DEVIANT PEERS, SUBSTANCE USE, AND CONDUCT PROBLEMS ACROSS ADOLESCENCE: MODERATORS OF SELECTION AND SOCIALIZATION PROCESSES

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ABSTRACT

Deviant Peers, Substance Use, and Conduct Problems Across Adolescence: Moderators of Selection and Socialization Processes

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Although the extant literature suggests that associations with deviant peers (ADP) contribute to the persistence and exacerbation of adolescent conduct problems (CP) and substance use (SU), few studies have investigated processes through which these relations develop, the stability of ADP, risk factors for ADP, or prospective relations among patterns of ADP, CP, and SU across adolescence and substance use disorder (SUD) in early adulthood. Relations among ADP with CP and ADP with SU may be due to selection processes (i.e., youth select into ADP groups) and/or socialization processes (youth are influenced by deviant peers once they enter the ADP group). In addition, selection and socialization processes may be moderated by neuropsychological and temperamental (i.e., emotionality) factors, though there is a dearth of literature examining moderators of these processes. The present study addressed these gaps in the literature by examining five research aims: (1) identify subgroups of youth who vary in type and levels of ADP and CP/SU at three different ages using latent class analysis, (2) investigate the stability of ADP and CP/SU subgroup membership using latent transition

analysis, (3) examine the prospective relations among ADP and CP/SU subgroup membership, (4) investigate potential neuropsychological and emotion regulation moderators of selection and socialization processes, and (5) evaluate prospective prediction to SUD in early adulthood from patterns of ADP and CP/SU subgroup membership across adolescence. Participants were youth who participated in a large-scale research project conducted through the Center for Education and Drug Abuse Research at the University of Pittsburgh. Youth and their families completed multiple assessments, beginning when youth were 10-12 years old, followed by assessments at 12-14, 16, and 22 years old. Results indicate (a) deviant peer groups vary based on type and severity of deviant behavior; (b) deviant peer group involvement increased across adolescence and continuity of deviant peer involvement was evident; (c) youth selected peers based on similar levels of deviant behavior across ages 10 to 16 years, but were influenced by these deviant peers to engage in CP and/or SU from ages 12-14 to 16 years; (d) relations between youth deviant behaviors and later selection of deviant friends differed according to levels of youth neuropsychological functioning and temperamental emotionality; and (e) earlier involvement with deviant peers, involvement with deviant peer groups defined by severe CP and SU, and youth engagement in both CP and SU were related to the greatest risk for SUD in early adulthood.

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CHAPTER 1
INTRODUCTION

A wide range of outcomes is related to involvement with deviant peers (e.g., peers who engage in aggressive behaviors, skip school, steal, cheat, and/or use substances), including antisocial behavior (Dishion, Nelson, & Bullock, 2004; Eddy & Chamberlain, 2000; Gardner, Dishion, & Connell, 2008), alcohol use (Kokkevi, Richardson, Florescu, Kuzman, & Stergar, 2007), tobacco use (Dishion, McCord, & Poulin, 1999; Kokkevi et al., 2007), marijuana use (Dishion et al., 2004), hard drug use (Kokkevi et al., 2007), and violent and non-violent criminal offending (Gatti, Tremblay, Vitaro, & McDuff, 2005). Association with deviant peers (ADP) has been shown to confer particular risk for adolescent conduct problems (CP; Dishion, Capaldi, Spracklen, & Li, 1995; Lacourse et al., 2006; Patterson, 1993; van Lier, Wanner, & Vitaro, 2007) and substance use (SU; Kirisci, Tarter, Mezzich, & Vanyukov, 2007; Kokkevi et al., 2007; Li, Barrera, Hops, & Fisher, 2002; Marshal, Molina, & Pelham, 2003; Wiesner, Silbereisen, & Weichold, 2008). For example, ADP has been linked to increased risk for incarceration (Esbensen & Huizinga, 1993), as well as increased likelihood and frequency of physical aggression and violence (Lacourse, Nagin, Tremblay, Vitaro, & Claes, 2003). In addition, ADP at ages 13-14 accounted for 49% of the variance in SU by ages 15-16 (Dishion et al., 1995), suggesting strong associations between ADP and SU.

Given that ADP continually has been identified as one of the most proximal risk factors for CP and SU, understanding deviant peer group development is crucial for preventing or mitigating these sequelae of ADP. Clarification of the development of ADP and mechanisms through which ADP confers risk is critical for the formulation of theoretical accounts of the developmental pathways followed by antisocial and substance-

using youth, as well as for the development of effective prevention and intervention strategies (Kazdin, 1995). Nevertheless, there remains a paucity of research examining processes that underlie relations among ADP, CP, and SU. To address this and other gaps in the literature, the present study examined two processes through which relations among ADP, CP, and SU likely develop, namely, selection and socialization (Kandel, 1978).

Selection and Socialization Processes

Theory and empirical literature suggest that relations among ADP with CP and ADP with SU result from at least two processes, selection and socialization (Aseltine, 1995; Bauman & Fisher, 1986; Coggans & McKellar, 1994; Ennett & Bauman, 1994; Kandel, 1978; Rowe, Woulbroun, & Gulley, 1994). Selection refers to the process through which youth select peer groups based on similarities in behavior, including CP and SU. Indeed, most youth select into peer groups based on behavioral homophily (i.e., the tendency to seek out and affiliate with peers most like themselves; Dishion, Patterson, Stoolmiller, & Skinner, 1991; Kandel, 1978, 1996; Kandel, Davies, & Baydar, 1990) and levels of CP and SU represent key similarities on which youth select friends (Dishion et al., 1991). Thus, in the selection model, prediction from ADP to subsequent CP and/or SU reflects continuity or worsening of prior youth CP and SU across adolescence, as opposed to the influence of deviant peers.

In contrast to selection, socialization refers to the influence of deviant peers on youth that leads to increases or maintenance of high levels of CP and/or SU (Asteline, 1995; Kandel, 1987). Patterson, DeBaryshe, and Ramsey's (1989) social learning model suggests that interactions with deviant peers and reinforcement of deviant behaviors lead

to risk for engaging in chronic delinquent behavior, including CP and SU. Dishion, Spracklen, Andrews, and Patterson (1996) further posited that "deviancy training" (i.e., the patterns of reinforcement that exist within deviant peer groups that serve to expand, maintain, and escalate antisocial behaviors; e.g., discussion, endorsement) may be one of the processes through which ADP leads to chronic delinquent behavior, CP, and SU. Thus, the socialization hypothesis suggests that relations among ADP, CP, and SU are a result of peer influence on youth, rather than selecting similarly behaving peers.

Some models of ADP suggest that selection wholly accounts for relations between deviant peer group affiliation and (a) CP and (b) SU (Farrell, 1994; Farrell & Danish, 1993; Fergusson, Woodward, & Horwood, 1999; Wiesner et al., 2008). A small empirical literature suggests that relations between ADP and CP, as well as between ADP and SU, exist largely because youth who are at risk for or exhibiting CP and SU choose to join deviant peer groups (Farrell, 1994; Farrell & Danish, 1993; Fergusson et al., 1999; Wiesner et al., 2008). For example, Fergusson and colleagues (1999) reported that the relation between ADP and early CP was significantly attenuated when controlling for pre-existing CP of the target youth. In addition, among middle school and high school-aged youth, target youth's SU predicts later peer SU, suggesting youth seek out peer groups that exhibit similar SU behavior (Farrell, 1994; Farrell & Danish, 1993; Wiesner et al., 2008). However, peer SU did not predict later target youth SU, indicating that the influence of these peers did not lead to changes in target youth SU (Farrell, 1994; Farrell & Danish, 1993; Wiesner et al., 2008).

Other models of ADP suggest socialization alone underlies the relations among deviant peer group affiliation, CP, and SU (Thornberry, Krohn, Lizotte, & Chard-

Wierschem, 1993; Wills & Cleary, 1999). Empirical support for socialization is evidenced in the deviancy training literature, which includes observational studies evaluating the effects of deviant talk among groups of adolescents (Dishion, Eddy, Hass, Li, & Spracklen, 1997). Evidence of iatrogenic effects of group intervention for CP studies provides further support for the socialization process (Dishion & Andrews, 1995; Poulin, Dishion, & Burraston, 2001), as do some longitudinal studies simultaneously examining selection and socialization (Dishion & Medici, 2000; Thornbery et al., 1993; Wills & Cleary, 1999). However, the large literature supporting socialization processes suggests that models of ADP cannot focus on selection only. Similarly, models involving only socialization processes cannot explain the empirical support for selection.

A third class of models of ADP points to the importance of both processes in the development of CP and SU during adolescence and suggests that selection and socialization are not mutually exclusive (e.g., Asteline, 1995; Dodge, Greenberg, Malone, & Conduct Problems Prevention Research Group, 2008; Kandel, 1978; Mercken, Candel, Williems, & de Vries, 2009; Patterson & Yoerger, 1997). Two-process models involving both selection and socialization suggest risk for CP and SU occurs as a result of youths' (a) seeking out similarly deviant peers and (b) being influenced by peers to become increasingly deviant once involved in this peer group. Kandel (1978) was among the first to argue that peer influence on CP and SU may have been overestimated because selection effects were not considered, and that to clarify associations among deviant peer group involvement, CP, and SU, models involving both selection and socialization are required. Indeed, Asteline (1995) found that socialization effects may be overestimated

by 60% if selection effects are not considered simultaneously. However, few investigations have examined both processes concurrently.

A small empirical literature supports this two-process, dynamic model of ADP (Dishion & Owen, 2002; Mercken et al., 2009) under which youth are viewed as both shaping and being shaped by their peer environment. For example, results from a large-scale, longitudinal study suggest that both selection and socialization underlie relations between ADP and CP (Dodge et al., 2008). In addition, Fergusson et al. reported that controlling for prior levels of CP and SU attenuates relations among ADP and subsequent CP and SU (Fergusson, Swain-Campbell, & Horwood, 2002). This pattern of relations suggests that prior levels of youth CP and SU account for part of the increase in CP and SU associated with deviant peer group involvement, but that influence by deviant peers also contributes to increases in CP and SU beyond initial levels of youth deviant behavior. Taken together, the extant empirical literature supports the importance of both socialization and selection processes in relations among ADP, CP, and SU and indicates that investigations of this social transactional perspective are necessary for clarifying the role of ADP in etiological models of CP and SU.

The present investigation is grounded in theories that combine these literatures and advocate a social transactional perspective that integrates selection and socialization processes (e.g., Dishion et al, 1996; Patterson & Yoerger, 1997). Before describing the gaps in the ADP literature addressed in the present study, methodological issues that likely obfuscate relations among ADP, CP, and SU and the roles of selection and socialization processes are considered.

Conceptualization and Measurement Issues

Deviant Peer Behavior and ADP

Inconsistent conceptualization and measurement of deviant peer behavior, ADP, CP, and SU plague the literature; consequently, discrepancies in defining deviant peer behavior muddy the understanding of relations among ADP, CP, and SU, including selection and socialization processes. Although most measures of peer deviant behaviors include peer SU and CP (Fergusson & Horwood, 1999), deviant behavior ranges from illegal acts such as selling drugs (Kirisci et al., 2007) to less severe forms of CP such as fighting (Dishion et al., 2002), as well as from use of tobacco products to use of hard drugs. A related measurement issue involves how items regarding engagement in these disparate SU and CP behaviors are considered. The number of CP and SU behaviors (as opposed to frequency or severity) is typically summed or averaged to reflect total deviant peer behaviors (Dishion, Bullock, & Granic, 2002; Gardner et al., 2008; Kirisci et al., 2007). However, this practice has the potential to mask possible differences in type, severity, and frequency of behaviors evidenced by deviant peer groups.

These methodological and measurement issues thus limit current understanding of not only selection and socialization processes, but also developmental pathways and patterns of CP and SU. Youth may select friends based largely on similar type of deviant behavior (CP and/or SU), and then experience socialization to engage in the behavior(s) more frequently. In contrast, youth may select friends based on severity of deviant behavior and then experience socialization to engage in increasingly severe and/or new forms of these behaviors. Thus, summing methods for indexing ADP may hinder

understanding of underlying processes, as well as pathways leading to co-occurring CP and SU among deviant peers and index youth.

Given high rates of co-occurrence between disruptive behavior disorders (i.e., oppositional defiant disorder, attention-deficit/hyperactivity disorder, and in particular, conduct disorder) and SU among adolescents (Angold, Costello, & Erkanli, 1999; Armstrong & Costello, 2002; Moss & Lynch, 2001; Robins & McEvoy, 1990), most deviant peer groups likely engage in some CP and SU behaviors. Indeed, even controlling for confounding factors related to alcohol use and crime (e.g., early onset conduct problems, family socioeconomic status, parental history of SU), increases in alcohol abuse predict increases in delinquent behaviors (Fergusson & Horwood, 2000). However, there are important variations in patterns of CP and SU across adolescent development (Moss & Lynch, 2001; Odgers et al., 2008; Patterson, 1993). Youth exhibiting CP early in adolescence are at risk for being exposed to illicit substances (Odgers et al., 2008) and engaging in SU (Moffitt, Caspi, Harrington, & Milne, 2002; Silberg, Rutter, D'Onofrio, & Eaves, 2003). However, 50% of youth who do not exhibit CP in early adolescence also are at risk for early exposure to illicit substance use and for subsequent substance dependence (Odgers et al., 2008). In sum, multiple pathways lead to co-occurring CP and SU in late adolescence, with one pathway marked by early onset CP and another without early onset CP.

These different developmental patterns of CP and SU suggest that there are likely multiple pathways to selection of substance-using peers. Some youth who exhibit higher levels of CP in early adolescence may select similarly behaving peers in terms of CP and then subsequently be influenced by these peers to engage in SU. In contrast, some youth

with low levels of early CP may select friends exhibiting similar SU behavior (e.g., experimentation in mid-adolescence or more impairing, atypical levels of SU) and subsequently be socialized to engage in CP. Thus, although SU and CP frequently co-occur, potential group differences exist in terms of onset, severity, and stability of peer CP and SU behaviors. As such, simply summing the number of peer SU and CP behaviors in defining deviant peer behavior likely prevents clear understanding of how deviant peer groups differ and how they develop across adolescence. This practice also inhibits delineation of pathways to co-occurring SU and CP among the index youth. Understanding of selection and socialization processes related to ADP requires more nuanced indicators of ADP that afford identification of potential subgroups of ADP based on type and severity of deviant peer behavior, as well as consideration of developmental patterns of co-occurring CP and SU among index youth and deviant peers.

Index Youth CP and SU

Consistent with the discussion regarding ADP and deviant peer behaviors above, clarification of the constructs of youth CP and SU is important for informing models of ADP, as well as selection and socialization processes. Generally, measures of CP reflect symptoms of oppositional defiant disorder (ODD), which involves a pattern of negativistic, hostile, and defiant behavior toward adults (American Psychiatric Association, 2000), and conduct disorder (CD), characterized by a pattern of behaviors including aggression, property destruction, deceitfulness or theft, and serious rule violations (APA, 2000). Validity of combining ODD and CD symptoms into one construct is supported by the high rates of comorbidity between and developmental staging of ODD and CD (Biederman, Newcorn, & Spirich, 1991; Maughan, Rowe,

Messer, Goodman, & Meltzer, 2004). Measures of youth SU typically used in the literature reflect frequency of use of a given substance (e.g., Li et al., 2002; Steinberg, Fletcher, & Darling, 1994; Weisner et al., 2008), rather than diagnostic categories of substance abuse and/or substance dependence. Such dimensional measures of CP and SU are necessary when considering selection and socialization, given that dimensional measures yield greater variability and thus are more useful for examining behavioral similarities on which youth choose friends, and to evaluate changes in SU and CP. However, few studies consider co-occurrence of SU and CP among youth as it relates to involvement with deviant peers. Such lack of consideration of co-occurring CP and SU among index youth complicates current understanding of developmental patterns of CP and SU and the roles of selection and socialization. In addition to these methodological limitations of the ADP literature, there is a dearth of empirical work examining developmental differences in selection and socialization processes, a gap in the literature that I consider in the next section.

Developmental Timing of Selection and Socialization Processes

The extant empirical literature suggests that selection and socialization processes occur during different periods of adolescence. Specifically, selection of deviant friends is likely a central process underlying relations among ADP, CP, and SU in early, compared to later, adolescence. Such timing is in part a result from typical changes during early adolescence. Young, pre-pubertal adolescents begin to experience lower levels of parental monitoring and supervision (Laird et al., 2003; Pettit et al., 2007), increases in risk-taking and sensation-seeking behaviors (Steinberg, 2008; Steinberg et al., 2008), and greater interest in and need for approval from peers (Brown, 2004). With increased

freedom to befriend peers who engage in risk-taking and sensation-seeking behaviors, youth are particularly susceptible to choosing similarly risky friends, and thus are at risk for the selection process. Nevertheless, because this early to mid-adolescent period is marked by high levels of susceptibility to peer influence (Steinberg & Monahan, 2007) and need for peer approval (Brown, 2004), socialization also is expected to play a role in relations among ADP, CP, and SU in these periods of adolescence.

Once deviant friends are selected in early and/or mid-adolescence, socialization likely becomes a more proximal risk process for CP and SU during late adolescence (Monahan et al., 2009). Typical post-pubertal, late adolescent youth are nearing adult levels of self-regulation and exhibit lower levels of risk taking, sensation seeking, and susceptibility to peer influence than younger adolescents. Selection processes likely decrease during late adolescence given concomitant decreases in the importance of peers and in risk taking (Brown, 2004; Steinberg, 2008; Steinberg & Morris, 2001). In short, typical youth become less likely to seek risk-taking friends. However, youth in late adolescence who have previously selected deviant peers are likely to continue to be susceptible to reinforcement for deviant behavior by their peers.

Consistent with this possibility, recent examination of this two-process model indicates differences in developmental timing of selection and socialization, with selection and socialization occurring in early to mid-adolescence and socialization largely accounting for relations among ADP, CP, and SU in late adolescence (Mercken et al., 2009; Monahan et al., 2009). By examining selection and socialization across early to mid-adolescence, the present study sought to extend this small literature. A dearth of literature also exists in a related area, specifically, in examination of the role of ADP

onset and stability of ADP in identifying youth most at risk for CP and SU through adolescence and into early adulthood.

Onset and Stability of Associations with Deviant Peers Predict CP, SU, and SUD

A small literature supports differential relations from ADP to CP and from ADP to SU depending on onset (selection) and stability (continued socialization) of ADP (Dishion et al., 1996; Patterson et al., 1989). Youth exhibiting an earlier onset of ADP also exhibit higher levels of CP (Lacourse et al., 2003). Specifically, youth whose involvement with deviant peers begins by age 11 commit more violent acts than those whose involvement begins in mid-adolescence (i.e., ages 14-15) and youth exhibiting early or mid-adolescent onset of ADP exhibit higher levels of violence than adolescents who never associate with deviant peers (Lacourse et al., 2003). These findings suggest that age of onset of ADP may aid in distinguishing atypically (i.e., at-risk) and typically developing youth, as youth who select deviant peers during pre- and early adolescence (ages 10-13) may be at greatest risk.

In addition, a small literature suggests that the stability of involvement with deviant peers also relates to youth CP and SU. For example, Warr (1993) found that the longer and more recent the exposure to deviant friends, the greater the frequency of SU and delinquent behaviors. In terms of transitions, youth who remained in deviant peer groups over a two-year period (from ages 12-14) and youth who changed from nondelinquent to delinquent friends showed the highest levels of delinquent behavior one year later (Brendgen, Vitaro, & Bukowski, 2000). Dishion and Medici (2000) found that during periods of engagement with deviant peer groups, youth are likely to exhibit increases in SU, suggesting that continued ADP should predict continued SU. In sum,

continuity of ADP and moving into deviant peer groups are associated with increased risk for CP and SU, compared to youth who do not associate with deviant peers or change from ADP to nondeviant peer groups (Brendgen et al., 2000; Dishion & Medici, 2000; Warr, 1993). Risk associated with continued exposure to deviant peers highlights the role of the socialization process in relations among ADP, CP, and SU.

However, levels of ADP, CP, and SU among adolescents must be considered within the context of typical changes during this developmental period to most accurately identify at-risk youth. Indeed, given the normative inverted U-shaped trajectories of risk-taking behavior (Steinberg, 2008), some levels of ADP may be expected during typical adolescent development, just as some increase in CP and SU behaviors is typical during mid- to late adolescence (Moffitt, 1993). Nevertheless, high levels and early onset of CP and SU, as well as onset and stability of deviant peer involvement, may aid in distinguishing youth who are at risk for atypical levels of ADP, CP, and SU. Even more, investigations of the effects of ADP onset and stability on CP and SU across different stages of adolescence and into early adulthood would afford greater specificity in identifying adolescents at most risk for problematic outcomes.

Developmental patterns of ADP, CP, and SU predict long-term outcomes of SUD, with earlier onset of each being associated with poor outcomes (Lacourse et al., 2006; Moffitt, 1993; Tubman, Vicary, von Eye, & Lerner, 1990). Youth exhibiting early CP are at higher risk for substance abuse and dependence in early adulthood (Fergusson et al., 2006). In addition, early-onset drug use (13-15 years) is associated with worse adult prognosis than later-onset drug use (16-19 years; Tubman et al., 1990). In a study examining developmental trajectories from ages 10-12 until 22 years using the same

sample examined in the present project, trajectories characterized by high levels of ADP, CP, emotion dysregulation, and poor executive functioning were associated with the highest risk for SUD in early adulthood (Kirisci et al., 2007). These findings suggest that SUD in early adulthood may have distinct associations with ADP, CP, and SU across adolescence; moreover, identification of youth at highest risk for negative sequelae associated with ADP can be refined further by consideration of potential moderators of selection and socialization processes, described next.

Potential Moderators of Selection and Socialization Processes

Although there are transactional processes between adolescents and their contexts (e.g., Kazdin & Kagan, 1994; Patterson et al., 1989; Rutter & Sroufe, 2000; Sameroff, 2009), there is a dearth of research examining interactive effects of individual factors and deviant peer context in predicting adolescent CP and SU. Although a variety of individual and contextual factors likely affect selection and influence of deviant peers, self-regulatory constructs have proximal and empirically supported relations with ADP, CP, and SU, suggesting these child-specific factors may be moderators of deviant peer group selection and influence.

A small empirical literature suggests that youth reward dominance and self-regulation may moderate selection and socialization processes underlying relations among ADP, CP, and SU. In terms of selection, adolescents exhibiting reward dominance (greater sensitivity to rewards than punishments) and low effortful control (self-regulation) are more likely to select into deviant peer groups (Goodnight, Bates, Newman, Dodge, & Pettit, 2006; McGloin & Shermer, 2009). In addition, among the sample for this study, neurobehavioral disinhibition (which includes multiple measures of

self-regulatory processes) at ages 10-12 is associated with engagement in deviant peer groups at age 16 (Feske et al., 2008). Taken together, youth with early onset CP or SU, as well as atypically high levels of reward dominance and poor self-regulation, may be at increased risk for choosing deviant peer groups compared to their counterparts who exhibit only one or neither of these risk factors.

Reward dominance and self-regulatory factors also may interact with deviant peer context in the prediction of subsequent CP and SU behaviors (Fergusson, Vitaro, Wanner, & Brendgen, 2007; Gardner et al., 2008; Goodnight et al., 2006). Youth with low self-regulatory abilities and/or high reward dominant styles are more vulnerable to deviant peer influences, whereas youth with high self-regulatory skills and/or low reward dominant styles are more resistant to peer influence (Dishion & Patterson, 2006; Wills & Dishion, 2004). Consistent with these associations, after controlling for initial levels of CP (i.e., selection), the relation between ADP at age 14 and CP at age 16 was enhanced among youth exhibiting higher, compared to lower, levels of reward dominance (Goodnight et al., 2006). Similarly, in a prospective longitudinal study, Gardner and colleagues (2008) found a stronger relation between ADP at 17 years and CP at 19 years among adolescents with low (i.e., 1 *SD* below the sample mean) as opposed to typical (i.e., within 1 *SD* of the sample mean) self-regulation. Even more, ADP did not predict subsequent CP among youth exhibiting high self-regulation (i.e., 1 *SD* above the sample mean). Taken together, self-regulation factors likely moderate the socialization processes of deviant peer group affiliation. However, this small literature typically considers youth in mid- and late adolescence; thus, the effects of these moderators among younger adolescents, who differ in their levels of reward dominance and effortful control abilities

relative to older adolescents (Steinberg, 2008), are uncertain. In sum, by considering interactions among youth-specific factors (i.e., temperamental emotionality and neuropsychological functioning) and ADP in prediction of CP and SU across early to mid-adolescence, the present study aimed to elucidate selection and socialization processes associated with ADP.

Gaps in the Literature

As noted, although a large literature supports relations among deviant peer group involvement, CP, and SU, processes through which these relations occur remain unclear. Areas of deviant peer research that warrant further investigation include simultaneous consideration of selection and socialization, examination of these processes and ADP across adolescent development, consideration of the relations among ADP, CP, SU, and co-occurring CP and SU, and evaluation of the impact of individual × context interactions on selection and socialization. A lack of a "gold standard" measure of deviant peer group involvement further confounds this empirical base. For example, it is unclear if selection and socialization processes differ according to type (i.e., CP vs. SU) or severity (e.g., skipping school vs. selling drugs) of deviant peer behavior. Indeed, exploration of the conceptualization of deviant peer behavior is necessary for advancement and organization of this literature.

Empirical investigations of both selection and socialization could illuminate the deviant peer processes and inform prevention and intervention strategies. Although many studies have focused on the impact of deviant peer group involvement on subsequent CP and SU behaviors (e.g., Dishion et al., 1999, 2004; Gatti et al., 2005; Kokkevi et al., 2007), fewer empirical investigations have examined the process through which these

groups develop (see Lacourse et al., 2006, for a notable exception). Indeed, risk associated with deviant friends is initiated with the process of selecting such peers as friends. Through prospectively investigating the early stages of choosing deviant peers and subsequent socialization by these peers, multiple points of intervention could be identified.

Even more, the lack of research investigating ADP processes in the context of typical adolescent development limits understanding of risk associated with deviant peer group involvement. Given the normative increases in risk taking, reward dominance, CP, and SU, as well as poorer self-regulatory skills in early and mid adolescence (Steinberg, 2008), it is likely that some levels of engagement with deviant peers are also typical. However, to my knowledge, no studies have examined onset and continuity of "typical" engagement with peers who exhibit CP and SU. Indeed, youth at risk for atypical levels of CP and SU related to ADP may be those who engage in the selection process earlier in adolescence than typical youth and experience continual socialization of these behaviors across adolescence. In addition, youth may differ in risk for selection and socialization depending on their developmental stage. For example, selection of deviant peers may primarily occur in early to mid adolescence, whereas socialization likely continues into late adolescence (Monahan et al., 2009). Thus, at-risk and typically developing youth may differ in the timing and persistence of selection and socialization as well. Consideration of outcomes, such as SUD, in early adulthood may distinguish higher from lower risk pathways involving ADP, CP, and SU in adolescence. Last, a paucity of research has investigated moderators of selection and socialization, despite evidence that

child × context interactions predict increases in CP and SU (Gardner et al., 2008; Goodnight et al., 2006).

The Current Study

Prior research has illustrated that ADP plays an important, albeit complex, role in the development of CP, SU, and SUD. In the present study, I used a person-centered approach to identify groups of youth based on (a) peers' CP and SU behaviors (i.e., ADP groups) and (b) index youths' severity of CP and SU behaviors (i.e., CP/SU groups). I used latent class analysis to identify unobserved groups (i.e., classes; see Statistical Analyses section, below) of youth based on response patterns of ADP, CP, and SU items. I then examined longitudinal patterns of ADP and CP/SU groups across adolescence and relations among these ADP and CP/SU groups with SUD in early adulthood. Each of these analyses was conducted in an existing dataset of youth at varying risk for SUD. This dataset includes multiple, repeated, and developmentally relevant measures of ADP, CP, and SU at ages 10-12 (Time 1), 12-14 (Time 2), and 16 (Time 3). These data also included measures of temperament (i.e., temperamental emotionality) and neuropsychological functioning (i.e., planning, attentional, and inhibitory abilities) at Time 1, which were expected to moderate selection and socialization processes. Lastly, SUD status at age 22 (Time 4) was measured. Specific goals and hypotheses of the present study are outlined below.

