	10.3	7.7	10.2
Hispanic	10.3	9.1	10.4
Asian	8.2	9.5	8.2
Other	4.0	2.9	4.1
Parents' education			
Less than HS	18.6	15.8	18.4
HS or greater	81.4	84.2	81.6
Nuclear family	58.9	66.5	58.7
Substance use (lifetime)			
Ever used marijuana	21.5	15.2	21.0
Ever used alcohol	77.2	75.6	77.4
Ever used cigarettes	54.4	47.0	53.1
C average or worse	30.1	23.1	30.3
Ever shoplifted	23.3	18.7	22.6

Note: The present analysis used the subset of 3,392 young adults who provided complete information on sex-related risk, victimization, and alcohol and drug use in 1995.

Statistical Analysis

A weighted confirmatory second-order factor analysis was conducted to create the generalized risk factor. At the first level, latent factors of alcohol use, drug use, and victimization were created from the observed responses in the 1995 (age 23) surveys. At the second level, a generalized risk factor was created from the three factors above, together with an observed indicator of sexual risk from the same survey. Factor scores based on this generalized risk factor were then used as a dependent variable in linear regression models. Below we describe the items used in the factor analysis, as well as the predictor variables used in the regression models.

Generalized Risk Indicator Variables (Age 23)

Sexual Risk

Level of sexual risk was determined by participants' responses to two questions: the number of partners with whom they had sexual intercourse (vaginal or anal) in the past year, and how often they and their partner(s) used condoms during that period

(1=always to 4=never). Both items included an option for participants to indicate that they had not had sex in the previous year. Participants were classified as high risk if they reported both having multiple partners and using condoms inconsistently or not at all. All other participants, including those who were not sexually active, were classified as low risk. We used this simple dichotomous indicator because the distribution of sexual risk in the sample was highly skewed for continuous measures and because the combination of multiple partners and unprotected sex is epidemiologically a uniquely risky behavior compared to either high levels of partners or low frequency of condom use in isolation (Anderson & May, 1992).

Alcohol

We included three indicators for the alcohol factor: frequency of alcohol use (ranging from 0=never in lifetime to 11=20+ days in the past month); the number of times drunk or intoxicated in the past year (ranging from 0=none to 6=40 or more times); and binge drinking, defined as having five or more alcoholic drinks on a single occasion in the last month (1=nondrinker, 2=drinker but not a binge drinker, 3=binge drinker).

Problem Drug Use

Three variables were used as indicators of the problem drug use factor: drug dependency in lifetime, negative consequences of drug use, and use of certain hard drugs; dependency and consequences items included all drugs except alcohol, tobacco, or prescription drugs (i.e., hard drugs and marijuana). Drug dependency was measured by a variable representing the sum of "yes" responses to each of the following drug consequences drawn from the Drug Abuse Screening Test (DAST) (Skinner, 1982): ever neglected family or live-in partner due to drugs, received complaints from parents or live-in partner about involvement with drugs, engaged in illegal activities in order to obtain drugs, experienced withdrawal symptoms when drug use was stopped, and had medical problems as a result of drug use (possible range=1-5). Consequences of drug use were assessed using the mean of five items in response to the question: "In the last 12 months, how many times have the following things happened to you because of your use of drugs?" Responses included "missed school or work, did something you later felt sorry for, felt really sick, passed out, were criticized by friends" (each rated from 0=none to 5=20 or more times). Use of specific hard drugs often linked with sexual enhancement (Longshore & Anglin, 1995; Paul, Stall, & Davis, 1993) was based on the mean of four items asking, "On how many occasions (if any) have you used [substance] during the last 12 months?" Crack cocaine, cocaine (any form), amphetamines, and ice were each rated separately from 0 (0 occasions) to 6 (40 or more occasions).

