Psychological Medicine (2009), **39**, 149–155. © 2008 Cambridge University Press
doi:10.1017/S0033291708003085 Printed in the United Kingdom

ORIGINAL ARTICLE

Alcohol and illicit drug dependence among parents: associations with offspring externalizing disorders

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Background. Previous research indicates that alcohol and drug dependence constitute aspects of a general vulnerability to externalizing disorders that accounts for much of the parent-offspring resemblance for these and related disorders. This study examined how adolescent offspring risk for externalizing psychopathology varies with respect to parental alcoholism and illicit drug dependence.

Method. Data from the Minnesota Twin Family Study, a community-based investigation of adolescents (age 17 years, $n=1252$) and their parents, were used. Lifetime diagnoses of alcohol and drug dependence (among both parents and offspring) and offspring attention deficit hyperactivity disorder, oppositional defiant disorder, conduct disorder, adult antisocial behavior, and nicotine dependence were assessed via structured interviews.

Results. Parental alcohol dependence and parental drug dependence were similarly associated with increased risk for nearly all offspring disorders, with offspring of alcohol and drug-dependent parents having approximately 2–3 times the odds for developing a disorder by late adolescence compared to low-risk offspring. Compared to parental dependence on other illicit drugs, parental cannabis dependence was associated with weaker increased risk for offspring externalizing disorders.

Conclusions. Both parental alcohol and drug dependence are independently associated with an increased risk for a broad range of externalizing psychopathology among late-adolescent offspring.

Received 8 June 2007; Revised 10 January 2008; Accepted 1 February 2008; First published online 15 April 2008

Key words: Externalizing disorders, offspring, parental psychopathology, substance dependence.

Introduction

Previous research has found that the covariance among alcohol and illicit drug use disorders is strongly heritable (for a review, see Iacono *et al*. 2008) and constitutes part of a general vulnerability to externalizing disorders that accounts for much of the parent-offspring resemblance for substance dependence and other externalizing psychopathology (Hicks *et al*. 2004). In addition, molecular genetic studies have uncovered candidate genes that appear to underlie this general externalizing vulnerability (Dick, 2007; Dick *et al*. 2008). These findings suggest that parental alcoholism and drug dependence should each be associated with a wide range of externalizing disorders among offspring. However, research comparing offspring outcomes for alcohol *versus* drug-dependent parents is lacking. The purpose of this study is to compare the risk for a broad range of externalizing disorders among offspring that is associated with parental alcohol dependence (net the effect of parental drug dependence) and parental drug dependence (net the effect of parental alcohol dependence). We specifically focused on late-adolescent outcomes in order to capture recent and potentially ongoing child externalizing disorders [e.g. attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD)], early-onset cases of substance dependence, and associated antisocial behavior that also becomes evident during this life stage.

Although the children of alcohol- and drug-dependent parents are known to have heightened risk for substance use and childhood disruptive disorders, comparisons of the degree of risk for these offspring outcomes based on the presence of parental alcohol or drug dependence is sparse. The vast majority of studies in this area either examine only parental alcohol dependence (e.g. Hill & Muka, 1996; Chassin *et al*. 1999; Curran *et al*. 1999; Jacob *et al*. 1999; Kuperman *et al*. 1999; Schuckit *et al*. 2000; Barnow *et al*. 2002; Lieb *et al*. 2002; Loukas *et al*. 2003; Ohannesian *et al*. 2005),

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or only parental drug dependence (e.g. Stanger *et al*. 1999; Clark *et al*. 2004). Alternatively, they combine parental alcohol and drug dependence into a single substance dependence construct (e.g. Merikangas *et al*. 1998). The few studies that have examined offspring outcomes as a function of parental alcoholism or drug dependence have obtained mixed results supporting both the existence of a shared diathesis and some specific effects (Gabel & Shindledecker, 1993; Milberger *et al*. 1999; Schuckit *et al*. 2000; Clark *et al*. 2004; Ohannessian *et al*. 2005). Because these studies vary substantially in their participant referral sources, types of disorders examined, assessment instruments, sample sizes, and age of offspring studied, it is not possible to specify the degree of risk for externalizing disorders experienced by offspring of alcohol- and drug-dependent parents. In addition, we are unaware of any study that examines the risk to offspring associated with parental dependence on cannabis compared to other drugs.

