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Delinquency, Depression, Religiosity, and Social Support in the Prediction of Substance Use: Findings from ADD Health

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Abstract

Delinquency, depression, religiosity, and social support have been demonstrated to relate to substance use in adolescence. We examined relations between these factors and substance use (cigarette use, marijuana use, frequency of intoxication using alcohol, and lifetime substance use) using the National Study of Adolescent to Adult Health (ADD Health), a large-scale nationally representative epidemiological study (N = 6504). Our results suggested that: 1) in simple correlations, delinquency and depression appeared to be related to higher levels of all forms of substance use, whereas religiosity and social support appeared to be inversely related with all forms of substance use, 2) in multiple and logistic regression analysis, delinquency remained a predictor of all forms of substance use, 3) depression predicted cigarette use and marijuana use but did not predict frequency of intoxication or lifetime substance use, 4) religiosity predicted lower levels of all forms of substance use, and 5) social support predicted less frequency of substance use but did not predict lifetime use. Results suggest that delinquency and depression may be risk factors for youth substance use, and that religiosity and social support may be associated with decreased risk for substance use. In addition, our analyses suggest that some of these relations may be confounded by other factors or combinations of factors.

Delinquency, Depression, Religiosity, and Social Support in the Prediction of Adolescent

Substance Use: Findings from ADD Health

Adolescence is a critical period for the development of substance use (King, Iacono,

McGue 2004; CASA, 2011; Moffitt, 1997). The average age of substance use initiation is 13-14

years (CASA, 2011). Rates of many forms of substance use are high in US adolescent

populations with three fourths of high school students having used marijuana, alcohol, or tobacco

and one eighth meeting criteria for DSM Substance Use Disorders (SUDs). Adolescent substance

use is associated with concurrent and future negative outcomes including SUDs with 90% of

adults with addiction having tried substance before age 18 (CASA 2011).The increased freedom

and independence that comes with adolescence may be partially associated with increases in

substance use during this period (CASA, 2011; Moffitt, 1997).

Risk and Protective Factors Relating to Adolescent Substance Use.

Research on individual differences in the tendency to use substances and to use them

heavily has provided evidence for several individual level and environmental factors relating to

substance use in adolescence. Risk factors are variables that are associated with a higher

likelihood that an individual will experience a negative outcome. Protective factors are variables

that are associated with a lower level of a negative outcome. (Hempfill et al., 2011). The factors

affecting substance use are diverse and the literature that has examined these topics is

multidisciplinary. For example, a literature review conducted by Hawkins, Catalano, and Miller

(1992) outlines seven categories of risk factors for adolescent substance use: legal, societal,

economic, social, attitudinal, physiological, and psychological. Another review (Hempfill et al.,

2011) suggested that risk and protective factors could be categorized by social context:

communities, families, schools, peer groups, and individuals. Twin and family studies have,

using longitudinal data and structural equation modeling, addressed issues related to determining

causal pathways (Krueger, 2016; King, Iacono, McGue 2004).

Including both risk factors and protective factors in models explaining differences in

adolescent substance use is advantageous because risk factors may be fundamentally and

conceptually different from protective factors (in addition to differences regarding directionality

of effects; Newcomb, Felix-Ortiz; 1992 Stone et al, 2012). For example, it is unclear whether

lack of a protective factor should be conceptualized as a risk factor or vice versa- the absence of

risk factors does not necessarily imply that an adolescent is without risk of using substances

(Newcomb, Felix-Ortiz, 1992). In addition, protective factors may be more likely to have a

mediated or confounded relationship with substance use than risk factors, which may have a

more direct link. Indeed, many studies investigating protective factors focus on factors mediating

the relation between protective factors and lower levels of substance use (Baier & Wright, 2001;

Wills et al., 2004; Walker et al., 2007; Wallace et al., 2007; Ford & Hill, 2012). Further support

for the idea that risk factors and protective factors are discrete constructs comes from research

suggesting that risk factors for substance use relate to higher levels of other risk factors and to

lower levels of protective factors (Evans et al., 1996; Aukst-Margetic, 2005; Davalos, Chavez, &

Guardolia, 2005; Stalk, Love, & Mueller, 2015; Hudson et al., 2015). Similarly, higher levels of

protective factors are often related to higher levels of other protective factors and lower levels of

risk factors (Evans et al., 1996 Davalos, Chavez, & Guardolia, 2005; Aukst-Margetic, 2005;

Harvey et al., 2015; Hudson et al., 2015). Some studies have even constructed separate indices

for risk factors and protective factors regarding adolescent substance use (Newcomb & Felix-Ortiz, 1992).

The present study focuses on two risk factors (delinquency and depression) and two protective factors (religiosity and social support) in relation to adolescent substance use. Research has suggested that depression and delinquency are important risk factors for adolescent substance use (Audrain-McGovern, Rodriguez, & Kassel, 2009; Brunelle et al., 2014; Ping, 2007; King, Iacono, & McGue, 2004; Kendler, 1993) and that religiosity and social support may protect against substance use (Nonnemaker, Mcneely, & Blum, 2003; Kovacs, Piko, & Fitzpatrick, 2011; Walker et al., 2007; Lifrak et al., 1997; Wills & Vaughn, 1989). Depression and delinquency-related constructs such as conduct disorder are suggested to be comorbid (Stalk, Love, & Mueller, 2015) and religiosity has been suggested to covary with social support (Harvey et al., 2015). In addition, both delinquency and depression have been suggested to be inversely related to both religiosity and social support (Davalos, Chavez, & Guardolia, 2005; Hudson et al., 2015; Evans et al., 1996; Aukst-Margetic, 2005). These interrelations suggest the possibility of multiple confounds in regards to these factors' relations to substance use.

