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The association between parental risk behaviors during childhood and having high risk networks in adulthood

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Abstract

Background—Prior research suggests that both social networks and parent drug use influence individual drug use among adolescents and that peers continue to influence drug use among adults. This analysis aims to determine whether parent drug use during childhood is associated with having drug-using networks in adulthood after adjusting for individual adult drug use.

Methods—650 young adult drug users were recruited through targeted street outreach and respondent-driven sampling in New York City (2006-2009). Baseline surveys ascertained demographics, network characteristics, drug use behaviors, and parental drug use during childhood. Negative binomial regression was used to evaluate this association.

Results—The median age was 33 years, 22% injected, 49% were Black, and during childhood 26% of mothers, 32% of fathers, and 13% of primary caregivers used drugs. After adjustment, having >1 parent who used drugs was associated with having a greater proportion of drug using (Adjusted Prevalence Ratio [APR]=1.18; 95% CI: 1.01-1.38) and specifically crack-smoking networks (APR=1.71; 95% CI: 1.21-2.43) in adulthood. Females' networks consisted of more drug users (APR=1.18; 95% CI: 1.01-1.38), injectors (APR=1.44; 95% CI: 1.09-1.90), crack smokers (APR=1.48; 95% CI: 1.18-1.87) and heroin users (APR=1.43; 95% CI: 1.13-1.81); blacks had a greater proportion of crack smoking (APR=1.41; 95% CI: 1.09-1.82), but a smaller proportion of injecting (APR=0.64; 95% CI: 0.43-0.94) and heroin smoking (APR=0.60; 95% CI: 0.47-0.77) networks as adults.

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Conclusions—These data suggest that parental drug use is independently associated with having drug-using networks in adulthood. Interventions that target parents and caregivers and that promote drug cessation could impede risky network formation in both adolescents and adults.

Keywords

social networks; peer influence; parent drug use; racial disparities; drug use

1. Introduction

For decades researchers have studied the social factors influencing drug use among adolescents and young adults (Babst et al., 1976; Best et al., 2005; Duan et al., 2009; Hawkins et al., 1992; Hoffman et al., 2006; Jinez et al., 2009; Kafka and London, 1991; Kandel, 1980; Kandel et al., 1978a; Korsnick and Judd, 1982; Li et al., 2000; Miller-Day, 2002; Newcomb et al., 1983; Oetting and Beauvais, 1986; Piko, 2001; Sargent and Dalton, 2001; Stanley and Lo, 2009; Steinberg et al., 1994; Wright and Fitzpatrick, 2004). Strong associations have been reported between the initiation and maintenance of adolescent drug use and intrapersonal characteristics, drug availability, peer influences, family structure, and parental factors. While theories on the relative importance of each vary throughout the literature, most researchers agree that peers and parents are the most prominent proximal influences of adolescent drug use.

Studies demonstrate strong and significant associations between adolescent drug use and social ties with peers who use drugs and those who they believe use drugs (Hawkins et al., 1992; Hoffman et al., 2006; Kandel et al., 1978a; Oetting and Beauvais, 1986; Wright and Fitzpatrick, 2004). Because most of these findings are from cross-sectional studies, it is unclear whether homophily by drug use within peer groups can be attributed to the influence of peers and pressure to conform with group norms or if it results from a selection process, whereby individuals purposefully select others with similar values, behaviors, and attributes (Kandel et al., 1978a). Findings from longitudinal studies suggest that both processes are driving this association (Kandel, 1980).

Most research in this area has focused on adolescents. However, regardless of age, social networks are thought to influence the behavior of individuals and group norms through social comparison processes, fear of social sanctions, information exchange, and socialization of new members (Fisher, 1988; Hall and Wellman, 1985; Latkin et al., 1995a). Studies among adult drug users also report that adults who use drugs are more likely to associate with others who use drugs (Best et al., 2005; Kandel et al., 1978a; Latkin et al., 1995b; Latkin et al., 1999). Just as the association between peer drug use and individual drug use among adolescents is thought to be the result of both behavioral influences within peer groups and individuals' selection into relationships with others who are similar to themselves, homophily with respect to drug use in adults is also thought to result from a combination of these processes.

While peers are thought to influence drug use behaviors over the duration of one's life, the importance of parental factors on individual drug use has typically only been examined among adolescents. Although not previously examined, it is possible that early exposure to drug use as a norm may also have long term effects both on one's drug use and on his/her selection of peers. Based upon the relationships described above, we would expect to see an association between parent drug use during one's childhood and the formation of high risk drug using networks in adulthood that is mediated by individual drug use. For example, parent drug use is strongly associated with adolescent drug use and adolescents who use drugs are also more likely to use drugs as adults. Furthermore, adults who use drugs are

more likely to associate with others who use drugs. Thus, there is a pathway between parental drug use during one's childhood and the formation of risky drug using networks during adulthood that is mediated through one's individual drug use (Figure 1). The authors hypothesize that parental drug use during childhood will continue to be associated with the formation of high risk drug using networks in their offspring as adults, even after adjusting for individual drug use, which is expected to partially mediate this relationship. This hypothesis is supported by several behavioral theories including the attachment theory and the social learning theory.