Cigarette Use

The latent cigarette use variable was computed from two indicators: frequency of cigarette use in the past 12 months and number of cigarettes smoked per day. Frequency in the past month was calculated from two items assessing cigarette use in the past 12 months and was distributed from 0 (never) to 11 (20 or more days in the past month). Number of cigarettes per day was assessed with one item, on a scale from "less than one cigarette per day" to "a pack or more of cigarettes per day," with an option "I don't smoke cigarettes."

Victimization

The victimization factor was based on items tapping victimization from theft, sexual victimization, and victimization by assault. Each item was prefaced by the question, "During the last three years, how often did the following happen to you?" Response options ranged from 0 (not at all) to 3 (3 or more times). The victimization from theft indicator was derived from the sum of two items: "someone stole something from you or tried to do so," and "you were burglarized." Sexual victimization was indicated with the sum of two items: "a friend or date pressured you to do more sexually than you wanted to" and "someone sexually assaulted you or tried to do so." Victimization via assault was represented by the single item, "someone physically assaulted you or attacked you or tried to do so."

Predictor Variables (Age 13)

Sociodemographic Characteristics

Age, race/ethnicity, and gender were measured on the baseline questionnaire. Age was treated as continuous in all analyses; because all participants were recruited from a single school grade, this variable reflects age relative to one's grade cohort. Highest educational attainment of the respondents' two parents was used to indicate family SES on a continuous variable from 0=no high school degree to 3=high school degree plus some college.

Behavioral Problems (Academic Orientation, Substance Use, and Deviance)

Academic orientation was measured in terms of grades, intentions, and number of elementary schools attended. Grades in the six months prior to the seventh grade survey were self-reported by the respondent as "mostly As," "mostly Bs," "mostly Cs," "mostly Ds," or "mostly Fs." Academic intentions were assessed with one item, "What is the highest level of school you plan to finish?" Respondents could indicate that 1, they may not finish high school; 2, they planned to finish high school; 3, they planned to attend vocational or trade school after high school graduation; 4, they planned to go to college; or 5, they planned to go to graduate or professional school. The number of elementary schools attended was recorded as a measure of instability of the academic environment during childhood, which may disrupt academic orientation.

To tap substance use, frequency of alcohol, cigarette and marijuana use by grade 7 were each measured by coding participants' responses on substance-specific scales that range from 0 (never used), to 11 (used 20 or more days in the past month). To assess binge drinking during grade 7, respondents were asked if they drank any alcohol in the past year, and if so, whether they had three or more alcoholic drinks in the last month; participants were classified as "nondrinker," "drinker but not a binge drinker," and "binge drinker." Hard drug use was assessed with eight items asking if the respondent had ever used cocaine, uppers (including speed and speedballs), downers (including Valium, Librium, and Quaaludes), psychedelics, heroin, morphine, codeine, or opium; a dichotomous measure was constructed from these items indicating "no hard drug use" versus "any hard drug use" by grade 7.

Deviance at age 13 was measured as the average of four items: number of times in the past year the student skipped school without a good excuse, cheated on a test, took something from a store, and was sent out of the classroom for causing trouble. Response options ranged from 0 (never) to 3 (more than 3 times). Internal consistency was adequate (α=.64).

Family and Social Environment

To assess parental substance use during early adolescence, students at grade 7 were asked the frequency with which the adult most important to them smokes cigarettes, drinks alcohol, and uses marijuana. Each substance was rated from 0 (never) to 3 (4-7 days a week). In addition, the average number of times the student reported being offered cigarettes, alcohol, or marijuana was measured separately for each substance on a scale from 0 (never) to 4 (5 or more times). The internal consistency reliability of a scale averaging these items was good (α=.77). Parental approval of drug use was assessed as the average of three items assessing students perceptions of how their parents would feel if they found out the student smoked, drank alcohol, and used marijuana, with response options "very upset," "pretty upset," "a little upset," and "they wouldn't care/not at all upset" (α=.61). To assess parental support, respondents were asked whether they would talk to their parents if they had a personal problem (yes/no). Students also indicated whether they were living in a nuclear family (i.e., with both the mother and father).