At a more descriptive level, rates of disorders among offspring of parents with substance problems vary widely, even within community-based studies. For example, prevalence estimates of ADHD in this group range from 5.4% (Schuckit *et al*. 2000) to 13.2% (Hill & Muka, 1996; Kuperman *et al*. 1999). Similarly, rates of conduct disorder (CD) among these offspring range from 0% (Schuckit *et al*. 2000) to 15.6% (Merikangas *et al*. 1998), rates of alcohol use diagnoses range from 0% (Schuckit *et al*. 2000) to 52.6% (Chassin *et al*. 1999), and rates of drug use diagnoses range from 1.9% (Kuperman *et al*. 1999) to 21.1% (Chassin *et al*. 1999). The large range of estimates in these studies is likely related to differing procedures for recruitment and sampling, diagnostic standards, participant ages, and sample sizes across studies.

The central aim of the present study is to expand on research describing the familial transmission of externalizing-spectrum disorders by examining the full range of externalizing disorders (defined here as childhood disruptive disorders, antisocial behavior, and substance dependence) among offspring of parents with alcohol or drug dependence. It was expected that both of these parental addictions would be associated with similarly broad-based risk for many, if not all, externalizing disorders among adolescent offspring. Although illicit drug dependence involves addiction to any of a number of substances, we were able to separate the effects attributable to the most commonly abused drug in this class, cannabis, from the remaining illicit substances. Because marijuana is often considered a step on the path toward using other, 'harder', illicit drugs (e.g. Kandel, 2002), we entertained the possibility that offspring risk conferred by parental cannabis dependence would be reduced compared to that associated with other and more stigmatized illicit drugs.

This study adds to our knowledge about risk to offspring of alcohol- and drug-dependent parents in several important ways. First, the sample is community-based. The vast majority of studies on this topic examine offspring of people who are *treated* for substance dependence. Due to Berkson's bias (demonstrating that people with more than one disorder are more likely to present for treatment), these offspring are likely at particular risk for a variety of other reasons. The present study involves a large sample of both parents and offspring, all of whom were directly assessed with in-person structured interviews. Although other studies have examined specific associations between different forms of parental and offspring psychopathology, it is rare to report rates of a broad variety of psychopathological outcomes among high- and low-risk offspring in the community, and to compare directly offspring of alcohol- and drug-dependent parents. In addition, the offspring were assessed at a uniform age in late adolescence, a crucial transition point in development when early-onset cases of disorders have developed and the vast majority of adolescents are about to complete high school and move on to college or full-time employment. Since late-onset substance use disorders may be particularly likely to be acquired through different pathways, this uniform age of assessment that captures early- but not late-onset cases represents a particular strength.

Methods

Participants

Participants for this study were drawn from the community-based sample of the Minnesota Twin Family Study, a longitudinal study of twins and their parents. Twins born in the state of Minnesota during specified birth years were identified; after excluding those twins who were adopted, mentally retarded, or otherwise did not meet inclusion criteria, over 82% participated in the study. Twins were approximately 17 years old at the time of their visit to the study (mean = 17.5, S.D. = 0.4 for males; mean = 17.5, S.D. = 0.5 for females). The present sample includes 578 males and 674 females along with their biological parents [626 families total; 626 mothers (mean age = 44.28, S.D. = 4.72), 544 fathers (mean age = 46.58, S.D. = 5.34)]. Twins were considered as separate cases; all statistical analyses accounted for the fact that two adolescents from each family were included by adjusting for correlated observations. The number of parents with alcohol, cannabis, and other drug dependence is

https://doi.org/10.1017/S0033291708003085 Published online by Cambridge University Press

Table 1. *Prevalence of diagnoses among offspring of parents with alcohol, cannabis, and other drug dependence*[a]

Offspring disorder	Alcohol dependence ($n=270$)[b]	Cannabis dependence ($n=62$)[b]	Other drug dependence ($n=50$)[b]	Neither parent substance-dependent ($n=280$)[b]
ADHD	5.7	4.8	14.0	0.6
ODD	10.5	21.8	34.0	3.3
CD	24.8	30.7	33.0	4.8
AAB	9.1	11.3	16.0	1.3
Nicotine dependence	18.9	23.4	33.0	3.5
Alcohol dependence	15.4	21.8	23.0	0.3
Drug dependence	7.6	13.7	18.0	1.1

ADHD, Attention deficit hyperactivity disorder; ODD, oppositional defiant disorder; CD, conduct disorder; AAB, adult antisocial behavior.

Values are percentages.