For example, many adolescent researchers argue that parents who use drugs are behavioral models for adolescents and that adolescents with parents who use drugs are more likely to initiate substance use as adolescents (Kandel et al., 1978b). However, it is unknown which behaviors children are modeling that lead them to initiate drug use during adolescence (e.g., coping mechanisms, social interactions, norms of acceptable behavior). Studies have also demonstrated that parental attitudes and behaviors, the quality of family life, the parent-child relationship, and parental drug use play crucial roles in the initiation and experimentation of drugs during adolescence (Miller-Day, 2002). Therefore, because adolescents select peers with similar values and beliefs and these values and beliefs are influenced by parent drug use behaviors and attitudes during childhood, it is possible that parent attitudes and behaviors during one's childhood could impact the peer selection process throughout adolescence and even adulthood. While several studies among adults link adolescent drug use with current drug use, few studies have explored the long term effects of parental drug use on their children's drug use and having drug using peers in adulthood after controlling for adult drug use.

The authors aim to determine whether parental drug use during one's childhood and the formation of risky drug using networks during adulthood are associated even after controlling for individual drug use as a mediator. This analysis aims to explore this residual effect of parental drug use during childhood on having drug using social networks in adulthood, or the effect remaining after controlling for individual drug use (Figure 1).

2. Methods

The data for this analysis were collected as part of a longitudinal study, Social Ties Associated with Risk of Transition (START) into injection drug use, which aimed to identify risk factors for initiating injection drug use in New York City. Young adults who recently initiated injection drug use and who were frequent non-injection drug users (heroin, crack or cocaine) were concurrently recruited through respondent-driven sampling (RDS) and targeted street outreach between July 2006 and June 2009.

Prior to study enrollment, socially disadvantaged neighborhoods in four New York City boroughs: Brooklyn, Bronx, Manhattan, and Queens were ethnographically mapped and areas with high drug activity were selected as recruitment sites (Ompad et al., 2008). As previously described, 46 RDS seeds and 217 targeted street outreach participants were recruited using random street-intercept sampling (Rudolph et al., 2011). Each RDS seed was asked to recruit up to three peers, each of whom were asked to recruit three additional peers, and so on until recruitment was administratively ended in June 2009. Of 621 participants screened to participate in the respondent-driven sample, 439 were eligible.

Eligible participants were 18-40 years old and were active injection or non-injection drug users (IDUs and NIDUs, respectively). IDUs reported injecting heroin, crack or cocaine for ≤ 4 years and at least once in the past 6 months. Visible track marks verified injection history. NIDUs reported non-injection use of heroin, crack or cocaine for ≥ 1 year and used

heroin, crack or cocaine 2-3 times per week in the last three months. Self-reported drug use was verified with a rapid drug urine test which screened for opiate and cocaine metabolites in the past 2-3 days. Those with a negative drug test were not eligible and were compensated for round-trip transportation to the research site.

After providing informed consent, all participants completed a 90-minute interviewer-administered questionnaire approved by both Columbia University and the New York Academy of Medicine institutional review boards. The survey ascertained demographic and social contextual characteristics (e.g., race/ethnicity, age, gender, education, income, homelessness, network size and composition), social and behavior characteristics (e.g., frequency and type of drug use, sexual risk behaviors), depression, conduct disorder, suicidal attempt/ideation and victimization. Participants were asked to list the names, nicknames, or initials for each person in the past year 1) whom he/she could borrow \$25 from, 2) who would let him/her stay at their place, 3) who he/she could talk to about personal or private matters, 4) who he/she used drugs with, 5) who he/she had sex with, 6) who he/she could ask for advice about health care or medical service, 7) who he/she could talk to about issues related to drug use (e.g., how to use drugs safely) and 8) who he/she could get information about social services like housing, welfare or social security. The number of unique individuals recorded was his/her total network size. Participants were then asked to provide information about each of the names provided (i.e., demographic characteristics, history of incarceration, and information about whether he/she injected drugs, smoked crack, or snorted heroin) during the past year.

Participants were also asked to recall drug use by their parents during his/her childhood. Participants were compensated \$30 and transportation costs for participating. In addition, RDS participants received 3 coupons to recruit drug-using peers to participate in the study. Finally, individuals with incomplete network information were removed from the analysis, leaving a final sample size of 650 (434 RDS recruits and 216 targeted street outreach recruits).