Peer substance use was measured as the average of six items (two each for cigarettes, alcohol, and marijuana). For each substance, students were asked whether their best friend uses the substance (yes/no), and the extent to which they were around other students who use the substance (1=never to 4=often). Item responses were standardized prior to averaging (α=.81).

Results

Creation of Generalized Risk Factor

A weighted second-order confirmatory factor analysis (CFA) was performed using latent factors for alcohol use, drug use, and victimization, and the observed sexual risk variable. Because the chi-square statistic is sensitive to large samples, we used the comparative fit index (CFI) and root-mean-square error of approximation (RMSEA) to evaluate model fit (Steiger & Lind, 1980). CFI values of > 0.95 are indicators of good model fit (Hu & Bentler, 1999). A smaller RMSEA shows a closer model fit; RMSEA values ≤ .05 represent good model fit, and values ≤ .08 reflect adequate model fit (Browne & Cudeck, 1993).

Support was found for the hypothesized model, which is presented in Figure 1 (CFI=.904, RMSEA=.047). The individual indicators significantly loaded onto each lower level factor, and each lower level factor was strongly and significantly related to the generalized risk factor (all *p*s<.001). The overall generalized risk factor explained 20% of the variance in the sexual risk indicator, 57% in the victimization factor, 55% in the drug use factor, 25% in the alcohol use factor, and 39% in the cigarette use factor. Based on these results, a generalized risk factor score was created for each participant from the indicators of alcohol use, drug use, victimization and sex risk and their factor loadings. This factor score was used as the outcome in our regression models.

Regressions Predicting Generalized Risk in Adulthood With Adolescent Characteristics

Table 2 shows the unadjusted bivariate and adjusted multivariate relationships between each predictor and generalized risk. With the exception of age and parental education, nearly all predictors had significant unadjusted relationships with generalized risk. Being female, Black, Asian, having good parental support, being from a nuclear family, and having high academic intentions at age 13 were all protective, leading to less risk at age 23. In contrast, being White or of a race/ethnicity other than White, Black, or Asian, attending a greater number of elementary schools, having parents and peers who used drugs and parents who approved of drug use during early adolescence, being offered substances, using cigarettes, marijuana, hard drugs, and alcohol (both frequently and binging), behaving deviantly, and having poor grades at age 13, were all bivariately related to greater generalized risk 10 years later, at age 23.

As shown by the multivariate model results, generalized risk in young adulthood was independently predicted by several sociodemographic characteristics, behavioral problems, and family and social environmental variables. Independent risk factors measured at age 13 included being young for one's cohort, exhibiting deviant behaviors, smoking more frequently, being exposed to important adults who used

FIGURE 1
MODEL DEMONSTRATING GENERALIZED RISK AMONG ALCOHOL USE, DRUG USE, VICTIMIZATION, AND SEXUAL RISK
(RMSEA = .047; CFI = .904)