[a] This is among families for whom diagnostic data was available on both mothers and fathers, or in which the parent who was assessed had at least one substance dependence diagnosis (i.e. if only one parent was assessed and that parent did not have a substance dependence diagnosis, their offspring were not included in the analyses for this table due to the possibility that the other parent may be substance dependent). Categories are not mutually exclusive, since parents may have had more than one diagnosis. The total sample included in this table consisted of 544 families (an additional 82 families participated in the study, but data on the fathers were not available in those cases).

[b] These sample sizes refer to the number of families falling into each category; for example, at least one parent had cannabis dependence in 62 families; therefore, these prevalence rates are based on the sample of 124 adolescents who were in these 62 families.

presented in Table 1. Fathers who did not visit the study were not examined. The results presented in this report were based on analyses conducted using only mothers' data for families in which fathers did not visit. However, because fathers who did not visit may have had undetected substance dependence, all analyses were repeated treating these families as entirely missing (i.e. only including families in which both parents were directly assessed). The pattern of significant results was identical.

The sample was predominantly (98%) white, as expected given the demographic make-up of Minnesota at the time the twins were born. Average socioeconomic status levels (Hollingshead, 1975) corresponded to parental occupations such as clerical and sales workers and small-business owners. Additional information regarding the study design and sample characteristics can be found elsewhere (Iacono *et al*. 1999, 2006; Iacono & McGue, 2002).

Measures

Parental alcohol and drug dependence

Lifetime alcohol, cannabis, and other illicit drug dependence were assessed among parents via structured interviews [the Substance Abuse Module (SAM; Robins *et al*. 1987), a supplement to the Composite International Diagnostic Interview (CIDI; Robins *et al*. 1988)]. DSM-III-R was used because it was the diagnostic system in use when data collection begun. Both definite (meeting all DSM-III-R criteria) and probable (missing one symptom) diagnoses were used in order to account for the fact that some people may forget symptoms when reporting on syndromes that may have occurred a number of years before. The effects of parental illicit drug dependence on offspring outcomes were examined separately for any illicit drug, marijuana, and any illicit drug but marijuana. Small sample sizes precluded the examination of effects associated with other illicit drugs besides marijuana. Effects of parental nicotine dependence were not examined because of the high degree of overlap between nicotine addiction and dependence on other substances in the parents (e.g. there were only 12 families of the 112 total where at least one parent was dependent on an illicit drug but neither parent was dependent on nicotine). This extensive co-morbidity would have rendered difficult the interpretation of analyses attempting to tease apart the effects of parental nicotine dependence from those of parental dependence on other substances.

Offspring externalizing disorder

Nicotine, alcohol dependence and illicit drug dependence (combining all types of illicit drugs, due to relatively low prevalence of specific addictions in this

https://doi.org/10.1017/S0033291708003085 Published online by Cambridge University Press

age group) among offspring were assessed in an analogous way to these disorders in parents (using the SAM structured interview). ADHD and ODD were assessed using the Diagnostic Interview for Children and Adolescents – Child Version (DICA-C; Reich & Welner, 1988). Symptoms of antisocial personality disorder (i.e. CD) occurring before age 15, and adolescent antisocial behavior (AAB; composed of the symptoms of antisocial personality disorder that must occur since age 15) were assessed among offspring using modified versions of the Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II; Spitzer *et al*. 1987). In previous work, we have demonstrated the construct validity of the AAB designation in adolescents (Marmorstein & Iacono, 2005), and thus we examined offspring rates of AAB in the current report. In addition, maternal reports of the childhood disruptive and substance use disorders were collected using the Diagnostic Interview for Children and Adolescents – Parent Version (DICA-P; Reich & Welner, 1988). If either informant reported a definite or probable DSM-III-R diagnosis, the disorder was considered present. In prior work, we have shown that combining mother and child diagnostic interview information related to externalizing disorders enhances the accuracy of the clinical characterization of offspring (Burt *et al*. 2001).