The purpose of this analysis was to assess the association between drug use by one's mother, father, or primary caregiver during childhood and having a greater proportion of drug using networks in adulthood. Primary caregiver was defined as the one person who was most attentive to his/her needs while growing up. Because the mother and/or father could also serve as the primary caregiver, these variables were not mutually exclusive (68% of primary caregivers were mothers and 8% were fathers). To prevent an association between parental drug use during childhood and the existence of drug using social networks in adulthood due to a parent's continued drug use and role in his/her social network, parents were not included in the makeup of one's social network in adulthood. Four drug using network outcomes were examined: the proportion of total networks in adulthood who 1) use drugs, 2) smoke crack, 3) inject, and 4) sniff heroin. Individual drug use over the past 6 months was expected to behave as a partial mediator of the relationships examined. Thus, when individual drug use mediated the relationship between parental drug use during childhood and the composition of social networks in adulthood, we controlled for individual drug use in order to measure the association between parental drug use during childhood and social network composition in adulthood that was not mediated by one's individual drug use. Demographic characteristics (e.g., age, gender, high school education, income, race/ethnicity, homelessness) and recruitment strategy were assessed as potential confounders. As there were no major differences in homophily or drug-using network size by any variables considered (e.g., gender, race/ethnicity, education, income, age, homelessness in the past 6 months, injection status, HIV status, heroin use in the past 6 months, cocaine use in the past 6 months, and crack use in the past 6 months) and the weights corresponding with

each of these characteristics were low (Rudolph et al., 2011), recruitment weights were not applied to the RDS recruits in this sample.

Descriptive statistics were used to characterize the sample. To account for varying sized social networks and over-dispersed data, we included the total number of non-parent social networks as an offset term in negative binomial regression models. This allowed us to model the proportion of drug using social networks rather than the total number of drug using social networks. Multivariate negative binomial regression models that did and did not account for geographic clustering by recruitment borough were used to assess this relationship. Because the coefficient estimates from each approach differed by less than 4% and in most cases by less than 1%, we present the findings from the simpler model that did not account for clustering by recruitment borough. Additionally, while many parent drug use variables were assessed in the preliminary phase of this analysis, we chose one variable to represent parent drug use in the final multivariate models. This decision was made because: 1) many of the parent drug use variables examined in the initial stage were collinear and could not be included together in the same model, 2) the variable, “> 1 parent who used drugs in the home while he/she was a child” best characterized the exposure we intended to measure, and 3) the findings from each of the final models could more easily be compared because the same exposure variable was used. Finally, for each model, individual drug use and parent drug use variables were only selected for inclusion if the type of drug used by the individual or parent matched the type of drug used by social network members in the outcome variable.

3. Results

Table 1 describes the study sample (N=650) by demographic characteristics, current drug use, and information about the types of drugs used by parents and other adults, both generally and in his/her home during childhood. The median age was 33, 75% reported 2-4 social networks, of whom, one or two used drugs. The median number of injecting, crack smoking, and heroin sniffing/snorting networks was 0, 0, and 1 respectively. Most were NIDUs (79%), male (71%), homeless (71%), and made less than \$10,000 annually (83%). About half were Black (49%) and slightly more than half had \geq a high school education (51%). 76%, 80%, and 56% of participants reported recent cocaine, crack, and heroin use, respectively. 26% of mothers, 32% of fathers, and 13% of primary caregivers used drugs during his/her childhood. Of those reporting drug use by his/her mother or father, most reported that he/she used drugs in the home (81% for mothers and 68% for fathers). On the contrary, only 28% of primary caregivers who used drugs used drugs at home. However, 76% reported that drugs were used in the home by > 1 parent during childhood. Many also reported use of heroin, crack, or cocaine by relatives other than parents during childhood (65%) and drug use by these relatives in the child's home (41%) (data not shown in table).

Table 2 presents the unadjusted prevalence ratios for the associations between parental drug use during childhood and the proportion of drug using networks in adulthood. As seen in table 2, the type of drug used by individuals and their parents is consistent with the type of drug used in each outcome variable. Drug use by one's mother or father during childhood was not significantly associated with having a greater proportion of drug using networks as an adult, but having a primary caregiver who used drugs was. Compared to those with a primary caregiver who did not use heroin, crack or cocaine while he/she was growing up, those who did have a primary caregiver using such drugs reported that drug users made up 22% more of his/her social network as adults. Although having a father who used drugs during his/her childhood did not significantly influence his/her future social ties with other drug users, having a father who used drugs in the home significantly increased the number of drug using social ties in adulthood by 30%. The increased risk of associating with other

drug users as an adult was similar for those who reported drug use by their primary caregiver (22%; 95% CI:3-45%) and drug use by their primary caregiver in the home (21%; 95% CI:4-40%). Individuals also had significantly more (37%; 95% CI:9-72%) drug using networks as an adult if > 1 parent used drugs in the home during childhood.

Current injection drug use was strongly associated with having more injecting networks in adulthood (PR=11.64; 95% CI:8.83-15.36) and parental cocaine use was moderately associated with having injecting networks in adulthood. For example, those with a father or primary caregiver who used cocaine during his/her childhood had 64% and 77% more injecting networks in adulthood, respectively, than those who did not. However, cocaine use by one's mother was not significantly associated with having a greater proportion of injecting peers in adulthood. Individuals who were exposed to others using heroin, crack, or cocaine in the home where they were raised had 51% more injecting networks as adults than those without this exposure (PR: 1.51; 95% CI: 1.10-2.08).