Aim 1: Identification of ADP and Index Youth CP/SU Groups

The first aim of the current project was to identify groups of youth defined by type and levels of (a) ADP and (b) conduct problems and substance use (CP/SU) at three time points (ages 10-12, 12-14, and 16 years).

Hypothesis 1a: ADP Groups

At each of three time points across adolescence, a four-class model representing latent classes of deviant peer behavior based on type (i.e., CP and SU) and severity was expected to fit the data best (see Figure 1 for Time 1 model). Specifically, at Times 1, 2, and 3, groups of youth exhibiting (a) low proportion of friends engaging in both CP or SU behavior (Low ADP), (b) relatively higher proportion of friends engaging in predominantly CP behavior (ADP-CP), (c) relatively higher proportion of friends engaging in predominantly SU behavior (ADP-SU), and (d) high proportion of friends engaging in both CP and SU behaviors (ADP-Combined, ADP-C) were expected. Although these groups were expected to emerge at each time point, the proportion of youth in each of these subgroups was expected to change over time. For example, given typical developmental changes across adolescence, including increases in CP and SU (Moffitt, 1993) and decreases in parental supervision (Laird et al., 1998), the proportion of youth in the Low ADP group was hypothesized to decrease from Time 1 to Time 2 and from Time 2 to Time 3. In addition, the proportion of youth in the ADP-CP, ADP-SU, and ADP-C groups was expected to increase from Time 1 to Time 2, consistent with previous research indicating that youth ADP (Warr, 1993) and SU (Bachman et al., 2008) increase across early to mid-adolescence. Moreover, rates of lifetime substance use nearly double between eighth grade and the end of high school (Johnston et al. 2007) and increases in alcohol abuse during these developmental periods predict increases in delinquent behaviors (Fergusson & Horwood, 2000). Taken together, these findings suggest that rates of co-occurring CP and SU likely continue to increase across

adolescence. Thus, it was expected that the proportion of youth in the ADP-C group would continue to increase from Time 2 to Time 3.

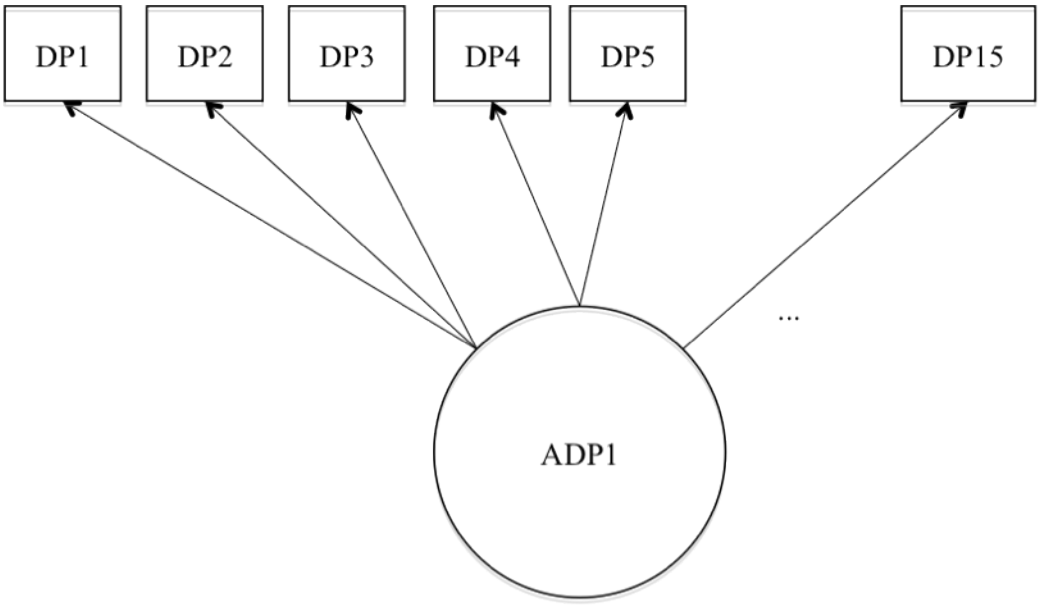

Figure 1

Latent Class Model of Association with Deviant Peers At Time 1 (ages 10-12)

Note. DP = Observed dichotomous deviant peer behavior items, ADP = Latent association with deviant peers variable at Time 1 indicating type and severity of peer deviant behavior.

Hypothesis 1b: Index Youth CP/SU Groups

Similar to hypotheses of ADP groups, at each of the three time points across adolescence, a four-class model representing latent classes of index youth based on type (i.e., CP and SU) and severity was expected to fit the data best (see Figure 2 for Time 1 model). Specifically, four groups characterized by (a) low levels of both CP and SU (Low CP/SU), (b) higher levels of CP and relatively lower levels of SU (CP), (c) relatively

lower levels of CP and higher levels of SU (SU), and (d) high levels of both CP and SU (CP+SU) were expected to emerge at Times 1, 2, and 3. Although I expected to identify these four groups at ages 10-12, 12-14, and 16, proportions of youth in each class were hypothesized to shift in a similar manner as the ADP groups. Specifically, the number of youth in the Low CP/SU class was expected to decrease from Time 1 to Time 2 and from Time 2 to Time 3, given the aforementioned typical increases in CP and SU behaviors across adolescence.

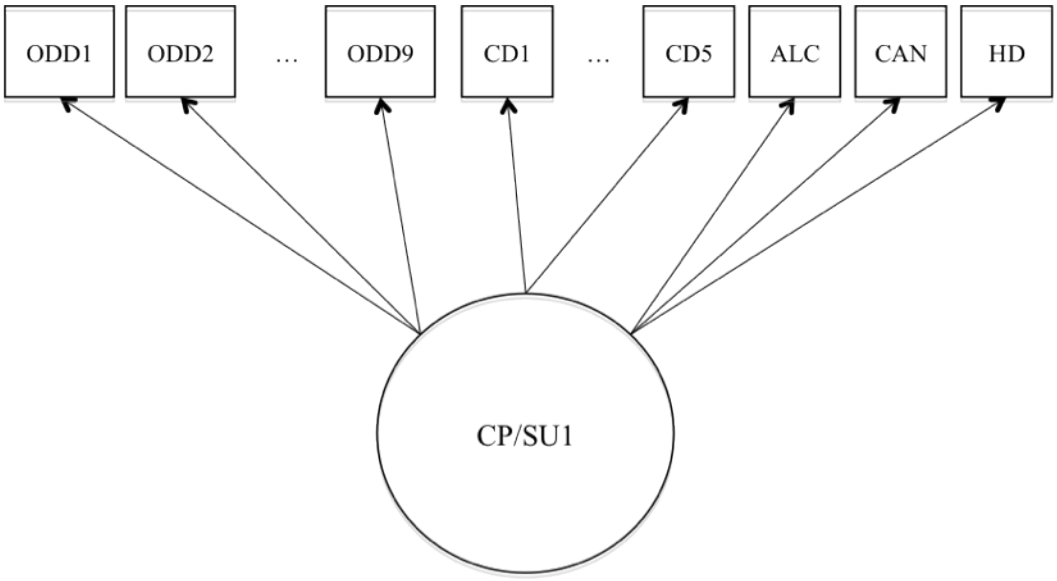

Figure 2

Latent Class Model of Index Youth Conduct Problems and Substance Use At Time 1 (ages 10-12)

Note. ODD = Observed dichotomous Oppositional Defiant Disorder symptom, CD = Observed dichotomous Conduct Disorder symptom, ALC = Observed dichotomous alcohol use item, CAN = Observed dichotomous cannabis use item, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1.

In concert with this decrease in size of the Low CP/SU group, increases in the number of youth classified in the SU, CP, and CP+SU groups were expected from Time 1 to Time 2. Consistent with previously reviewed literature (Fergusson & Horwood, 2000; Moffitt, Caspi, Harrington, & Milne, 2002; Silberg, Rutter, D'Onofrio, & Eaves, 2003), the proportion of youth exhibiting co-occurring CP and SU behaviors (i.e., CP+SU class) was hypothesized to continue to increase from Time 2 to Time 3.

Aim 2: Stability of ADP and CP/SU Groups

Following identification of classes of youths' ADP and CP/SU, the second aim was to examine stability of (a) ADP group membership and (b) CP/SU group membership among youth across the three time points (i.e., ages 10-12, 12-14, and 16 years).

Hypothesis 2a: Stability of ADP Groups

In terms of stability of ADP group membership, I expected some developmental patterns to be rather stable, whereas others were likely to be characterized by a shift in group membership, with youth moving out of Low ADP groups to those defined by some involvement with deviant peers (see Figure 3). Specifically, given recent empirical investigations of ADP trajectories (Lacourse et al., 2003), a large proportion of youth were expected to remain in the Low ADP group across ages 10-12, 12-14, and 16. Similarly, youth in the ADP-C group at age 10-12 were expected to remain in this group at ages 12-14 and 16, as a similar trajectory of persistent high ADP has been reported (Lacourse et al., 2003). In contrast to this stability, given that deviant peers exhibiting either primarily CP or primarily SU behaviors are at risk for co-occurring CP and SU (Moffitt et al., 2002; Silberg et al., 2008), I also expected some youth in the ADP-CP and

ADP-SU groups at Times 1 and 2 to transition to the ADP-C group during early (i.e., ages 12-14 or Time 2) and mid-adolescence (i.e., ages 14-16 or Time 3), respectively (Bachman et al., 2008; Johnston et al. 2007; Moffitt, 1993).

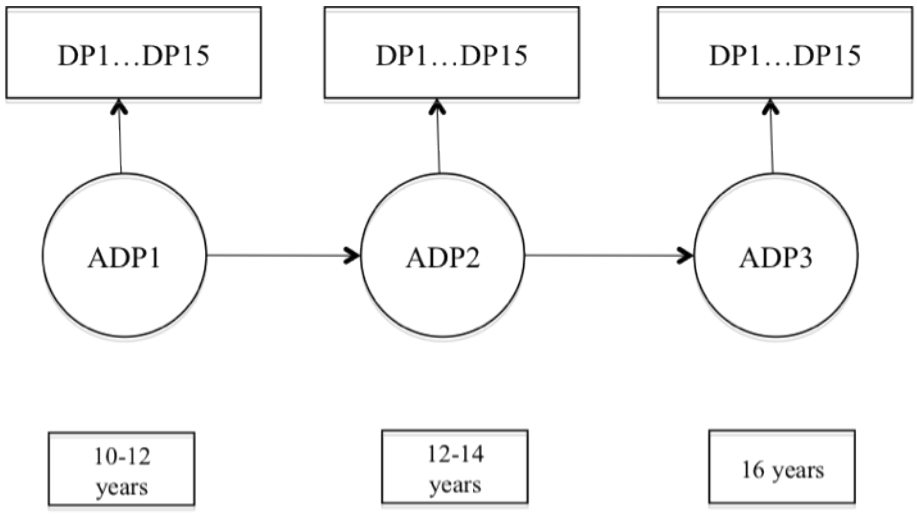

Figure 3

Latent Transition Model of Association with Deviant Peers (ADP): Patterns of Latent ADP Class Membership Across Times 1, 2, and 3

Note. DP = Observed dichotomous deviant peer behavior items, ADP 1= Latent association with deviant peers variable indicating type and severity of peer deviant behavior at Time 1.

In addition, I hypothesized that some adolescents in the Low ADP group would transition to the ADP-SU, ADP-CP, or ADP-C groups between Times 2 and 3, given typical increases in ADP across adolescence (Lacourse et al., 2003).

Hypothesis 2b: Stability of Index Youth CP/SU Groups

In terms of stability of CP/SU group membership, I expected different developmental patterns (see Figure 4). First, given that significantly elevated levels of CP and SU behaviors are atypical (Moffitt, 1993), I hypothesized that a group of youth would remain in the Low CP/SU group across ages 10-12, 12-14, and 16. Similarly, youth in the CP+SU group at ages 10-12 were expected to remain in that group across ages 12-14 and 16, given that early onset CP and SU confer risk for continued and oftentimes worsening CP and SU (Moffitt et al., 2002; Silberg et al., 2003). I also expected some developmental transitions among CP and SU groups. Specifically, I hypothesized that some youth in the SU or CP groups would transition to the CP+SU group from Time 1 to Time 2 and from Time 2 to Time 3 (Fergusson & Horwood, 2000; Moffitt et al., 2002; Silberg et al., 2003). Lastly, given typical increases in CP and SU across adolescence (Moffitt, 1993), some youth in the Low CP/SU group were expected to transition to the CP, SU, or CP+SU groups from Time 1 to Time 2 and from Time 2 to Time 3. As previously noted, the proportion of youth engaging in SU and/or CP behavior increases in mid-adolescence (i.e., Time 3) (Bachman et al., 2008; Johnston et al., 2007; Moffitt, 1993). Thus, a larger proportion of youth were hypothesized to transition out of the Low CP/SU group from Time 2 to Time 3 compared to Time 1 to Time 2.

Aim 3: Selection and Socialization Processes

The third aim was to examine selection and socialization processes using previously enumerated groups of youth ADP and CP/SU through prospective prediction from (a) CP/SU group membership to ADP group membership (i.e., selection into ADP groups), as well as from (b) ADP group membership to CP/SU group membership (i.e.,

socialization within ADP groups) among youth across the three time points (ages 10-12, 12-14, and 16 years).

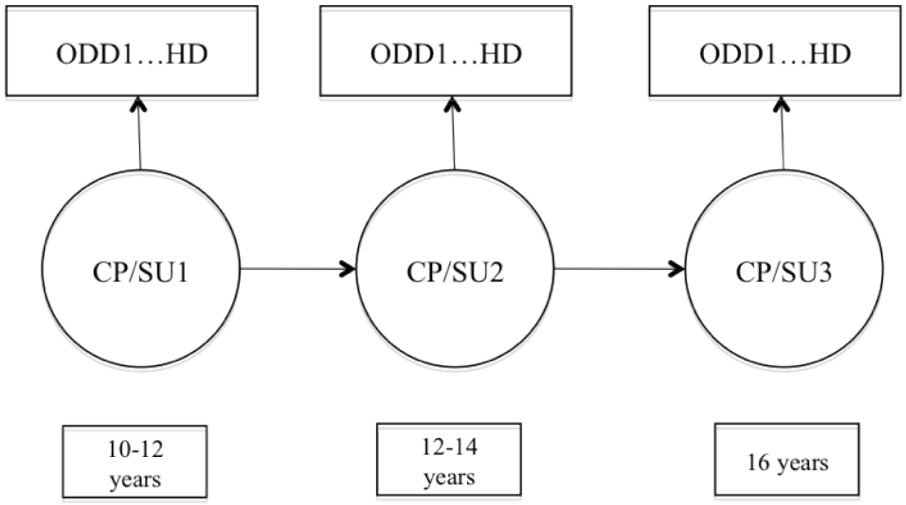

Figure 4

Latent Transition Model of Index Youth Conduct Problems and Substance Use (CP/SU): Patterns of Latent CP/SU Class Membership Across Times 1, 2, and 3

Note. ODD = Observed dichotomous Oppositional Defiant Disorder symptom, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1.

Hypothesis 3a: Selection

Significant prospective prediction from youth CP/SU groups to subsequent ADP group membership was expected (see Figure 5), given the increased importance of peers and peer approval from early to mid-adolescence (Brown, 2004). Moreover, I expected that behavioral homophily, or similarity in type of behavior (i.e., CP vs. SU), would affect subsequent ADP group membership. Specifically, the following prospective relations were hypothesized: Low CP/SU group membership would predict Low ADP

group membership, SU group membership would predict ADP-SU group membership, CP group membership would predict ADP-CP group membership, and CP+SU group membership would predict ADP-C group membership (see Table 1). Similar patterns of selection processes were expected from Time 1 to Time 2 and from Time 2 to Time 3.

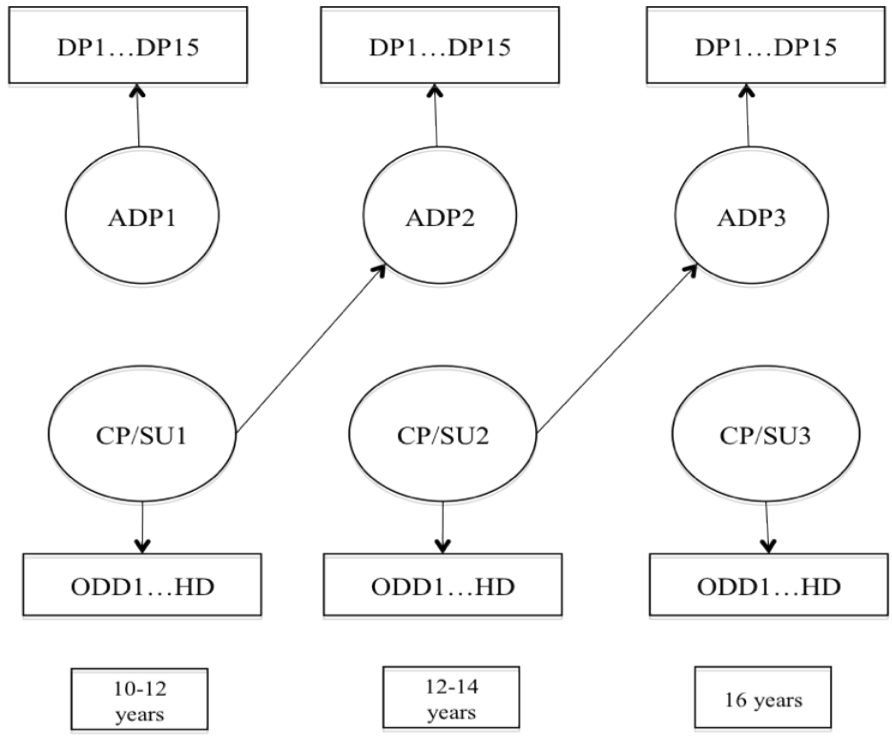

Figure 5

Conceptual Model of Selection Process Across Times 1, 2, and 3

Note. DP = Observed dichotomous deviant peer behavior items, ADP 1= Latent association with deviant peers variable indicating type and severity of peer deviant behavior at Time 1, ODD = Observed dichotomous Oppositional Defiant Disorder symptom, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1.

Table 1.
Hypothesized Selection Process Relations

Index Youth CP/SU Class		**Predicted ADP Class**	
Time 1	Time 2	Time 2	Time 3
(Ages 10-12)	*(Ages 12-14)*	*(Ages 12-14)*	*(Age 16)*
CP+SU		*ADP-C*	
CP		*ADP-CP*	
SU		*ADP-SU*	
Low CP/SU		*Low ADP*	
	CP+SU		*ADP-C*
	CP		*ADP-CP*
	SU		*ADP-SU*
	Low CP/SU		*Low ADP*

Note. CP/SU = Latent class indexed by observed dichotomous conduct problem and substance use items, CP+SU = latent class of index youth exhibiting high levels of both CP and SU, CP = latent class of index youth exhibiting relatively higher levels of CP and relatively lower levels of SU, SU = latent class of index youth exhibiting relatively higher levels of SU and relatively lower levels of CP, Low CP/SU = latent class of index youth exhibiting low levels of both CP and SU, ADP Class = Latent class indexed by observed dichotomous peer deviant behavior items, ADP-C = latent class of association with deviant peers exhibiting both CP and SU, ADP-CP = latent class of association with deviant peers exhibiting predominantly CP, ADP-SU = latent class of association with deviant peers exhibiting predominantly SU, Low ADP = latent class of association with deviant peers exhibiting low levels of deviant behavior

Hypothesis 3b: Socialization

I hypothesized that youth would be influenced and reinforced for CP and/or SU behaviors that deviant peers also exhibit and likely endorse (see Figure 6; Dishion et al., 1995, 1997). Thus, I expected the following prospective relations among youth: Low ADP would predict Low CP/SU, ADP-CP would predict CP, ADP-SU would predict SU, and ADP-C would predict CP+SU (see Table 2). Given normative increases in susceptibility to peer influence during early and mid-adolescence (Fergusson et al., 2002; Steinberg & Monahan, 2007), evidence of socialization was expected from Time 1 to Time 2 and from Time 2 to Time 3.

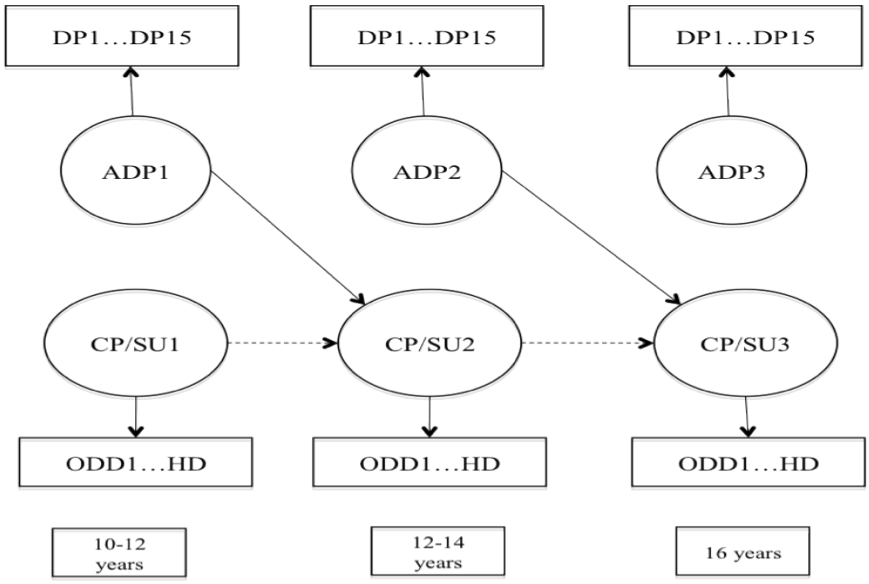

Figure 6

Conceptual Model of Socialization Process Across Times 1, 2, and 3

Note. DP = Observed dichotomous deviant peer behavior items, ADP 1= Latent association with deviant peers variable indicating type and severity of peer deviant behavior at Time 1, ODD = Observed dichotomous Oppositional Defiant Disorder symptom, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1. Dashed lines indicate controlling for continuation of CP/SU class membership. Solid lines indicate socialization process.

Table 2.
Hypothesized Socialization Process Relations

ADP Class		**Predicted Index Youth CP/SU Class**	
Time 1	Time 2	Time 2	Time 3
(Ages 10-12)	*(Ages 12-14)*	*(Ages 12-14)*	*(Age 16)*
ADP-C		*CP+SU*	
ADP-CP		*CP*	
ADP-SU		*SU*	
Low ADP		*Low CP/SU*	
	ADP-C		*CP+SU*
	ADP-CP		*CP*
	ADP-SU		*SU*
	Low ADP		*Low CP/SU*

Note. CP/SU Class = Latent class indexed by observed dichotomous conduct problem and substance use items, CP+SU = latent class of index youth exhibiting high levels of both CP and SU, CP = latent class of index youth exhibiting relatively higher levels of CP and relatively lower levels of SU, SU = latent class of index youth exhibiting relatively higher levels of SU and relatively lower levels of CP, Low CP/SU = latent class of index youth exhibiting low levels of both CP and SU, ADP Class = Latent class indexed by observed dichotomous peer deviant behavior items, ADP-C = latent class of association with deviant peers exhibiting both CP and SU, ADP-CP = latent class of association with deviant peers exhibiting predominantly CP, ADP-SU = latent class of association with deviant peers exhibiting predominantly SU, Low ADP = latent class of association with deviant peers exhibiting low levels of deviant behavior

Aim 4: Child-Specific Factors as Moderators of Selection and Socialization

The fourth aim was to evaluate moderating effects of neuropsychological and temperamental (i.e., emotionality) factors on both selection into ADP groups and susceptibility to influence of deviant peers (i.e., socialization effects).

Hypothesis 4a: Moderation of Selection

Consistent with previous research (Feske et al., 2008; Goodnight et al., 2006; McGloin & Shermer, 2009), I hypothesized that neuropsychological functioning and temperamental emotionality at Time 1 (ages 10-12) would moderate prospective relations from CP/SU group membership at Time 1 and Time 2 (ages 12-14) to ADP group membership at Time 2 and Time 3 (age 16), respectively (see Figure 7). Specifically, I expected that youth in CP, SU, or CP+SU groups who also exhibit negative temperamental emotionality or poor neuropsychological functioning would be at increased risk for subsequent membership in ADP-CP, ADP-SU, and ADP-C groups compared to youth with typical levels of temperamental emotionality and/or neuropsychological functioning. In contrast, youth exhibiting positive temperamental emotionality or age-appropriate neuropsychological functioning were expected to be buffered from risk for selecting deviant peers (i.e., ADP group membership) exhibiting CP and/or SU behaviors.

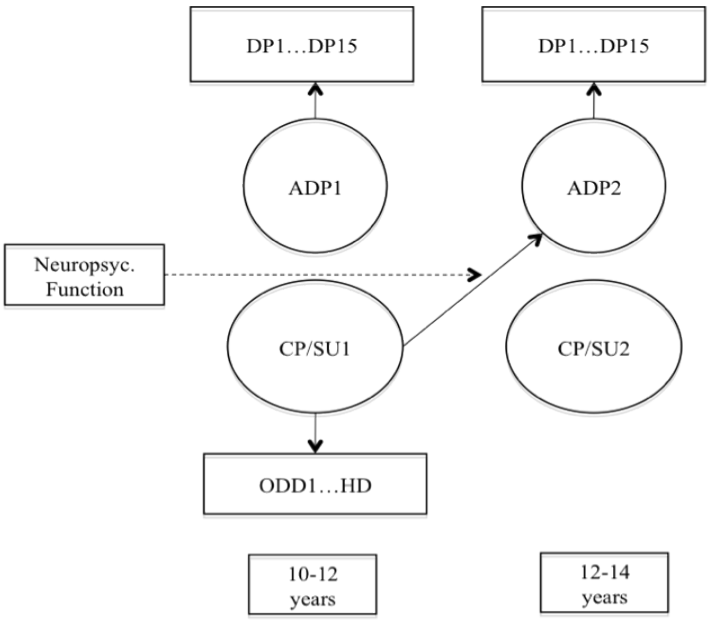

Figure 7

Latent Transition Model of the Moderating Role of Neuropsychological Functioning on Selection Process from Time 1 to Time 2

Note. DP = Observed dichotomous deviant peer behavior items, ADP 1= Latent association with deviant peers variable indicating type and severity of peer deviant behavior at Time 1, ODD = Observed dichotomous Oppositional Defiant Disorder symptom, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1, Neuropsyc. Function = Observed continuous neuropsychological functioning of index youth at Time 1.
Solid line indicates selection process.
Dashed line indicates moderating role of neuropsychological functioning on selection process.

Hypothesis 4b: Moderation of Socialization

Temperamental emotionality and neuropsychological functioning at ages 10-12 were expected to moderate the socialization process, or prospective prediction from ADP group at ages 10-12 and 12-14 to CP/SU group at ages 12-14 and 16, respectively (see Figure 8).