Delinquency and Depression as Risk factors for Adolescent Substance Use

In order to explain substance use in adolescence, risk factors should be examined. Delinquency, a form of externalizing behavior, is the tendency to reject social rules and laws whereas depression is a cluster of internalising symptoms characterized by dysphoria, fatigue, and anhedonia. Depression and delinquency are interrelated and both are factors that may influence adolescent substance use (Brunelle et al., 2014; Watts & Wright; Ping, 2007; King, Iacono, & McGue, 2004; Kendler, 1993). In addition, the relationships between delinquency,

depression, and substance use may be complex and interactive, and may confound each other (Scalco et al., 2014; Wu et al., 2007).

Delinquency. Delinquency has been demonstrated in clinical and epidemiological studies to relate to several forms of substance use including use of alcohol, cannabis, cigarettes, hallucinogens, and opiates (Audrain McGovern, Rodriguez, & Kassel, 2009; Brunelle et al., 2014; Watts & Wright). In a sample of adolescent males, Watts & Wright (1990) demonstrated that substance use explained almost half of the variation in violent and nonviolent delinquency. In a clinical sample of adolescents with substance addiction, delinquency related to higher levels of substance use (Brunelle et al., 2014). Furthermore, Landsman et al. (2011) demonstrated that in a sample of urban minority middle schoolers, a trajectory of delinquency predicted later substance use, but that substance use did not predict later delinquency.

Substance use has been conceptualized as a facet of delinquency (Moffitt, 1997) but a factor analysis performed by White (1991) suggests that delinquency and substance use cluster differently in adolescent populations indicating that they may be discrete or partially discrete constructs. Also consistent with the hypothesis that substance use and delinquency are separate constructs is the observation that developmentally, substance use and delinquency are distributed differently across the lifespan, with delinquency usually ending in emerging adulthood and with substance use beginning in adolescence and typically continuing throughout the lifespan (White, 1991; Moffitt, 1997). Recently, research from Krueger and colleagues (2016) using genetic-epidemiological studies suggests that delinquency and substance use are influenced by a largely genetic tendency to externalize, or to act out impulses rather than to suppress them. It has also been suggested that adolescents with delinquency use substance to medicate dysphoria (Watts &

Wright, 1990). Scalco et al. (2014) found evidence of complex interactive effects of externalizing (e.g., delinquency) and internalizing (e.g., depression and anxiety) in relation to substance use.

Depression: Depression has been suggested to be associated with adolescent substance use in clinical, epidemiological, and community samples (Ping, 2007; King, Iacono, & McGue, 2004; Kendler, 1993). In a large-scale (N = 16,464) study of Finnish adolescents aged 14-16, individuals who had used substances five times were five times more likely to experience depressive symptomatology than adolescents who had not used (Torikka et al., 2001). Ping and colleagues (2007) demonstrated that adolescent alcohol abuse and dependence were significantly related with higher levels of depression. King et al. (2004) demonstrated that while it was not as strong a predictor as externalizing disorder, Major Depressive Disorder at age 11 significantly predicted substance use at age 14. The relation between depression and substance use may be more robust in females, at more severe levels of depressive symptomatology, and during adulthood (Kendler et al., 1993).

Self medication of depression using substances is often given as an explanation for covariation between the two phenomena. This explanation has received empirical support (Audrain-McGovern et al., 2009). In addition, it has been suggested that substance use may biochemically induce depression (Swendsen & Merikangas, 2000). In a review of the literature on comorbidity between substance use and depression, Swendsen and Merikangas (2000) suggest (using research from twin, family, and clinical studies), that the relation between Substance Use Disorder and Major Depression is reciprocally caused, rather than caused by a shared etiologic variable. The relation between depression and substance use may be confounded

by other factors. Wu et al. (2007) demonstrated that after controlling for covariates, the relation

between depression and substance use was significant in boys, but not in girls. Furthermore,

some studies have found that demographic factors such as education or ethnicity may partially

confound the relationship between depression and marijuana use (Degenhart, Hall, & Linsky,

2003). Relatively few studies have examined confounding effects of factors on the relation

between depression and substance use in adolescence.

Religiosity and Social Support as Protective Factors Against Substance Use

In addition to identifying risk factors and understanding how they relate to substance use,

protective factors (variables that relate to lower rates of a problematic outcome) against

adolescent substance use need to be well understood. Religiosity, a factor that has been shown to

relate to several important health behaviors including less substance use (Nonnemaker, Mcneely,

& Blum, 2003), refers to the tendency to engage in a set of religious behaviors and beliefs. Social

support is the tendency for an individual to believe that people in their life care about them or

may refer to the tendency to seek out emotional support from important relational figures. Social

support, like religiosity, has been shown to relate to lower levels of substance use (Mcdonough,

Jose & Stuart, 2015). Religiosity and social support are interrelated and both have been

conceptualized as important protective factors against adolescent substance use (Nonnemaker,

Mcneely, & Blum, 2003; Kovacs, Piko, & Fitzpatrick, 2011; Walker et al., 2007; Mcdonough,

Jose & Stuart, 2015).