Statistical analyses

Analyses were conducted using the SAS PROC GENMOD procedure (SAS Institute, Cary, NC, USA) accounting for the inclusion of two participants (twin offspring) in each family (using generalized estimating equations). First, we modeled the likelihood of each offspring diagnosis (ADHD, ODD, CD, AAB, nicotine dependence, alcohol dependence, and drug dependence) given parental alcohol dependence and adjusting for parental drug dependence (i.e. including parental drug dependence in the model). Next, we modeled the likelihood of each offspring diagnosis given parental drug dependence and adjusting for parental alcohol dependence (i.e. including parental alcohol dependence in the model). These analyses provided an estimate of the effect of each parental disorder net the effect of the other disorder. Effects of parental drug dependence were extended by examining the offspring risk associated with parental cannabis dependence and parental dependence on all non-cannabis illicit drugs, again adjusting for parental alcohol dependence. Maternal and paternal diagnoses were combined for all analyses (if either parent had a history of the disorder, it was considered present). A participant (or set of parents) may have had both alcohol and drug dependence; this analytic technique – entering both alcohol and drug dependence into the model simultaneously – yields the effect of one disorder (e.g. alcohol dependence) on the dependent variable (child psychopathology) *net* the effect of the other disorder (e.g. drug dependence).

Results

Descriptive statistics

The following percentages represent the rates at which at least one parent in the family had a history of dependence on the drug: cannabis 9.9%, amphetamine 5.9%, sedatives 1.6%, opioids 1.4%, cocaine 1.3%, hallucinogens 1.3%, inhalants 0.2%, PCP 0.2%.

As expected, alcohol, cannabis, and other drug dependence were highly co-morbid: each pair of disorders was significantly associated with each other among parents [all χ^2 values (1 df) $\geqslant 26.5$, all p values < 0.001). Of families in which at least one parent had alcohol dependence, 17.8% also had cannabis dependence in at least one parent and 15.2% also had other drug dependence in at least one parent. Of families in which at least one parent had cannabis dependence, 78.7% also had alcohol dependence in at least one parent and 43.6% also had other drug dependence in at least one parent. Of families in which at least one parent had other drug dependence, 85.4% also had alcohol dependence in at least one parent and 54.0% also had cannabis dependence in at least one parent.

Among all adolescents in the community-based sample, 4.2% had ADHD, 16.1% had ODD, 20.1% had CD, 6.6% had AAB, 15.0% had nicotine dependence, 11.8% had alcohol dependence, and 5.4% had drug dependence. Rates of these disorders among offspring of parents with alcohol dependence, cannabis dependence, and other drug dependence are presented in Table 1. In general, rates of each disorder were most elevated among offspring of other drug-dependent parents, somewhat less elevated among offspring of cannabis-dependent parents, and somewhat less elevated (but still higher than offspring of parents without alcohol or drug dependence) among offspring of alcohol-dependent parents.

Associations between parental alcohol and drug dependence and offspring externalizing disorders

As indicated in Table 2, parental alcohol dependence (adjusting for parental drug dependence) was associated with increased risk for all offspring externalizing disorders. Parental drug dependence (adjusting for parental alcohol dependence) was associated with increased risk for all offspring disorders except ADHD, for which the association was in the expected direction but non-significant (odds ratio 1.65). Turning to parents in this group who had cannabis dependence, the

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Table 2. *Risk for offspring diagnoses associated with parental alcohol and drug dependence*

	Parental alcohol dependence[a]		Parental drug dependence[b]		Parental cannabis dependence[b]		Parental non-cannabis drug dependence[b]	
Offspring disorder	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
ADHD	2.77*	1.18–6.46	1.65	0.63–4.32	0.88	0.25–3.19	4.01**	1.66–9.72
ODD	2.28***	1.46–3.56	2.02**	1.20–3.39	1.14	0.65–1.99	2.33**	1.29–4.23
CD	1.85**	1.27–2.68	1.70*	1.04–2.78	1.61	0.94–2.76	1.78*	1.00–3.18
AAB	2.25**	1.22–4.14	1.93*	1.01–3.66	1.55	0.79–3.03	2.49**	1.25–4.98
Nicotine dependence	1.96**	1.27–3.05	1.77*	1.05–2.99	1.55	0.87–2.78	2.71***	1.52–4.84
Alcohol dependence	2.18**	1.32–3.61	1.98*	1.14–3.42	1.97*	1.11–3.49	2.06*	1.16–3.65
Drug dependence	2.25*	1.09–4.62	2.97**	1.49–5.88	2.73**	1.38–5.42	4.00***	2.02–7.93

OR, Odds ratio; CI, confidence interval; ADHD, attention deficit hyperactivity disorder; ODD, oppositional defiant disorder; CD, conduct disorder; AAB, adult antisocial behavior.

[a] Adjusting for parental drug dependence.

[b] Adjusting for parental alcohol dependence.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

risk to offspring was significantly elevated only for alcohol and drug dependence. For offspring whose parents were dependent on non-cannabis drugs, the odds of having an externalizing diagnosis were significantly elevated for all disorders.