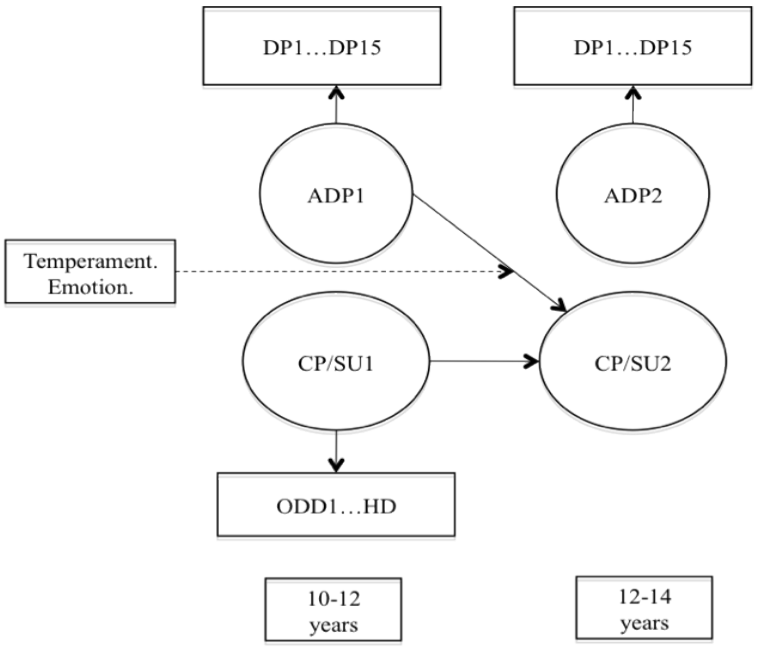

Figure 8

Latent Transition Model of the Moderating Role of Emotion Regulation on Socialization Process from Time 1 to Time 2

Note. DP = Observed dichotomous deviant peer behavior items, ADP 1= Latent association with deviant peers variable indicating type and severity of peer deviant behavior at Time 1, ODD = Observed dichotomous Oppositional Defiant Disorder symptom, HD = Observed dichotomous hard drug use, CP/SU1 = Latent variable describing type and severity of index youth conduct problems and substance use at Time 1, Temperament. Emotion.= Observed continuous temperamental emotionality of index youth at Time 1.
Solid lines indicates socialization process, controlling for continued CP/SU class membership.
Dashed line indicates moderating role of emotion regulation on socialization process.

Given that youth with low self-regulatory abilities are more vulnerable to deviant peer influences (Dishion & Patterson, 2006; Gardner et al., 2008; Goodnight et al., 2006; Wills & Dishion, 2004), I hypothesized that youth exhibiting negative temperamental emotionality and/or poor neuropsychological functioning at Time 1 would be more susceptible to deviant peer influence at Times 1 and 2. Thus, these youth were expected to exhibit greater continuity and/or exacerbation of CP and/or SU behaviors as indexed by CP/SU group membership at Times 2 and 3.

Aim 5: SUD Distal Outcome Associated with Adolescent Patterns of ADP and CP/SU

The fifth aim was to examine the prospective prediction from ADP and CP/SU group membership across adolescence to substance use disorder at age 22.

Hypothesis 5: Predicting SUD

Given that earlier onset of ADP, CP, and SU predict long-term outcomes of SUD (Fergusson et al., 2006; Kirisci et al., 2007; Lacourse et al., 2006; Moffitt, 1993; Tubman, Vicary, von Eye, & Lerner, 1990), I expected that early (i.e., ages 10-12), as well as more proximal (Time 3) membership in ADP-CP, ADP-SU, ADP-C, CP, SU, and/or CP+SU groups would predict SUD at age 22 (for example, see Figure 9).

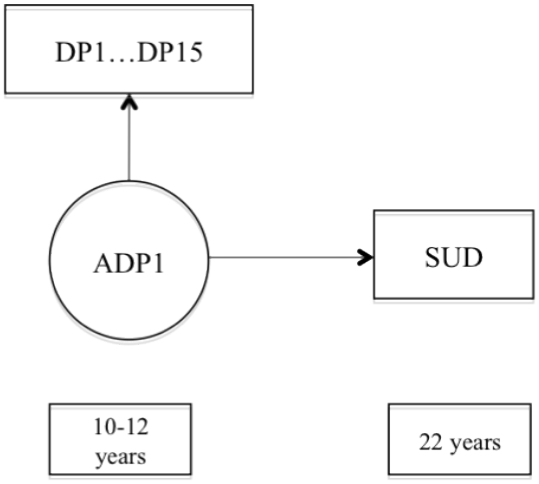

Figure 9

Model of Distal Outcome Related to ADP Latent Classes at Time 1

Note. DP = Observed dichotomous deviant peer behavior items, ADP1 = Latent association with deviant peers variable at Time 1 indicating type and severity of peer deviant behavior, SUD = observed dichotomous substance use disorder.

CHAPTER 2
METHOD

Participants

The present study involves secondary analyses of data collected for a National Institute on Drug Abuse (NIDA)-funded longitudinal study conducted at the Center for Education and Drug Abuse Research (CEDAR) at the University of Pittsburgh. Recruitment and baseline assessments began in 1990 when index children were aged 10-12 years (Time 1). Three of the follow-up assessments occurred when index children were 12-14 (Time 2), 16 (Time 3), and 22 (Time 4) years old. The primary objective of the CEDAR project was to use a prospective design to understand etiological pathways to substance use disorders. Sampling methods were designed to recruit youth at high and low risk for SUD on the basis of the presence or absence of a lifetime diagnosis of substance use disorder or other psychiatric disorders in the biological father. Biological fathers with and without histories of psychiatric diagnoses were recruited through substance dependence treatment programs and other venues. Fathers who had a child aged 10-12 years (index youth) were eligible to participate and were further screened for inclusion and exclusion criteria. Index youth were classified into one of three groups according to their biological father's lifetime prevalence of mental health disorders: (a) paternal history of substance use disorder (N =344, 44.4%), (b) paternal history of other psychiatric diagnosis not including substance use disorders (N =81, 10.5%), or (c) no lifetime paternal history of psychiatric diagnosis (N =350, 45.1%). Fathers were considered to have a substance use disorder if they met lifetime *DSM-III-R* criteria (APA, 1987), the most recent edition when the study was initiated, for any substance abuse or dependence. Index children were included in the present study if they completed

assessments at Time 1 (10-12 years old; *N*=775, 71% male) and at least one subsequent time point, namely, Time 2 (12-14 years old; *N*=649; 72% male), Time 3 (16 years old; *N*=613, 73% male), and/or Time 4 (22 years old; *N*=425, 71% male). The sample contains more males than females because recruitment of females began four years after CEDAR was underway. The sample is predominantly Caucasian (76%; 22% African American, 2% other ethnicities). Recruitment sources and procedures, as well as inclusion and exclusion criteria, are described in detail elsewhere (Clark et al., 1997).

Procedure

All procedures were approved by the Institutional Review Board of the University of Pittsburgh. The present project was determined to be exempt by the Temple University Institutional Review Board. In terms of informed consent, the goals, procedures, risks, and benefits of the research protocol were explained in detail to all adult participants. Of fathers meeting criteria to participate, 87% consented. All minor children provided assent. In addition, a Certificate of Confidentiality from NIDA was obtained. Adolescent ADP was measured via an interview with a research associate at Times 1, 2, and 3. Index youth and mothers reported on the index youth's ODD and CD symptoms via structured clinical interviews at Time 1. Index youth also reported on ODD and CD symptoms via structured clinical interviews at Times 2 and 3. Index youths' SU was measured via self-report at Times 1, 2, and 3, and index youths' SUD was measured via structured clinical interview with the index youth at Time 4. Youth neuropsychological functioning and temperamental emotionality were measured at Time 1 using laboratory measures and mother report, respectively. Each of these measures is presented in greater detail below.

Measures

Associations with Deviant Peers

At Times 1, 2, and 3, youth reported on the proportion of their friends who engaged in delinquent and antisocial behaviors over the previous six months (e.g., hit someone with the idea of hurting that person, used alcohol) using 15 items from the Peer Delinquency Scale (PDS) of the Pittsburgh Youth Study Interview (Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998). Items were rated on a scale from 0 (*none of my friends*) to 4 (*all of my friends*). However, of the 15 PDS items indexed at each Times 1, 2, and 3 (i.e., total of 45 ADP items across time), only four items had skewness coefficients below 1.0, whereas 32 items had skewness coefficients above 2.0. Because of the highly skewed distribution of most items on the PDS, all items were dichotomized such that endorsement of an item indicates that one or more peers engage in that particular deviant behavior. Peer deviant behavior items on the PDS included a combination of peer CP (12 items) and peer SU behaviors (3 items). Specifically, as shown in Table 3 (*N*'s vary due to missing data), peer CP was indexed by peer ODD and CD behaviors and peer SU was indexed by peer use of alcohol, marijuana, and/or hard drugs. Each PDS item was used as a class indicator for ADP class membership at each Times 1, 2, and 3 so that classes were allowed to vary in type and severity of deviant peer behavior. Among the current sample, higher overall scores (i.e., including both peer CP and SU behaviors) on the PDS are related to neurobehavioral disinhibition (which includes indices of CP, temperament, and neuropsychological functioning; Feske et al., 2008), as well as to increased risk for youth CP and SU (Moss et al., 2002, 2003).

Conduct Problems

At Times 1, 2, and 3, the *DSM-III-R* version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children--Epidemiologic Version (K-SADS-E; Puig-Antich, Orvaschel, Tabrixi, & Chamberg, 1981) was used to index symptoms of ODD (9 symptoms; e.g., often argues with adults) and CD (15 symptoms; e.g., often initiates physical fights). Both the mother of the index child and the index child completed the K-SADS-E at Time 1. Using the "or" rule, if either mother or index child endorsed a symptom, that symptom was considered present or positive.

Table 3.
Percentage of Deviant Peer Behavior Endorsed Across Ages 10-12, 12-14, and 16

	10-12 years (*N*=719-752)	12-14 years (*N*=617-643)	16 years (*N*=597-612)
Skip school	27.3	43.0	69.5
Lie, disobey, talk back	71.1	77.5	89.1
Purposefully damage or destroy property	26.0	33.7	41.0
Stole something worth less than $5	25.7	36.8	45.5
Stole something worth between $5 and $100	11.3	19.1	31.8
Stole something worth more than $100	3.2	8.0	14.5
Went or attempted to steal from building	9.8	13.0	17.1
Joyriding	5.0	10.5	21.4
Hit someone	42.1	41.5	46.3
Attacked someone with a weapon	6.5	8.2	14.9
Mugging with or without a weapon	3.2	4.7	8.7
Sold hard drugs	1.9	6.1	15.5
Used alcohol	9.4	29.4	72.9
Used marijuana or hashish	3.7	19.8	58.4
Used hard drugs	.9	4.2	14.6

At Times 2 and 3, only the index child reported on ODD and CD symptoms on the K-SADS-E. All symptoms are dichotomous. Eight of the CD symptoms were rarely endorsed, with fewer than 5% of the sample reportedly engaging in any one of these

behaviors across Times 1, 2, and 3 (see Table 4). These low base rate CD symptoms were omitted from further analyses. In total, nine ODD symptoms and five CD symptoms were used as indicators for CP/SU class membership at each Times 1, 2, and 3.

Table 4.
Percentage of Index Youth Endorsing Conduct Problems Across Ages 10-12, 12-14, and 16

	10-12 years (*N*=775)	12-14 years (*N*=649)	16 years (*N*=613)
Oppositional defiant disorder symptoms			
Often loses temper	32.8	16.6	14.2
Often argues with adults	23.0	12.8	13.4
Defies or refuses adult requests	16.8	6.5	6.9
Annoys others	19.7	11.4	7.7
Blames other for own mistakes	22.6	4.5	4.9
Touchy or easily annoyed	27.1	15.4	15.0
Angry and resentful	21.3	7.1	7.2
Spiteful or vindictive	16.0	9.2	8.5
Swears or uses obscene language	11.0	13.3	21.0
Conduct disorder symptoms			
Frequent truancy	4.1	9.7	27.1
Often lies	13.8	5.7	3.6
Vandalism	8.5	7.1	8.6
Conned others	15.2	12.3	16.5
Often initiates physical fights	7.0	3.4	4.4
*Run away from home (at least twice)	3.1	2.5	4.7
*Sets fires	2.5	.9	1.5
*Going into building to steal	1.9	1.5	3.1
*Has stolen while confronting a victim	.5	.6	.8
*Use of weapon to try to hurt someone	2.1	1.7	3.4
*Physically cruel to people	1.9	.5	1.0
*Physically cruel to animals	1.2	.5	1.1
*Has forced someone into sexual activity	0	0	0

* indicates low base rate conduct disorder symptoms dropped from further analyses.

Substance Use

At Times 1, 2, and 3, youth reported their SU using the substance use domain scores from the Drug Use Screening Inventory-Revised (DUSI-R; Tarter, Mezzich, Kirisci, & Kaczynski, 1994). This subscale includes frequency of use of 19 different drugs, which are collapsed into 9 categories: (1) alcohol, (2) cannabis, (3) ecstasy, (4)

hallucinogens (e.g., LSD), (5) opiates, (6) sedatives (e.g., heroin, methadone, prescription pain killer pills, barbiturates), (7) PCP, (8) inhalants (e.g., glue), and (9) stimulants (e.g., amphetamines, cocaine). Frequency was rated on a scale from *no use* to *daily use* for each of the 19 different drugs. From these data, 9 items reflecting the highest use for each drug category were used in the present study. However, use across Times 1, 2, and 3 was highly skewed, with skewness coefficients for most categories of drugs greater than 2. Only item distributions for alcohol use at Time 3 (skewness coefficient = .79) and cannabis use at Time 3 (skewness coefficient = 1.89) were not highly skewed. Given these distributions, all substance use items were dichotomized so that endorsement indicates use of that substance at least one time per year. Base rates for drugs other than alcohol and cannabis were extremely low (see Table 5). Use of ecstasy, hallucinogens, inhalants, opiates, PCP, sedatives, and stimulants were collapsed into one category, hard drug use, for Times 1, 2, and 3.

Table 5.
Percentage of Index Youth Endorsing Substance Use Across Ages 10-12, 12-14, and 16

	10-12 years (*N*=775)	12-14 years (*N*=652)	16 years (*N*=621)
Alcohol	4.0	12.0	35.7
Cannabis	.9	5.5	24.8
Hard Drugs	.9	1.3	6.2
*Ecstasy	0	.1	.6
*Hallucinogens	0	.3	2.3
*Opiates	0	.1	.9
*Sedatives	0	0	.3
*PCP	0	0	.1
*Inhalants	.8	.5	.9
*Stimulants	.1	.6	3.4

* indicates drugs collapsed into Hard Drugs category of substance use for all further analyses.

Thus, three dichotomous items reflecting self-reported alcohol, cannabis, and hard drug use were used as indicators of CP/SU class membership at each Times 1, 2, and 3. Among the present sample, higher ratings on the DUSI-R are associated with lower neuropsychological functioning (Aytaclar, Tarter, Kirisci, & Lu, 1999) and scores from the DUSI-R distinguish among those at risk for CP and SUD (Kirisci, Tarter, Mezzich, & Reynolds, 2008).

Substance Use Disorder

At Time 4, young adult substance use disorder status was assessed using an expanded version of the Structured Clinical Interview for *DSM-III-R* (SCID; Spitzer, Williams, & Gibbon, 1987), which included extensive detail in substance use behavior. A committee of a board-certified psychiatrist (chair), another psychiatrist or clinical psychologist, and the research associate who conducted the interview used the best-estimate procedure to derive diagnoses. Of the 775 participants, data on only 425 index youth were available at Time 4.

Temperamental Emotionality

Mothers reported on youth temperament using the Revised Dimensions of Temperament Survey (DOT-S; Windle, 1992) at Time 1. The Mood Quality subscale (7 items, $\alpha = .87$) from the DOT-S was used as an index of emotion regulation. Items were rated from 1 (*usually false)* to 4 (*usually true*) and included "laugh and smile at a lot of things" and "generally happy." Ratings were summed so that higher scores indicate higher levels of temperamental positive mood and lower scores indicate higher levels of negative mood. Consistent with previous research in the present sample (Kirisci & Blackson, 1996), the sum of DOT-S responses was used as an index of emotion

regulation. Scores on the DOT-S distinguish youth at high and low risk for substance abuse (Blackson, Tarter, Martin, & Moss, 1996; Windle, 1991), and adolescent substance abusers from normal controls among the current sample (Tarter & Mezzich, 1991). Ratings from the DOT-S also were associated with ADP among the present sample (Blackson & Tarter, 1994).

Neuropsychological Functioning

At Time 1, youth completed a battery of neuropsychological tests that were administered by trained master's-level clinical associates. Scores on these tests (described in greater detail, below) constitute a single first-order factor, executive cognitive functions (ECF) that discriminates youth at high and low risk for SUD and predicts SU between childhood and adolescence (Aytaclar et al., 1999); thus, I used the combined scores on these tests as an index of neuropsychological functioning. Higher scores correspond to higher levels of ECF. The specific tasks administered included the Stroop Color Word Test (Stroop, 1935), Porteus Mazes Test (Porteus, 1965), Vigilance Test (Schneider & Detweiler, 1987), Motor Restraint Test (Parsons, Tarter, & Edelberg, 1972), Forbidden Toys Test (Cole, Usher, & Cargo, 1993; Silverman & Ragusa, 1992), and Block Design Test of the WISC-III-R (Wechsler, 1972).

Using a computer interactive format for the Stroop Color Word Test, youth were required to label the colors of word stimuli while ignoring the word name (e.g., to say "blue" when the word "red" is printed in blue). The ability to suppress perceptual interference is an indicator of attentional control (Stroop, 1935). The Porteus Mazes Test (Porteus, 1965) is a commonly used test of planning ability, which requires youth to trace the paths of increasingly difficult mazes. On the Vigilance Test (Schneider & Detweiler,

1987), youth attended to rapidly changing computer displays of four single letters in a 2 × 2 matrix and were required to hit the space bar when 1 of 2 target letters appeared. Errors of commission to nontarget stimuli (i.e., responding when the child should inhibit prepotent responses) were used to index impulse errors. The Motor Restraint task (Parsons et al., 1972) involved youth's tracing the outline of a 180° arc as slowly as possible on a computer monitor using a light-pen. The index of performance for the Motor Restraint task is the total time taken to complete 5 trials. The Forbidden Toy task (Cole et al., 1993; Silverman & Ragusa, 1992) involved youth's performing a symbol-number matching task while being observed by two experimenters through a mirror. Mean scores of the two raters documenting the frequency of off-task distraction behaviors (interrater reliability correlation coefficient = .98) were used as an index of off-task behavior. Last, for the Block Design task (Wechsler, 1972), youth were administered a series of timed trials in which they were required to organize blocks into patterns that matched a design presented by the examiner.

Socioeconomic Status

Household socioeconomic status (SES) was indexed using Hollingshead ratings (Hollingshead, 1990). Given that SES is related to recruitment group status (i.e., paternal history of substance use diagnosis; Moss et al., 2002), risk for SU and SUD, and ADP among the proposed sample (Moss et al., 2003), SES was examined as a covariate of ADP and CP/SU class membership.

Paternal Axis I Psychiatric Diagnoses

Lifetime paternal psychiatric and substance use disorder diagnoses were made according to *DSM-III-R* criteria, the most recent version of the *DSM* at the time of

recruitment and initial data collection. Given that ADP, CP, SU, SUD, neuropsychological functioning, and temperament are each related to paternal psychiatry history among the current sample (Aytaclar et al., 1999; Moss et al., 2003), recruitment group was examined as a covariate of ADP and CP/SU class membership.

Statistical Analyses

Multiple Imputation

Consistent with most longitudinal data, the current dataset spanning ages 10-12 to 22 years was marked by missingness. Certain strategies for dealing with missingness (e.g., complete casewise analysis or listwise deletion, complete case analyses or pairwise deletion, nonresponse weighting, mean imputation) may lead to bias among the sample. Thus, rather than omitting participants with missing data from the analyses, I used multiple imputation to address missing data across Times 1, 2, and 3. Compared to youth for whom all data were available, youth for whom data were not available at one or more assessments at Times 1, 2, or 3 tended to be from lower SES backgrounds, $t(773) = 2.14$, $p = .03$, Cohen's $d = .15$; exhibit higher levels of CP at Time 3, $t(611) = 3.28$, $p = .001$, Cohen's $d = .27$; and have poorer neuropsychological functioning at Time 1, $t(751) = 2.08$, $p = .04$, Cohen's $d = .15$. Because of the high attrition rate at age 22 (data available on 54.8% of original sample), there was insufficient coverage to impute SUD outcome data at Time 4 (see Aim 5). However, using multiple imputation across Times 1, 2, and 3 allowed me to maximize the sample size and protect against bias in the analytic sample for Aims 1-4.

Multiple imputation (MI) is an analytic technique that fills in missing data by predicting missing values from all other available data (e.g., demographic factors, other

study variables). One benefit of MI over other types of imputation (e.g., single imputation) is that MI imputes *several* values for each missing value. Put another way, MI results in multiple complete datasets that vary in terms of the values of the imputed data. Results are then averaged across datasets to obtain final estimates of effects (Rubin, 1987; Schafer, 1997). This approach allows for variability resulting from both sampling error and model uncertainty. Thus, MI is beneficial for the current analyses because it (a) accommodates many different patterns of missing data, (b) reflects uncertainty in missing values, and (c) assumes that two people have the same probability of having missing data on a variable (e.g., deviant peer affiliation at Time 3) *only if* they have the same values for all other variables (also referred to as the missing at random assumption; Little & Rubin, 2002). Using MI minimized the need to make assumptions about the missing data mechanism, assumptions that would have biased coefficient estimates and standard errors for Aims 1-4. For multiple imputation, I used SAS PROC MI (SAS Institute Inc., 2006) to create 25 completed datasets. I conducted analyses using the statistical software Mplus 6.11 (Muthén & Muthén, 1998-2011), which averaged results across the 25 imputed datasets. Bivariate correlations among study variables and descriptive statistics were examined within the imputed datasets.

Latent Class Analysis

Latent class analysis (LCA) was used to examine the first research aim. LCA (Muthén & Muthén, 2000) empirically derives groups of individuals based on the aggregation of observed categorical items. LCA was used to identify groups of youth (a) whose friends exhibit different types and levels of CP and SU behavior (i.e., ADP) and (b) who exhibit different levels of CP and SU (i.e., CP/SU) at Times 1, 2, and 3. LCA

refers to these groups of individuals as classes, specifically, latent categorical classes. Each latent class (e.g., an ADP group characterized by high peer CP+SU levels) describes the relations among the observed items (i.e., severity of peer CP and SU behaviors).

LCA is an iterative model building process that seeks to identify the best fitting model using both statistical indices and conceptual/practical implications (Nylund, Muthén, & Asparouhov, 2007). First, the unconditional model is specified (i.e., 1-class model) and used as a comparison for an increasing number of classes until the models specified no longer converge or the results are no longer useful for application. After models with varying numbers of classes are derived, two types of model parameters are evaluated to assess model fit, item probability parameters and class probability parameters. Item probabilities are class-specific and refer to the probability of endorsing an item for an individual in a given latent class. For example, an item probability of .90 for Class 1 indicates that for those classified in Class 1, there is a 90% chance of endorsing that particular item. Class probabilities describe the relative size of classes, or the percentage of the sample that the latent class represents. In addition to these two parameters, posterior class probabilities, the individual's probabilities of being in each of the latent classes depending on the response pattern for the observed items, were considered. Posterior class probabilities are based on both of the model parameters (i.e., item and class probabilities). Each individual is assigned to membership in one of the latent classes based on his/her highest posterior probability score (i.e., modal class assignment).

One challenge of LCA is identifying the number of latent classes that best describes the heterogeneity in observed items (e.g., 3-class vs. 4-class model). Statistical

fit indices are used to assess model fit and to determine the optimal number of classes. Although there is no a single method of assessing model fit, Nylund and colleagues (2007) recommend examining a combination of indices that have been shown to be most appropriate for determining number of classes in LCA models. The Bayesian Information Criterion (BIC; Schwartz, 1978), sample size adjusted BIC (ABIC; Sclove, 1987), and the Akaike Information Criterion (AIC; Akaike, 1987) are often used to determine model fit (Nylund et al., 2007). Smallest values on each of these indices indicate the best-fitting model. In addition, the Bootstrap Likelihood Ratio Test (BLRT; Nylund et al., 2007) estimates the log likelihood differences in comparing the fit of the model with *k* classes to the fit of the model with *k-1* classes. A significant BLRT indicates that the *k* class model significantly improves overall model fit compared to the *k-1* class model. Given that simulation studies suggest that the BLRT and BIC indices provide the most reliable indicators of true number of classes (Nylund et al., 2007), these indices primarily are considered in the model building process. Entropy, a measure of separation among classes, is also considered when determining number of classes. Entropy values approaching one indicate clearer delineation of classes (Celeux & Soromenho, 1996), or suggest classes represent distinct subgroups of individuals. Substantive theory and class size are also used to determine the number of latent classes. For example, reasonable smallest class size was considered within the context of prevalence rates of conduct problems and substance use across adolescence. Finally, interpretability of the number of classes and practical considerations (e.g., how well do the classes identified correspond to hypothesized classes) are used to determine the optimal number of classes.

Examining Covariates of Latent Classes

To control for demographic variables (i.e., age, sex, paternal SUD history, other paternal psychiatric history, and SES), these variables were included as covariates in each set of LCAs. Because the model and classes can change when including covariates, posterior item probabilities, class size, and posterior class membership probabilities were examined to ensure that the classes derived with and without each covariate were similar. Specifically, I conducted a series of logistic regressions, run separately for each ADP and CP/SU class at each Times 1, 2, and 3. The categorical latent class variable was regressed on each covariate.

Latent Transition Analysis

I used latent transition analysis (LTA; Clogg, 1995) to analyze Aims 2 and 3, which sought to identify developmental patterns of (a) ADP and (b) CP and SU behaviors across early to mid-adolescence and selection and socialization processes across Times 1, 2, and 3, respectively. LTA is a type of longitudinal, autoregressive analysis that examines change in latent categorical classes of individuals across time (e.g., Cain, Epler, Steinley, & Sher, 2010). The LTA approach can be viewed as a structural equation model, which uses LCA as a measurement model for identifying unique classes at each time point and then uses autoregressive modeling as a structural model to describe transitions among the classes over time. Autoregressive models directly describe change among time points, and are often used when change is assumed to be discontinuous (e.g., change from CP class at Time 2 to CP+SU class at Time 3). These models use conditional probabilities to describe change among categorical outcomes across time. The

relation between two categorical outcomes is specified as a multinomial logistic regression, where the outcome at time *t* is regressed on the variable at *t-1*.

To identify transitions among latent classes and configure a LTA model, several steps using the Mplus latent variable framework are considered (Muthén, 2002; Muthén & Muthén, 1998-2007; Nylund, 2007). First, the best fitting LCA model (e.g., 4-class model) for each time point is used as the measurement model, given that LCA is the most commonly used measurement model for LTA (Nylund, 2008). Second, measurement invariance is determined. Measurement invariance assumes that parameters for each class (e.g., conditional item probabilities) across time are equal. If the best fitting LCA model is similar across time points (e.g., same number and types of classes across time points), full measurement invariance is appropriate. Partial measurement invariance constrains some, but not all, parameters across time. Full measurement noninvariance does not make any assumptions about the equality of the parameters, and estimates parameters freely across classes and across time.

In the final stages of the LTA, autoregressive models are conducted that use the measurement model at each of the time points to assess change and continuity in the latent classes over time. After individuals are assigned to a class at each time point (i.e., modal class assignment) based on the LCA, cross-tabulation of changes in class membership over time are examined to provide preliminary information about stability and transitions in class membership. For example, to investigate developmental patterns of ADP, I examined the class sizes of each ADP class identified at each Times 1, 2, and 3. Next, autoregressive models are performed on the best fitting models identified through LCA at each time point. Specifically, for Aim 2, which evaluated stability of

ADP and CP/SU class membership, autoregressive models identified transitions and transition patterns of each ADP and CP/SU class membership from (a) ages 10-12 to 12-14 and (b) ages 12-14 to 16. For example, to examine stability and change in ADP class membership from Time 1 to Time 2, ADP class membership at Time 2 was regressed on ADP membership at Time 1 within the LTA framework. Similarly, to investigate selection processes associated with ADP (Aim 3), ADP class membership at Times 2 and 3 were regressed on CP/SU class membership measured at Times 1 and 2, respectively. To examine socialization processes associated with ADP (Aim 3), CP/SU class membership at Times 2 and 3 were regressed on ADP class membership at Times 1 and 2, respectively. These socialization analyses also controlled for prior CP/SU class membership at Times 1 and 2 to isolate the socialization process of ADP.