Religiosity. Several forms of religiosity has been suggested to have an impact on positive

health outcomes including lower levels of substance use (Nonnemaker, Mcneely, & Blum, 2003;

Kovacs, Piko, & Fitzpatrick, 2011; Walker et al., 2007). Nonnemaker et al. (2003), using a large

epidemiological study of adolescents, found both public (religious attendance of services and groups) and private dimensions (prayer and importance of religion) of religiosity to relate to lower levels of substance use; the public dimension was more protective against regular use while the private dimension was more associated with experimental substance use. Kovacs, Piko, & Fitzpatrick (2011) demonstrated that religious affiliation and religious attendance were related to less substance use and experimentation. A structural model tested by Walker (2007) found that behavioral aspects (such as church attendance) and personal aspects (such as spirituality and forgiveness) were found to have an mediated pathway to less substance use.

It has been suggested that religiosity is protective against substance use by way of lower levels of delinquency (Baier & Wright, 2001; Ford & Hill, 2012). Religious institutions may promote lower levels of substance use through moral sanction against deviance. Ford and Hill's analysis (2012) indicated that conservative values toward substance use was a stronger mediator of religion's inverse effect on substance use than was mental health. Another mediational studies have also demonstrated that the effect of religiosity on substance use may be mediated by self control (Ford & Hill, 2012). In addition, religious institutions may provide a space where adolescents form social networks with other youth whose value systems discourage substance use and where peer pressure to use substance is decreased (Wallace et al., 2007). Religious attendance and gathering may also increase social support, another suggested protective factor.

Social Support. Social support has been conceptualized as a protective factor against substance use (Hundleby & Mercer, 1987; Lifrak et al., 1997). However, this may be true mostly when examining the relation between adult or family support and substance use in adolescence. Studies have found that peer support is sometimes associated with higher, rather than lower

levels of substance use (Wills et al., 2004; Wills & Vaughan, 1989; Lifrak et al., 1997). For

example, Wills and Vaughan (1989) found that in a sample of urban adolescents, peer support

was associated with more cigarette and alcohol use and that this relation was stronger when

subjects had friends who were substance users. In a sample of early adolescents, Wills et al.

(2004) demonstrated that peer support was associated with higher levels of substance use. Lifrak

et al. (1997) found that girls who received more social support from classmates used more

substances, particularly cigarettes. In addition, there may be a social climate encouraging

substance use in middle and high school. Adolescents who use substance may experience more

social support by way of increased popularity. In addition, substance use in adolescents may be a

socially bonding activity. Although the relation between many forms of peer support and

substance use may be positive, peer support may affect substance use through multiple pathways

with different effects on substance use. Adolescents who feel more supported by peers may be

more resilient toward peer pressure, making them less likely to use substance to gain popularity

(Mcdonough, Jose & Stuart, 2015).

Although higher levels of peer support may relate to more substance use in adolescence,

support from other sources such as family, community, and adults have consistently been found

to relate to less substance use (Lifrak et al., 1997; Wills & Vaughn, 1989). In a sample of early

adolescents, Wills et al. (2004) found that parental support was inversely related to substance

use. Lifrak et al. (1997) found that in boys, perceived social support from teachers and from

parents related to less substance use. Closer relationships with teachers or parents may promote

values that are more consistent with convention and with the establishment values, or may

promote learning of coping skills that may protect against stress and substance use (Wills et al.,

2004). Positive feelings engendered by any form of social support may make adolescents less vulnerable to medication of emotional pain using substance (Casper et al., 2005).

Lifetime Substance Use Versus Lifetime Abstinence from Substance Use

Recently, research has focused on investigating individual differences between adolescents who have used substances (lifetime users) and adolescents who have never tried or used substances (lifetime abstainers; Tucker et al., 2006; Davis & Spillman, 2011; Owens & Slocum, 2015). Considering the high prevalence of substance use in adolescence, some scholars have conceptualized substance use as normative in adolescence (Owens & Slocum, 2015). Further, it has been suggested that adolescents who completely abstain from substance use are less well adjusted than adolescents who experiment or use some substances lightly. Abstainers, who comprise a minority of adolescents, have been shown to present a different psychosocial profile than adolescents who have used substances (Tucker et al., 2006; Owens & Slocum, 2015). Owens and Slocum (2015) found that adolescents who abstained from substances and delinquency completely were more likely to exhibit certain internalizing behaviors such has passiveness, fearfulness, shyness, and exclusion from peers. Inconsistent with these results,Tucker (2006) demonstrated that lifetime abstainers, in comparison to experimenters and heavier users, were not more depressed, had a greater interest in school, and did not have lower quality relationships (despite being less socially active in peer groups and in school) than experimenters or heavy users. In light of these somewhat contradictory findings, further research is warranted on differences between lifetime users and lifetime abstainers.

Several explanations have been provided for why some adolescents use substances and why some do not. Abstention may be influenced by moral beliefs (Owens & Slocum, 2015),

which, in some adolescents, may be religious. In a survey of college students, 63.5% reported

moral reasons and 43.7% reported religious beliefs for not using illicit drugs (Davis & Spillman,

2011). The explanation that peer exclusion influences some adolescents to refrain from using

substance is partially supported by Davis & Spillman's (2011) survey of college students, which

found that few students (12.2%) endorsed not knowing where to find drugs as a reason for

choosing not to use illicit drugs. Abstainers may avoid substance use because they are less

vulnerable to peer pressure, perhaps due to increased levels of social support from family

(Tucker et al., 2006).