Current crack use was strongly associated with having a greater proportion of crack smoking networks (PR=5.83; 95% CI: 3.98-8.54). Crack use by one's primary caregiver and drug use by > 1 parent during childhood were also associated with having a greater proportion of crack smoking networks as an adult, but mother's crack use was not. For example, those with a primary caregiver who used crack while he/she was growing up had 57% more crack smoking networks as adults than those who did not (PR: 1.57; 95% CI: 1.06-2.33). Similarly, those with > 1 parent using drugs at home during childhood had 59% more crack smoking networks as adults than those who did not (PR: 1.59; 95% CI: 1.11-2.27). Finally, those raised in a household where people used crack had 38% more crack smoking networks in adulthood than those who did not (PR: 1.38; 95% CI: 1.11-1.73).

Current heroin use was associated with a greater proportion of heroin snorting/sniffing networks (PR=6.59; 95% CI:4.63-9.37), but parental drug use during childhood was not. Having relatives who used heroin and growing up with people using heroin in the home were associated with significant increases in the proportion of heroin sniffing/snorting networks in adulthood (43% (data not shown in tables) and 73%, respectively).

Finally, table 3 presents a final multivariate model for each of the four outcomes. While several different parent drug use variables were considered in the bivariate phase of this analysis, only one parent drug use variable (> 1 parent who used drugs in the home while he/she was growing up) was selected for inclusion in the final models. After adjustment, the association between having > 1 parent who used drugs in the home while he/she was growing up and having a greater proportion of drug using networks in adulthood remained significant. While individual drug use over the past 6 months was significantly associated with having a greater proportion of drug using networks in the unadjusted model, the association was not significant after accounting for drug use in the home by > 1 parent during childhood. Current injection drug use was most strongly associated with having a greater proportion of injecting networks in adulthood in both the unadjusted and adjusted models. While parents' cocaine use during childhood was significantly associated with having more injecting networks in adulthood before adjusting for individual injection drug use, race/ethnicity and gender, after adjustment, the relationship between parent drug use and the proportion of injecting networks was no longer significant. Thus, the association between parents' cocaine use during his/her childhood and having injecting networks in adulthood is completely mediated by individual characteristics of an IDU or other social factors not measured here (e.g., other parental factors, childhood peer influence, availability of drugs, intrapersonal characteristics). Additionally, Blacks were significantly less likely (APR: 0.64; 95% CI: 0.43-0.94) and females were significantly more likely to associate with others who injected drugs (APR:1.44; 95% CI:1.09-1.90) after adjustment. We also

examined the association between parental drug use and having crack smoking networks in adulthood. In the final model, individual crack use, gender, race/ethnicity, and parental drug use were significantly associated with having a greater proportion of crack smoking networks in adulthood. Those who had > 1 parent using drugs in the home during childhood had 71% more crack smoking networks than those who did not. Blacks (APR:1.41; 95%CI: 1.09-1.82) and females (APR:1.48; 95%CI:1.18-1.87) were also more likely to associate with other crack smokers in adulthood.

Finally, we assessed the relationship between parental drug use during childhood and having heroin snorting/sniffing networks in adulthood. After adjustment, current heroin use remained strongly associated with having more heroin sniffing/snorting networks in adulthood. Individuals who used heroin as adults were 5.5 times (95%CI:3.8-7.8) as likely to associate with others who sniffed/snorted heroin than those who did not currently use heroin. Of note, race and gender remained associated with having social ties with heroin sniffer/snorters as adults, after adjustment. Females were more likely and Blacks were less likely to have a greater proportion of heroin sniffing/snorting networks in adulthood.

4. Discussion

These findings demonstrate that parental drug use during one's childhood may be independently associated with his/her social network structure in adulthood. For example, there was a fairly consistent relationship between having > 1 parent who used drugs in the home during childhood and having a larger proportion of his/her social ties with drug users as adults. After adjusting for individual drug use, this variable was significantly associated with an increased proportion of social ties with other drug users, and specifically with those who smoked crack.

After adjustment, there was also a residual association between race and gender in the final models for the proportion of injecting, crack smoking, and heroin sniffing/snorting networks. After adjustment, blacks and males had significantly smaller proportions of injecting networks as adults. This may in part be explained by the lower prevalence of injection drug use among blacks in the sample and the greater tendency for females to inject with a partner compared to males. Females and black drug users also had significantly greater proportions of crack smoking networks as adults. These findings likely reflect the disproportionate burden of the crack epidemic in black neighborhoods and homophily by gender and race with respect to the formation of social ties. While crack use and parental drug use remained significantly associated with having a greater proportion of crack smoking networks as adults even after adjusting for potential confounders, the effect of crack use was attenuated. Finally, males and blacks were less likely to form relationships with other heroin users, after adjustment. Further research is needed to better understand the social constructs that gender and race are measuring here.