Associative Latent Transition Analysis

Associative latent transition analysis (ALTA; Flaherty, 2008) was used to examine Aim 4, which evaluated the moderational roles of (a) temperamental emotionality and (b) neuropsychological functioning on selection and socialization processes. The ALTA setting can be thought of as a discrete-state analog to an autoregressive cross-lag model. In this setting, relations with each moderator (i.e., temperamental emotionality and neuropsychological functioning) are allowed to be class-varying. For example, to test the moderating role of temperamental emotionality on selection from Time 1 to Time 2, the relation between temperamental emotionality and ADP class membership at Time 2 was allowed to vary across classes of CP/SU at Time 1. Temperamental emotionality and neuropsychological functioning were analyzed separately as moderators of selection and of socialization. For example, in examining the

moderating role of temperamental emotionality on socialization, the relation between emotionality and CP/SU at Time 2 was allowed to vary across classes of ADP at Time 1, and the relation between emotionality and CP/SU at Time 3 was allowed to vary across classes of ADP at Time 2. The same approach was used to test the moderating role of neuropsychological functioning on the socialization process. For all moderation of socialization analyses, previous CP/SU class membership was controlled.

Distal Outcome Analysis

To examine the presence of differences in SUD outcome at Time 4 (Aim 5), I included SUD in each LCA from Aim 1. However, as previously noted, these analyses were run using the original and not multiply imputed dataset because of lack of sufficient coverage at Time 4. The Mplus software program uses full-information maximum likelihood estimation under the assumption that data are missing at random and is widely accepted as an appropriate way of handling missing data (Muthén & Shedden, 1999; Schafer & Graham, 2002). A multiple imputation approach is used to account for missing data due to youth who miss 1 or more assessments but return to the study for later assessments (Bacik, Murphy, & Anthony, 1998). By including the distal outcome in the LCA, I could examine probabilities of SUD at Time 4 separately for each ADP and CP/SU class.

CHAPTER 3
RESULTS

Descriptive Statistics

Means, standard deviations, and frequencies of all study variables in the original compared to the imputed datasets across Times 1, 2, and 3 were nearly identical (see Tables 6, 7, and 8). Because some imputed data fell outside of the possible range of values, sample sizes for imputed variables vary. Within the original sample (i.e., without multiple imputation), there was a high base rate of SUD (39.1%, $N = 166$) at Time 4 ($M =$ 21.89 years, $SD = .44$), which reflects the high-risk nature of the sample.

Using imputed data, continuous study variables at Time 1 were significantly correlated in expected directions (see Table 9). For example, lower SES and poorer neuropsychological functioning (i.e., ECF) were correlated with higher summed levels of CP and ADP. Similarly, SES and summed indices of CP and ADP across Times 1, 2, and 3 were significantly correlated in the expected directions (see Table 10). Bivariate correlations indicated some continuity in ADP (e.g., ADP1 with ADP2) and CP (e.g., CP2 with CP3). In addition, higher levels of ADP were associated with higher levels of CP across time (e.g., ADP1 with CP2; CP2 with ADP3).

Table 6.
Comparison of Base Rates and Means Between Original and Imputed Data at Time 1

	Original Data			Imputed Data		
	N	Percent Endorsed (*N*)	Mean (*SD*)	*N*	Percent Endorsed (*N*)	Mean (*SD*)
Age	775		11.42 (.91)	19325		11.42 (.91)
Male	775	71.0 (550)		19375	71.0 (13750)	
African-American	775	21.8 (169)		19379	21.8 (4225)	
Other ethnicity	775	2.7 (21)		19379	2.7 (527)	
SES	775		41.47 (13.91)	18500		40.40 (13.09)
Paternal History SUD	775	44.4 (344)		19375	44.4 (8600)	
Paternal History Dx	775	10.5 (81)		19379	10.5 (2029)	
DP: Skip school	719	27.3 (196)		17975	27.3 (4900)	
DP: Lie, disobey, talk back	736	71.1 (523)		18400	71.1 (13075)	
DP: Purposefully damage/destroy property	730	26.0 (190)		18250	26.0 (4625)	
DP: Stole something worth less than $5	721	25.7 (185)		18025	25.7 (4625)	
DP: Stole something worth between $5 and $100	723	11.3 (82)		18075	11.3 (2050)	
DP: Stole something worth more than $100	723	3.2 (23)		18075	3.2 (575)	
DP: Went or attempted to steal from building	725	9.8 (71)		18125	9.8 (1775)	
DP: Joyriding	746	5.0 (37)		18650	5.0 (925)	
DP: Hits someone	741	42.1 (312)		18525	42.1 (7800)	
DP: Attacked someone with a weapon	739	6.5 (48)		18475	6.5 (1200)	
DP: Mugging with or without a weapon	744	3.2 (24)		18600	3.2 (600)	
DP: Sold hard drugs	752	1.9 (14)		18800	1.9 (350)	
DP: Used alcohol	748	9.4 (70)		18700	9.4 (1750)	

Table 6. (continued)						
DP: Used marijuana or hashish	748	3.7 (28)		18700	3.7 (700)	
DP: Used hard drugs	746	.9 (7)		18650	.9 (175)	
ODD: Often loses temper	775	32.8 (254)		19375	32.8 (6350)	
ODD: Often argues with adults	775	23.0 (178)		19375	23.0 (4450)	
ODD: Defies or refuses adult requests	775	16.8 (130)		19375	16.8 (3250)	
ODD: Annoys others	775	19.7 (153)		19375	19.7 (3825)	
ODD: Blames other for own mistakes	775	22.6 (175)		19375	22.6 (4375)	
ODD: Touchy or easily annoyed	775	27.1 (210)		19375	27.1 (5250)	
ODD: Angry and resentful	775	21.3 (165)		19375	21.3 (4125)	
ODD: Spiteful or vindictive	775	16.0 (124)		19375	16.0 (3100)	
ODD: Swears or uses obscene language	775	11.0 (85)		19375	11.0 (2125)	
CD: Frequent truancy	775	4.1 (32)		19375	4.1 (800)	
CD: Often lies	775	13.8 (107)		19375	13.8 (2675)	
CD: Vandalism	775	8.5 (66)		19375	8.5 (1650)	
CD: Conned others	775	15.2 (118)		19375	15.2 (2950)	
CD: Often initiates physical fights	775	7.0 (54)		19375	7.0 (1350)	
SU: Alcohol	775	4.0 (31)		19375	4.0 (775)	
SU: Cannabis	775	.9 (7)		19375	.9 (175)	
SU: Hard Drugs	775	.9 (7)		19386	.9 (182)	
Temperamental Emotionality	737		25.31 (3.16)	18425		25.31 (3.16)
ECF	753		-.004 (1.01)	18630		-.02 (1.01)
CP sum	755		2.52 (3.12)	19375		2.52 (3.11)
ADP sum	766		2.36 (2.50)	19150		2.36 (2.50)

Note. Age = age at Time 1, SES = socioeconomic status at Time 1, Paternal History SUD = paternal history of substance use disorder, Paternal History Dx = paternal history of psychiatry disorder other than substance dependence, No Paternal History Dx = no paternal history of any psychiatric disorder, DP = deviant peer behavior dichotomous items, ODD = oppositional defiant disorder symptoms, CD = conduct disorder symptoms, ECF = executive cognitive functions, CP sum = sum of 9 ODD and 5 CD symptoms at Time 1, ADP sum = sum of 15 DP dichotomous items at Time 1.

Table 7.

Comparison of Base Rates and Means Between Original and Imputed Data at Time 2

	Original Data			Imputed Data		
	N	Percent Endorsed (*N*)	Mean (*SD*)	*N*	Percent Endorsed (*N*)	Mean (*SD*)
Age	651		13.48 (.95)	16225		13.48 (.95)
DP: Skip school	637	43.0 (274)		15925	43.0 (6850)	
DP: Lie, disobey, talk back	636	77.5 (493)		15900	77.5 (12325)	
DP: Purposefully damage/destroy property	627	33.7 (211)		15675	33.7 (5275)	
DP: Stole something worth less than $5	617	36.8 (227)		15425	36.8 (5675)	
DP: Stole something worth between $5 and $100	617	19.1 (118)		15425	19.1 (29590)	
DP: Stole something worth more than $100	623	8.0 (50)		15575	8.0 (1250)	
DP: Went or attempted to steal from building	622	13.0 (81)		15550	13.0 (2025)	
DP: Joyriding	641	10.5 (67)		16025	10.5 (1675)	
DP: Hits someone	643	41.5 (267)		16075	41.5 (6675)	
DP: Attacked someone with a weapon	643	8.2 (53)		16075	8.2 (1325)	
DP: Mugging with or without a weapon	639	4.7 (30)		15975	4.7 (750)	
DP: Sold hard drugs	642	6.1 (39)		16050	6.1 (975)	
DP: Used alcohol	633	29.4 (186)		15825	29.4 (4650)	
DP: Used marijuana or hashish	640	19.8 (127)		16000	19.8 (3175)	
DP: Used hard drugs	638	4.2 (27)		15950	4.2 (675)	
ODD: Often loses temper	649	16.6 (108)		16225	16.6 (2700)	
ODD: Often argues with adults	649	12.8 (83)		16225	12.8 (2075)	
ODD: Defies or refuses adult requests	649	6.5 (42)		16225	6.5 (1050)	
ODD: Annoys others	649	11.4 (74)		16225	11.4 (1850)	

Table 7. (continued)				
ODD: Blames other for own mistakes	649	4.5 (29)	16225	4.5 (725)
ODD: Touchy or easily annoyed	649	15.4 (100)	16225	15.4 (2500)
ODD: Angry and resentful	649	7.1 (46)	16225	7.1 (1150)
ODD: Spiteful or vindictive	649	9.2 (60)	16225	9.2 (1500)
ODD: Swears or uses obscene language	649	13.3 (86)	16225	13.3 (2150)
CD: Frequent truancy	649	9.7 (63)	16225	9.7 (1575)
CD: Often lies	649	5.7 (37)	16225	5.7 (925)
CD: Vandalism	649	7.1 (46)	16225	7.1 (1150)
CD: Conned others	649	12.3 (80)	16225	12.3 (2000)
CD: Often initiates physical fights	649	3.4 (22)	16225	3.4 (550)
SU: Alcohol	652	14.3 (93)	16300	14.3 (2325)
SU: Cannabis	652	6.6 (43)	16300	6.6 (1075)
SU: Hard Drugs	652	1.5 (10)	16300	1.5 (250)
CP	649	1.43 (2.41)	16225	1.43 (2.41)
ADP	651	3.46 (3.24)	16275	3.46 (3.24)
Note. Age = age at Time 2, DP = deviant peer behavior dichotomous items, ODD = oppositional defiant disorder symptoms, CD = conduct disorder symptoms, CP sum = sum of 9 ODD and 5 CD symptoms at Time 2, ADP sum = sum of 15 DP dichotomous items at Time 2.				

Table 8.
Comparison of Base Rates and Means Between Original and Imputed Data at Time 3

	Original Data			Imputed Data		
	N	Percent Endorsed (*N*)	Mean (*SD*)	*N*	Percent Endorsed (*N*)	Mean (*SD*)
Age	621		16.09 (.45)	15476		16.09 (.45)
DP: Skip school	607	69.5 (422)		15175	69.5 (10550)	
DP: Lie, disobey, talk back	606	89.1 (540)		15150	89.1 (13500)	
DP: Purposefully damage/destroy property	602	41.0 (247)		15050	41.0 (6175)	
DP: Stole something worth less than $5	602	45.5 (274)		15050	45.5 (6850)	
DP: Stole something worth between $5 and $100	600	31.8 (191)		15000	31.8 (4775)	
DP: Stole something worth more than $100	598	14.5 (87)		14950	14.5 (2175)	
DP: Went or attempted to steal from building	597	17.1 (102)		14925	17.1 (2550)	
DP: Joyriding	608	21.4 (130)		15200	21.4 (3250)	
DP: Hits someone	611	46.3 (283)		15275	46.3 (7075)	
DP: Attacked someone with a weapon	609	14.9 (91)		15225	14.9 (2275)	
DP: Mugging with or without a weapon	610	8.7 (53)		15250	8.7 (1325)	
DP: Sold hard drugs	611	15.5 (95)		15275	15.5 (2375)	
DP: Used alcohol	612	72.9 (446)		15300	72.9 (11150)	
DP: Used marijuana or hashish	611	58.4 (357)		15275	58.4 (8925)	
DP: Used hard drugs	610	14.6 (89)		15250	14.6 (2225)	
ODD: Often loses temper	613	14.2 (87)		15325	14.2 (2175)	
ODD: Often argues with adults	613	13.4 (82)		15325	13.4 (2050)	
ODD: Defies or refuses adult requests	613	6.9 (42)		15325	6.9 (1050)	
ODD: Annoys others	613	7.7 (47)		15325	7.7 (1175)	

Table 8. (continued)						
ODD: Blames other for own mistakes	613	4.9 (30)		15325	4.9 (750)	
ODD: Touchy or easily annoyed	613	15.0 (92)		15325	15.0 (2300)	
ODD: Angry and resentful	613	7.2 (44)		15325	7.2 (1100)	
ODD: Spiteful or vindictive	613	8.5 (52)		15325	8.5 (1300)	
ODD: Swears or uses obscene language	613	21.0 (129)		15325	21.0 (3225)	
CD: Frequent truancy	613	27.1 (166)		15325	27.1 (4150)	
CD: Often lies	613	3.6 (22)		15325	3.6 (550)	
CD: Vandalism	613	8.6 (53)		15325	8.6 (1325)	
CD: Conned others	613	16.5 (101)		15325	16.5 (2525)	
CD: Often initiates physical fights	613	4.4 (27)		15325	4.4 (675)	
SU: Alcohol	621	44.6 (277)		15525	44.6 (6925)	
SU: Cannabis	620	31.0 (192)		1550	31.0 (4800)	
SU: Hard Drugs	621	7.7 (48)		15525	7.7 (1200)	
CP sum	613		1.75 (2.60)	15325		1.75 (2.61)
ADP sum	618		5.51 (3.73)	15450		5.51 (3.73)
Note. Age = age at Time 3, DP = deviant peer behavior dichotomous items, ODD = oppositional defiant disorder symptoms, CD = conduct disorder symptoms, CP sum = sum of 9 ODD and 5 CD symptoms at Time 3, SU = dichotomous substance use items, ADP sum = sum of 15 DP dichotomous items at Time 3.						

Moderators of selection and socialization were correlated in expected directions with summed ADP and CP across Times 1, 2, and 3 (see Table 11). For example, poorer neuropsychological functioning and more negative temperamental emotionality at Time 1 were related to higher levels of ADP and CP.

Table 9.

Bivariate Correlations Among Continuous Study Variables at 10-12 Years after Multiple Imputation (N=17,318)

Variable	1	2	3	4	5
1. Age	-				
2. SES	.04**	-			
3. CP sum	.11**	-.21**	-		
4. ADP sum	.18**	-.16**	.35**	-	
5. ECF	.30**	.27**	-.16**	-.13**	-
6. Emotionality	-.02**	.12**	-.26**	-.10**	.07**

Note. SES = socioeconomic status, CP sum = sum of binary CD and ODD symptoms, ADP sum = sum of binary association with deviant peers items, ECF = executive control factor, Emotinality = temperamental emotionality.
** $p < .01$.

Table 10.

Bivariate Correlations Among Age, SES, Index Youth Conduct Problems, and Associations with Deviant Peers Across Times 1, 2, and 3 after Multiple Imputation (N=13,275)

Variable	1	2	3	4	5	6	7	8	9
1. Age 1	-								
2. Age 2	.95**	-							
3. Age 3	.55**	.57**	-						
4. SES	.04**	.04**	.02	-					
5. ADP 1	.25**	.22**	.18**	.18**	-				
6. ADP 2	.30**	.31**	.15**	.19**	.44**	-			
7. ADP 3	.17**	.16**	.08**	.11**	.30**	.48**	-		
8. CP 1	.09**	.06**	.02	.17**	.34**	.30**	.26**	-	
9. CP 2	.14**	.13**	.06**	.16**	.33**	.47**	.36**	.50**	-
10. CP 3	.02**	.03**	.03**	.14**	.23**	.34**	.48**	.34**	.45**

Note. Age 1 = Age at Time 1, SES = socioeconomic status at Time 1, CP 1 = sum of dichotomous CD and ODD symptoms at Time 1, CP 2 = sum of dichotomous CD and ODD symptoms at Time 2, CP 3= sum of dichotomous CD and ODD symptoms at Time 3, ADP 1= sum of dichotomous deviant peer behavior items at Time 1, ADP 2= sum of dichotomous deviant peer behavior items at Time 2, ADP 3= sum of dichotomous deviant peer behavior items at Time 3.
** $p < .01$.

Table 11.

Bivariate Correlations Among Study Moderators at Time 1 and Index Youth Conduct Problems and Associations with Deviant Peers Across Times 1, 2, and 3 after Multiple Imputation (N=13,395)

Variable	1	2	3	4	5	6	7
1. ADP 1	-						
2. ADP 2	.45**	-					
3. ADP 3	.32**	.49**	-				
4. CP 1	.36**	.32**	.26**	-			
5. CP 2	.35**	.48**	.36**	.50**	-		
6. CP 3	.25**	.34**	.48**	.34**	.45**	-	
7. ECF	-.10**	-.02*	-.03**	-.13**	-.11**	-.20**	-
8. Mood	-.10**	-.13**	-.09**	-.27**	-.15**	-.17**	.08**

Note. CP 1 = sum of dichotomous CD and ODD symptoms at Time 1, CP 2 = sum of dichotomous CD and ODD symptoms at Time 2, CP 3= sum of dichotomous CD and ODD symptoms at Time 3, ADP 1= sum of dichotomous deviant peer behavior items at Time 1, ADP 2= sum of dichotomous deviant peer behavior items at Time 2, ADP 3= sum of dichotomous deviant peer behavior items at Time 3, ECF = executive cognitive functions, Mood = temperamental affect.
** $p < .01$.

Aim 1: Identification of ADP and CP/SU Classes Across Times 1, 2, and 3

At Times 1, 2, and 3, cross-sectional LCA models of each ADP and CP/SU were run by first testing a one-class model (i.e., the independence model) and then exploring models with more classes. For each of the six LCA models, tables describe fit information (i.e., log likelihood ratio, AIC, BIC, ABIC, *p* value for the BLRT, entropy, smallest class size) for LCA models with one through five classes. Row 1 contains the fit indices for a one-class model, row 2 for a two-class model, and so on. As previously noted, the BLRT and BIC indices provide the most reliable indicators of true number of classes (Nylund et al., 2007), so these indices primarily were considered in the model building process. In addition, for each LCA model, the conditional item probabilities (i.e.,

probability of endorsing each class indicator item given membership in a particular class) are displayed in figures. Finally, relations with demographic covariates are reported to further describe classes for each LCA model.

Aim 1a: Identifying ADP Classes

ADP LCA at Time 1

Examining results for the ADP LCA model at Time 1 in Table 12, the BIC is minimized in the three-class model and thus indicates that the three-class model fits the data best. Other indices continue to indicate a better fitting model with each additional class (i.e., log likelihood, AIC, ABIC, BLRT); however, the four- and five-class models did not reveal substantively distinct or meaningful classes. The three-class model had adequate delineation of classes as indicated by the entropy (.786).

Table 12.
Associating with Deviant Peers Class Model Comparison at Ages 10-12

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	15	-3679.482	7388.964	7458.582	7410.95	N/A[a]	N/A[a]	766 (100.0)
2	31	-3019.085	6100.169	6244.046	6145.607	0.000	.870	165 (22.0)
3	47	-2881.753	5857.506	6075.641	5926.395	0.000	.786	68 (9.2)
4	63	-2848.131	5822.263	6114.657	5914.604	0.000	.786	30 (4.0)
5	79	-2828.516	5815.032	6181.686	5930.825	0.013	.821	11 (1.5)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

Posterior class probabilities ranged from .887 to .931, indicating most youth in the sample (≈ 90%) were placed into a class that reflects their respective levels of severity of peer CP and SU. The smallest class size (9.8%, $n = 68$) was both reasonable in size and

conceptually meaningful. In sum, multiple fit indices and parameters indicate that the three-class model best fits the data, rather than the four-class model hypothesized

Given the conditional item probabilities for each ADP class at Time 1 (see Figure 10), the three classes were distinguished by (1) low levels of peer deviant behavior (Low ADP), (2) predominantly peer CP behaviors (ADP-CP), and (3) both peer CP and SU behaviors (ADP-C). The Low ADP class (56.0%) included youth with a low probability of endorsing peer CP and SU behaviors. Although youth in this Low ADP class exhibited a roughly 50% chance of endorsing peers' "lie, disobey," this peer CP item did not distinguish among classes.

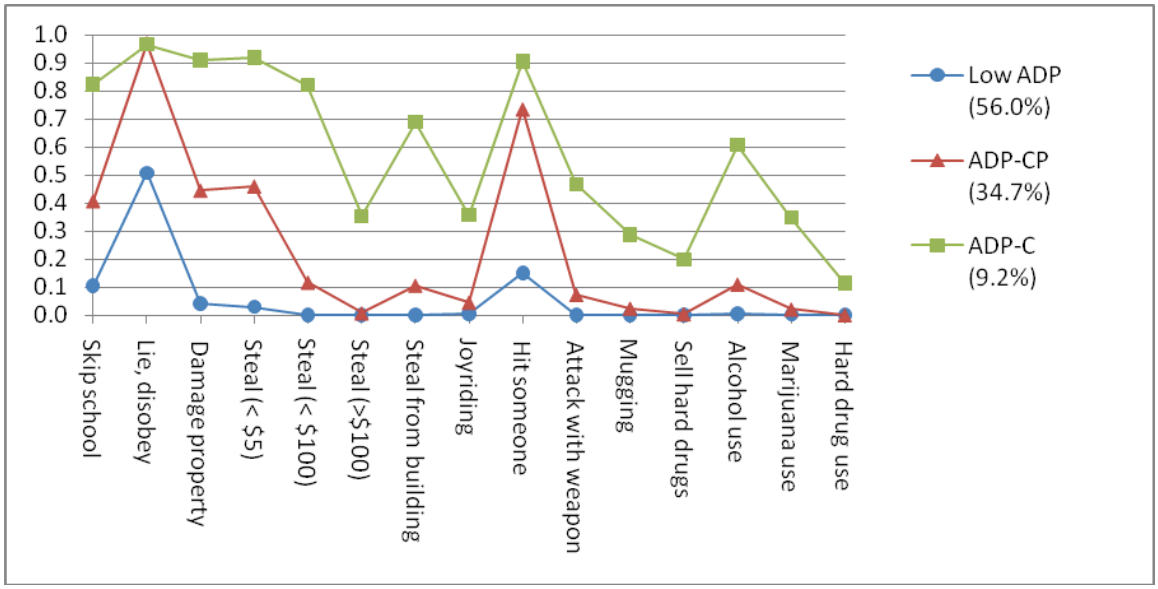

Figure 10
Conditional Item Probability Profile Plots for the Three-Class Model of Association with Deviant Peers at Ages 10-12 (N = 766)
Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class.
Percentage of sample classified in each latent class provided in legend.

The ADP-CP class (34.7%) was comprised of youth who had a moderate probability of endorsing having friends who engage in CP behavior, particularly hitting others, skipping school, property damage, and petty theft (<$5). In contrast, the ADP-C class (9.2%) was

characterized by moderate to high probability of endorsing having friends who engage in both CP and SU behaviors, including peer CP behaviors seen among the ADP-CP class, as well as friends who engage in alcohol use and more serious forms of CP, such as attacking someone with a weapon and stealing from a building. Although the three classes identified were expected, a fourth class of youth engaged with peers exhibiting primarily SU behaviors did not emerge as hypothesized.

In terms of demographic differences, logistic regressions (Table 13) suggested that compared to youth in the Low ADP class, youth in the ADP-CP and the ADP-C classes were more likely to be male, have a paternal history of substance dependence, and be from a lower SES background. In addition, compared to youth in the Low ADP class, youth in the ADP-C class were more likely to be older.

Table 13.
Log Odds Coefficients and Odds Ratio for Three-Class ADP Model at Ages 10-12 with a Demographic Factor as a Covariate Using the Low ADP Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
ADP-CP	Age	.121	.111	1.090	1.129
	Male	1.121**	.235	4.775	3.068
	SES	-.022**	.008	-2.969	.978
	Paternal SUD	.557**	.196	2.837	1.745
	Paternal Dx	.052	.293	.179	1.053
ADP-C	Age	.742**	.233	3.185	2.100
	Male	.752*	.336	2.239	2.121
	SES	-.038**	.012	-3.044	.963
	Paternal SUD	.823**	.283	2.910	2.277
	Paternal Dx	-.928	.628	-1.478	.395

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, Age = age at Time 1 (ages 10-12), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal SUD = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$.

ADP LCA at Time 2

Different from the LCA model of ADP at Time 1, results for the ADP LCA model at Time 2 (see Table 14) indicated a four-class model best fit the data, which was consistent with hypothesis 1a. Although other fit indices continued to indicate a better fitting model with each additional class, the BIC is minimized in the four-class model. The four-class model also had good delineation of classes (entropy = .873) and most youth were assigned to classes that were highly related to their levels of severity of peer CP and SU (posterior class probabilities range =.881 to .948). The smallest class size (11.0%, *n* = 72) represented a reasonable percentage of the sample and was substantively meaningful.

Table 14.
Associating with Deviant Peers Class Model Comparison at Ages 12-14

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	15	-4212.578	8455.156	8522.334	8474.709	N/A[a]	N/A[a]	651 (100.0)
2	31	-3349.968	6761.936	6900.770	6802.345	0.000	.870	165 (33.1)
3	47	-3203.179	6500.358	6710.848	6561.624	0.000	.845	83 (13.2)
4	63	-3140.314	6406.629	6688.775	6488.751	0.000	.873	72 (11.0)
5	79	-3112.721	6383.443	6737.245	6486.421	0.000	.889	18 (2.8)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

Patterns of conditional item probabilities for each ADP class at Time 2 (see Figure 11) indicated that three ADP classes at Time 2 were similar to the ADP classes identified at Time 1 (i.e., Low ADP, ADP-CP, ADP-C). Again, these three classes were consistent with hypotheses. At Time 2, the Low ADP (57.1%) and ADP-CP (19.3%)

classes were defined by similar types and levels of peer deviant behavior as at Time 1. However, different from the Time 1 ADP-C class, the Time 2 ADP-C class (12.6%) was characterized by a low probability of severe peer CP behaviors (e.g., attacking someone with a weapon, stealing from a building) and a high probability of peer alcohol and peer cannabis use. In addition, a fourth class distinguished by more severe levels of both peer CP and SU behaviors emerged (ADP-severe combined, ADP-SC, 11.0%), characterized by a high probability of moderate peer CP behaviors (e.g., skipping school, property damage), moderate to high probability of severe peer CP behaviors (e.g., stealing something worth >$100, attacking someone with a weapon, selling hard drugs), and a high probability of alcohol and cannabis use. This ADP-SC class was not hypothesized, rather an ADP-SU class was expected at Time 2.