The Present Study

The present study uses the National Longitudinal Study of Adolescent to Adult Health

(ADD Health), a large-scale, nationally representative epidemiological study that tracks

numerous important health variables such as substance use, psychological and psychosocial

factors, and demographics across the lifespan. The aim of the present study is to examine the

cross-sectional relations between two psychological risk factors (delinquency and depression)

and two psychosocial protective factors (religiosity and social support), and four substance use

outcomes (cigarette use, marijuana use, frequency of intoxication, and lifetime substance use).

This study is important for two reasons: 1.) A study investigating protective and risk factors

using a model that incorporates both would be novel to the ADD Health literature. To our

knowledge, the model that we fit is novel to the ADD Health literature. In addition, in the

general literature, few studies have explained substance use using these factors in one model 2.)

The present study includes lifetime substance use as a dependent variable. Few studies using data

from ADD Health or in the general literature have investigated this factor as a dependent

variable.

Hypotheses:

1.) Delinquency and depression will be associated with more substance use.

2.) Religiosity and social support will be associated with less substance use.

Methods

Participants

The present study uses data from Wave 1 of the public access files of The National

Longitudinal Study of Adolescent to Adult Health (ADD Health). ADD Health is a nationally

representative, longitudinal epidemiological study that tracks health behaviors and related

variables such as demographic, physiological, economic, social, and psychological factors. Wave

1 was collected in 1994-1995 and consists of 6504 adolescents from grades 7-12 (mean age =

16). The sample was 51.6% female (n=3356) and 48.4% (n=3147) male. Of the participants in

the sample, 66.0% (n=4294) identified as white/Caucasian, 24.9% (n=1619) were Black or

African American, 11.4% (n=743) were Hispanic, 4.2% (n=270) were Asian or Pacific Islander,

and 6.5% (n=425) identified as "other" (participants could mark more than one ethnicity). Data

was collected by self report.

Measures

Substance Use. Cigarette use frequency was assessed by asking respondents how many

days in the past 30 days they had smoked cigarettes, with participants responding with a specific

number between 0 and 30. Participants who had not smoked in the last thirty days were not asked

this question and were coded as having smoked 0 times. Marijuana use frequency was assessed

by asking participants how many times they had used marijuana in the past 30 days with participants responding with a specific number. Participants who had not used marijuana in the last thirty days were not asked this question and were coded as having smoked 0 times. Frequency of intoxication was assessed by asking how many times over the last 12 months the respondent had gotten drunk or "very, very high" on alcohol (1 = never, 2 = one or two times in the past 12 months, 3 = once a month or less (3 to 12 times in the last 12 months), 4 = two or three days a week, 5 = one or two days a week, 6 = three to five days a week, 7 = every day or almost every day).

Depression. Depression was indexed using a modified version of the Center for Epidemiologic Studies Depression scale (CESD), a well validated (Radloff, 1991), 20 item measure for depression research in epidemiology. The modified version used by the present study uses 19 items. Items from the CESD are statements that describe symptoms of depression. Participants were asked to indicate on a scale of 0 - 3 how often each item was true in the past week. Items from the CESD include "You thought your life was a failure" and "You felt sad" (0 = never or rarely, 1 = sometimes, 2 = a lot of the time, 3 = most of the time or all of the time). This scale was modified such that the items "Your sleep was restless" and "You could not get going" were omitted. The item that previously read "You felt that everything you did was an effort" was replaced by "You felt that you were too tired to do things". One item, "It was hard to get started doing things" was added to the scale. Items 4, 8, 11, and 15 (e.g., item 11: "You were happy") were reverse-coded. Scores from the CESD were summed in order to construct the scale that we used for our depression measure. In order to assess the internal consistency of this

measure, we computed Cronbach's Alpha for the CESD in the ADD Health Wave 1 sample. The reliability coefficient was "good" at .86.

Delinquency. Self reports of delinquency were taken using the Delinquency Scale constructed by ADD Health (Harris et al, 2009), a 15 item scale that asked how many times in the last 12 months participants engaged in behaviors that broke the law, broke conventional social rules, or participated in violent behavior (e.g., How often did you take something from a store without paying for it?"). This scale was indexed using a likert scale from 0-3 (0 = never, 1 = one or two times, 2 = three or four times, 3 = five or more times). Scores from the Delinquency Scale were summed in order to construct this measure. In order to assess the internal consistency of this measure, we computed Cronbach's Alpha for the this scale in the ADD Health Wave 1 sample. The reliability coefficient was "good" at .83.

Religiosity. We examined religiosity using self report of frequency of church attendance in the past year. The question used to index this factor was "In the past 12 months, how often did you attend religious services (1 = never, 2 = less than once a month, 3 = once a month or more, but less than once a week, and 4 = once a week or more).

Social Support. We assessed social support using self report from the Protective Factors survey administered by ADD Health (Harris et al, 2009). This scale asks questions that measure the extent to which participants feel supported and cared for by family, friends, and adults in their life (e.g., "How much do you feel that your parents care about you?"; 1 = not at all, 2= very little, 3 = somewhat, 4 = quite a bit, 5 = very much). In order to assess the internal consistency of this measure, we computed Cronbach's Alpha for this scale in the ADD Health Wave 1 sample. The reliability coefficient was "acceptable" at .78.

Having Ever Used. We included having ever used, or lifetime use, as a dependent measure. We conceptualized lifetime use as having used cigarettes, marijuana, or alcohol. We coded data from the following questionnaire items such that "0" denoted never having used (abstinence) and "1" denoting having used one or more of these substances: cigarettes, marijuana, and alcohol. The following questions were used to construct this measure: "Have you ever tried cigarette smoking, even just 1 or 2 puffs?", "Have you had a drink of beer, wine, or liquor—not just a sip or a taste of someone else's drink—more than 2 or 3 times in your life?", and "How old were you when you tried marijuana for the first time? If you never tried marijuana, enter "0.""".