While having > 1 parent who used drugs in the home while growing up was selected as the standard measure for parent drug use during childhood in the adjusted models, other parent drug use variables were also associated with having a greater proportion of drug using networks as adults in unadjusted (Table 2) and adjusted models (data not shown). Overall, findings from our unadjusted models suggest that drug use by a parent or primary caregiver is significantly associated with future relationships with drug using, injecting, and crack smoking peers. In each case, the type of drug used by the parent/caregiver, the number of parents using drugs, the type of parent/caregiver (e.g., primary caregiver, mother, or father), and whether drugs were used inside the home where he/she was raised were important factors. Also interesting, parental influence increased when drugs were used in the home by the father, but not by the primary caregiver. For example, those who reported that his/her

father had used drugs in the home had 30% more drug using peers as adults, whereas those reporting that their father had used drugs in a more general sense (not specifically in the home) were not at an increased risk for associating with drug using peers as adults. As mothers were more likely to be primary caregivers than fathers, it is likely that fathers spent less time in the home, which may partially explain this finding. The same trend was not observed for drug use by the primary caregiver or mother. Those who reported drug use by a primary caregiver during childhood reported approximately 22% more drug using social networks in adulthood than those who did not, compared with 21% more drug using peers as adults among those who reported that a primary caregiver used drugs in the home. Drug use by the mother did not influence adult social networks.

Growing up in a household where others (not necessarily parents or caregivers) used drugs was also strongly associated with having a greater proportion of social networks who inject drugs, smoke crack and sniff/snort heroin later in life. The significance of the association between drug use by relatives and having relationships with a greater proportion of drug users later in life was weak and inconsistent (data not shown in tables). Thus, drug use by one or more parents and specifically drug use by parents and caregivers in the home during childhood were most strongly associated with having high risk drug using networks in adulthood after controlling for one's own drug use.

There are several limitations. First, participants were asked to recall information from their childhood and as a consequence, recall bias may exist. However, this bias is not thought to differ by one's current drug use or by the outcomes considered. In addition, sensitive information is asked of all participants recruited, and it is possible that responses may be biased by social desirability. However, we did observe a number of high risk behaviors and the proportions of individuals reporting these behaviors are consistent with previous studies in this population, which suggests that this bias is minimal. Additionally, we did not collect information about parent drug use during different stages of childhood and adolescence, so we are unable to determine whether there are specific life stages over which drug use by parents and other caregivers is more influential.

Comparisons with similar studies suggest that START participants may have under-reported the number of individuals in his/her social network who used drugs (Latkin et al., 1995c; Pilowsky et al., 2007; Weeks et al., 2002). However, because the total number of non-parent social networks was included as an offset term in our negative binomial regression models, our measures represent the proportion of drug using social networks rather than the absolute number of drug using social networks, so this bias is likely minimized. Further, the use of an offset term for total non-parent social network size enabled us to account for variations in this self-reported measure.

Because the primary goal for this study was to evaluate the risk of initiating injection drug use, this sample consists of young, frequent heroin, crack, and cocaine users and young adult drug users who recently initiated injection drug use. Therefore, the findings from this analysis may not be generalizable to other types of drug users.

Despite these limitations, there are a number of strengths. While we relied on self-report data to some extent, current use of heroin, crack and cocaine was confirmed with a rapid urine drug test. In addition, while the study instrument was cross-sectional, we were able to assess a quasi-temporal association because participants were asked to recall experiences from childhood, which preceded their drug use. Finally, our findings are consistent with several behavioral theories which support the presence of a residual effect of parental drug use during childhood on having drug using social networks in adulthood. For example, according to the attachment theory, the first relationships that children develop are those

with their parents and the quality of these relationships can influence the types of relationships that he/she forms in the future. Thus, children with more secure relationships with their parents have more positive and fewer negative relationships with others and are more likely to be leaders than followers. Similarly, insecure children are more likely to be followers than leaders. In this analysis, one's relationship with his/her parents and/or primary caregiver serves to mediate the relationship between parent drug use during childhood and the formation of high risk drug using networks in adulthood. Our findings are also consistent with the social learning theory. According to this theory, the family is the social unit that is primarily responsible for modeling communication behavior and social skills. Relationships formed later in life tend to mimic those relationships between youth and their role models. When youths establish a positive relationship with a role model, he/she tends to mimic the role model's behaviors (Bandura, 1986) and his/her own values and attitudes about drug use mirror those of their parents' beliefs (Kafka and London, 1991; Query, 1985). This can act either to socialize youth into drug abuse or to shield them against it. Thus, according to the social learning theory, the type of relationship with his/her parent or primary caregiver and that individual's beliefs and attitudes about drug use are likely responsible for the observed residual association between parent drug use during childhood and the formation of high risk drug using networks in adulthood.