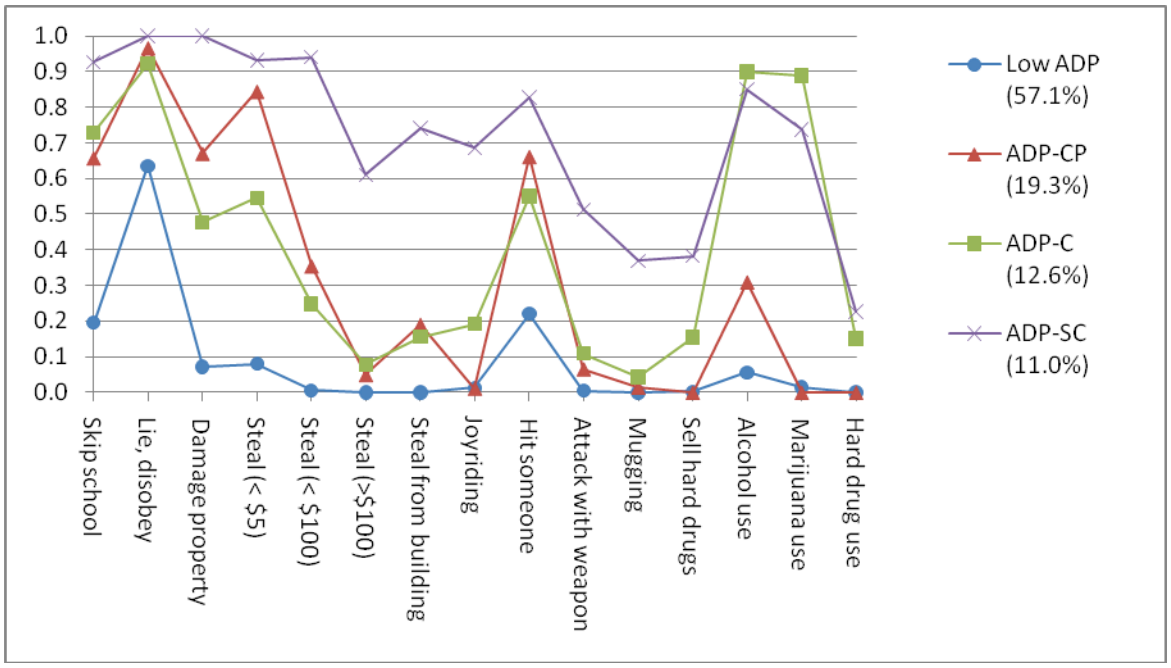

Figure 11
Conditional Item Probability Profile Plots for the Four-Class Model of Association with Deviant Peers at Ages 12-14 (N=651)
Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Percentage of sample classified in each latent class provided in legend.

Logistic regressions (see Table 15) suggested that compared to youth in the Low ADP class, youth in the ADP-CP, ADP-C, and ADP-SC classes were significantly more likely to have a paternal history of substance dependence and were largely more likely to be male, although this difference only reached marginal significance for youth in the ADP-SC class. Youth in the ADP-CP and ADP-SC classes were more likely to be from a lower SES background compared to youth in the Low ADP class. In addition, compared to youth in the Low ADP class, youth in the ADP-C and ADP-SC classes were more likely to be older.

Table 15.
Log Odds Coefficients and Odds Ratio for Four-Class ADP Model at Ages 12-14 with a Demographic Factor as a Covariate Using the Low ADP Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
ADP-CP	Age	-.164	.149	-1.098	.849
	Male	2.029**	.667	3.040	7.606
	SES	-.024*	.010	-2.404	.976
	Paternal SUD	1.013**	.264	3.831	2.754
	Paternal Dx	-.916	.614	-1.493	.400
ADP-C	Age	1.291**	.195	6.619	3.636
	Male	-.629*	.283	-2.220	.533
	SES	-.017	.013	-1.322	.983
	Paternal SUD	.888**	.277	3.207	2.430
	Paternal Dx	-.006	.476	-.012	.994
ADP-SC	Age	.977**	.204	4.793	2.656
	Male	.663^	.358	1.853	1.941
	SES	-.044**	.011	-4.007	.957
	Paternal SUD	.877**	.282	3.114	2.404
	Paternal Dx	-.818	.730	-1.120	.441

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, Age = age at Time 2 (ages 12-14), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal SUD = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$, ^ $p < .10$.

ADP LCA at Time 3

Consistent with hypotheses, results for the ADP LCA model at Time 3 (see Table 16) indicated a four-class model best fit the data, similar to the ADP model specified at Time 2. The four-class model minimized the BIC, had good separation of classes (entropy = .811), and high association between response patterns and class assignment (posterior class probabilities range =.847 to .926). The smallest class size (11.3%, *n* = 67) was both reasonable in size and conceptually important.

Table 16.
Associating with Deviant Peers Class Model Comparison at Ages 16

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	15	-4764.904	9559.808	9626.205	9578.583	N/A[a]	N/A[a]	618 (100.0)
2	31	-3785.183	7632.366	7769.587	7671.167	0.000	.911	246 (40.0)
3	47	-3647.432	7388.864	7596.91	7447.693	0.000	.806	149 (24.3)
4	63	-3572.52	7271.040	7549.909	7349.895	0.000	.811	67 (11.3)
5	79	-3531.02	7220.039	7569.732	7318.921	0.000	.808	40 (7.8)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

Evaluation of the conditional item probabilities for each ADP class at Time 3 (see Figure 12) suggested similar Low ADP (29.3%), ADP-C (28.6%), and ADP-SC (11.3%) classes compared to Time 2 ADP classes. However, compared to the Time 2 ADP-SC class, the ADP-SC class at Time 3 was characterized by increased probability of severe peer CP (e.g., steal something worth >$100, attacking someone with a weapon, sell hard drug) and peer SU (e.g., hard drug use) behaviors. In contrast to ADP classes at Times 1 and 2, a class defined predominantly by peer SU (i.e., ADP-SU, 30.8%), with particularly

high probability of alcohol and cannabis use, emerged at Time 3. Results were partially consistent with expectations, as ADP-SU, ADP-C, and Low ADP classes were identified. However, different from hypotheses, no ADP-CP class emerged at Time 3, rather an ADP-SC class was identified.

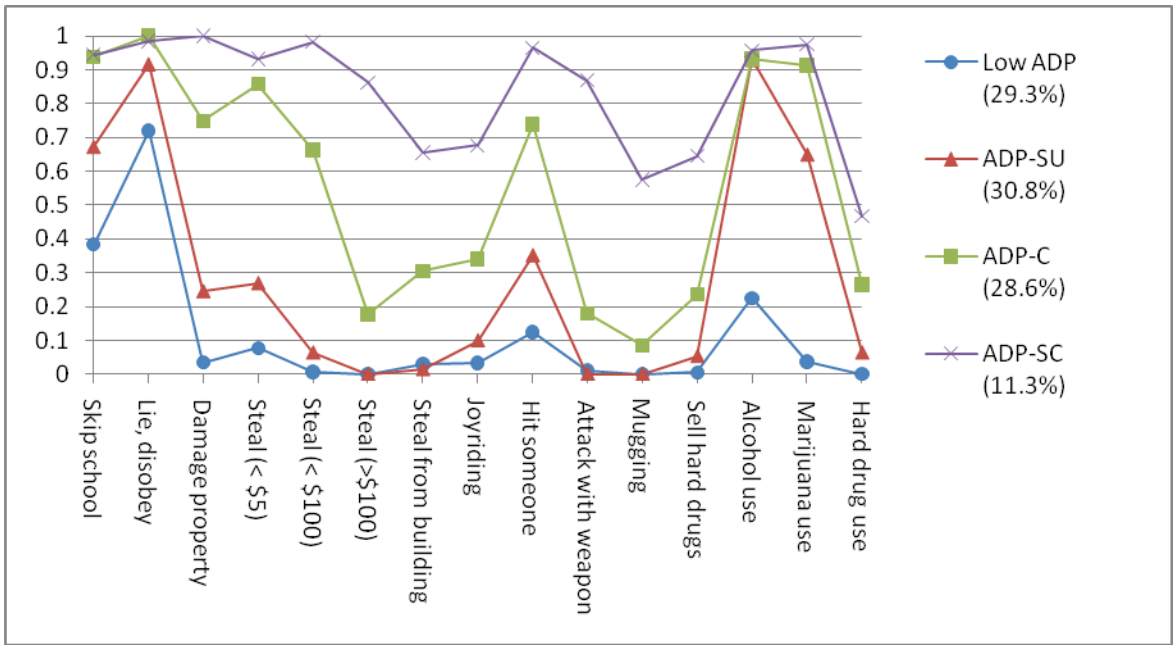

Figure 12
Conditional Item Probability Profile Plots for the Four-Class Model of Association with Deviant Peers at Age 16 (N = 618)
Note. Low ADP = low level of association with deviant peers class, ADP-SU= association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Percentage of sample classified in each latent class provided in legend.

A series of logistic regressions (see Table 17) revealed that youth in the higher risk ADP classes were from more at-risk backgrounds. Compared to youth in the Low ADP class at Time 3, youth in the ADP-CP, ADP-C, and ADP-SC classes were more likely to have a paternal history of substance dependence and to be male, although these differences only reached marginal significance for some ADP classes. In addition, compared to youth in the Low ADP class, youth in the ADP-SC class were more likely to be from lower SES backgrounds.

Table 17.
Log Odds Coefficients and Odds Ratio for Four-Class ADP Model at Age 16 with a Demographic Factor as a Covariate Using the Low ADP Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
ADP-SU	Age	.156	.271	.578	1.169
	Male	-.577*	.276	-2.087	.562
	SES	.003	.011	.275	1.003
	Paternal SUD	.562^	.304	1.847	1.754
	Paternal Dx	-.902^	.472	-1.912	.406
ADP-C	Age	-.052	.272	-.192	.949
	Male	1.013**	.322	3.142	2.754
	SES	.001	.009	.097	1.001
	Paternal SUD	.771**	.246	3.140	2.162
	Paternal Dx	-.413	.337	-1.227	.662
ADP-SC	Age	.412	.328	1.255	1.510
	Male	.584^	.335	1.742	1.793
	SES	-.037**	.010	-3.771	.964
	Paternal SUD	1.581**	.346	4.573	4.860
	Paternal Dx	-1.087^	.641	-1.697	.337

Note. Low ADP = low level of association with deviant peers class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, Age = age at Time 3 (age 16), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal SUD = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$, ^ $p < .10$.

Aim 1b: Identifying Index Youth CP/SU Classes

CP/SU LCA at Time 1

Results for the CP/SU LCA model at Time 1 (see Table 18) indicated that the three-class CP/SU model best fit the data, as this model minimized the BIC and had adequate separation of classes as indicated by the entropy (.772). Posterior class probabilities ranged from .892 to .929, indicating most youth (≈ 90%) were placed into a class that reflects their respective levels of severity of index youth CP and SU. The smallest class size (11.3%, $n = 85$) is both reasonable in size and conceptually meaningful. Of note, a four-class, rather than three-class CP/SU model was hypothesized.

According to conditional item probabilities for each CP/SU class at Time 1 (see Figure 13), the three classes were distinguished by nearly no index youth CP or SU (No

CP/SU), low levels of index youth CP (Low CP), and higher levels of index youth CP (High CP). Index youth in the No CP/SU class (48.3%) had a nearly zero probability of endorsing CP or SU behaviors. The Low CP class (40.4%) was comprised of youth who had a low to moderate probability of endorsing ODD and CD symptoms, such as being

Table 18.
Index Youth Conduct Problems and Substance Use Class Model Comparison at Ages 10-12

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	17	-4928.156	9890.312	9969.421	9915.437	N/A[a]	N/A[a]	775 (100.0)
2	35	-4230.025	8530.049	8692.919	8581.778	0.000	0.880	177 (22.3)
3	53	-4110.076	8326.152	8572.784	8404.484	0.000	0.772	85 (11.3)
4	71	-4079.342	8300.685	8631.078	8405.619	0.000	0.831	75 (9.2)
5	89	-4049.587	8277.173	8691.329	8408.711	0.000	0.836	30 (4.1)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

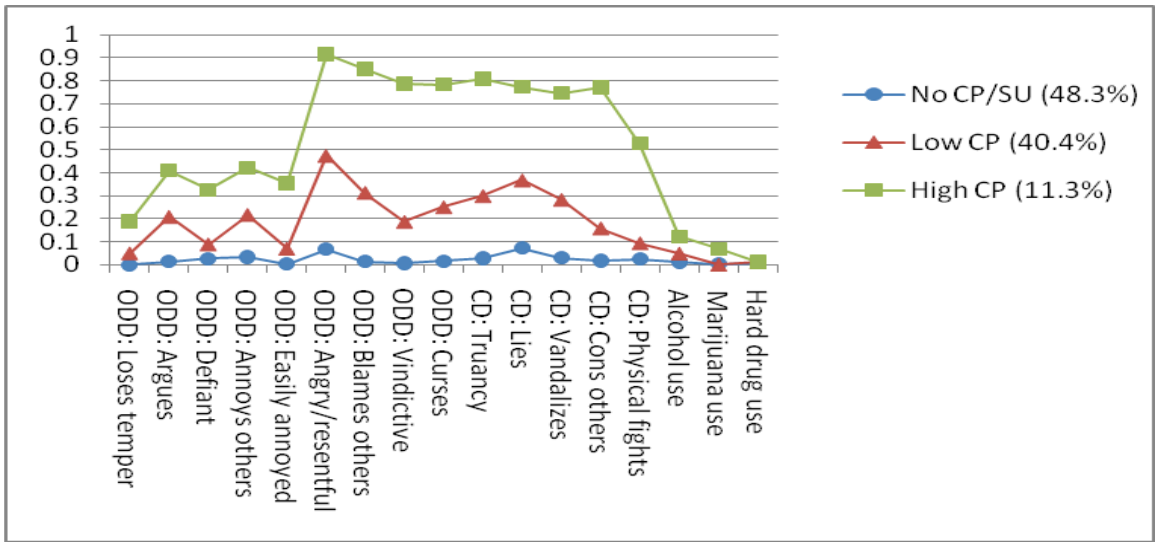

Figure 13
Conditional Item Probability Profile Plots for the Three-Class Model of Index Youth Conduct Problems/Substance Use at Ages 10-12 (N=775)
Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class.
Percentage of sample classified in each latent class provided in legend.

Table 19.
Log Odds Coefficients and Odds Ratio for Three-Class CP/SU Model at Ages 10-12 with a Demographic Factor as a Covariate Using the No CP/SU Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
Low CP	Age	.151	.107	1.409	1.163
	Male	1.641**	.248	6.619	5.160
	SES	-.025**	.008	-3.223	.975
	Paternal SUD	.400*	.203	1.970	1.492
	Paternal Dx	-.422	.332	-1.269	.656
High CP	Age	.256^	.146	1.748	1.292
	Male	1.658**	.404	4.108	5.249
	SES	-.054**	.011	-5.058	.947
	Paternal SUD	1.323**	.314	4.208	3.755
	Paternal Dx	-.003	.402	.008	.997

Note. Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, Age = age at Time 1 (ages 10-12), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal DEP = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$, ^ $p < .10$.

angry and/or resentful and lying. In contrast, moderate to high probability of endorsing similar index youth CP behaviors characterized the third class, High CP. Youth in the High CP class exhibited a high probability of endorsing some ODD and three out of four CD symptoms, including vandalizing and conning others. In sum, two of the four hypothesized CP/SU classes emerged at Time 1, No CP/SU and CP. Different from expectations, classes defined by index youth engagement in SU and in co-occurring CP and SU were not identified.

A series of logistic regressions (see Table 19) revealed that compared to youth in the No CP/SU class at Time 1, youth in the Low CP and High CP classes were more likely to be male, have a paternal history of substance dependence, and to be from lower SES backgrounds.

CP/SU LCA at Time 2

Similar to the Time 1 CP/SU LCA model, results for the CP/SU LCA model at Time 2 (see Table 20) indicated that the three-class CP/SU model, rather than the

hypothesized four-class model, fit the data best. The three-class model had a low BIC and good delineation of classes as indicated by the entropy (.827). Compared to the four-class model, the three-class CP/SU model had an acceptable smallest class size (10.0%, *n* = 61), which was also substantively meaningful. With the three-class model, most youth in the sample (range of posterior class probabilities = .905 to .946) were placed into a class that was consistent with their respective levels of severity of index youth CP and SU.

Table 20.
Index Youth Conduct Problems and Substance Use Class Model Comparison at Ages 12-14

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	17	-3273.953	6581.906	6658.067	6604.092	N/A[a]	N/A[a]	652 (100.0)
2	35	-2736.542	5543.084	5699.886	5588.761	0.000	0.895	121 (19.0)
3	53	-2663.838	5433.676	5671.118	5502.844	0.000	0.827	61 (10.0)
4	71	-2599.44	5340.881	5658.964	5433.54	0.000	0.835	31 (4.9)
5	89	-2567.18	5312.361	5711.085	5428.51	0.000	0.825	33 (5.2)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

Evaluation of conditional item probabilities for each CP/SU class at Time 2 (see Figure 14) indicated two similar CP/SU classes at Times 1 and 2: No CP/SU (69.5% of the sample at Time 2) and Low CP (20.5% of the sample at Time 2) classes. In contrast to the third CP/SU class at Time 1, a class of youth exhibiting moderate to high probability of endorsing not only index youth CP but also index youth SU behaviors (i.e., CP+SU) emerged at Time 2 and represented 10.0% of the sample. Index youth in the CP+SU class exhibited a moderate probability of endorsing ODD and CD symptoms, as well as alcohol

and cannabis use. These three classes were consistent with hypotheses, although no class of index youth engaging primarily in SU behaviors emerged as expected.

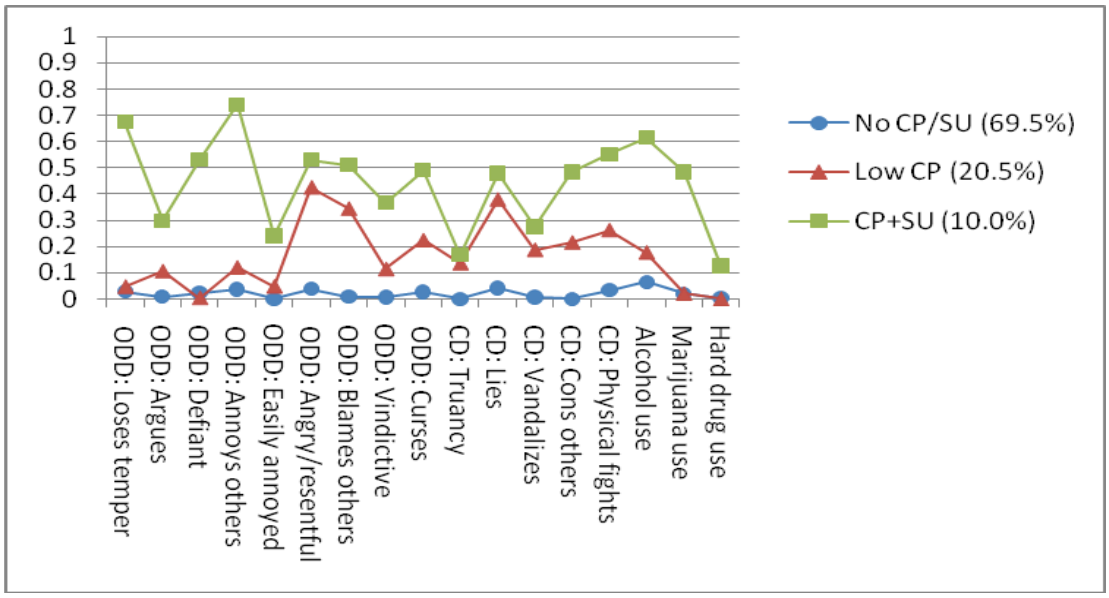

Figure 14
Conditional Item Probability Profile Plots for the Three-Class Model of Index Youth Conduct Problems/Substance Use at Ages 12-14 (N=652)
Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class.
Percentage of sample classified in each latent class provided in legend.

Table 21.
Log Odds Coefficients and Odds Ratio for Three-Class CP/SU Model at Ages 12-14 with a Demographic Factor as a Covariate Using the No CP/SU Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
Low CP	Age	1.298*	.602	2.155	3.662
	Male	.484	.519	.931	1.623
	SES	-.037**	.014	-2.701	.964
	Paternal SUD	.551*	.266	2.071	1.735
	Paternal Dx	.548	.410	1.338	1.730
CP+SU	Age	.075	.230	.325	1.078
	Male	.750	.590	1.272	2.117
	SES	-.043**	.010	-4.279	.958
	Paternal SUD	1.224**	.291	4.204	3.401
	Paternal Dx	.141	.473	.299	1.151

Note. Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class, Age = age at Time 2 (ages 12-14), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal DEP = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$.

Logistic regressions (see Table 21) revealed that compared to the No CP/SU class at Time 2, youth in the Low CP and CP+SU classes were more likely to have a paternal history of substance dependence and to be from lower SES backgrounds. Youth in the Low CP class were more likely to be older than youth in the No CP/SU class.

CP/SU LCA at Time 3

Similar to the Times 1 and 2 CP/SU LCA models, results for the CP/SU LCA model at Time 3 (see Table 22) indicated that the three-class CP/SU model best fit the data, as this model had a low BIC, which did not decrease much with the addition of a fourth class, and also had good separation of classes (entropy = .866). Most youth in the sample (range of posterior class probabilities = .912 to .959) were placed into a class that reflects their respective levels of severity of index youth CP and SU. The three-class CP/SU model had an acceptable smallest class size (17.0%, n = 104), which was also conceptually important. Again, the number of classes that emerged was not consistent with the hypothesized four-class model.

Similar to Times 1 and 2, conditional item probabilities for each CP/SU class at Time 3 (see Figure 15) indicated a No CP/SU class (61.6%). In addition, the CP+SU class (17.0% of the sample) was similar to the Time 2 CP+SU class in terms of a moderate to high probability of endorsing a range of CP behaviors, as well as alcohol and cannabis use. Of note, although the ADP-SC class was in part characterized by a moderate probability of peer hard drug use, no CP/SU class at Time 3 exhibited levels of hard drug use comparable to the ADP-SC class. In contrast to the third CP/SU classes at Times 1 and 2, a class of youth exhibiting a high probability of alcohol and marijuana use (i.e., SU) emerged at Time 3 and represented 21.4% of the sample; these youth also had a

moderate probability of exhibiting two ODD symptoms, loses temper and annoys others. In sum, the three classes were consistent with hypotheses in terms of differences in type of index youth behaviors, although no CP class emerged at Time 3 as expected.

Table 22.
Index Youth Conduct Problems and Substance Use Class Model Comparison at Ages 16

Classes	Free parameters	Log likelihood	AIC	BIC	ABIC	BLRT	Entropy	Smallest Class Size *n* (%)
1	17	-3838.96	7711.926	7787.259	7733.286	N/A[a]	N/A[a]	621 (100.0)
2	35	-3326.21	6722.426	6877.523	6766.404	0.000	0.844	156 (25.5)
3	53	-3167.47	6440.938	6675.799	6507.532	0.000	0.866	104 (17.0)
4	71	-3103.22	6348.443	6663.068	6437.654	0.000	0.836	72 (11.8)
5	89	-3060.81	6299.627	6694.016	6411.455	0.000	0.825	19 (3.0)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion, ABIC=Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
[a]BLRT and Entropy not available for the one-class model.

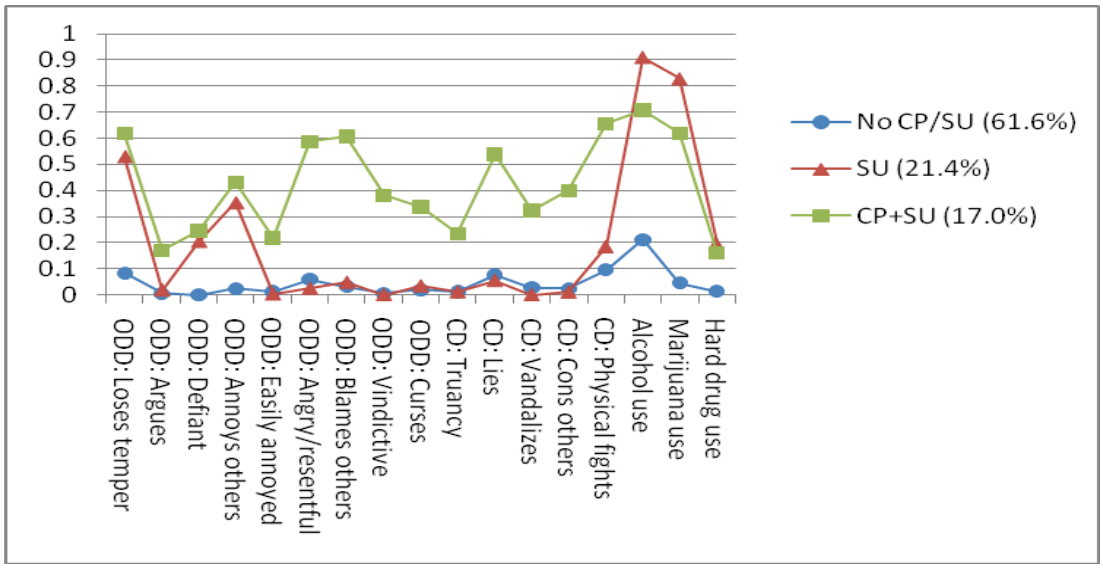

Figure 15
Conditional Item Probability Profile Plots for the Three-Class Model of Index Youth Conduct Problems/Substance Use at Age 16 (N=621)
Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class.
Percentage of sample classified in each latent class provided in legend.

Compared to the No CP/SU class at Time 3 (Table 23), youth in the SU and CP+SU classes were more likely to have a paternal history of substance dependence and to be from lower SES backgrounds. Youth in the SU class were more likely to be male and older than youth in the No CP/SU class.

Table 23.
Log Odds Coefficients and Odds Ratio for Three-Class CP/SU Model at Age 16 with a Demographic Factor as a Covariate Using the No CP/SU Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
SU	Age	1.019**	.253	4.023	2.770
	Male	.814*	.363	2.242	2.257
	SES	-.022*	.009	-2.294	.978
	Paternal SUD	.612**	.230	2.668	1.844
	Paternal Dx	.024	.377	.063	1.024
CP+SU	Age	.008	.323	.024	1.008
	Male	-.205	.262	-.785	.815
	SES	-.034**	.009	-3.854	.967
	Paternal SUD	1.519**	.271	5.615	4.568
	Paternal Dx	-.354	.425	-.834	.702

Note. SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class, Age = age at Time 3 (age 16), Male = sex (female = 0, male = 1), SES = socioeconomic status at Time 1 (ages 10-12), Paternal DEP = paternal history of substance use disorder (no history = 0, history =1), Paternal Dx = paternal history of other psychiatric disorder (no history = 0, history =1).
** $p < .01$, * $p < .05$.

Aim 2: Stability of ADP and CP/SU Classes Across Times 1, 2, and 3

Stability and developmental timing of ADP and index youth CP/SU class membership was examined using LTA. Given the differences in type and number of ADP and index youth CP/SU classes across Times 1, 2, and 3, full measurement noninvariance was assumed so that parameters were freely estimated across classes and across time. For each ADP and CP/SU class, cross-tabulation of changes in class membership over time was examined first. Next, LTA conditional transition probabilities were explored to evaluate stability and change in class membership. With the addition of latent classes from different time points into the LTA model, slight alterations to class membership

were evidenced. However, both ADP and CP/SU class interpretations remained consistent across all LTAs (e.g., the Low ADP classes continued to be characterized by low levels of peer CP and SU at Times 1, 2, and 3).

Aim 2a: Stability of ADP Classes

Cross Tabulation of ADP Class Membership

Most youth (70%) moved into an ADP class characterized by some deviant peer behavior by Time 3. As outlined in Table 24, the Low ADP class comprised just over half the sample at Times 1 (56.0%) and 2 (57.1%), but, consistent with hypotheses, decreased at Time 3 (29.3%).