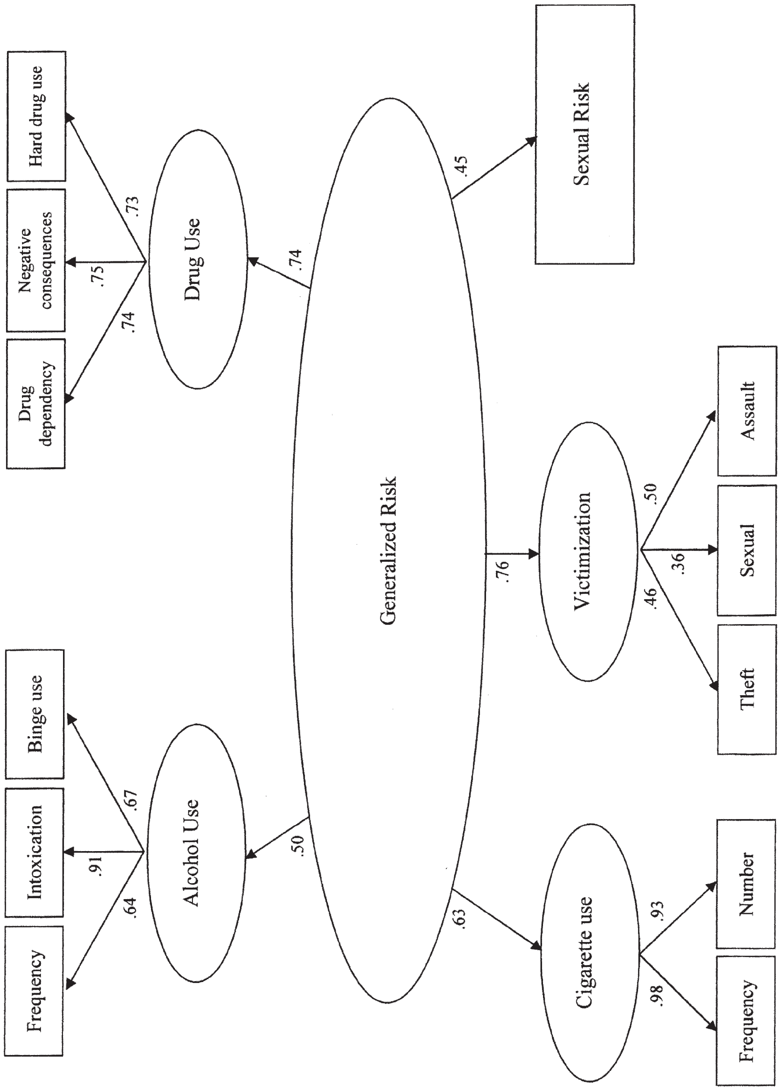

Table 2

Unadjusted and Adjusted Coefficients of Regression Models Predicting Generalized Risk at Age 23 With Individual Personal and Environmental Characteristics Measured at Age 13

	Unadjusted (Bivariate)			Adjusted (Multivariate)		
	Coefficient	SE	95% Confidence Interval	Coefficient	SE	95% Confidence Interval
Sociodemographics						
Female	-21.57	2.20	-26.37, -17.07***	-18.94	2.06	-23.16, -14.72***
Age	1.01	2.92	-4.97, 6.99	-12.25	2.98	-18.36, -6.15***
High parental education	-2.31	2.00	-6.40, 1.79	3.60	1.69	0.16, 7.05*
Race/ethnicity [a]						
Black	-24.56	4.66	-34.09, -15.02***	-27.25	5.41	-38.31, -16.19***
Hispanic	1.00	5.82	-10.91, 12.91	-9.63	4.89	-19.63, 0.37+
Asian	-32.49	4.62	-41.94, -23.04***	-11.74	3.83	-19.58, -3.90**
Other race	28.04	10.00	7.58, 48.50**	12.98	8.98	-5.38, 31.34
Behavioral problems						
Cigarette use	9.22	0.65	7.90, 10.56***	4.86	0.76	3.32, 6.41***
Marijuana use	10.30	0.95	8.35, 12.25***	0.89	1.19	-1.54, 3.31
Hard drug use	66.13	7.98	49.81, 82.45***	-3.78	7.55	-19.22, 11.66
Alcohol use	7.86	0.71	6.41, 9.30***	0.18	0.95	-1.76, 2.11
Binge drinking	31.35	2.57	26.10, 36.61***	2.66	3.44	-4.37, 9.70
Deviance	36.26	2.84	30.45, 42.07***	10.67	3.20	1.12, 17.23**
Poor grades	21.06	1.92	17.13, 24.99***	8.72	1.92	4.79, 12.65***
Multiple schools	5.17	1.52	2.07, 8.28**	1.74	1.29	-0.89, 4.38
Low academic intentions	11.94	1.74	8.39, 15.50***	2.25	1.77	-1.37, 5.88
Family/social environment						
Adult marijuana use	20.99	3.44	13.95, 28.03***	2.52	3.31	-4.24, 9.28
Adult cigarette use	9.06	1.01	7.00, 11.12***	2.77	1.06	0.61, 4.93*
Adult alcohol use	15.98	1.67	12.56, 19.40***	7.20	1.53	4.08, 10.32***
Parent approval of drugs	30.34	4.62	20.89, 39.78***	2.56	4.12	-5.87, 10.98
Offers of substances	22.42	1.58	19.19, 25.65***	6.50	2.02	2.37, 10.64**
Peer drug use	33.13	2.17	28.68, 37.57***	-1.77	4.28	-10.54, 6.99
Parental support	-22.78	3.04	-28.99, -16.56***	-5.18	3.32	-11.98, 1.62
Nuclear family	-20.88	1.74	-27.43, -14.34***	-7.07	3.12	-13.46, -0.68*