With limitations acknowledged, this analysis suggests that interventions that target parents and caregivers and promote drug cessation and a drug-free environment in the child's home may help impede the formation of high-risk, drug-using networks in adulthood. The residual effect of race/ethnicity on having IDU, crack smoking, and heroin snorting/sniffing networks in adulthood suggests that further research is needed to explore other social and environmental aspects of risk to help explain what race/ethnicity is measuring. Given the direct relationship between drug use, HIV, and the increased burden of HIV in black communities, these data also suggest that examination of parental characteristics on sexual network formation is warranted and may provide more evidence of an earlier point of HIV and substance use prevention in the black community.

References

- Babst D, Miran M, Koval M. The relationship between friends' marijuana use, family cohesion, school interest, and drug abuse prevention. *J. Drug Educ.* 1976; 6:23–41.
- Bandura, A. *Social Foundations of Thought and Action: A Social Cognitive Theory.* Prentice-Hall; Englewood Cliffs, NJ: 1986.
- Best D, Gross S, Manning V, Gossop M, Witton J, Strang J. Cannabis use in adolescents: the impact of risk and protective factors and social functioning. *Drug Alcohol Rev.* 2005; 24:483–488. [PubMed: 16361204]
- Duan L, Chou C-P, Andreeva V, Pentz M. Trajectories of peer social influences as long-term predictors of drug use from early through late adolescence. *J. Youth Adolesc.* 2009; 38:454–465. [PubMed: 19636757]
- Fisher JD. Possible effects of reference group-based social influence on AIDS-risk behavior and AIDS prevention. *Am. Psychologist.* 1988; 43:914–920.
- Hall, A.; Wellman, B. *Social Networks and Social Support.* In: Cohen, S.; Syme, L., editors. *Social Support and Health.* Academic Press; New York City: 1985.
- Hawkins J, Catalano R, Miller J. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: implications for substance abuse prevention. *Psychol. Bull.* 1992; 12:64–105. [PubMed: 1529040]
- Hoffman BR, Sussman S, Unger JB, Valente TW. Peer influences on adolescent cigarette smoking: a theoretical review of the literature. *Subst. Use Misuse.* 2006; 41:103–155. [PubMed: 16393739]
- Jinez, L.J.n.; Souza, J.R.M.d.; Pillon, SC. Drug use and risk factors among secondary students. *Revista Latino-Americana de Enfermagem.* 2009; 17:246–252. [PubMed: 19551280]

- Kafka RR, London P. Communication in relationships and adolescent substance use: the influence of parents and friends. *Adolesc.* 1991; 26:587–598.
- Kandel D. Drug and drinking behavior among youth. *Annu. Rev. Sociol.* 1980; 6:235–285.
- Kandel D, Kessler R, Margulies R. Antecedents to adolescent initiation to drug use: a developmental analysis. *J. Youth Adolesc.* 1978a; 7:13–40.
- Kandel DB, Kessler RC, Margulies RZ. Antecedents of adolescent initiation into stages of drug-use - developmental analysis. *J. Youth Adolesc.* 1978b; 7:13–40.
- Korsnick J, Judd C. Transitions in social influence at adolescence: who induces cigarette smoking? *Dev. Psychol.* 1982; 18:359–368.
- Latkin C, Mandell W, Oziemkowska M, Celentano D, Vlahov D, Ensminger M, Knowlton A. Using social network analysis to study patterns of drug-use among urban drug-users at high-risk for HIV aids. *Drug Alcohol Depend.* 1995; 38:1–9. [PubMed: 7648991]
- Latkin CA, Knowlton AR, Hoover D, Mandell W. Drug network characteristics as a predictor of cessation of drug use among adult injection drug users: a prospective study. *Am. J. Drug Alcohol Abuse.* 1999; 25:463–473. [PubMed: 10473009]
- Li XM, Stanton B, Feigelman S. Impact of perceived parental monitoring on adolescent risk behavior over 4 years. *J. Adolesc. Health.* 2000; 27:49–56. [PubMed: 10867352]
- Miller-Day M. Parent-adolescent communication about alcohol, tobacco, and other drug use. *J. Adolesc. Res.* 2002; 17:604.
- Newcomb M, Huba G, Bentler P. Mother's influence on the drug use of their children: confirmatory tests of direct modeling and mediational theories. *Dev. Psychol.* 1983; 19:714–726.
- Oetting E, Beauvais F. Peer cluster theory: drugs and the adolescent. *J. Counsel. Dev.* 1986; 65:17–22.
- Ompad DC, Galea S, Marshall G, Fuller CM, Weiss L, Beard JR, Chan C, Edwards V, Vlahov D. Sampling and recruitment in multilevel studies among marginalized urban populations: the IMPACT studies. *J. Urban Health.* 2008; 85:268–280. [PubMed: 18214686]
- Piko B. Smoking in adolescence do attitudes matter? *Addict. Behav.* 2001; 26:201–217. [PubMed: 11316377]
- Pilowsky DJ, Hoover D, Hadden B, Fuller C, Ompad DC, Andrews HF, de Leon CL, Hoepner L, Xia Q, Latkin C. Impact of social network characteristics on high-risk sexual behaviors among non-injection drug users. *Subst. Use Misuse.* 2007; 42:1629–1649. [PubMed: 17934988]
- Query J. Comparative admission and follow-up study of American Indians and whites in a youth chemical dependency unit on the north central plains. *The Int. J. Addict.* 1985; 20:489–502.
- Rudolph AE, Crawford ND, Latkin C, Heimer R, Benjamin EO, Jones KC, Fuller CM. Sub-populations of illicit drug users reached by targeted street outreach and respondent driven sampling strategies: implications for research and public health practice. *Ann. Epidemiol.* 2011; 21:280–289. [PubMed: 21376275]
- Sargent JD, Dalton M. Does parental disapproval of smoking prevent adolescents from becoming established smokers? *Pediatrics.* 2001; 108:1256–1262. [PubMed: 11731645]
- Stanley JM, Lo CC. School-related factors affecting high school seniors' methamphetamine use. *J. Drug Educ.* 2009; 39:401–418. [PubMed: 20443455]
- Steinberg L, Fletcher A, Darling N. Parental monitoring and peer influences on adolescent substance use. *Pediatrics.* 1994; 93:1060–1064. [PubMed: 8197008]
- Weeks MR, Clair S, Borgatti SP, Radda K, Schensul JJ. Social networks of drug users in high-risk sites: finding the xonnections. *AIDS Behav.* 2002; 6:193–206.
- Wright DR, Fitzpatrick KM. Psychosocial correlates of substance use behaviors among African American youth. *Adolesc.* 2004; 39:653–667.