Discussion

The results of this study indicate that overall, both parental alcohol and drug dependence are associated with similar and elevated levels of risk for a broad range of externalizing disorders among offspring. This extends research on the generalized transmission of risk for externalizing psychopathology by demonstrating that two specific parental externalizing disorders – alcohol and drug dependence – both relate to risk for a broad range of childhood and adolescent disruptive behavior, antisocial, and substance use disorders. This is consistent with the idea that an externalizing disorder – specifically alcohol or illicit drug dependence – in parents confers risk for offspring externalizing disorders in part through a general genetically influenced vulnerability toward externalizing disorders that is transmitted from parent to child (Hicks *et al*. 2004).

As Table 1 highlights, compared to families where neither parent is dependent on alcohol or illicit drugs, the offspring of parents with alcohol, cannabis, or other illicit drug dependence are at substantially elevated risk for all of the externalizing outcomes (e.g. prevalence rates were at least three times higher in these families for all adolescent outcomes). However, after adjusting for the effects of parental alcohol dependence, the effects of parental cannabis dependence are somewhat weaker than the effects of other drugs, with the effects of cannabis dependence significant only for alcohol and drug dependence among offspring. There are several possible reasons for this. Cannabis is often viewed as a 'gateway drug' – i.e. not as severe as the use of other drugs, and a step on the pathway toward other drug use (e.g. Kandel, 2002). It seems possible, then, that individuals who become dependent on cannabis but do not become dependent on other 'harder' drugs may have influences that contribute to adaptive functioning (e.g. a good family life, a steady job). In addition, cannabis use is more common than the use of other drugs and therefore heavy use may be associated with less deviance (e.g. people who use cannabis may have more ability to maintain work and relationships than people who use other drugs). Cannabis may also be easier to access than many other drugs, making association with more deviant individuals less typical of cannabis users compared to users of other drugs.

Rates of psychopathology among offspring of substance-dependent parents in this study were generally consistent with the range of rates reported in previous studies, although our rates of CD were somewhat higher than previous estimates. This study also adds to the descriptive literature by reporting rates of ODD, AAB, and nicotine dependence among these offspring and also by separating out the rates of externalizing psychopathology among offspring of cannabis-dependent and other drug-dependent parents. As such, it builds on existing research by further broadening our understanding of the degree to which parental substance dependence is associated with a wide range of externalizing outcomes.

https://doi.org/10.1017/S0033291708003085 Published online by Cambridge University Press

This study has clinical implications. It is clear that child and adolescent offspring of parents with histories of substance dependence of any sort are at risk for a wide variety of negative outcomes. Although parental cannabis dependence is associated with weaker risk to offspring than parental dependence on other drugs, the relatively weaker effect of cannabis dependence is unlikely to warrant different assessment or treatment strategies. It would be prudent to inquire about a history of substance dependence among parents of youth presenting for psychological evaluation or treatment of externalizing disorders; in addition, inquiry into the type of substance dependence would be appropriate. It would also make sense to evaluate and implement preventative or treatment interventions for children of adults who enter substance abuse treatment programs. In addition, it is worth noting that among the offspring disorders examined in this study, substance dependence is typically one of the last to develop [i.e. although sequence effects were not examined, ADHD must be present prior to age 7 to be diagnosed, CD must be present prior to age 15 to be diagnosed, and ODD typically has an onset prior to age 8 (APA, 1994)]. Therefore, offspring of substance-dependent parents who are exhibiting one of these other disorders earlier in childhood warrant particular attention because they may be especially prone to develop later substance dependence.

This study has some limitations. Participants in this study were primarily Caucasian; although they were representative of the population of families with at least one child in the state of Minnesota at the time the adolescent participants were born (Holdcraft & Iacono, 2004), it is not known how well these findings would generalize to other groups. In addition, different results could be expected for offspring in studies of parents with severe or persistent alcohol and/or drug addictions. Moreover, although the uniform age of the offspring was a strength in that we were able to examine these issues among adolescents on the cusp of a key developmental transition (i.e. high-school graduation) and specifically focus on early-onset cases of substance dependence, we cannot be certain that these findings would be the same for younger offspring whose risk is less likely to be expressed or in older offspring who have settled into adult patterns of drug and alcohol use and whose externalizing behavior may have persisted into adulthood or desisted. In addition, it is striking that we found these effects using lifetime diagnoses, since parents may have had alcohol and/or drug dependence before the offspring were born. Future research examining how the timing of parental substance use disorder relates to offspring outcome would be useful. Further, the slightly differing patterns of results between cannabis and other drug dependence could be due to a multitude of other factors that may differentiate families in which the parents have a history of cannabis dependence compared to those in which the parents have a history of dependence on other drugs. A comprehensive examination of these factors was beyond the scope of this paper, but an examination of possible differences would be helpful in explaining the present results.