Procedure

Log Transformations. In order to approximate a normal distribution, we log-transformed scores for delinquency, cigarette use frequency, marijuana use frequency, and frequency of intoxication.

Results

Descriptive Statistics

We computed descriptive statistics on our independent variables and dependent variables. These data are presented in Table 1.

Depression, Delinquency, Religiosity, and Social Support. We computed means and standard deviations for depression, delinquency, religiosity, and social support. These data can be found in Table 1. The average score on the depression scale (CESD) was low at 10.93 (SD = 7.52, possible range = 0-57). This score indicates no clinical significance (Radloff, 1991). The average score on the delinquency scale was 4.08 (SD = 5.06, possible range = 0-45) indicating a low level of delinquency in the sample. The average score on the religiosity index was

moderately high at 2.75 (SD = 1.21, possible range = 1-4), indicating that the average score for

service attendance frequency was between "less than once a month" and "once a month or more,

but less than once a week". The average score on the social support scale was 23.99 (SD = 4.79,

possible range = 0-32) indicating that the sample felt moderately socially supported.

Substance Use. We computed means and standard deviations for cigarette use frequency,

marijuana use frequency, and on the index for frequency of intoxication. These data can be found

in table 1. The average score for cigarette use frequency was low at 4.46 days that the subject

smoked in the last month (SD = 9.52, possible range = 0-30). The average score for marijuana

use frequency was very low at 1.88 (SD = 18.23) times having smoked marijuana in the last

month. The average score for the frequency of intoxication index was low at 1.61 (SD = 1.21,

possible range = 1-7), which indicated that the average response was between "never" and "1 or

2 times in the last year".

Correlations. Correlations between depression, delinquency, religiosity, social support,

cigarette use, marijuana use, and frequency of intoxication were computed. These data are

reported in table 2.

Predicting Substance Use

Frequency of Substance Use. We fit three multiple linear regression models, each

predicting a different form of substance use. Table 3.1 shows the model predicting cigarette use

frequency. Table 3.2 shows the model predicting marijuana use frequency. Table 3.3 shows the

model predicting frequency of intoxication. Each model used the same predictor variables:

depression, delinquency, religiosity, social support, and sex (included as a covariate).

Frequency of Cigarette Use. The regression model predicting cigarette use frequency explained 13.3% of the variance ($p < .001$). Depression and delinquency both related to higher levels of cigarette use. Delinquency was a significant predictor of cigarette use ($\beta = .22$, $p < .001$) as was depression ($\beta = .07$, $p < .001$). Religiosity and social support both related to a lower level of cigarette use. The effect of religiosity ($\beta = -.15$, $p < .001$) and social support ($\beta = -.11$, $p < .001$) were both significant. Sex did not significantly predict cigarette use.

Frequency of Marijuana Use. The regression model predicting marijuana use frequency explained 12.2% of the variance in marijuana use ($p < .001$). Delinquency and depression significantly predicted a higher level of marijuana use while religiosity and social support predicted lower levels of marijuana use. The effect of delinquency on marijuana use was significant ($\beta = .27$, $p < .001$) as was the effect of depression ($\beta = .04$, $p < .01$). Religiosity was significantly related to ($\beta = -.18$, $p < .001$) less marijuana use and social support had an significant effect ($\beta = -.07$, $p < 001$). Male sex significantly predicted marijuana use ($\beta = .03$, $p < .05$).

Frequency of Intoxication. The model predicting frequency of intoxication explained 16.5% of the variance ($p < .001$). Delinquency related to higher frequency of intoxication, religiosity, and social support. Delinquency related significantly to frequency of intoxication ($\beta = .32$, $p < .001$). Religiosity and social support both significantly related to lower frequency of intoxication ($\beta = -.11$, $p < .001$ and $\beta = .11$, $p < .001$ respectively). Depression and sex did not significantly frequency of intoxication.

Ever Having Used Substances. We fit a logistic regression model predicting whether 18-year old adolescents in the ADD Health Wave 1 sample would remain abstinent from substances

(coded as "0") or would use substance (coded as "1") at or before the age of 18. The predictors were the same as were used for the linear regression models: delinquency, depression, religiosity, social support, and sex. Frequencies and means are displayed in table 4. Logistic regression analyses predicting having ever used substance are displayed in table 5. Delinquency (OR = 1.28, $p < .001$) and religiosity (OR = .71, $p < .001$) were the only factors significantly relating to having ever used. Depression, social support, and sex did not significantly predict having used substances. Adolescents who were younger or older than 18 years of age were not included in the analysis because we viewed abstinence by the age of 18 to be an important developmental milestone.

Discussion

Researchers have used both risk and protective factors in order to explain differences in adolescent substance use. Depression and delinquency have been suggested as important risk factors for adolescent substance use and religiosity and social support have been suggested as protective factors against adolescent substance use. We examined relationships between these factors (delinquency, depression, religiosity, and social support) and 4 conceptualizations of substance use (frequency of cigarette use, frequency of marijuana use, frequency of intoxication using alcohol, and lifetime use). We hypothesized that depression and delinquency would relate to more substance use and that religiosity and social support would relate to less substance use.