+ p < .10 * p < .05 ** p < .01 *** p < .001
[a] Reference group = White

alcohol or cigarettes, having poor grades, being more frequently offered cigarettes, alcohol, and marijuana, and having a parent with a high level of education. Being Black or Asian (relative to White), being female, and coming from a nuclear family served protective functions, predicting lower risk at age 23. Protective factors that dropped out of the multivariate model included having strong parental support and high academic intentions during early adolescence. Risk factors that dropped out of the multivariate model included being of a race/ethnicity other than White, Black, Hispanic, or Asian, attending multiple elementary schools, alcohol, marijuana, and other illicit drug use, parental approval of drug use, use of marijuana by an important adult, and peer substance use.

DISCUSSION

In this longitudinal investigation, adolescent personal and environmental variables predicted generalized risk encompassing five psychosocial health problems—sexual risk for HIV and other STDs, victimization, alcohol use, and problem drug use—measured 10 years later. Although prior work has examined predictors and correlates of these health risks separately, to our knowledge, this is the first study to demonstrate that multiple forms of risk among young adults are not only related to each other, but also share common etiologies in adolescence. By demonstrating both strong interrelations among concurrent risks in young adulthood, as well as common predictors of these risks, our research findings suggest that comprehensive, early interventions may be able to stem problems across multiple domains before they begin or become severe.

The present study's findings demonstrate the primary importance of substance use and other behavioral factors in the prediction of young adult risk. Consistent with research on the negative impact of parental and peer drug use (Chassin et al., 2002; Ellickson et al., 1999; Kaplow et al., 2002; Martinez et al., 1998; Newcomb et al., 1983; Windle, 1990), individuals who reported that the adult most important to them used alcohol or cigarettes while they were in grade 7 and who received more offers of these substances were more likely to be at risk 10 years later. By creating contexts that facilitate risk, the substance use of important others in the adolescent's life may set the stage for multiple problems in young adulthood. For example, adolescents who are exposed to unsafe, risky situations in which substances are being used may be at increased risk of experiencing other problems related to victimization and sexual behavior. Without effective intervention, adolescents may increasingly become enmeshed in such contexts, leading risk to persist past the adolescent years. Furthermore, adolescents may model the behavior and preferences of important adults and members of their peer group, leading to long-term risk behaviors that begin in adolescence and continue over time. Thus, intervention with parents may be as vital as programs targeted toward adolescents. Parent- and family-centered intervention approaches have been efficacious in the realm of adolescent substance use and other problem behaviors (e.g., Dishion & Kavanagh, 2000; Spoth, Redmond, & Shin, 2001; Waldron, Slesnick, Brody, Turner, & Peterson, 2001). Our results suggest that dual-arm interventions that target both adults' alcohol use and adolescents' problem behaviors might be successful in reducing current and later problems.

