Drug and Alcohol Dependence 169 (2016) 48–55

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Internalizing symptoms and conduct problems: Redundant, incremental, or interactive risk factors for adolescent substance use during the first year of high school?

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ARTICLE INFO

Article history:
Received 20 May 2016
Received in revised form 6 September 2016
Accepted 7 October 2016
Available online 17 October 2016

Keywords:
Conduct problems
Internalizing symptomatology
Substance use
Drugs
Depression
Anxiety

ABSTRACT

Aim: The complex interplay of externalizing and internalizing problems in substance use risk is not well understood. This study tested whether the relationship of conduct problems and several internalizing disorders with future substance use is redundant, incremental, or interactive in adolescents.
Methods: Two semiannual waves of data from the Happiness and Health Study were used, which included 3383 adolescents (M age = 14.1 years old; 53% females) in Los Angeles who were beginning high school at baseline. Logistic regression models tested the likelihood of past six-month alcohol, tobacco, marijuana, and any substance use at follow-up conditional on baseline conduct problems, symptoms of one of several internalizing disorders (i.e., Social Phobia and Major Depressive, Generalized Anxiety, Panic, and Obsessive-Compulsive Disorder), and their interaction adjusting for baseline use and other covariates.
Findings: Conduct problems were a robust and consistent risk factor of each substance use outcome at follow-up. When adjusting for the internalizing-conduct comorbidity, depressive symptoms were the only internalizing problem whose risk for alcohol, tobacco, and any substance use was incremental to conduct problems. With the exception of social phobia, antagonistic interactive relationships between each internalizing disorder and conduct problems were found when predicting any substance use; internalizing symptoms was a more robust risk factor for substance use in teens with low (vs. high) conduct problems.
Conclusions: Although internalizing and externalizing problems both generally increase risk of substance use, a closer look reveals important nuances in these risk pathways, particularly among teens with comorbid externalizing and internalizing problems.

1. Introduction

Substance use often co-occurs with a range of externalizing problems throughout adolescence (Brown et al., 1996; Maslowsky et al., 2013a,b; Merikangas et al., 2010). Although Conduct Problems (CPs) and other externalizing problems are well-established risk factors for adolescent substance use (King et al., 2004; Maslowsky et al., 2013a,b), the role of internalizing symptomatology (IntSx) in teen substance use risk is less clear. Some research shows that anxiety and depression are associated with subsequent substance use in adolescents (Buckner et al., 2008; Crum et al., 2008; King et al., 2004; Sartor et al., 2007); however, results are not always replicated (Pardini et al., 2007) and do not appear to be as strong as the corresponding risk of substance use associated with CPs (King et al., 2004; Maslowsky and Schulenberg, 2013). Further complicating matters, there is considerable comorbidity between CPs and IntSx in teens (Lewinsohn et al., 1993). Hence, the interplay between CP and IntSx in adolescent substance use risk may be multifaceted.

1.1. The interplay of conduct problems and internalizing symptomatology in adolescent substance use

There are several ways in which CPs and IntSx may interplay in teen substance use risk. If the association of IntSx with substance use risk is mostly explained by the overlap with CPs, this would suggest that the internalizing pathway to substance use risk is

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http://dx.doi.org/10.1016/j.drugalcdep.2016.10.007
0376-8716/

redundant with CPs, whereby, both CPs and IntSx explain the same variance in substance use risk. If the association of IntSx with substance use risk occurs over and above overlapping risk accounted for by CPs, this would suggest that the internalizing pathway to substance use risk is *incremental* and that some meaningful degree of risk is conferred by IntSx even in the absence of high levels of CPs. These two patterns of results can be discerned by models of substance use risk in which IntSx and CPs are included as simultaneous predictors to control for their overlapping variance.

A third pattern regarding the interplay between CPs and IntSx in substance use risk can be determined by models of substance use testing the interaction between the IntSx and CPs. This interactive association could be expressed in one of two ways: (1) a synergistic interaction – the combination of having both high CPs and high IntSx is associated with a disproportionately larger increase in risk than what would be expected based on the risk carried by IntSx or CPs alone; and (2) an antagonistic interaction – the combination of having both high CPs and high IntSx is associated with a disproportionately smaller risk than what would be expected based on the risk carried by IntSx or CPs alone.