We examined intercorrelations between depression, delinquency, religiosity, social support, cigarette use, marijuana use, and frequency of intoxication. In these analyses, our hypotheses were supported, with depression and delinquency relating to higher levels of all forms of substance use. Also consistent with our hypotheses, correlation analyses found that

religiosity and social support related to lower levels of all forms of substance use. Although we did not test statistically for significant differences between correlations, it appears that delinquency had the most robust effect on all forms of substance use frequency while depression had the least robust effect. Although significant, effects were generally less robust than expected. Delinquency had moderate correlations with frequency of cigarette use, frequency of marijuana use, and frequency of intoxication. Social support moderately correlated with frequency of cigarette use and frequency of intoxication, and correlated modestly with marijuana use. Religiosity had a moderate correlation with frequency of cigarette use and modest correlations with frequency of marijuana use and frequency of intoxication. Depression had modest correlations with frequency of cigarette use, frequency of marijuana use, and frequency of intoxication.

We fit three multiple regression models predicting cigarette use frequency, marijuana use frequency, and frequency of intoxication using alcohol. For each regression model, the predictor variables were the same: depression, delinquency, religiosity and social support. Our hypotheses were generally supported by these analyses. Delinquency significantly related to higher levels of every form of substance use. Depression related to higher levels of cigarette use frequency and marijuana use frequency, but did not relate to intoxication frequency and lifetime use status. In the regression models, religiosity related to lower levels of all forms of substance use and social support related to lower levels of all forms of substance use frequency, but did not relate to lifetime use status.

Our results finding that delinquency and substance use are related are generally consistent with several other studies in the literature (Audrain-McGovern, Rodriguez, & Kassel, 2009;

Brunelle et al., 2014; Watts & Wright, 1990; Landsman et al., 2011). However, some studies

have found relations between delinquency and substance to be robust rather than moderate. For

example, in a mixed penal and community sample, Watts & Wright (1990) found that use of

substances explained almost half of the variance in minor and in violent delinquency. In a

clinical sample of adolescents with addiction, delinquency related robustly to several forms of

substance use (Brunelle et al., 2014).

Genetic-epidemiological studies using twin samples conducted by Krueger and

colleagues (2016) suggest that delinquency and substance use are caused by a genetically linked

externalizing factor. Although our data is cross sectional and has limited causal implications, our

findings that substance use and delinquency are significantly interrelated in the context of other

risk and protective factors, are consistent with this theory. In addition, genes and environment

may interact to produce covariance between substance use and delinquency in adolescents

(Weeland et al., 2015). Adolescents who have a genetic predisposition to externalizing may be

drawn to social circles in which delinquent behavior and substance use, both socially learned

behaviors that share some motivations, are more heavily endorsed. In turn, adolescents whose

friends use more substance and who engage in more delinquent behavior may learn these

behaviors and increase use of both.

Although the present study found that depression correlated significantly with all forms

of substance use, depression did not relate to frequency of intoxication or having ever used

substances when examined in the context of other factors. Even when significant, the effects of

depression on substance use were modest in both simple correlations and in multiple regression.

This is consistent with King et al.'s (2004) findings that internalizing disorders were less robust

in the prediction of substance use than were externalizing disorders. Our finding that depression

did not significantly relate to frequency of intoxication when including other factors in the model

is also consistent with Wu et al.'s (2008) analysis which found that after controlling for several

covariates, depression's effect on alcohol abuse was insignificant in girls. Our findings and Wu

et al's suggest that the relation between adolescent depression and some forms of substance use

may be confounded by other factors or combinations of factors.

Some studies suggest that the relation between depression and substance use may be

stronger later in life but that deviance and disinhibition are more important for explaining

substance use in earlier periods(Kendler et al, 1993; King et al., 2004). Certain symptoms of

depression such as behavioral inhibition may even protect against substance use in adolescence

(Scalco et al, 2014). Another explanation for the modest effect of depression on substance use

may involve our measures of depression and substance use. The CESD captures normal-range

depressive symptoms as well as severe symptoms. Stronger effects on substance use may be

present at more severe levels of depression . Similarly, we examined substance use frequency,

not Substance Use Disorder. A stronger relation between depression and substance use may

occur at severe levels of depression (Kendler et al., 1993; King, Iacono, McGue, 2004; Stalk,

Love & Mueller, 2015). The fact that our measures captured lower levels of both depression and

substance use may explained depression's weak effect on substance use in our analysis. Further

research is warranted on the relation between mild to moderate depression and substance use

outcome.

Our results suggest that religiosity (specifically, religious service attendance) is related to

less substance use in adolescence. This is consistent with analyses suggesting that public or

behavioral dimensions of religiosity relate to less substance use in adolescence (Nonnemaker, McNeely, and Blum, 2003; Kovacs, Piko, & Fitzpatrick, 2011; Walker et al., 2007). For example, Nonnemaker, Mcneely, and Blum (2003) demonstrated that public domains of religiosity (e.g., service attendance and religious youth group activities) related to several important health outcomes including less cigarette, marijuana, and alcohol use. Our analysis did not test personal or private dimensions of religiosity such as prayer or importance of religion. Further analysis of our data would benefit from inclusion of personal or private dimensions of religiosity such as importance of religion; differing conceptualizations of religiosity may relate differentially to substance use.