Table 24.
Percentage of Sample (n) in ADP Class Across Time 1, 2, and 3

	10-12 years (*N*=766)	12-14 years (*N*=651)	16 years (*N*=618)
Low ADP	56.0 (429)	57.1 (371)	29.3 (181)
ADP-CP	34.7 (266)	19.3 (126)	
ADP-SU			30.8 (191)
ADP-C	9.2 (71)	12.6 (82)	28.6 (176)
ADP-SC		11.0 (72)	11.3 (70)

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.

An ADP latent class defined by primarily peer CP comprised roughly one-third of the sample at Time 1 (ADP-CP, 34.7%), but decreased in size at Time 2 (19.3%), and was not identified at Time 3. Rather, at Time 3 only, an ADP class characterized by peer SU emerged and comprised nearly one-third of the sample (30.8%). An ADP-C class was identified at each time point, which slightly increased from Times 1 (9.2%) to 2 (12.6%),

and dramatically increased in size from Times 2 to 3 (28.6%), a pattern consistent with hypotheses. Last, an ADP class characterized by severe levels of peer CP and SU emerged at only Times 2 and 3 and consistently comprised about 11% of the sample.

LTA of ADP Class Membership.

Consistent with cross-tabulation results of ADP classes across Times 1 and 2, transitions among ADP classes from ages 10-12 to 12-14 were marked by high levels of stability of the Low ADP class and moderate stability of ADP classes defined by some deviant peer behavior (see Table 25). Most youth in the Low ADP class at Time 1 remained in that class at Time 2 (74.2%). In contrast, only moderate levels of stability were evidenced among youth in the ADP-CP (38.5%) and ADP-C (37.6%) classes from Time 1 to Time 2. Among those in the ADP-CP class at Time 1 who transitioned out of this class at Time 2, most (28.4%) showed a decrease in involvement with deviant peers (i.e., transitioned to the Low ADP class). In contrast, among youth in the ADP-C class at Time 1 who transitioned out of that class at Time 2, similar proportions of youth changed to associating with peers exhibiting more severe CP and SU behaviors (i.e., the ADP-SC class, 22.2%) as moved to associating with peers exhibiting low levels of both CP or SU behaviors (i.e., the Low ADP; 25.7%).

An overall trend of increased involvement with deviant peers resulted from the LTA examining stability of ADP class membership from Times 2 to 3 (see Table 26). Although not as stable as from Times 1 to 2, most youth in the Low ADP class at Time 2 remained in that class at Time 3 (48.9%). In concert with this lower rate of stability of the Low ADP class from age 12-14 to 16, nearly one-third of youth in the Low ADP class at Time 2 became involved with peers exhibiting SU at Time 3 (ADP-SU, 31.8%). Youth in

the ADP-CP class at Time 2 (identified at Times 1 and 2 only) tended to either engage with peers exhibiting only SU (31.8%) or both CP and SU (40.7%) at Time 3. Stability of membership in the ADP-C (49.3%) and ADP-SC (47.1%) classes was moderate from Times 2 to 3, and transitions out of these classes largely resulted in continuing involvement with peers who engaged in some form of deviant behavior. Among the

Table 25.
Transition Probabilities for Association with Deviant Peer Latent Classes from Time 1 to Time 2

Time 1 (Ages 10-12)	Time 2 (Ages 12-14)			
	Low ADP (56.1%)	ADP-CP (23.1%)	ADP-C (11.4%)	ADP-SC (9.4%)
Low ADP (57.3%)	.742	.137	.033	.089
ADP-CP (34.2%)	.284	.385	.184	.147
ADP-C (8.5%)	.257	.146	.376	.222

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.

Table 26.
Transition Probabilities for Association with Deviant Peer Latent Classes from Time 2 to Time 3

Time 2 (Ages 12-14)	Time 3 (Age 16)			
	Low ADP (31.0%)	ADP-SU (30.5%)	ADP-C (28.0%)	ADP-SC (10.5%)
Low ADP (55.0%)	.489	.318	.168	.025
ADP-CP (21.0%)	.136	.318	.407	.139
ADP-C (12.6%)	.013	.432	.493	.068
ADP-SC (11.4%)	.094	.083	.352	.471

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.

youth who transitioned out of the ADP-C and ADP-SC classes, 43.2% of youth in the ADP-C class at 12-14 years transitioned to engagement with peers who primarily engaged in SU (i.e., alcohol and cannabis) at age 16. In addition, some youth in the ADP-SC class at 12-14 years became involved with peers exhibiting less severe forms of both of these deviant behaviors at 16 years (ADP-C, 35.2%).

Aim 2b: Stability of Index Youth CP/SU Classes

Cross Tabulation of CP/SU Class Membership

Although a decrease in proportion of index youth in the No CP/SU class was expected, across Times 1, 2, and 3 the No CP/SU class comprised half or more than half of the sample (see Table 27), peaking at 69.5% at Time 2 (ages 12-14). The Low CP class represented a large portion of the sample at Time 1 (40.4%), but decreased in size at Time 2 (20.5%), and was not identified at Time 3. Two classes, High CP and SU, were only identified at one time point, Times 1 and 3, respectively. Emergence of the High CP class (11.3%) at only ages 10-12 and the SU class at only age 16 indicate levels of index youth SU may be particularly low in early adolescence, whereas SU may be typical among those in mid-adolescence (21.4%). Last, a class of index youth identified by both CP and SU behaviors

Table 27.
Percentage of Sample (n) in Index Youth CP/SU Class Across Times 1, 2, and 3

	10-12 years (*N*=775)	12-14 years (*N*=652)	16 years (*N*=621)
No CP/SU	48.3 (375)	69.5 (453)	61.6 (382)
Low CP	40.4 (313)	20.5 (134)	
High CP	11.3 (87)		
SU			21.4 (133)
CP+SU		10.0 (65)	17.0 (106)

Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class.

emerged at only Times 2 and 3 and nearly doubled from ages 12-14 (10.0%) to age 16 (17%). This increase in the CP+SU class was consistent with hypotheses.

LTA of CP/SU Class Membership

Transitions from Times 1 to 2 in CP/SU class membership were marked by decreases in index youth deviant behavior, yet some stability in deviant behavior among youth in the highest risk CP/SU class at Time 1 (High CP). Consistent with cross-tabulation results of CP/SU classes across Times 1 and 2 noted above, stability of No CP/SU class membership was 95.1% (see Table 28) across Times 1 to 2. In addition, most youth in the Low CP/SU class at Time 1 transitioned to the No CP/SU class at Time 2 (66.3%). Less than one-third of youth in the Low CP class at Time 1 exhibited stability in class membership from Time 1 to Time 2 (29.5%). Youth in the High CP class at ages 10-12 tended to continue to exhibit some deviant behavior at ages 12-14, with 43.1% exhibiting low levels of CP and 32.8% exhibiting both CP and SU behaviors.

Similarly, from Times 2 to 3, most youth in the No CP/SU class at Time 2 stayed in this class at Time 3 (72.7%). Also similar to the transitions evidenced from Times 1 to 2, nearly half of the youth in the Low CP class at ages 12-14 transitioned to the No CP+SU class at age 16 (49.0%). However, different from latent transitions from Time 1 to 2, youth in the Low CP class at ages 12-14 tended to exhibit largely divergent patterns of behavior at age 16, with 49.0% exhibiting nearly zero CP or SU behaviors (i.e., No CP/SU class) and 37.0% exhibiting both CP and SU behaviors (i.e., CP+SU) at Time 3. Last, consistent with the continued deviant behavior among youth in the highest risk class (i.e., High CP) from Times 1 to 2, 97.2% of youth in the highest risk class at Time 2 (i.e.,

CP+SU) continued to exhibit some type of deviant behavior at Time 3. Specifically, there was moderate stability of membership in the CP+SU class (55.4%) from ages 12-14 to 16. Among those not remaining in the CP+SU class across ages 12-14 and 16, most transitioned to the SU class (41.8%).

Table 28.
Transition Probabilities for Index Youth Conduct Problem/Substance Use Latent Classes from Time 1 to Time 2

Time 1 (Ages 10-12)	Time 2 (Ages 12-14)		
	No CP/SU (75.5%)	Low CP (18.5%)	CP+SU (6.1%)
No CP/SU (49.3%)	.951	.038	.011
Low CP (38.9%)	.663	.295	.043
High CP (11.8%)	.241	.431	.328

Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class.

Table 29.
Transition Probabilities for Index Youth Conduct Problem/Substance Use Latent Classes from Time 2 to Time 3

Time 2 (Ages 12-14)	Time 3 (Age 16)		
	No CP/SU (60.5%)	SU (21.5%)	CP+SU (18.0%)
No CP/SU (70.3%)	.727	.202	.071
Low CP (18.5%)	.490	.140	.370
CP+SU (11.2%)	.028	.418	.554

Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class.

Aim 3: Selection and Socialization Processes

Aim 3a: Selection

To examine selection of deviant peers across Times 1, 2, and 3, ADP class at Times 2 and 3 was regressed on index youth CP/SU class at Times 1 and 2, respectively. Consistent with expectations and behavioral homophily, 68.6% of index youth exhibiting nearly zero CP or SU (i.e., No CP/SU class; see Table 30) at ages 10-12 selected similarly non-deviant peers as friends (i.e., Low ADP class) at ages 12-14. However, nearly half of index youth (49.2%) exhibiting some CP behavior (i.e., Low CP class) at ages 10-12 selected friends who largely exhibited non-deviant behavior (i.e., Low ADP) at ages 12-14. Only 23.4% of index youth exhibiting low levels of CP behavior at ages 10-12 chose friends who also exhibited CP behaviors (ADP-CP) at ages 12-14. In contrast, selection of similarly behaving peers as friends was evidenced in transitions from the High CP class at Time 1 to ADP classes at Time 2. Indeed, 77.5% of index youth exhibiting high levels of CP at ages 10-12 chose friends who exhibited some deviant behavior at ages 12-14; specifically, CP (29.5%), both CP and SU (21.3%), or severe levels of both CP and SU (26.7%). Although index youth in the High CP class at Time 1 generally selected deviant peers as friends at Time 2, selection based on specific type of deviant behavior (i.e., CP vs. SU) was not evidenced. That is, youth in the High CP class at Time 1 were relatively as likely to select deviant peers exhibiting CP (i.e., similar type and severity of deviant behavior), as they were to select deviant peers exhibiting CP and SU or severe CP and SU.

Table 30.
Transition Probabilities for Selection Process: Transitions from Index Youth Conduct Problem/Substance Use Latent Class at Time 1 to Association with Deviant Peer Latent Class at Time 2

Time 1 (Ages 10-12)	Time 2 (Ages 12-14)			
	Low ADP (56.1%)	ADP-CP (20.4%)	ADP-C (12.4%)	ADP-SC (11.1%)
No CP/SU (50.3%)	.686	.162	.113	.040
Low CP (38.8%)	.492	.234	.114	.159
High CP (10.9%)	.226	.295	.213	.267

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class.

In contrast to patterns of selection in early adolescence, selection of friends based on similar type and severity of CP and SU behaviors was evidenced from early to mid-adolescence (from Times 2 to 3). Specifically, 90.4% of index youth in the CP+SU class at ages 12-14 chose friends who exhibited either CP and SU (ADP-C, 32.6%) or severe levels of CP and SU (ADP-SC, 57.8%) at age 16. In addition, 35.5% of index youth exhibiting nearly zero CP or SU at ages 12-14 selected non-deviant friends (i.e., Low ADP class) at age 16. This pattern of selection was consistent with expectations. However, results also suggested that index youth do not only select friends based on similarities in CP and/or SU behaviors, as 35.8% of youth in the No CP/SU class at Time 1 selected friends who engaged in SU at Time 2. Index youth exhibiting low levels of CP at ages 12-14 had the highest probability (38.9%) of selecting friends who exhibited both

CP and SU at age 16, compared to selecting friends engaging in any other combination of type and severity of deviant behavior (i.e., Low ADP, ADP-SU, ADP-SC).

Table 31.
Transition Probabilities for Selection Process: Transitions from Index Youth Conduct Problem/Substance Use Latent Class at Time 2 to Association with Deviant Peer Latent Class at Time 3

Time 2 (Ages 12-14)	Time 3 (Age 16)			
	Low ADP (29.3%)	ADP-SU (31.3%)	ADP-C (28.9%)	ADP-SC (10.5%)
No CP/SU (69.7%)	.355	.358	.254	.033
Low CP (21.2%)	.214	.259	.389	.138
CP+SU (9.1%)	.000	.097	.326	.578

Note. Low ADP = low level of association with deviant peers class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class.

Aim 3b: Socialization

To examine potential influence of deviant peers on index youth across Times 1, 2, and 3, CP/SU class at Times 2 and 3 was regressed on index youth ADP class at Times 1 and 2, respectively. Previous CP/SU class membership was controlled in all analyses to isolate socialization processes. In contrast to hypotheses, results suggested low levels of socialization from ages 10-12 to ages 12-14 (see Table 32). Despite being friends with deviant peers, youth in the ADP-CP (61.9%) and ADP-C (65.8%) classes at Time 1 were most likely to be in the No CP/SU class at Time 2. Of youth exposed to friends engaging in CP at ages 10-12, 32.6% exhibited similar CP behavior at ages 12-14. Of note, 82.5% of index youth whose peers were primarily non-deviant at ages 10-12 exhibited nearly zero CP or SU at ages 12-14, suggesting socialization to avoid behavior problems.

Table 32.
Transition Probabilities for Socialization Process: Transitions from Association with Deviant Peer Latent Class at Time 1 to Index Youth Conduct Problem/Substance Use Latent Class at Time 2 Controlling for Index Youth Conduct Problems/Substance Use Latent Class at Time 1

Time 1 (Ages 10-12)	Time 2 (Ages 12-14)		
	No CP/SU (73.5%)	Low CP (20.9%)	CP+SU (5.6%)
Low ADP (54.7%)	.825	.136	.039
ADP-CP (36.0%)	.619	.326	.055
ADP-C (9.3%)	.658	.179	.163

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class.

Compared to socialization from Times 1 to 2, results from Times 2 to 3 suggested moderate levels of socialization (see Table 33). Although substantial proportions of youth in the ADP-CP (42.2%), ADP-C (38.2%), and ADP-SC (40.0%) classes at Time 2 transitioned to the No CP/SU class at Time 3, the majority of youth in each of these classes (ADP-CP, 57.8%; ADP-C, 61.7%; ADP-SC, 60.0%) exhibited SU or SU and CP at Time 3. However, there was no evidence that socialization processes varied by type of deviant peer behavior. For example, compared to youth with friends engaging in predominantly CP at Time 2 (ADP-CP, 22.6%), youth with friends engaging in both CP and SU behaviors at Time 2 (ADP-C, 20.1% and ADP-SC, 22.6%) were not more likely to transition to the CP+SU class at Time 3. Similar to socialization analyses from Times 1 to 2, most index youth whose peers were primarily non-deviant at ages 12-14 exhibited nearly zero CP or SU at age 16, suggesting socialization to not engage in antisocial behaviors.

Table 33.
Transition Probabilities for Socialization Process: Transitions from Association with Deviant Peer Latent Class at Time 2 to Index Youth Conduct Problem/Substance Use Latent Class at Time 3 Controlling for Index Youth Conduct Problems/Substance Use Latent Class at Time 2

Time 2 (Ages 12-14)	Time 3 (Age 16)		
	No CP/SU (58.6%)	SU (23.7%)	CP+SU (17.8%)
Low ADP (56.9%)	.723	.131	.146
ADP-CP (19.5%)	.422	.352	.226
ADP-C (12.5%)	.382	.416	.201
ADP-SC (11.1%)	.400	.374	.226

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class.

Aim 4: Child-Specific Factors as Moderators of Selection and Socialization

Prior to analyzing the moderating roles of neuropsychological functioning and temperamental emotionality on selection and socialization, I explored relations of these moderator variables with ADP and CP/SU class membership. Neuropsychological functioning at Time 1 predicted ADP class membership at Times 1 and 3, and temperamental emotionality at Time 1 predicted ADP class membership at Time 2 (see Table 34). Youth exhibiting poorer neuropsychological functioning at ages 10-12 were more likely to be in the ADP-CP or the ADP-C classes at ages 10-12 compared to the Low ADP class. Although only marginally significant, poorer neuropsychological functioning was associated with higher likelihood of membership in the ADP-SC class (OR = .755, $p < .10$) compared to the Low ADP class at age 16. Neuropsychological functioning did not differentiate among classes at ages 12-14, which was the only time point temperamental emotionality predicted ADP class membership. Compared to youth

in the Low ADP class, youth with more negative temperamental emotionality were more likely to be in the ADP-CP or ADP-C classes, and marginally more likely to be in the ADP-SC class at ages 12-14.

Table 34.
Log Odds Coefficients and Odds Ratio for ADP Models at Ages 10-12, 12-14, and 16 with a Moderator as a Covariate Using the Low ADP Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
Time 1					
ADP-CP	ECF	-.400**	.103	-3.864	.670
	Emotionality	-.053	.056	-.952	.948
ADP-C	ECF	-.361*	.152	-2.380	.697
	Emotionality	-.095	.063	-1.510	.909
Time 2					
ADP-CP	ECF	-.110	.124	-.881	.896
	Emotionality	-.125**	.040	-3.101	.822
ADP-C	ECF	-.095	.137	-.690	.909
	Emotionality	-.110*	.044	-2.498	.896
ADP-SC	ECF	.105	.195	.541	1.111
	Emotionality	-.118^	.061	-1.939	.889
Time 3					
ADP-SU	ECF	.153	.145	1.058	1.165
	Emotionality	.055	.048	1.138	1.057
ADP-C	ECF	-.066	.125	-.529	.936
	Emotionality	-.044	.036	-1.219	.957
ADP-SC	ECF	-.281^	.155	-1.809	.755
	Emotionality	-.074	.056	-1.322	.929

Note. Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class, ECF = executive cognitive functions at Time 1, Emotionality = temperamental emotionality at Time 1.
** $p < .01$, * $p < .05$, ^ $p < .10$.

In contrast to relations with ADP class membership, both neuropsychological functioning and temperamental emotionality at Time 1 predicted CP/SU class membership at Times 1, 2, and 3 (see Table 35). Similar to relations with ADP class membership, poorer neuropsychological functioning and more negative temperamental emotionality conferred greater risk for membership in CP/SU classes characterized by some rather than no CP and/or SU behaviors. For example, youth exhibiting poorer neuropsychological functioning and/or more negative temperamental emotionality at ages

10-12 were more likely to be in the Low CP and the High CP classes at ages 10-12 compared to the No CP/SU class. However, at Time 2, each of these moderators predicted membership in different CP/SU classes. Compared to youth in the No CP/SU class at ages 12-14, youth exhibiting poorer neuropsychological functioning or more negative temperamental emotionality were more likely to be in the CP+SU and Low CP classes, respectively. At Time 3, moderators only predicted class membership in the highest risk CP/SU class, CP+SU. Compared to youth in the No CP/SU class, youth with more negative temperamental emotionality and poorer neuropsychological functioning were more likely to be in the CP+SU class at age 16.

Table 35.
Log Odds Coefficients and Odds Ratio for Three-Class CP/SU Model at Ages 10-12, 12-14, and 16 with a Moderator as a Covariate Using the No CP/SU Class as the Comparison Group

Class	Effect	Logit	*SE*	*t*	Odds ratio
Time 1					
Low CP	ECF	-.252*	.101	-2.508	.777
	Emotionality	-.122**	.039	-3.162	.885
High CP	ECF	-.468**	.122	-3.841	.626
	Emotionality	-.281**	.046	-6.047	.755
Time 2					
Low CP	ECF	-.119	.163	-.729	.888
	Emotionality	-.166**	.042	-3.940	.847
CP+SU	ECF	-.315*	.146	-2.148	.730
	Emotionality	-.088^	.046	-1.914	.916
Time 3					
SU	ECF	-.118	.127	-.926	.889
	Emotionality	-.070	.036	-1.922^	.932
CP+SU	ECF	-.604**	.128	-4.736	.547
	Emotionality	-.103**	.037	-2.803	.902

Note. No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class, ECF = executive cognitive functions at Time 1, Emotionality = temperamental emotionality at Time 1.
** $p < .01$, * $p < .05$, ^ $p < .10$.

Aim 4a: Moderation of Selection

To examine the moderation of selection, the relation between ADP class membership and (a) neuropsychological functioning and (b) temperamental emotionality were allowed to vary across prior CP/SU class. Results indicated minimal moderation of selection from Times 1 to 2 with only temperamental emotionality, and not neuropsychological functioning, significantly moderating this process (see Table 36).

Table 36.
Moderation of Selection from Times 1 to 2: Log Odds Coefficients and Odds Ratios for ECF Predicting ADP Class Membership at Time 2 within each CP/SU Class at Time 1

Class (ages 10-12)	Outcome (ages 12-14)	Logit	*SE*	*t*	Odds ratio
No CP/SU	ADP-CP	-.436	.337	-1.294	.647
	ADP-C	-.232	.213	-1.092	.793
	ADP-SC	-.059	.331	-.180	.943
Low CP	ADP-CP	.178	.245	.729	1.195
	ADP-C	.116	.304	.382	1.123
	ADP-SC	.502	.347	1.444	1.652
High CP	ADP-CP	.779^	.457	1.704	2.179
	ADP-C	.145	.426	.340	1.156
	ADP-SC	.423	.612	.690	1.527

Note. ECF = executive cognitive functions at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Low ADP class used as comparison group for each multinomial regression.
^ $p < .10$.

Youth exhibiting no CP or SU behaviors and higher levels of negative temperamental emotionality at ages 10-12 were at risk for ADP-SC, compared to Low ADP class membership, at ages 12-14 (see Table 37). Although many youth (68.6%; see Table 30) in the No CP/SU class selected into the Low ADP class from Time 1 to Time 2, negative temperamental emotionality may put youth at-risk for later ADP over and above the level of index youth CP and SU.

Table 37.
Moderation of Selection from Times 1 to 2: Log Odds Coefficients and Odds Ratios for Emotionality Predicting ADP Class Membership at Time 2 within each CP/SU Class at Time 1

Class (ages 10-12)	Outcome (ages 12-14)	Logit	*SE*	*t*	Odds ratio
No CP/SU	ADP-CP	-.025	.135	-.188	.975
	ADP-C	-.037	.128	-.294	.964
	ADP-SC	-.280**	.099	-2.820	.756
Low CP	ADP-CP	-.090	.109	-.831	.914
	ADP-C	-.067	.066	-1.029	.935
	ADP-SC	.137	.236	.580	1.147
High CP	ADP-CP	-.056	.121	-.460	.946
	ADP-C	.105	.127	.825	1.111
	ADP-SC	-.035	.242	-.144	.966

Note. Emotionality = temperamental emotionality at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Low ADP class used as comparison group for each multinomial regression.
** $p < .01$.

Both neuropsychological functioning and temperamental emotionality moderated the selection processes from Time 2 to Time 3. Among youth in the No CP/SU class at ages 12-14, better neuropsychological functioning was associated with a higher likelihood of being in the ADP-C and ADP-SC compared to the Low ADP class at age 16 (see Table 38). Put another way, index youth exhibiting no CP or SU (i.e., No CP/SU class), as well as better neuropsychological functioning, were at increased risk for later involvement in a deviant peer group characterized by peer CP and SU behaviors.

In contrast, among youth exhibiting some CP behaviors, poorer neuropsychological functioning and negative emotionality conferred risk for later involvement with peers engaging in severe levels of both CP and SU (see Tables 38 and 39 above). Index youth exhibiting low levels of CP at ages 12-14 and poorer neuropsychological functioning were at increased risk for involvement with peers

engaging in severe levels of both CP and SU, compared to peers engaging in non-deviant (i.e., Low ADP) behaviors at age 16.

Table 38.
Moderation of Selection from Times 2 to 3: Log Odds Coefficients and Odds Ratios for ECF Predicting ADP Class Membership at Time 3 within each CP/SU Class at Time 2

Class (ages 12-14)	Outcome (ages 16)	Logit	*SE*	*t*	Odds ratio
No CP/SU	ADP-SU	.438	.660	.664	1.550
	ADP-C	1.095**	.412	2.658	2.989
	ADP-SC	1.215**	.394	3.086	3.370
Low CP	ADP-SU	.134	.191	.699	1.143
	ADP-C	-.051	.165	-.311	.950
	ADP-SC	-.939**	.359	-2.614	.391
CP+SU	ADP-SU	.516	.838	.615	1.675
	ADP-C	.115	.462	.249	1.122
	ADP-SC	.439	.557	.787	1.551

Note. ECF = executive cognitive functions at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-SU = association with deviant peers who primarily exhibit substance use class ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Low ADP class used as comparison group for each multinomial regression.
** $p < .01$.

Table 39.
Moderation of Selection from Times 2 to 3: Log Odds Coefficients and Odds Ratios for Emotionality Predicting ADP Class Membership at Time 3 within each CP/SU Class at Ages 12-14

Class (ages 12-14)	Outcome (ages 16)	Logit	*SE*	*t*	Odds ratio
No CP/SU	ADP-SU	.099^	.056	1.779	1.140
	ADP-C	-.003	.050	-.069	.997
	ADP-SC	.212	.282	.752	1.236
Low CP	ADP-SU	-.037	.137	-.271	.964
	ADP-C	-.109	.102	-1.064	.897
	ADP-SC	-.259*	.128	-2.025	.772
CP+SU	ADP-SU	-.271	.330	-.822	.763
	ADP-C	-.072	.302	-.239	.931
	ADP-SC	-.078	.286	-.271	.925

Note. Emotionality = temperamental emotionality at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-SU = association with deviant peers who primarily exhibit substance use class ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
Low ADP class used as comparison group for each multinomial regression.
* $p < .05$, ^ $p < .10$.

Similarly, among youth in the Low CP class at ages 12-14, negative temperamental emotionality was associated with a higher likelihood of being in the ADP-SC rather than the Low ADP class at age 16. Only 13.8% of youth in the Low CP class at Time 2 transitioned to the ADP-SC class at Time 3 (see Table 31). Levels of neuropsychological functioning and temperamental emotionality among these Low CP youth may aid in prediction of later atypical levels of ADP.

Aim 4b: Moderation of Socialization

To examine the moderation of socialization, the relation between CP/SU class membership and (a) neuropsychological functioning and (b) temperamental emotionality were allowed to vary across previous ADP class. In all analyses regarding moderation of socialization, previous CP/SU class membership was controlled. Similar to moderation of selection, results indicated little moderation of socialization from Times 1 to 2, with only temperamental emotionality and not neuropsychological functioning (see Table 40) significantly moderating this process.

Table 40.
Moderation of Socialization from Times 1 to 2: Log Odds Coefficients and Odds Ratios for ECF Predicting CP/SU Class Membership at Time 2 within each ADP Class at Time 1

Class (10-12)	Outcome (ages 12-14)	Logit	*SE*	*t*	Odds ratio
Low ADP	Low CP	.096	.486	.197	1.101
	CP+SU	-.473	.646	-.732	.623
ADP-CP	Low CP	-.065	.256	-.253	.937
	CP+SU	-.397	.345	-1.151	.672
ADP-C	Low CP	.574	.523	1.098	1.775
	CP+SU	.542^	.317	1.712	1.719

Note. ECF= executive cognitive functions at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class.
No CP/SU class used as comparison group for each multinomial regression.
^ $p < .10$.

Youth in the ADP-C class who also exhibited higher levels of positive temperamental emotionality at ages 10-12 were more likely to be in the Low CP class (see Table 41) compared to the No CP/SU class, at ages 12-14. Stated differently, youth who exhibited higher levels of positive emotionality were more susceptible to influence of deviant peers than those with more negative emotionality to continue or begin engaging in subsequent CP and/or SU behaviors. With only 17.9% of youth in the ADP-C class at Time 1 (see Table 32) transitioning to the Low CP class at Time 2, positive temperamental emotionality may aid in better prediction of which youth are susceptible to deviant peer influence.