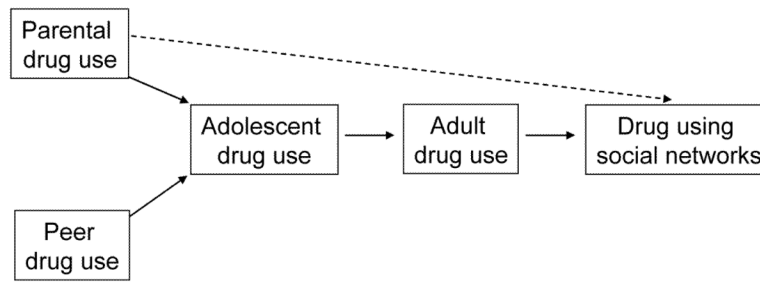


Figure 1. Conceptual Framework for the association between parental drug use during one's childhood and the formation of drug using social networks in adulthood.

Table 1

Demographic, current drug use, and parental drug use characteristics among young adult heroin, crack, and cocaine users in New York City between 2006 and 2009 (N=650)

	N	%
Demographic characteristics		
Age (median, IQR)	33	28-37
Number of social networks (median, IQR) ^I	3	2-4
Number of drug using networks (median, IQR) ^I	1	1-2
Number of crack smoking networks (median, IQR) ^I	0	0-0
Number of heroin sniffing networks (median, IQR) ^I	1	0-1
Number of injecting networks (median, IQR) ^I	0	0-1
Injection Status		
NIDU	510	78.5
IDU	140	21.5
Race/Ethnicity		
Black	320	49.2
Other	330	50.8
Gender		
Male	455	70.5
Female	190	29.4
Education		
< High School/GED	319	49.2
≥ High School	330	50.9
Homeless in past 6 months		
No	166	28.9
Yes	409	71.1
Total annual income		
< \$10,000	512	83.1
≥ \$10,000	104	16.9
Current drug use		
Cocaine use (last 6 months)		
No	155	24.0
Yes	491	76.0
Crack use (last 6 months)		
No	132	20.3
Yes	517	79.7
Heroin use (last 6 months)		
No	281	43.6
Yes	363	56.4

	N	%
Demographic characteristics		
During childhood _____		
Mom used heroin, crack, or cocaine		
No	425	74.4
Yes	146	25.6
Dad used heroin, crack, or cocaine		
No	365	68.4
Yes	169	31.7
Primary caregiver used heroin, crack, or cocaine		
No	563	86.9
Yes	85	13.1
Mom used drugs in the home		
No	40	19.3
Yes	167	80.7
Dad used drugs in the home		
No	77	32.2
Yes	162	67.8
Primary caregiver used drugs in the home		
No	349	71.7
Yes	138	28.3
>1 parent used drugs in the home		
No	76	23.8
Yes	243	76.2
Mom used cocaine		
No	425	83.3
Yes	85	16.7
Dad used cocaine		
No	365	78.8
Yes	98	21.2
Primary caregiver used cocaine		
No	599	92.6
Yes	48	7.4
Mom used crack		
No	425	87.3
Yes	62	12.7
Dad used crack		
No	365	88.0
Yes	50	12.0
Primary caregiver used crack		
No	617	95.7
Yes	28	4.3

	N	%
Demographic characteristics		
Mom used heroin		
No	425	85.9
Yes	70	14.1
Dad used heroin		
No	365	80.8
Yes	87	19.3
Primary caregiver used heroin		
No	610	94.3
Yes	37	5.7

¹ excluding parents

Unadjusted prevalence ratios for the association between childhood parental drug use and proportion of non-parent drug using networks in adulthood among young adult heroin, crack and cocaine users in New York City between 2006 and 2009.