Other types of early behavioral problems may also presage risk for psychosocial health problems in adulthood. Deviant behaviors during adolescence, such as misbehaving and doing poorly in school, were predictive of adult risk, as in earlier studies of individual risk outcomes (e.g., Boyd et al., 2003; Capaldi et al., 2002; Chassin et al., 2002; French & Dishion, 2003). Adolescent smoking was also a key behavioral predictor of adult risk. In other work, we have found that smoking in adolescence reflects a more overt tendency toward behavioral deviance than does use of alcohol (which is normative during adolescence) or use of marijuana (which is more often covert) (Ellickson, Tucker, & Klein, 2001; Tucker, Ellickson, & Klein, 2002). The fact that we obtained significant associations for these behaviors suggests that youths who mark themselves as different from their peers by engaging in overt deviance are likely to be vulnerable in adulthood as well.

Many of the other personal and environmental factors measured in the present study were also robust unique predictors of generalized risk. Among the sociodemographic variables, and in accordance with prior work showing gender to be related to specific risks (Stets & Henderson, 1991; O'Keefe, 1997), we found that males were at greater overall risk for psychosocial health problems in young adulthood. In addition, parental education had a negative (but nonsignificant) association with risk in bivariate analyses, but a positive association in multivariate analyses. Given the reversal in the sign of the coefficient, the observed multivariate relationship is likely to be due to a suppressor effect (Conger & Jackson, 1972).

We also found that age was a predictor of later risk. That is, adolescents who were younger than others in their grade cohort in junior high school were candidates for multiple health risks as young adults. These results are seemingly contrary to studies that have found greater behavioral problems among youths who are old for their cohort, both among those who were grade retained, as well as among those who had later school entry (Byrd, Weitzman, & Auinger, 1997). Nevertheless, our findings are consistent with prior work using different waves and outcomes from the same dataset (e.g., Ellickson & McGuigan, 2000), as well as research indicating that older children (who delay school entry) have slightly better academic achievement (Stipek, 2002). One possible interpretation of our findings, based on problem behavior theory (Jessor & Jessor, 1977), is that adolescents who are young for their cohort may try to emulate older peers, for whom different types of behaviors are considered to be developmentally appropriate. For example, alcohol use is illegal for adolescents, but normatively acceptable for young adults. Thus, adolescents who are young for their cohort may be prematurely exposed to norms and behaviors that are more appropriate for an older age group. They may consequently be pressured to engage in behaviors (e.g., sexual intercourse) for which they may not be developmentally prepared. In the absence of early intervention programs for such individuals, this precocious adolescent risk behavior may, in turn, render them vulnerable to future risks that persist through adolescence and young adulthood.

Our results for race/ethnicity are somewhat difficult to interpret, although consistent with some prior research. African American and Asian respondents exhibited lower levels of risk than did Whites. These effects mirror prior findings for substance use for both adolescent and adult African Americans and Asians, and for Asians' low levels of risk in general (Bachman et al., 1991; CDC, 2003; Ellickson Collins, & Bell, 1999; Kandel & Yamaguchi, 2002; Windle, 1990). Nevertheless, research also suggests that African Americans are at greater risk for sexual risk, HIV, and victimization than are Whites in both adolescence and adulthood (CDC, 2002, 2003; Uehara et al., 1996; Pallone & Hennessy, 2000; Yamaguchi & Kandel, 1987). Other unmeasured variables may be necessary to understand these complex patterns of risk, including a more sophisticated measure of SES than used in the present study, for both adolescents' neighborhoods as well as their families, as well as measures of racial/ethnic identity. It may be that African American race has a different association with the unique variance in victimization and sexual risk than with the variance that these risks share with substance use. Prior research indicates that certain ethnic-specific behaviors and norms may serve to augment or decrease risk (e.g., related to sexual behavior and cigarette use) in qualitatively different ways among racial/ethnic groups (Griesler & Kandel, 1998; Landrine, Richardson, Klonoff & Flay, 1994; Rotosky, Regnerus, & Wright, 2003). For example, the central role of the church in some African American communities may help to explain African American adolescents' lower use of substances (Steinman & Zimmerman, 2004), whereas the emphasis on educational achievement in some Asian cultures may serve a protective function for Asian adolescents (Ellickson et al., 1999).