Similar to moderation of socialization from Times 1 to 2, results indicated minimal moderation of socialization from Times 2 to 3. Neuropsychological functioning moderated the relation between Low ADP and later CP/SU class membership (see Table 42).

Table 41.
Moderation of Socialization from Times 1 to 2: Log Odds Coefficients and Odds Ratios for Emotionality Predicting CP/SU Class Membership at Time 2 within each ADP Class at Time 1

Class (10-12)	Outcome (ages 12-14)	Logit	*SE*	*t*	Odds ratio
Low ADP	Low CP	-.068	.085	-.805	.934
	CP+SU	-.141	.157	-.896	.868
ADP-CP	Low CP	-.115	.080	-1.427	.891
	CP+SU	.009	.153	.059	1.009
ADP-C	Low CP	.533*	.255	2.090	1.704
	CP+SU	.224^	.132	1.699	1.251

Note. Emotionality = temperamental emotionality at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class.
No CP/SU class used as comparison group for each multinomial regression.
* $p < .05$, ^ $p < .10$.

Among youth in the Low ADP class at ages 12-14, poorer neuropsychological functioning was associated with a higher likelihood of being in the CP+SU rather than the No CP/SU class at age 16. In other words, youth with minimal exposure to peer CP or SU were still at risk for later CP and SU behaviors if they also exhibited poorer compared to better neuropsychological functioning. With only 14.6% of youth in the Low ADP class at Time 2 (see Table 33) transitioning to the CP+SU class at Time 3, neuropsychological functioning may aid in better prediction of which youth are at risk for later CP and SU behaviors.

Table 42.
Moderation of Socialization from Times 2 to 3: Log Odds Coefficients and Odds Ratios for ECF Predicting CP/SU Class Membership at Time 3 within each ADP Class at Time 2

ADP (ages 12-14)	Outcome (age 16)	Logit	*SE*	*t*	Odds ratio
Low ADP	SU	-.002	.175	-.010	.998
	CP+SU	-.666**	.239	-2.790	.514
ADP-CP	SU	-.279	.608	-.458	.757
	CP+SU	-.457	.664	-.688	.633
ADP-C	SU	-.219	.427	-.514	.803
	CP+SU	-.385	.402	-.958	.680
ADP-SC	SU	.053	.724	.073	1.054
	CP+SU	-1.911	1.406	-1.359	.148

Note. ECF = executive cognitive functions at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
No CP/SU class used as comparison group for each multinomial regression.
** $p < .01$.

The relation between ADP class membership at Time 2 and CP/SU class membership at Time 3 did not change by level of temperamental emotionality (see Table 43).

Table 43.
Moderation of Socialization from Times 2 to 3: Log Odds Coefficients and Odds Ratios for Emotionality Predicting CP/SU Class Membership at Time 3 within each ADP Class at Time 2

ADP (ages 12-14)	Outcome (age 16)	Logit	*SE*	*T*	Odds ratio
Low ADP	SU	.033	.075	.438	1.034
	CP+SU	-.021	.081	-.260	.979
ADP-CP	SU	-.075	.130	-.577	.928
	CP+SU	-.100	.147	-.676	.905
ADP-C	SU	-.069	.157	-.442	.933
	CP+SU	-.081	.162	-.500	.922
ADP-SC	SU	-.058	.199	-.291	.944
	CP+SU	.141	.214	.659	1.151

Note. Emotionality = temperamental emotionality at Time 1, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.
No CP/SU class used as comparison group for each multinomial regression.
** $p < .01$, * $p < .05$, ^ $p < .10$.

Aim 5: SUD Outcome Associated with Adolescent ADP and CP/SU

To test the predictive validity of ADP and CP/SU classes, I examined whether SUD at age 22 differed across classes. As previously noted, the percentage of missing SUD data at age 22 led to insufficient coverage to impute data, so the following analyses were conducted within the original sample. Even with the non-imputed, original dataset and with the addition of a distal outcome, ADP and CP/SU classes were similar to those identified in Aim 1 in terms of class size and conditional item probabilities.

Aim 5a: Prediction of SUD from ADP Classes Across Times 1, 2, and 3

Significant differences in SUD outcome were evidenced across ADP classes and across time. The probability of SUD at age 22 was highest among youth involved with peers exhibiting severe levels of CP and SU (ADP-SC, 79.8%) at age 16 (see Table 44). High probability of SUD at age 22 also was evidenced among youth engaged with peers

exhibiting both CP and SU at Time 1 (ADP-C, 68.1%) and among youth engaged with peers exhibiting severe levels of CP and SU at Time 2 (ADP-SC, 67.9%).

Table 44.
Probability of SUD Outcome at Age 22 Probability By ADP Class Membership Across Ages 10-12, 12-14, and 16

	10-12 years (*N*=772)	12-14 years (*N*=689)	16 years (*N*=661)
Low ADP	.300	.255	.142
ADP-CP	.458	.538	
ADP-SU			.332
ADP-C	.681	.495	.555
ADP-SC		.679	.798

Note. SUD = substance use disorder at Time 4, Low ADP = low level of association with deviant peers class, ADP-CP = association with deviant peers who primarily exhibit conduct problems class, ADP-SU = association with deviant peers who primarily exhibit substance use class, ADP-C = association with deviant peers who exhibit both conduct problems and substance use class, ADP-SC = association with deviant peers who exhibit severe levels of conduct problems and substance use class.

In sum, youth at highest risk for SUD in early adulthood exhibited early involvement with deviant peers with multiple types of and severe deviant behaviors, as well as more proximal involvement with severely deviant peers. Indeed, youth engaged with peers exhibiting non-deviant behavior at the most proximal time point (i.e., age 16) were at lowest risk for SUD at age 22 (Low ADP at Time 3, 14.2%). Of note, 33.2% of youth in the ADP-SU class at age 16 exhibited SUD at age 22, a percentage comparable to youth with non-deviant friends at age 10-12. This pattern of relations lends further support to the notion that the ADP-SU class may be comprised of typically developing adolescents.

Aim 5b: Prediction of SUD from Index Youth CP/SU Classes Across Times 1, 2, and 3

Among CP/SU classes across Times 1, 2, and 3, youth exhibiting multiple types of deviant behavior were at the greatest risk for SUD in early adulthood. Specifically, the probability of SUD at age 22 (see Table 45) was highest among index youth exhibiting both CP and SU at ages 12-14 (79.3%) and at age 16 (79.5%). Early onset CP (High CP

at Time 1, 62.1%) and proximal SU (SU at Time 3, 68.8%) also were associated with a high probability of SUD at age 22.

Table 45.
Probability of SUD Outcome at Age 22 Probability By Index Youth CP/SU Class Membership Across Ages 10-12, 12-14, and 16

	10-12 years (*N*=775)	12-14 years (*N*=690)	16 years (*N*=663)
No CP/SU	.303	.304	.189
Low CP	.434	.499	
High CP	.621		
SU			.688
CP+SU		.793	.795

Note. SUD = substance use disorder at Time 4, No CP/SU = index youth exhibiting nearly zero conduct problems or substance use class, Low CP = index youth exhibiting low levels of conduct problems class, High CP = index youth exhibiting high levels of conduct problems class, SU = index youth exhibiting primarily substance use class, CP+SU = index youth exhibiting both conduct problems and substance use class.
Analyses conducted using original data set, not multiply imputed dataset.

CHAPTER 4
DISCUSSION

Although the extant literature suggests that ADP contribute to the persistence and exacerbation of adolescent CP and SU, few studies have simultaneously investigated selection and socialization processes. In addition, few investigations consider ADP, CP, and SU within the context of typical adolescent development, or examine factors that may increase specificity in identification of at-risk youth. Last, the most common methods of identifying deviant peer group involvement do not distinguish between peer CP and SU behaviors, and consequently are likely to group together at-risk and typically developing youth. Through exploration of differences in quality and type of deviant behaviors (CP and SU), the stability of ADP, risk factors for ADP, and prospective relations among patterns of ADP, CP, and SU across adolescence and SUD in early adulthood, the present study addressed these gaps in the literature.

Results indicated that (a) deviant peer groups varied based on type and severity of deviant peer behavior, as well as risk for later SUD; (b) deviant peer group involvement increased across adolescence and continuity of deviant peer involvement was evident; (c) youth selected peers based on similar levels of deviant behavior across ages 10 to 16 years, but were influenced by these deviant peers to engage in CP and/or SU from ages 12-14 to 16 years; (d) relations between youth deviant behaviors and later selection of deviant friends differed according to levels of youth neuropsychological functioning and temperamental emotionality; and (e) earlier involvement with deviant peers, involvement with deviant peer groups defined by severe CP and SU, and youth engagement in both CP and SU were related to the greatest risk for SUD in early adulthood. In sum, the current project was the first to examine subgroups of youth who differ in type and levels of ADP,

the stability of ADP across adolescence, moderators of selection and socialization, and an external validator (distal outcome, SUD) of subgroups differing on ADP, CP, and SU within the same sample. Findings clarify and extend previous research regarding developmental pathways to ADP, co-occurring CP and SU, and SUD in early adulthood.

Aim 1: Identification of ADP and CP/SU

Use of a person-centered approach to identify classes or subtypes of ADP and index youth CP and SU behaviors allowed for delineation of risk pathways for CP, SU, and SUD. Previous research using summing methods to identify ADP and considering index youth CP and SU behaviors separately (Dishion, Bullock, & Granic, 2002; Kirisci et al., 2007) preclude distinguishing this more nuanced characterization of deviant peer groups, specific risk associated with deviant peer involvement, and development of co-occurring CP and SU.

Consistent with hypotheses, multiple subtypes of deviant peer groups that vary in type and severity of deviant peer behavior, as well as in association with risk factors for continued CP and SU, were identified. Patterns of ADP subtypes, such as prevalence and type of deviant peer behavior, suggest that some involvement with deviant peers is likely typical. For example, involvement with peers primarily engaged in alcohol and cannabis use (i.e., ADP-SU) in mid-adolescence was evidenced among a significant portion of the present sample. Moreover, rates of early adulthood SUD were similar among youth involved with these deviant peers (ADP-SU) compared to youth not involved with deviant peers in early adolescence. In addition, nearly three-quarters of the present sample noted involvement with some deviant peers by mid-adolescence. This increased involvement with deviant peers is consistent with previous literature indicating that ADP

increases from early to mid-adolescence, followed by a decline in ADP after age 15 or 16 (Elliott & Menard, 1996; Warr, 1993). Previous methods of indexing ADP, such as summing all peer deviant behaviors, would likely categorize these typically developing adolescents with those at significant risk for continued CP and SU and later SUD. Indeed, "gold standard" indices of ADP (Dishion et al., 2002; Kirisci et al., 2007) likely have precluded distinguishing among typical and severe levels of peer deviant behaviors, including selling hard drugs and attacking someone with a weapon. Youth involved with these severely deviant peers exhibited additional risks for continued CP and SU, such as lower SES and paternal history of SUD (Kirisci et al., 2007; Lacourse et al., 2006). Taken together, results suggest important qualitative and quantitative differences in subtypes of deviant peer involvement.

Different from hypotheses, subtypes of ADP and index youth CP/SU were not consistent across early to mid-adolescence, though findings were consistent with the developmental patterns suggested by previous research. From early to mid-adolescence, index youth antisocial behavior was defined first by CP, then by CP and co-occurring CP and SU, and finally by SU and co-occurring CP and SU. A group of index youth exhibiting SU did not emerge until 12-14 years (i.e., CP+SU), and was not central to defining index youth antisocial behavior until age 16 (i.e., SU) when CP became less useful in distinguishing among index youth (i.e., a CP class did not emerge at age 16). Findings follow a similar pattern to extant literature, with evidence of SU increases during mid- to late adolescence, perhaps due to decreased parental supervision, increased access to substances, and/or increases in sensation-seeking behavior (Clark & Winters, 2002; Johnston et al., 2007; Steinberg, 2008). Indeed, a national US study found that 39%

of youth reported drinking alcohol and 19% reported using marijuana by the eighth grade (Bachman et al., 2008), when most youth are 13 or 14 years old. Even more, rates of lifetime substance use nearly double between eighth grade and the end of high school (Johnston et al., 2007). Future research should seek to replicate these findings and examine whether subtypes of index youth CP/SU in late adolescence differ in type and/or prevalence from mid-adolescence.

In comparing subtypes of ADP and index youth CP/SU, type of antisocial behavior was similar across these developmental periods, but results suggested earlier onset and greater severity of co-occurring CP and SU among peers compared to index youth. From early to mid-adolescence, ADP subtypes were defined first by peer CP and co-occurring SU and CP, then by peer CP, co-occurring SU and CP, and severe levels of both types of deviant behaviors, and finally by SU, co-occurring SU and CP, and severe levels of both types of antisocial behavior. Index youth reports of earlier onset of co-occurring peer CP and SU, as well as severe levels of peer CP and SU, are likely related to inaccuracies of index youth perceptions of peer behavior. Youth perception and thus youth responses on measures of peer deviant behavior are influenced by index youths' own deviant behaviors. Youth exhibiting higher levels of aggression tend to overestimate the levels of aggression that their best friends exhibit (Prinstein & Wang, 2005). In addition, youth's perception of peer SU is more strongly associated with youth's prior SU than with peer self-reported SU (Iannotti, Bush, & Weinfurt, 1996). This perceptual bias associated with self-reports of friends' deviant behavior likely led to index youth reports of hard drug use among peers and not themselves, as well as of more severe forms of peer CP. Of note, correlations between adolescents' own and friends' behavior tend to be two

to three times stronger when considering adolescents' *perceptions* of friends' deviant behaviors compared to friends' self-report of these behaviors (Iannotti & Bush, 1992; see Kandel, 1996, for a review). Thus, obtaining youth report of peer behavior likely better predicts risk of later index youth CP than peer self-report of deviant behavior. Indeed, these biased perceptions of peer deviant behaviors seemed to predict later patterns of index youth behavior. For example, index youth reported that deviant peers engaged in either CP or co-occurring CP and SU at ages 10-12, but at ages 12-14, deviant index youth self-reported exhibiting either CP or co-occurring CP and SU.

Aim 2: Stability of ADP, CP, and SU across Adolescence

Consistent with hypotheses and previous literature (Clark & Winters, 2002; Johnston et al., 2007; Moffitt, 1993), both peers and index youth exhibited increased and more varied antisocial behavior across early to mid-adolescence. For example, during the transition to mid-adolescence, increased involvement with peers engaging in some deviant behavior was apparent, with those previously not in a deviant peer group reportedly befriending peers exhibiting alcohol and cannabis use. This trend further suggests that involvement with peers using alcohol and cannabis in mid-adolescence is likely typical, rather than atypical, risky behavior.

In terms of continuity of involvement with deviant peers, stability varied by subtype of ADP. Youth involved with peers exhibiting early onset co-occurring CP and SU, as well as those who befriended peers exhibiting severe levels of co-occurring deviant behavior, were at greatest risk for continuity of ADP. Of note, youth involved with deviant peers exhibiting only one type of and less severe deviant behavior showed the greatest instability of ADP, particularly during early adolescence. Variable-centered

methods of indexing ADP, such as summing deviant peer behavior, may have contributed to the wide range of ADP continuity estimates in previous literature (Thornberry et al., 1993; Warr, 1993). Indeed, conflicting findings of stability of ADP mark the extant literature, with one study finding that less than 45% of adolescents are affiliated with deviant peers for more than one year (Thornberry et al., 1993), whereas another study indicated that about 67% of adolescents who associate with deviant friends are likely to maintain such friends over several years (Warr, 1993). In sum, examination of ADP subtypes in the present study afforded greater specificity in identifying youth at risk for continued involvement with deviant peers across early to mid-adolescence.

Similar to ADP stability, continuity of index youth antisocial behavior varied by subgroup of CP/SU behaviors, again suggesting varied pathways to SU and co-occurring CP and SU among youth. Consistent with hypotheses, continuity across time was high among youth exhibiting (a) no CP or SU behaviors, and (b) high levels of CP or co-occurring CP and SU. Youth exhibiting moderate levels of CP and only one type of antisocial behavior exhibited the greatest instability, with some showing desistance of antisocial behavior and others exhibiting increased and expanded types of deviant behavior. This pattern of findings is consistent with developmental models of antisocial behavior spanning from childhood to adolescence that include stable low, increasing, decreasing, and stable high rates of CP and/or aggression (Broidy et al., 2003; Moffitt, 1993). That is, across early to mid-adolescence, youth continued to exhibit either high CP and SU or no CP and SU, whereas some youth exhibiting only CP either expanded antisocial behavior to include SU or decreased to exhibiting no CP or SU.

Results indicated a developmental pathway to SU through prior CP, which later expanded to include SU. However, a pathway to index youth SU that does not include prior CP also emerged. These varying developmental patterns of antisocial behavior are consistent with recent evidence that suggests multiple pathways leading to SU in late adolescence, with one pathway marked by early onset CP and another without early onset CP (Moffitt et al., 2002; Odgers et al., 2008; Silberg et al., 2003). Extending this previous literature, current findings suggest that developmental pathways to SU that include early CP may more likely lead to co-occurring SU and CP. In contrast, pathways to SU not marked by previous CP may be followed by typically developing youth who, in mid-adolescence, experiment with alcohol and/or cannabis use and are not at risk for co-occurring CP and SU. Further research is necessary to evaluate and confirm these potential developmental trajectories.

Aim 3: Selection and Socialization

The present study added to the small literature simultaneously considering selection and socialization processes. Consistent with hypotheses and previous research, results indicated both selection and socialization underlie relations among ADP, CP, and SU (Dodge et al., 2008; Kandel, 1978; Mercken et al., 2009). However, differences in developmental timing were evidenced, with selection occurring across early to mid-adolescence and socialization primarily occurring in mid-adolescence. Results are consistent with and extend findings of Monahan and colleagues (2009), who reported that socialization, rather than selection, primarily accounts for relations among ADP and antisocial behaviors in late adolescence. In addition to the influence of deviant peers, decreases in parental supervision (Laird et al., 2003; Pettit et al., 2007), and thus

increases in opportunity to engage in CP and SU behaviors, likely contribute to the role of socialization in mid- and late adolescence.

Partially consistent with hypotheses, selection, but not socialization, was specific to type of deviant peer behavior in mid-adolescence. Youth exhibiting co-occurring CP and SU were likely to select peers also exhibiting both types of deviant behavior, rather than only one type. Thus, behavioral homophily during this period of adolescence may be specific to similar types of deviant behavior. In contrast, during early adolescence, youth appeared to select peers only based on the presence of deviant or non-deviant behaviors; type of deviant behavior did not influence selection. As youth gain greater independence in mid-adolescence, they are afforded greater opportunities to select friends engaged in the same variety of antisocial behaviors. Given risk of continued involvement with deviant peers engaging in both CP and SU, efforts to monitor friend choices during this period of adolescence to prevent entry into deviant peer groups may be necessary. Future research should consider whether such parental variables modify ADP, CP, and SU trajectories.

Aim 4: Moderation of Selection and Socialization

Consistent with hypotheses and previous research (Gardner et al., 2008; Goodnight et al., 2006), results suggested that selection and socialization processes varied across levels of child-specific factors, namely, neuropsychological functioning and temperamental emotionality. In mid-adolescence, poorer neuropsychological functioning and higher levels of negative temperamental emotionality incremented risk associated with index youth CP in predicting later selection of severely deviant peers. Of note, less than 15% of youth exhibiting CP later befriended peers engaging in severe forms of CP

and SU behaviors, suggesting joint consideration of child-specific factors and peer context may elucidate particularly risky, less common developmental pathways. Thus, the present study extends previous research examining moderation of socialization to include moderators of selection processes. In addition, findings add to child-specific factors previously identified as moderating socialization (i.e., reward dominance and self-regulation) to include neuropsychological functioning and temperamental emotionality.

Partially consistent with hypotheses, minimal evidence of moderation of socialization emerged. By controlling for previous youth CP and SU, socialization processes across adolescence were isolated and significant moderation was evidenced only in early adolescence and only for temperamental emotionality. In contrast to expectations, youth involved with peers exhibiting both CP and SU and exhibiting more positive, compared to negative, temperamental emotionality were at risk for later increases in CP. Less than 20% of youth involved with peers exhibiting CP and SU in early adolescence later transitioned to exhibiting low levels of CP; thus, consideration of temperamental emotionality contributed to clarification of this relatively less common pathway to index youth CP. Although I had hypothesized that negative emotionality would increment risk for socialization, youth who exhibit positive emotionality may be well-liked by deviant peers and thus more central to deviant peer groups. In turn, they may receive high levels of deviancy training, or encouragement and reinforcement to engage in CP and/or SU behaviors. Indeed, youth who are central figures or highly visible in a deviant peer group are more susceptible to peer influence to engage in deviant behavior than youth who are peripheral members of deviant peer groups (Ellis & Zarbatany, 2007).

Aim 5: SUD Outcome Associated with Adolescent ADP and CP/SU

As expected, subtypes of ADP and index youth CP/SU across adolescence varied in terms of risk for SUD in early adulthood. High risk for SUD in early adulthood was related to earlier involvement with deviant peers, involvement with deviant peer groups defined by severe CP and SU, and youth engagement in both CP and SU. Results are consistent with previous research suggesting that early involvement with deviant peers is linked to later violent offending (Lacourse et al., 2006), as well as Warr's (1993) findings that more recent ADP is linked to increased risk for CP and SU. Moreover, evidence of distinct patterns among ADP, CP, and SU in adolescence predicting SUD outcome in early adulthood is consistent with previous studies using the present sample (Kirsci et al., 2007). Finally, these results lend further support to evidence that some types of involvement with deviant peers may be typical in mid-adolescence, such as engagement with peers exhibiting only SU. Consistent with this possibility, involvement with peers engaging in primarily SU in mid-adolescence conferred similar risk of SUD in early adulthood as involvement with few deviant peers in early adolescence.

Strengths, Limitations, and Future Directions

Among the strengths of this study were the longitudinal data spanning early to mid-adolescence and early adulthood and the repeated measures at each time point. The prospective nature of the sample afforded examination of differences in deviant peer involvement across time, developmental timing of selection and socialization, and risk processes leading to SUD in early adulthood. Availability of indices of neuropsychological functioning represented another strength of this study. Use of a person-centered approach to identify classes of ADP and of index youth CP and SU

afforded an opportunity to consider typical and atypical behaviors, as well as specificity of selection and socialization processes. Finally, consideration of moderators of processes underlying ADP allowed for clarification of at-risk developmental pathways. Indeed, transactional processes between individuals and their context are central to a developmental psychopathology perspective and critical for understanding adolescent behavior (e.g., Kazdin & Kagan, 1994; Patterson et al., 1989; Rutter & Sroufe, 2000; Sameroff, 2009; Steinberg & Avenevoli, 2000).

Despite these strengths, the current study is limited by a lack of data regarding deviant peer involvement in late adolescence and reliance on youth self-report of CP during adolescence. As no indices of ADP were administered after age 16 in the project from which these data were derived, I was unable to examine potential subtypes of ADP in late adolescence. This lack of data also precluded examination of relative roles of selection and socialization during this period of adolescence. Furthermore, index youth CP at ages 12-14 and 16 were solely indexed by youth self-report. Youth may have underreported antisocial behaviors in terms of severity and/or frequency. Future research could address these issues by using person-centered approaches to examining ADP in late adolescence and using parent and/or teacher report of CP to examine selection and socialization processes. Nevertheless, youth report is frequently used in research involving CP and SU, particularly among adolescents, as parents and teachers have less knowledge about these behaviors, particularly covert antisocial behaviors. Youth also were aware of confidentiality requirements during data collection, which minimizes some concerns about reporting biases among youth.

Future research also should explore other potential moderators of selection and socialization, such as parental supervision, SES, neighborhood factors, and centrality of deviant peer groups. Among youth from lower SES backgrounds, selection of deviant peers may be higher than among youth from higher SES backgrounds (Moss, Lynch, & Hardie, 2003). Disparate findings regarding the impact of neighborhood factors on relations among ADP, SU, and CP exist. For example, there is some evidence that among African-American samples, social organization modestly moderates the relation between parental monitoring and CP and SU, as well as the relations among ADP, CP, and SU (Rankin & Quane, 2002). However, a second study found that relations between involvement with deviant peers and deviant behavior were independent of neighborhood poverty (Mrug & Windle, 2009). Given this small literature, further empirical examinations of moderators of selection and socialization are necessary. Future research that considers these issues will advance our understanding of deviant peer group development and influence. Findings of these investigations would provide an important framework for etiological and intervention models that could potentially reduce the costs and sequelae associated with deviant peer group involvement.

Conclusions and Clinical Implications

In conclusion, a number of main findings emerged from the present study. First, deviant peer groups are not equivalent in terms of severity and type of deviant behavior, risk for continued ADP, or risk for SUD. Second, risk for selection and socialization vary across early to mid-adolescence. Third, youth vary in terms of risk for selecting deviant peers and being influenced by these peers. Taken together, findings can inform prevention and intervention efforts by increasing specificity in identification of at-risk

youth and shifting focus from preventing entry into deviant peer groups to decreasing susceptibility to deviant peer influence from early to mid-adolescence. Thus, developmentally sensitive assessments should include not only CP and SU, but contextual (e.g., parent and peer processes) and child (e.g., neuropsychological and self-regulation) variables that may influence youth's CP and SU behaviors. Each of these areas can inform case conceptualization (e.g., initiating, maintaining, or exacerbating factors), as well as provide potential opportunities for intervention as some of these variables may be targets of treatment.

Evidence from the present study and previous research also suggests that youth who exhibit poor neuropsychological functioning and self-regulation are at greater risk for selection and socialization (Gardner et al., 2006). These youth may benefit most from individual and/or parent-focused interventions, rather than group-based interventions that expose youth to deviant peers. Nevertheless, caution must be used with group-based approaches, given the possibility for deviancy training among group members (e.g., Dishion et al., 1991). Group-based interventions for youth with CP, such as the Coping Power Program (Lochman & Wells, 2002, 2004; Lochman, Wells, & Lenhart, 2008), explicitly acknowledge this risk and provide additional structure and suggestions for addressing potential deviant talk and deviancy training during group meetings. In addition, programs like Coping Power address peer processes highlighted by the present study's results (e.g., avoiding and minimizing influence of deviant peers, developing prosocial relationships). Assessing these peer variables can facilitate developing a more effective treatment plan and goals for index youth, as well as provide additional treatment targets and outcomes to consider and potentially monitor.

Future research should evaluate whether using risk factors for selection and socialization to match youth to treatment modality for CP and/or SU influences treatment outcome. In a recent study examining outcomes of community-based Multisystemic Therapy for adolescent problem behavior, association with deviant peers was significantly related to treatment failure, particularly when youth were involved with gangs (Boxer, 2011). It may be that youth exhibiting poor self-regulation were at greatest risk for treatment failure, particularly if exposed to peers engaging in severe deviant behaviors. Thus, future research that examines poor self-regulation and neuropsychological functioning in the context of intervention efforts could have implications for whether treatment-matching is effective, whether these variables predict treatment outcome, and whether these child-specific variables are modified by intervention efforts. Although a complex task, consideration of such potential moderators, as well as additional contextual variables (e.g., ADP, parental monitoring), will facilitate identification and intervention with youth at risk for continued CP and SU. Even more, the negative outcomes experienced by these youth, their family and friends, and broader social networks affected by youth CP and SU may be reduced.

REFERENCES CITED

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika, 52*, 317-332.

American Psychiatric Association (1987). *Diagnostic and statistical manual of mental disorders, 3rd edition-revised (DSM-III-R).* Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders, Fourth edition, Text revision (DSM-IV-TR).* Washington, DC: Author.

Armstrong, T.D., & Costello, E.J. (2002). Community studies on adolescent substance use, abuse, or dependence and psychiatric comorbidity. *Journal of Consulting and Clinical Psychology, 70*, 1224-1239.