It has been suggested that the inverse relationship between religiosity and substance use is partially mediated by other factors including mental health and lower deviance. These claims have received empirical support in the form of structural models testing mediation (Walker et al., 2007; Wallace et al., 2007) Although we did not test a mediational model, our correlational analyses are consistent with these claims. We found that religiosity inversely correlated significantly with depression, which in turn correlated significantly with substance use. Similarly, religiosity significantly related to lower delinquency, which was significantly related to higher levels of substance use. Further analyses of our data would do well to test mediational models using delinquency, depression, and social support as mediators of the inverse relation between religiosity and substance use.

We found that social support was related to less substance use. This is consistent with analyses that show that various forms of social support, particularly adult and family support, are inversely related to substance use (Mcdonough, Jose & Stuart, 2015; Lifrak et al., 1997; Wills &

Vaughn, 1989). Social support from adults or family may be an alternative coping strategy that

may detract from use of substance to cope with stress or other risk factors for substance use. In

addition, youth who receive social support from parents or adults may gain skills that protect

against substance use. Closeness with adults may also engender values more consistent with

convention or with the establishment.

The measure we used for assessment of social support may have weakened our results

regarding social support and substance use. The measure used to assess social support by ADD

Health included items that gauged social support from several sources including peer support.

This is less than optimal because peer support may relate to substance use in a significant and

conceptually different way than other forms of social support (Wills et al., 2004; Wills &

Vaughan, 1989; Lifrak et al., 1997). Although several forms of social support have been shown

to relate to less substance use, adolescent peer support may be associated with more substance

use (Mcdonough, Jose & Stuart, 2015). Including an item (out of a scale that consisted of eight

items) that measured peer support may have reduced the strength of our results regarding social

support and substance use.

In order to assess whether 18-year-old lifetime users (adolescents who had used

substances) differed from lifetime abstainers (adolescents who had never used substances) of the

on scores regarding delinquency, depression, religiosity, and social support, we compared means

on scores for these variables between the two groups. We found that lifetime users, on average,

were significantly more depressed, higher on delinquency, more religious, and felt more socially

supported. These analyses were consistent with our hypotheses that delinquency and depression

would relate to substance use and that religiosity and social support would relate to less

substance use. Adolescents who were younger or older than 18 year of age were not included in the analysis because we viewed abstinence by the age of 18 to be an important developmental milestone.

We also fit a logistic regression model using lifetime use as a criterion variable and delinquency, depression, religiosity, social support, and sex as predictor variables. In this model, delinquency related to higher probability of being a lifetime user and religiosity related to a lower probability of being a lifetime user. Depression, social support, and sex did not significantly relate to lifetime use status. This model partially supported our hypothesis that delinquency and depression would relate to higher levels of substance use and that religiosity and social support would relate to lower levels of substance use.

Our results are not consistent with research suggesting that lifetime abstainers are badly adjusted in comparison to lifetime users. In particular, our findings are not consistent with research suggesting that abstainers are more socially excluded and have internalizing problems. These results are consistent with Tucker's (2006) findings that lifetime abstainers are not more likely than lifetime users to be depressed or to have relationships of poor quality. Our results are consistent with Haskin's (1999) finding that lifetime abstainers are more religious than lifetime users. Our result that lifetime users were higher on delinquency is unsurprising in light of Haskin's finding that abstainers are more prone to novelty seeking, another form of externalizing.

Our results that depression and social support did not significant relate to higher likelihood of lifetime use status may be partially due to the smaller sample of the group of 18-year-olds that we examined (N = 1162), relative to all of the subjects in the sample (N = 6504).

However, these results suggest that the relation between depression and lifetime use and that the

relation between social support and lifetime use may be confounded by delinquency, religiosity,

or both. Further research is warranted in order to understand possible confounding factors acting

on social support and depression in relation to lifetime use status. Effects, while usually

significant, were less robust than expected in all analyses performed. There was a wide age range

of this sample, including adolescents from middle school and high school. In addition, this

sample is nationally representative and therefore not demographically homogenous. This, along

with the fact that there is a relatively lower average age in the sample studied (with less

opportunity to start using substances earlier in life compared to later) (mean age = 16) may have

decreased our ability to detect effects. However, subjects may not have passed through a

developmental period where they have had the opportunity to develop the full blown Substance

Use Disorder and smaller magnitude relations may be seen between risk and protective factors

and non-pathological level substance use compared to substance use disorder.

Some limitations of the nature of our data may be relevant when interpreting our results.

Our data is cross sectional, limiting our ability to perform analyses that would test a causal

relation. Our study is also limited by the fact that our data was collected through self-report and

therefore are subject to problems associated with this form of data collection. The

generalizability of this study is limited by the year that data was collected. Wave 1 of the ADD

Health in-home sample data was collected in 1994-1995. Since the mid nineties, patterns of

substance use may have changed. If data had been collected in present day (2016), it is possible

that our results would have been different. However, it is likely that relations between

psychological/psychosocial factors and substance use in the mid 1990's are similar to current

patterns today. Using data from Monitoring the Future, a large-scale longitudinal study, Brown et al. (2001) found a high degree of consistency between 1976 and 1997 in regards to psychosocial correlates of substance use, indicating that these patterns may be more stable rather than volatile. In addition, our results were similar to many studies using more modern data (Ping et al., 2007; Wu et al., 2007;Kovacs, Piko, & Fitzpatrick, 2011; Brunelle et al., 2014; Mcdonough, Jose & Stuart, 2015).