1.2. Research gaps on the interplay of conduct problems and internalizing symptomatology in substance use risk

Thus far, research on the CP-IntSx comorbidity has primarily focused on Conduct Disorder and Major Depressive Disorder as risk factors for substance use. To date, evidence indicates that both forms of psychopathology are associated with substance use independent of one another (Connor et al., 2004; Crum et al., 2008; Ingoldsby et al., 2006; King et al., 2004), incrementally to one another (Brook et al., 2015; Ingoldsby et al., 2006; Lansford et al., 2008), and interactively (e.g., Marmorstein and Iacono, 2001; Maslowsky and Schulenberg, 2013). These latter studies of adolescents have found that high levels of both CPs and depressive symptoms are associated with a disproportionately larger increase in risk for substance use than either disorder independently (i.e., synergistic interaction; Marmorstein and Iacono, 2001; Maslowsky and Schulenberg, 2013; Miller-Johnson et al., 1998; Pardini et al., 2007). However, research has yet to examine whether this interactive relationship exists between CPs and other forms of IntSx, such as the various type of anxiety disorder symptoms often present in adolescents (Grant et al., 2004). Understanding how the internalizing-externalizing interplay in substance use risk present across multiple forms of IntSx can elucidate whether additional IntSx beyond depression are needed in risk prediction modeling, developmental psychopathology theories, and prevention strategies that target affect.

1.3. The present study

The present study examines CPs and IntSx at the beginning of 9th grade to predict transitions in substance use by a six-month follow-up period. This period, which reflects the first year of high school, provides insight into this significant developmental period marked by social transitions, new academic demands, and access to older peer groups, and therefore is a high-risk period for substance use onset and escalation (Eaton et al., 2010; SAMHSA, 2009). We first examine relationships of CPs and multiple forms of IntSx (i.e., Major Depressive Disorder, Generalized Anxiety Disorder, Social Phobia, Panic Disorder, and Obsessive-Compulsive Disorder) to adolescent substance use risk in isolation from one another to replicate and extend past findings. We then address the primary aim of this paper which is to examine whether relations involving CPs and IntSx to substance use risk are *redundant*, *incremental*, or *interactive*. It is hypothesized that a synergistic interaction exists between depressive symptomatology and CPs on substance use given recent findings showing a synergistic association rather than the antagonistic kind (Maslowsky et al., 2013a,b; Maslowsky and Schulenberg, 2013). No a priori hypotheses were put forth regarding how the other IntSx symptoms associate with substance use risk in the context of possible CP comorbidity.

2. Methods

2.1. Participants and procedures

The current study utilizes survey data from a cohort of 9th grade students enrolled in 10 public high schools in the Greater Los Angeles area assessed at baseline (fall 2013) and again at a six-month follow-up (spring 2014). Participating schools were selected based on their representation of diverse demographic characteristics. Students who were not enrolled in a special education program (e.g., severe learning disabilities) or English as a Second Language Programs were eligible to participate ($N = 4100$). Among those eligible, 3874 (94.5%) assented to participate in the study, of whom 3383 (82.5%) provided active written parental consent and enrolled in the study at baseline. The study had a 97% retention rate between baseline and follow-up with a total of 3293 teens participating at follow-up. Paper-and-pencil surveys were administered during in-class 60-min survey administrations. Researchers communicated to students that their responses would be strictly confidential and not shared with their teachers, parents, or school staff. Students were not individually compensated; however, each participating school was compensated for their general activity fund. Questionnaires were administered in a random order and some students did not complete the entire survey within the time allotted or were absent on one of the assessment days. Consequently, participants who did not complete key IntSx, CP, and substance use measures used in this report were not included in the final sample used in analyses. Depending on the particular analyses, sample size ranged from 2896 to 3229. The study was approved by the Institutional Review Board at the University of Southern California.

2.2. Measures

2.2.1. Conduct problems. CPs were assessed at the baseline assessment using an 11-item measure of past six-month behavior (e.g., stealing, lying to parents, running away; Lloyd-Richardson et al., 2002; Resnick, 1997; Thompson et al., 2007). Six of the 11 items assessed are behaviors consistent with a Conduct Disorder diagnosis. The frequency of each behavior was ascertained with six ordinal response options varying from never to 10 or more times in the past six-months (scored 1–6, respectively) and a weighted sum score was computed across the 11 items. A weighted sum score of CPs was used in the analyses to most accurately reflect CPs endorsed. A weighted score is optimal given both a mean and a sum score would include individuals who had missing data on items and thus not accurately reflect a true endorsement of 11 CP items. The CP scale exhibited good internal consistency in the sample ($\alpha = 0.79$) and exhibited characteristic patterns of association with IntSx symptoms and substance use, suggesting good evidence of construct validity.

2.2.2. Internalizing symptomatology. The Revised Children's Anxiety and Depression Scale (RCADS) was administered at baseline to assess Major Depressive Disorder, Generalized Anxiety Disorder, Social Phobia, Panic Disorder, and Obsessive-Compulsive Disorder symptoms (Chorpita et al., 2000). The Major Depressive scale included 10 items relating to depressive symptoms (e.g., "I feel sad or empty"). The Generalized Anxiety Disorder scale included six items relating to worry about the future (e.g., "I worry about things"). The Social Phobia scale includes nine items relating to