Aseltine, R.H. (1995). A reconsideration of parental and peer influences on adolescent deviance. *Journal of Health and Social Behavior, 36,* 103-121.

Aytaclar, S., Tarter, R., Kirisci, L., & Lu, S. (1999). Association between hyperactivity and executive cognitive functioning in childhood and substance abuse in early adolescence. *Journal of American Academy of Child and Adolescent Psychiatry, 38*, 172-178.

Bachman, J.G., O'Malley, P.M., Schulenberg, J.E., Johnston, L.D., Freedman-Doan, P., & Messersmith, E.E. (2008). *The education-drug use connection: How success and failures in school relate to adolescent smoking, drinking, drug use, and delinquency.* New York: Taylor and Francis Group/Lawrence Erlbaum.

Bacik, J.M., Murphy, S.A., & Anthony, J.C. (1998). Drug use prevention data, missed assessments and survival analysis. *Multivariate Behavioral Research, 33*, 573-588.

Biederman, J., Newcorn, J., & Spirich, S. (1991). Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *American Journal of Psychiatry, 148*, 564-577.

Blackson, T.C., Tarter, R.E., & Mezzich, A.C. (1996). Interaction between childhood temperament and parental discipline practices on behavioral adjustment in preadolescent sons of substance abuse and normal fathers. *American Journal of Drug and Alcohol Abuse, 22*, 335-348.

Blackson, T.C., & Tarter, R.E. (1994). Individual, family, and peer affiliation factors predisposing to early-age onset of alcohol and drug use. *Alcoholism: Clinical and Experimental Research, 18,* 813-821.

Boxer, P. (2011). Negative peer involvement in multisystemic theray for the treatment of youth problem behavior: Exploring outcome and process variables in "real-world" practice. *Journal of Clinical Child & Adolescent Psychology, 40*, 848-854.

Bozdogan, H. (1987). Model selection and Akaike's Information Criterion (AIC): The general theory and its analytic extensions. *Psychometrika, 52*, 345-370.

Brendgen, M., Vitaro, F., & Bukowski, W.M. (2000). Stability and variability of adolescents' affiliation with delinquent friends: Predictors and consequences. *Social Development, 9*, 205-225.

Broidy, L.M., Nagin, D.S., Tremblay, R.E., Bates, J.E., Brame, B., Dodge, K., et al. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. *Developmental Psychology, 39I, 222-245.*

Brown, B. (2004). Adolescents' relationship with peers. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (2nd ed., pp. 363-394). New York: Wiley.

Cain, A.S., Epler, A.J., Steinley, D., & Sher, K.J. (2010). Stability and change in patterns of concerns related to eating, weight, and shape in young adult women: A latent transition analysis. *Journal of Abnormal Psychology, 119*, 255-267.

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification, 13*, 195-212.

Clark, D., Moss, H.B., Kirisci, L., Mezzich, A., Miles, R. & Ott, P. (1997). Psychopathology in preadolescent sons of fathers with substance use disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 495-502.

Clark, D.B., & Winters, K.C. (2002). Measuring risks and outcomes in substance use disorders prevention research. *Journal of Consulting and Clinical Psychology, 70*, 1207-1233.

Clogg, C. (1995). Latent class models. In G. Armiger, C. Clogg & M. Sobel (Eds.), *Handbook of statistical modeling for the social and behavioral sciences* (pp. 311-359). New York: Plenum.

Coggans, N., & McKellar, S. (1994). Drug use amongst peers: Peer pressure or peer preference? *Drugs, Education, Prevention, and Policy, 1*, 15-26.

Collins, L.M., & Sawyer, A.D. (Eds.) (2001). *New methods for the analysis of change.* Washington, DC: American Psychological Association.

Collins, L.M., & Wugalter, S.E. (1992). Latent class models for stage-sequential dynamic latent variables. *Multivariate Behavioral Research, 27,* 131-157.

Connell, A. Bullock, B.M., Dishion, T.J., Shaw, D., Wilson, M., & Gardner, F. (2008). Family intervention effects on co-occurring early childhood behavioral and emotional problems: A latent transition analysis approach. *Journal of Abnormal Child Psychology, 36*, 1211-1225.

Costello, E.J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry, 60*, 837-844.

Dishion, T.J., & Andrews, D.W. (1995). Preventing escalation in problems behaviors with high-risk young adolescents: Immediate and 1-year outcomes. *Journal of Consulting and Clinical Psychology, 63,* 538-548.

Dishion, T.J., Andrews, D.W., Kavanagh, K., & Soberman, L.H. (1996). Preventive interventions for high-risk youth: The Adolescent Transition Program. In R.D. Peters & R.J. McMahon (Eds.), *Preventing childhood disorders, substance abuse, and delinquency* (pp. 184-214). Thousand Oaks, CA: Sage.

Dishion, T.J., Bullock, B.M., & Granic, I. (2002). Pragmatism in modeling peer influence: Dynamics, outcomes, and change processes. *Development and Psychopathology, 14*, 969-981.

Dishion, T.J., Capaldi, D., Spracklen, K.M., & Li, F. (1995). Peer ecology of male adolescent drug use. *Developmental and Psychopathology, 7*, 803-824.

Dishion, T.J., Eddy, J.M., Hass, E., Li, F., & Spracklen, K. (1997). Friendships and violent behavior during adolescence. *Social Development, 6*, 207-223.

Dishion, T.J., McCord, J., & Poulin, F. (1999). When interventions harm—Peer groups and problem behavior. *American Psychologist, 54*, 755-764.

Dishion, T.J., & Medici Skaggs, N. (2000). An ecological analysis of monthly 'bursts' in early adolescent substance use. *Applied Developmental Science, 4*, 89-97.

Dishion, T.J., & Owen, L.D. (2002). A longitudinal analysis of friendships and substance use: Bidirectional influence from adolescence to adulthood. *Developmental Psychology, 38,* 480-491.

Dishion, T.J., & Patterson, G.R. (2006). The development and ecology of antisocial behavior in children and adolescents. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology: Vol. 3. Risk, disorder, and adaptation* (2nd ed., pp. 503-541) Hoboken, NJ: Wiley.

Dishion, T.J., Patterson, G.R., Stoolmiller, M., & Skinner, M.L. (1991). Family, school, and behavioral antecedents to early adolescent involvement with antisocial peers. *Developmental Psychology, 27,* 172-180.

Dishion, T.J., Spracklen, K.M., Andrews, D.W., & Patterson, G.R. (1996). Deviancy training in male adolescent friendships. *Behavior Therapy, 27*, 373-390.

Dodge, K.A., Greenberg, M.T., Malone, P.S., & Conduct Problems Prevention Research Group. (2008). Testing an idealized dynamic cascade model of the development of serious violence in adolescence. *Child Development, 79*, 1907-1927.

Eddy, J.M., & Chamberlain, P. (2000). Family management and deviant peer association as mediators of the impact of treatment condition on youth antisocial behavior. *Journal of Consulting and Clinical Psychology, 68*, 857-863.

Elliott, D.S., & Menard, S. (1996). Delinquent friends and delinquent behavior: Temporal and developmental patterns. In J.D. Hawkins (Ed.), *Delinquency and crime: Current theories* (pp. 28-67). Cambridge: Cambridge University Press.

Ellis, W.E., & Zarbatany, L. (2007). Peer group status as a moderator of group influence on children's deviant, aggressive, and prosocial behavior. *Child Development, 78*, 1240-1254.

Ennett, S.T., & Bauman, K.E. (1994). The contribution of influence and selection to adolescent peer group homogeneity: The case of adolescent cigarette smoking. *Journal of Personality and Social Psychology, 67,* 653-663.

Esbensen, F. & Huizinga, D. (1993). Gangs, drugs, and delinquency in a survey of urban youth. *Criminology, 31*, 565-589.

Farrell, A.D. (1994). Structural equation modeling with longitudinal data: Strategies for examining group differences and reciprocal relationships. *Journal of Consulting and Clinical Psychology, 62*, 477-487.

Farrell, A.D., & Danish, S.J. (1993). Peer drug associations and emotional restraint: Causes or consequences of adolescents' drug use? *Journal of Consulting and Clinical Psychology, 61,* 327-334.

Fergusson, D.M., & Horwood, L.J. (1998). Early conduct problems and later life opportunities. *Journal of Child Psychology and Psychiatry, 39,* 1097-1108.

Fergusson, D.M., & Horwood, L.J. (1999). Prospective childhood predictors of deviant peer affiliations in adolescence. *Journal of Child Psychology and Psychiatry, 40,* 581-592.

Fergusson, D.M., & Horwood, L.J. (2000). Alcohol abuse and crime: A fixed-effects regression analysis. *Addiction, 95*, 1525-1536.

Fergusson, D.M., Horwood, L.J., & Ridder, E.M. (2006). Conduct and attentional problems in childhood and adolescence and later substance use, abuse and dependence: Results of a 25-year longitudinal study. *Drug and Alcohol Dependence, 88*, 814-826.

Fergusson, D.M., Swain-Campbell, N.R., & Horwood, L.J. (2002). Deviant peer affiliations, crime and substance use: A fixed effects regression analysis. *Journal of Abnormal Child Psychology, 30*, 419-430.

Fergusson, D.M., Vitaro, F., Wanner, B., & Brendgen, M. (2007). Protective and compensatory factors mitigating the influence of deviant friends on delinquent behaviours during early adolescence. *Journal of Adolescence*, *30*, 33-50.

Fergusson, D.M., Woodward, L.J., & Horwood, L.J. (1999). Childhood peer relationship problems and young involvement with deviant peers in adolescence. *Journal of Abnormal Child Psychology, 27*, 357-370.

Feske, U., Tarter, R.E., Kirisci, L., Gao, Z., Reynolds, M., & Vanyukov, M. (2008). Peer environment mediates parental history and individual risk in the etiology of cannabis use disorder in boys: A 10-year prospective study. *American Journal of Drug and Alcohol Abuse, 34*, 307-320.

Flaherty, B.P. (2008). Testing the degree of cross-sectional and longitudinal dependence between two discrete dynamic processes. *Developmental Psychology, 44*, 468-480.

Fromme, K., & Ruela, A. (1994). Mediators and moderators of young adults' drinking. *Addiction, 89,* 63-71.

Gardner, T.W., Dishion, T.J., & Connell, A.M. (2008). Adolescent self-regulation as resilience: Resistance to antisocial behavior within the deviant peer context. *Journal of Abnormal Child Psychology, 36,* 273-284.

Gatti, U., Tremblay, R.E., Vitaro, F., & McDuff, P. (2005). Youth gangs, delinquency and drug use: A test of selection, facilitation, and enhancement hypotheses. *Journal of Child Psychology and Psychiatry, 46*, 1178-1190.

Goodnight, J.A. Bates, J.E., Newman, J.P., Dodge, K.A., & Pettit G.S. (2006). The interactive influences of friend deviance and reward dominance on the development of externalizing behavior during middle adolescence. *Journal of Abnormal Child Psychology, 34*, 573-583.

Graham, J.W., Collins, L.M., Wugalter, S.E., Chung, N.K., & Hansen, W.B. (1991). Modeling stage-sequential processes: A substance use prevention example. *Journal of Consulting and Clinical Psychology, 59,* 48-57.

Hansen, W.B., Tobler, N.S., & Graham, J.W. (1990). Attrition in substance use prevention research: A meta-analysis of 85 longitudinally followed cohorts. *Evaluation Review, 14*, 677-685.

Hollingshead, A.B. (1990). Four factor index of social status. New Haven, CT: Private Printing.

Humphreys, K., & Janson, H. (2000). Latent transition analysis with covariates, nonresponse, summary statistics and diagnostics. *Multivariate Behavioral Research, 35,* 89-118.

Iannotti, R.J., Bush, P.J., & Weinfurt, K.P. (1996). Perception of friends' use of alcohol, cigarettes, and marijuana among urban schoolchildren: A longitudinal analysis. *Addictive Behaviors, 21*, 615-632.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., & Schulenberg, J.E. (2007). *Monitoring the future: National results on adolescent drug use: Overview of key findings, 2006* (NIH Publication No. 07-6202). Bethesda, MD: National Institute on Drug Abuse.

Kandel, D.B., Davies, M., & Baydar, N. (1990). The creation of interpersonal contexts: Homophily in dyadic relationships in adolescence and young adulthood. In L.N. Robins & M. Rutter (Eds.), *Straight and devious pathways from childhood to adulthood* (pp. 221-241). New York: Cambridge University Press.

Kandel, D.B. (1978). Homophily, selection, and socialization in adolescent friendships. *American Journal of Sociology, 84,* 427-436.

Kandel, D.B. (1996). The parental and peer context of adolescent deviance: An algebra of interpersonal influences. *Journal of Drug Issues, 26,* 289-316.

Kazdin, A.E. (1995). *Conduct disorder in childhood and adolescence, 2nd ed.* Thousand Oaks, CA: Sage.

Kazdin, A.E., & Kagan, J. (1994). Models of dysfunction in developmental psychopathology. *Clinical Psychology: Science and Practice*, *1*, 35-52.

Kirisci, L., & Blackson, T. (1996, August). *Psychometric evaluation of the Dimensions of Temperament Survey*. Paper presented at the annual meeting of the American Psychological Association, Toronto, Canada.

Kirisci, L., Mezzich, A.C., Reynolds, M., Tarter, R.E., & Aytaclar, S. (2009). Prospective study of the association between neurobehavior disinhibition and peer environment on illegal drug use in boys and girls. *American Journal of Drug and Alcohol Abuse, 35*, 145-150.

Kirisci, L., Tarter, R. Mezzich, A., & Reynolds, M. (2008). Screening current and future diagnosis of psychiatric disorders using the revised drug use screening inventory. *American Journal of Drug and Alcohol Abuse, 34*, 653-665.

Kirisci, L., Tarter, R., Mezzich, A., & Vanykov, M. (2007). Developmental trajectory classes in substance use disorder etiology. *Psychology of Addictive Behaviors, 21*, 287-296.

Kokkevi, A., Richardson, C., Florescu, S., Kuzman, M., & Stergar, E. (2007). Psychosocial correlates of substance use in adolescence: A cross-national study in six European countries. *Drug and Alcohol Dependence, 86*, 67-74.

Lacourse, E., Nagin, D.S., Tremblay, R.E., Vitaro, F., & Claes, M. (2003). Developmental trajectories of boys' delinquent group membership and facilitation of violent behaviors during adolescence. *Developmental and Psychopathology, 15*, 183-197.

Lacourse, E., Nagin, D.S. Vitaro, F., Côté, S., Arseneault, L., & Tremblay, R.E. (2006). Prediction of early-onset deviant peer group affiliation: A 12-year longitudinal study. *Archives of General Psychiatry, 63*, 562-567.

Laird, R.D., Pettit, G.S., Dodge, K.A., & Bates, J.E., (1998). The social ecology of school-age child care. *Journal of Applied Developmental Psychology, 19*, 341-360.

Li, F., Barrera, M., Hops, H., & Fisher, K.J. (2002). The longitudinal influence of peers on the development of alcohol use in late adolescence: A growth mixture analysis. *Journal of Behavioral Medicine, 25*, 293-315.

Little, R.J.A., & Rubin, D.B. (2002). *Statistical analyses with missing data* (2nd ed.). New York: Wiley.

Leckman, J. Sholomaskas, D., & Thompson, W. (1982). Best estimate of lifetime psychiatric diagnosis: A methodological study. *Archives of General Psychiatry, 39*, 879-883.

Lochman, J.E., & Wells, K.C. (2002). Contextual social-cognitive mediators and child outcome: A test of the theoretical middle in the Coping Power program. *Development and Psychopathology, 14*, 945-967.

Lochman, J.E., & Wells, K.C. (2004). The Coping Power Program for preadolescent boys and parents: Outcome effects at the 1-year follow-up. *Journal of Consulting and Clinical Psychology, 72*, 571-578.

Lochman, J.E., Wells, K.C., & Lenhart, L.A. (2008). *Coping power: Child group program, facilitator guide*. New York, NY: Oxford University Press.

Loeber, R., Farrington, D.P., Stouthamer-Loeber, M., & Van Kammen, W.B. (1998). *Antisocial behavior and mental health problems: Explanatory factors in childhood and adolescence.* Mahwah, NJ: Lawrence Erlbaum.

MacLeod, C. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Bulletin, 21*, 508-515.

McCutcheon, A.L. (1987). *Latent class analysis.* Beverly Hills, CA: Sage.

McGloin, J.M., & Shermer, L.O. (2009). Self-control and deviant peer network structure. *Journal of Research in Crime and Delinquency, 46*, 35-72.

Mendelsohn, M., & Erdwins, C. (1978). The disruptive behavior scale: An objective assessment of unmanageable social behavior in adolescents. *Journal of Clinical Psychology, 34*, 426-428.

Mercken, L., Candel, M., Willems, P., & de Vries, H. (2009). Social influence and selection effects in the context of smoking behavior: Changes during early and mid adolescence. *Health Psychology, 28*, 73-82.

Ming, K., & Rosenbaum, P.A. (2001). A note on optimal matching with variable controls using the assignment algorithm. *Journal of Computational and Graphical Statistics, 10*, 455-463.

Moffitt, T.E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674-701.

Moffitt, T.E., Caspi, A., Harrington, H., & Milne, B.J., (2002). Males on the life-course persistent and adolescence-limited anti-social pathways: Follow-up at age 26. *Developmental Psychopathology, 14*, 179-207.

Monahan, K.C., Steinberg, L., & Cauffman, E. (2009). Affiliation with antisocial peers, susceptibility to peer influence, and antisocial behavior during the transition to adulthood. *Developmental Psychology, 45*, 1520-1530.

Moss, H.B., & Lynch K.G. (2001). Comorbid disruptive behavior disorder symptoms and their relationship to adolescent alcohol use disorders. *Drug and Alcohol Dependence, 64*, 75-83.

Moss, H.B., Lynch, K.G., & Hardie, T.L. (2003). Affiliation with deviant peers among children of substance dependent fathers from pre-adolescence into adolescence: Associations with problem behaviors. *Drug and Alcohol Dependence, 7I,* 117-125.

Mrug, S., & Windle, M. (2009). Mediators of neighborhood influences on externalizing behavior in preadolescent children. *Journal of Abnormal Child Psychology, 37*, 265-280.

Muthén, B. (2002). Beyond SEM: General latent variable modeling. *Behaviormetrika, 29,* 81-117.

Muthén, L.K., & Muthén, B.O. (1998-2011). *Mplus user's guide. Sixth edition.* Los Angeles, CA: Muthén & Muthén.

Muthén, B., & Muthén, L.K. (2000). Integrating person-centered and variable-centered analysis. Growth mixture-modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24,* 882-891.

Muthén, B., & Shedden, K. (1999). Finite mixture modeling with mixture outcomes using the EM algorithm. *Biometrics, 3*, 463-46.

Nylund, K.L. (2007). *Latent transition analysis: Modeling extensions and an application to peer victimization.* Unpublished doctoral dissertation, University of California, Los Angeles.

Nylund, K., Muthén, B., & Asparouhov, T. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling, 14*, 535-569.

Nylund, K., Bellmore, A., Nishina, A., & Graham, S. (2007). Subtypes, severity, and structural stability of peer victimization: What does latent class analysis say? *Child Development, 78,* 1706-1722.

Odgers, C.L., Capsi, A., Nagin, D.S., Piquero, A.R., Slutske, W.S., Milne, B.J., et al. (2008). Is it important to prevent early exposure to drugs and alcohol among adolescence? *Psychological Science, 19*, 1037-1044.

Oxford, M.L., Harachi, T.W., Catalano, R.F., & Abbott, R.D. (2000). Preadolescent predictors of substance initiation: A test of both the direct and mediated effect of family social control factors on deviant peer associations and substance initiation. *American Journal of Drug and Alcohol Abuse, 27,* 599-616.

Parsons, O., Tarter, R.E., & Edelberg, R. (1972). Altered motor control in chronic alcoholics. *Journal of Abnormal Psychology, 80,* 308-314.

Patterson, G.R., DeBaryshe, B.D., & Ramsey, E. (1989). A developmental perspective on antisocial behavior. *American Psychologist, 44*, 329-335.

Patterson, G.R., Dishion, T.J., & Yoerger, K. (2000). Adolescent growth in new form of problem behavior: Macro- and micro-peer dynamics. *Prevention Science, 1,* 3-13.

Patterson, G.R., & Stouthamer-Loeber, M. (1984). The correlation of family management practices and delinquency. *Child Development*, 55, 1299-1307.

Patterson, G.R., & Yoerger, K. (1997). A developmental model for late onset delinquency. In R. Dienstbeir & D.W. Osgood (Eds.), *The Nebraska Symposium on Motivation: Vol. 44. Motivation and delinquency* (pp. 119-177). Lincoln, NE: University of Nebraska Press.

Pettit, G.S., Keiley, M.K., Laird, R.D., Bates, J.E., & Dodge, K.A. (2007). Predicting the developmental course of mother-reported monitoring across childhood and adolescence from early proactive parenting, child temperament, and parents' worries. *Journal of Family Psychology, 21*, 206-217.

Porteus, S. (1965). Porteus Maze Test: Fifty years of application. Palo Alto, CA: Pacific Books.

Poulin, F., Dishion, T.J., & Burraston, B. (2001). 3-Year iatrogenic effects associated with aggregating high-risk adolescents in cognitive-behavioral preventive interventions. *Applied Developmental Science, 5*, 214-224.

Prinstein, M.J., & Wang, S.S. (2005). False consensus and adolescent peer contagion: Examining discrepancies between perceptions and actual reported levels of friends' deviant and health risk behaviors. *Journal of Abnormal Child Psychology, 33,* 293-306.

Puig-Antich, J. Orvaschel, H., Tabrixi, M.A., & Chamberg, W.J. (1981). The scheduled for affective disorders and schizophrenia for school-age children, epidemiologic version, 3rd. Department of Child and Adolescent Psychiatry, New York State Psychiatric Institute, New York.

Rankin, B.H., & Quane, J.M. (2002). Social contexts and urban adolescent outcomes: The interrelated effects of neighborhoods, families, and peers on African-American youth. *Social Problems, 49*, 79-100.

Robins, L.N., & McEvoy, L. (1990). Conduct problems as predictors of substance use. In L.N. Robins & M. Rutter (Eds.), *Straight and devious pathways from childhood to adulthood* (pp. 182-204). Cambridge: Cambridge University Press.

Rubin, D.B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Rutter, M., & Sroufe, L.A., (2000). Developmental psychopathology: Concepts and challenges. *Development and Psychopathology, 12*, 265-296.

Sameroff, A. (2009). The transactional model. In A. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (pp. 3-21). Washington, DC: American Psychological Association.

Schwartz, G. (1978). Estimating the dimensions of a model. *Annals of Statistics, 6,* 461-464.

Schafer, J.L. (1997). *Analyses of incomplete multivariate data*. London: Chapman and Hall.

Schafer, J.L., & Graham, J.W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147-177.

Schneider, W., & Detweiler, M. (1987). Connectionist/control architecture for working memory. In G.H. Bower (Ed.), *The Psychology of Learning and Motivation: Advances in Research and Theory, Vol. 21* (pp. 53-119). San Diego, CA: Academic Press.

Sclove, S.L. (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika, 52*, 333-343.

Silberg, J., Rutter, M., D'Onofrio, B., & Eaves, L. (2003). Genetic and environmental risk factors in adolescent substance use. *Journal of Child Psychology and Psychiatry, 44*, 664-676.

Silverman, I., & Ragusa, D. (1992). A short-term longitudinal study of early development of self-regulation. *Journal of Abnormal Child Psychology, 20*, 415-435.

Simons, R.L., Wu, C.I., Conger, R.D., & Lorenz, F.O. (1994). Two routes to delinquency: Differences between early and late starters in the impact of parenting and deviant peers. *Criminology, 32*, 247-276.

Snyder, J., Dishion, T.J., & Patterson, G.R. (1986). Determinants and consequences of associating with deviant peers during preadolescence and adolescence. *Journal of Early Adolescence, 6*, 29-43.

Spitzer, R.L., Williams, J.B.W., & Gibbon, M. (1987). Structured Clinical Interview for *DSM-III-R* (SCID). New York: New York State Psychiatric Institute, Biometrics Research.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*, 78-106.

Steinberg, L., Albert, D. Cauffman, E., Banich, M. Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology, 44*, 1764-1778.

Steinberg, L., & Avenevoli, S. (2000). The role of context in the development of psychopathology: A conceptual framework and some speculative propositions. *Child Development*, *71*, 66-74.

Steinberg, L., Fletcher, A., & Darling, N. (1994). Parental monitoring and peer influences on adolescent substance use. *Pediatrics, 93,* 1060-1064.

Steinberg, L., & Monahan, K.C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43,* 1531-1543.

Stroop, J.R. (1935). Studies of interference of series verbal reactions. *Journal of Experimental Psychology, 18*, 643-662.

Tarter, R., & Mezzich, A. (1991). Ontogeny of substance abuse: Perspectives and findings. In M. Glantz & R. Pickens (Eds.), *Vulnerability to drug abuse*. Washington, DC: American Psychiatric Association.

Tarter, R., Mezzich, A., Kirisci, L., & Kaczynski, N. (1994). Reliability of the Drug Use Screening Inventory among adolescent alcoholics. *Journal of Child and Adolescent Substance Abuse, 3*, 25-36.

Tarter, R.E., Kirisci, L., Mezzich, A., Cornelius, J.R., Pajer, K., Vanyukov, M., et al.. (2003). Neurobehavioral disinhibition in childhood predicts early age at onset of substance use disorder. *American Journal of Psychiatry, 160*, 1078-1085.

Thornberry, T.P., Krohn, M.D., Lizotte, A.J., & Chard-Wierschem, D. (1993). The role of juvenile gangs in facilitating delinquent behavior. *Journal of Research in Crime and Delinquency, 30*, 55-87.

Tubman, J.G., Vicary, J.R., von Eye, A., & Lerner, J.V. (1990). Longitudinal substance use and adult adjustment, *Journal of Substance Abuse, 2*, 317-334.

van Lier, P.A., Wanner, B., & Vitaro, F. (2007). Onset of antisocial behavior, affiliation with deviant friends, and childhood maladjustment: A test of the childhood- and adolescent-onset models. *Development and Psychopathology, 19*, 167-185.

Vitaro, F., Brendgen, M., & Tremblay, R.E. (2000). Influence of deviant friends on delinquency: Searching for moderator variables. *Journal of Abnormal Child Psychology, 28*, 313-325.

Warr, M. (1993). Age, peers, and delinquency. *Criminology, 31*, 17-40.

Wechsler, D. (1972). *Wechsler Intelligence Scale for Children-Revised*. New York: Psychological Corporation.

Wiesner, M., Silbereisen, R.K., & Weichold, K. (2008). Effects of deviant peer association on adolescent alcohol consumption: A growth mixture modeling analysis. *Journal of Youth and Adolescence, 37*, 537-551.

Wills, T.A, & Clearly, S.D. (1999). Peer and adolescent substance use among 6^{th}-9^{th} graders: Latent growth analyses of influence versus selection mechanisms. *Health Psychology, 18*, 453-463.

Wills, T.A., & Dishion, T.J. (2004). Temperament and adolescent substance use: A transactional analysis of emerging self-control. *Journal of Clinical Child and Adolescent Psychology, 33,* 69-81.

Windle, M. (1991). The difficult temperament in adolescence: Associations with substance use, family support, and problem behaviors. *Journal of Clinical Psychology, 47*, 310-315.

Windle, M. (1992). The Revised Dimensions of Temperament Survey (DOTS-R): Simultaneous group confirmatory factor analysis for adolescent gender groups. *Psychological Assessment, 4*, 228-234.

Woodward, L.J., & Fergusson, D.M. (1999). Early conduct problems and later risk of teenage pregnancy in girls. *Development and Psychopathology, 11*, 127-141.