The majority of interventions have focused on reducing only one health risk at a time, such as problem drinking or illicit drug use (e.g., Kivlahan, Marlatt, & Fromme, 1990; Trudeau, Spoth, Lillehoj, Redmond, & Wickrama, 2003). However, the intertwining of multiple risks during young adulthood points to the need for comprehensive, early interventions that may prevent several risks simultaneously, before psychosocial problems develop. A few existing interventions have targeted more than one problem behavior, such as both substance use and deviance (e.g., Mason, Kosterman, Hawkins, Haggerty, & Spoth, 2003), and their effects over a long period of time should be carefully examined. Further research is also needed to determine whether interventions would be more effective in targeting several problem behaviors at once or whether they should address problems sequentially at developmentally appropriate time points. Our results also point to several warning signs during adolescence that presage vulnerability to multiple health risks as an adult and are clear candidates for intervention efforts during middle school and later. These include deviant behavior, smoking, and exposure to substances by friends and family. In particular, consistent with our other work (e.g., Ellickson et al., 2001; Martino, Collins, & Ellickson, 2004; Tucker, Ellickson, & Klein, 2002), smoking early in adolescence (by age 13) may be an especially powerful marker of later risk that may be amenable to prevention.

Our findings also suggest that interventions aimed at multiple risk behaviors might profit from greater sensitivity to the differential vulnerability of certain sociodemographic groups, including boys, those who are young for their cohort, and Whites. One way of doing this is to incorporate information or activities that help specific groups understand their differential vulnerability into an existing effective intervention (Ellickson, Collins, & Bell, 1999). Another, more expensive, alternative is to develop more intensive interventions targeted at these higher risk groups (Gendreau & Andrews, 1990).

The generalizability of the results is limited by the sampling frame of the study, which included adolescents from schools in California and Oregon. However, estimates of drug use and violence from this sample have closely paralleled those from national samples within the same time period (CDC, 1997, 2002; Ellickson, McGuigan, Adams, Bell, & Hays, 1996; Ellickson, Saner, & McGuigan, 1997). In addition, participant attrition occurred over the 10-year period, and individuals who dropped out or could not be located may differ in terms of risk than those who were retained. Use of weights corrected for over 90% of the differences between attriters and nonattriters with respect to gender, race/ethnicity, SES, and family status, but they do not account for any differences that may exist on unmeasured variables.

Although we found support for the existence of a single risk factor in emerging adulthood that has a basis in adolescent risk, the generalized risk factor did not account for all of the variance in the individual risk indicators. Prior research has suggested that more than one factor may be necessary to capture the variance associated with adolescent risk (Guilamo-Ramos, Litardo, & Jaccard, 2005; Osgood et al., 1988; Paradise & Cauce, 2003; Willoughby et al., 2004), and this also seems to be true in adulthood. In addition, other unmeasured psychosocial variables, such as perceptions of health risk and attitudes about health behaviors, may uniquely contribute to our understanding of some of the risks examined. The present study elucidated the predictors of a generalized risk construct, but our findings do not preclude the existence of unique predictors of specific forms of risk, or of different types of psychosocial predictors than those measured in the present study.

In spite of these limitations, the present investigation demonstrated that the correlates of early personal and environmental risk factors extend well beyond adolescence into the period of young adulthood. As individuals in their early 20s begin to experience freedom from parental supervision, they undergo significant social role changes (e.g., employment, college, marriage) and may be faced with an entirely new set of peer norms and opportunities for involvement in risk behaviors (Arnett, 2000; Bachman et al., 1997; Newcomb & Bentler, 1988). Comprehensive, early interventions that target early risk factors may help curb the development of a variety of psychosocial health problems during this critical stage and, in so doing, stem the cycle of risk. Individuals whose problems in adolescence have not been sufficiently addressed may be ill prepared for the demands of young adulthood and, as demonstrated by the present study, may be vulnerable to a variety of more serious risks at that age.

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