Table 2

	Association between childhood parental drug use and proportion of adult networks who					
	Use Drugs N=605	Inject Drugs N=600	Smoke Crack N=601	Sniff/Snort Heroin N=601	PR	95% CI
Demographic characteristics						
Age	1.00	0.99-1.01	0.92	0.89-0.94	1.03	1.02-1.05
Race/Ethnicity						
Black	1.09	0.96-1.23	0.18	0.13-0.26	1.50	1.24-1.80
Other	Ref	Ref	Ref	Ref	Ref	Ref
Gender						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	1.17	1.02-1.33	1.63	1.17-2.27	1.36	1.12-1.66
Education						
< High School/GED	Ref	Ref	Ref	Ref	Ref	Ref
≥ High School	0.89	0.78-1.01	0.86	0.62-1.18	1.14	0.95-1.38
Homeless in past 6 months	1.23	1.06-1.43	0.95	0.65-1.38	1.58	1.27-1.98
Total annual income						
< \$10,000	0.91	0.77-1.07	0.85	0.57-1.28	1.01	0.79-1.30
≥ \$10,000	Ref	Ref	Ref	Ref	Ref	Ref
Current drug use						
Cocaine use (last 6 months)	1.09	0.94-1.27				
Crack use (last 6 months)	1.36	1.15-1.61			5.83	3.98-8.54
Heroin use (last 6 months)	0.96	0.85-1.09				6.59
Injection Status						
NIDU	Ref	Ref	Ref	Ref	Ref	Ref
IDU	0.88	0.74-1.05	11.64	8.83-15.36	0.56	0.44-0.76
						2.55
						1.96-3.33

Association between childhood parental drug use and proportion of adult networks who						
	Use Drugs N=605	Inject Drugs N=600	Smoke Crack N=601	Sniff/Snort Heroin N=601	PR	95% CI
During childhood						
Mom used <u>heroin, crack, or cocaine</u>	1.06	0.91-1.23				
Dad used <u>heroin, crack, or cocaine</u>	0.97	0.84-1.12				
Primary caregiver used <u>heroin, crack, or cocaine</u>	1.22	1.03-1.45				
People used <u>heroin, crack, or cocaine</u> in the home	1.12	0.99-1.27	1.51	1.10-2.08	1.11	0.92-1.34
Mom used <u>drugs</u> in the home	1.28	0.97-1.71				
Dad used <u>drugs</u> in the home	1.30	1.03-1.65				
Primary caregiver used <u>drugs</u> in the home	1.21	1.04-1.40				
>1 parent used <u>drugs</u> in the home	1.37	1.09-1.72	0.66	0.36-1.21	1.59	1.11-2.27
Mom used <u>cocaine</u> while growing up			1.13	0.72-1.76		
Dad used <u>cocaine</u> while growing up			1.64	1.09-2.45		
Primary caregiver used <u>cocaine</u> while growing up			1.77	1.06-2.94		
Mom used <u>crack</u> while growing up			1.20	0.90-1.59		
Dad used <u>crack</u> while growing up			1.01	0.73-1.38		
Primary caregiver used <u>crack</u> while growing up			1.57	1.06-2.33		
People used <u>crack</u> in the home			1.38	1.11-1.73		
Mom used <u>heroin</u> while growing up			1.02	0.68-1.53		
Dad used <u>heroin</u> while growing up			1.01	0.71-1.45		
Primary caregiver used <u>heroin</u> while growing up			1.06	0.61-1.83		
People used <u>heroin</u> in the home			1.73	1.31-2.27		
Recruitment variable						
RDS vs. Targeted outreach	1.12	0.97-1.29	0.34	0.25-0.47	1.35	1.10-1.66
					0.61	0.47-0.79

Table 3

Final adjusted prevalence ratios for the associations between childhood parental drug use and the proportion of adult networks who use drugs, inject drugs, smoke crack, and sniff/snort heroin (2006-2009).

	Association between childhood parental drug use and proportion of adult networks who					
	Use Drugs N=605	Inject Drugs N=600	Smoke Crack N=601	Sniff/Snort Heroin N=601	APR	95% CI
Crack use			3.31	2.01-5.45		
Heroin use					5.49	3.84-7.83
IDU vs. NIDU	8.91	6.35-12.50				
Black vs. other race/ethnicity	0.64	0.43-0.94	1.41	1.09-1.82	0.60	0.47-0.77
Female vs. Male	1.18	1.01-1.38	1.44	1.09-1.90	1.43	1.13-1.81
≥ High School/GED vs. < High School/GED					0.75	0.60-0.94
Homeless vs. not	1.26	1.06-1.50		1.58	1.18-2.11	
> 1 parent used drugs in the home while growing up	1.18	1.01-1.38		1.71	1.21-2.43	
RDS vs. Targeted Outreach	1.20	1.01-1.42				