Despite some limitations, our study contributes to the literature. Our study is the first using data from ADD Health to incorporate depression, delinquency, religiosity, and social support in a model examining variation in four outcomes of adolescent substance use. In addition, our study is nationally representative and is therefore less susceptible to methodological issues present in penal or clinical samples. In addition, through examining intercorrelations and linear relationships our study has several implications for theory regarding substance use. Our study highlights both the importance of delinquency and depression as possible risk factors for several forms of substance use. In addition, our study highlights the importance of religiosity and social support as possible protective factors against substance use.

Our findings may be clinically relevant. Programs seeking to reduce adolescent substance use should consider these factors when designing interventions or prevention programs for Substance Use Disorders (SUD). For example, religiosity and social support may be, in addition to being protective against substance use, helpful in the treatment of SUD. Yeterian et al. (2015) demonstrated that religiosity and spirituality were significantly associated with reductions in drug-related problems across treatment. Similarly, social support from family and friends during treatment was associated with better outcome in treatment of SUD (Chi et al., 2009). Reducing

depression and delinquency may also positively affect treatment outcome. Hogue (2016) found

that decreases in delinquency and depression were both related to better treatment outcome.

Programs seeking to reduce adolescent substance use should consider these factors when

designing interventions or prevention programs.

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Tables

Table 1. Means and Standard Deviations for Measures of Risk/Protective Factors and Substance Use

Measure	M	SD
Delinquency Scale (0-45)	4.08	5.06
Depression Scale (0-57)	10.93	7.52
Religiosity Scale (1-4)	2.75	1.21
Social Support Scale (0-32)	23.99	4.79
Days Smoked Cigarettes in Past 30 Days (0-30)	4.26	9.52
Times Smoked Marijuana in Past 30 Days	1.88	18.23
Frequency of Intoxication Index (1-7)	1.61	1.21

Table 2. Intercorrelations Among Measures of Risk/Protective Factors and Substance Use

Variable	1	2	3	4	5	6	7
1. Depression	-						
2. log(Delinquency)	.28	-					
3. Religiosity	-.12	-.11	-				
4. Social Support	-.43	-.34	.17	-			
5. log(Cigarette Use)	.19	.29	-.20	-.24	-		
6. log(Marijuana Use)	.15	.32	-.15	-.19	.41	-	
7. log(Frequency of Intoxication)	.15	.37	-.16	-.23	.45	.46	-

Note: All coefficients are significant at $p < .001$.

Regression Analyses for Risk/Protective Factors and Gender Predicting Frequency of Cigarette Use, Marijuana Use, and Intoxication

Table 3.1: Predicting log(Cigarette Use Frequency)

Variable	B	SE B	β	t	p
Depression	0.01	0.00	.07	5.01	.00
log(Delinquency)	0.29	0.02	.22	17.23	.00
Religiosity	-0.07	0.01	-.15	-13.01	.00
Social Support	-0.01	0.00	-.11	-8.15	.00
Sex	-0.01	0.01	-.01	-.86	.39

Note: R^2 =.133 (N = 6504, $p < .001$). β shows the standardized beta-weight.

Table 3.2: Predicting log(Marijuana Use Frequency)

Variable	B	SE B	β	t	p
Depression	0.00	.00	.04	2.70	.01
log(Delinquency)	0.22	.01	.27	20.93	.00
Religiosity	-.22	.00	-.18	-8.90	.00
Social Support	-.01	.00	-.07	-5.08	.00
Sex	.02	.01	.03	2.32	.02

Note: R^2 =.122 (N = 6504, $p < .001$). β shows the standardized beta-weight.

Table 3.3. Predicting log(Frequency of Intoxication)

Variable	B	SE B	β	t	p
Depression	.00	.00	.01	.68	.50
log(Delinquency)	.13	.005	.32	25.83	.00
Religiosity	-.01	.00	-.11	-9.53	.00
Social Support	-.01	.00	-.11	-7.99	.00
Sex	.004	.00	.01	1.03	.30

Note: R^2 = .165 (N = 6504, $p < .001$). β shows the standardized beta-weight.

Table 4. Frequencies and means for subjects who have never tried substances vs. subjects who have tried substances

Variable	Lifetime Abstainers (n =236)	Lifetime Users (n =926)	x^2 or t	df	p
Male	102 (17.7%)	473 (82.3%)	4.65	1	.03
Female	134 (22.8%)	453 (77.2%)	-	-	-
Depression	9.47	11.53	3.92	1160	.00
log(Delinquency)	1.63	4.30	8.39	1159	.00
Religiosity	3.07	2.55	6.27	1155	.00
Social Support	24.70	22.84	5.49	1158	.00

Note: A x^2 test was performed to determine whether males or females were different in terms of having ever used cigarettes, marijuana, or alcohol. The rest of the rows show t-scores. Total N = 1162. Adolescents who were younger or older than 18 were not included in the analysis because we viewed abstinence by the age of 18 to be an important developmental milestone.

Table 5. Logistic Regression Analyses Predicting Having Ever Used Cigarettes, Marijuana, or Alcohol

Variable	B	SE	Wald	OR [Exp(B)]	p
Depression	.01	.013	.75	1.01	.39
log(Delinquency)	.25	.037	46.37	1.28	.00
Religiosity	-.34	.071	22.49	-.71	.00
Social Support	-.03	.020	2.50	-.97	.11
Sex	.07	.158	.18	1.07	.67

Note: Cox and Snell R^2 = .110. Nagelkerke R^2 = .174. Odds Ratio (OR) reports the exponentiated unstandardized beta-weight (B). N = 1162. Adolescents who were younger or older than 18 were not included in the analysis because we viewed abstinence by the age of 18 to be an important developmental milestone.

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