This study represents an examination of externalizing disorders among late-adolescent offspring of alcohol- and drug-dependent parents in a community-based sample. The results of this study support the notion that overall, parental alcohol and drug dependence are both associated with broad-based risk for a range of externalizing psychopathology to offspring. Future research investigating the mechanisms driving these associations would be useful and possibly helpful for developing targeted preventative interventions for externalizing disorders among offspring of parents who have histories of dependence on any substance.

Acknowledgments

This research was supported by grants AA09367 from the National Institute on Alcohol Abuse and Alcoholism; DA05147, DA016892, and K01DA022456-01 from the National Institute on Drug Abuse; and a research grant from the Alcoholic Beverage Medical Research Foundation.

Declaration of Interest

None.

References

Barnow S, Schuckit M, Smith TL, Preuss U, Danko G (2002). The relationship between the family density of alcoholism and externalizing symptoms among 146 children. *Alcohol and Alcoholism* **37**, 383–387.

Burt SA, Krueger RF, McGue M, Iacono WG (2001). Sources of covariation among attention-deficit/hyperactivity disorder, oppositional defiant disorder, and conduct disorder: the importance of shared environment. *Journal of Abnormal Psychology* **110**, 516–525.

Chassin L, Pitts SC, DeLucia C, Todd M (1999). A longitudinal study of children of alcoholics: predicting young adult substance use disorders, anxiety, and depression. *Journal of Abnormal Psychology* **108**, 106–119.

Clark DB, Cornelius J, Wood DS, Vanyukov M (2004). Psychopathology risk transmission in children of parents with substance use disorders. *American Journal of Psychiatry* **161**, 685–691.

Curran GM, Stoltenberg SF, Hill EM, Mudd SA, Blow FC, Zucker RA (1999). Gender differences in the relationships among SES, family history of alcohol disorders and alcohol dependence. *Journal of Studies on Alcohol* **60**, 825–832.

Dick D (2007). Identification of genes influencing a spectrum of externalizing psychopathology. *Current Directions in Psychological Science* **16**, 331–335.

Dick DM, Aliev F, Wang JC, Grucza RA, Schuckit M, Kuperman S, Kramer J, Hinrichs A, Bertelsen S, Budde J.P, Hesselbrock V, Porjesz B, Edenberg HJ, Bierut LJ, Goate A (2008). Using dimensional models of externalizing psychopathology to aid in gene identification. *Archives of General Psychiatry* **65**, 310–318.

Gabel S, Shindledecker R (1993). Parental substance abuse and its relationship to severe aggression and antisocial behavior in youth. *American Journal on Addictions* **2**, 48–58.

Hicks BM, Krueger RF, Iacono WG, McGue M, Patrick CJ (2004). Family transmission and heritability of externalizing disorder: a twin-family study. *Archives of General Psychiatry* **61**, 922–928.

Hill SY, Muka D (1996). Childhood psychopathology in children from families of alcoholic female probands. *Journal of the American Academy of Child and Adolescent Psychiatry* **35**, 725–733.

Holdcraft LC, Iacono WG (2004). Cross-generational effects on gender differences in psychoactive drug abuse and dependence. *Drug and Alcohol Dependence* **74**, 147–158.

Hollingshead AB (1975). *Four Factor Index of Social Status*. New Haven, CT: Yale University Department of Sociology.

Iacono WG, Carlson SR, Taylor J, Elkins IJ, McGue M (1999). Behavioral disinhibition and the development of substance-use disorders: findings form the Minnesota Twin Family Study. *Development and Psychopathology* **11**, 869–900.

Iacono WG, Malone SM, McGue M (2008). Behavioral disinhibition and the development of early-onset addiction: common and specific influences. *Annual Review of Clinical Psychology* **4**, 12.1–12.24.

Iacono WG, McGue M (2002). Minnesota Twin Family Study. *Twin Research* **5**, 482–487.

Iacono WG, McGue M, Krueger RF (2006). Minnesota Center for Twin and Family Research. *Twin Research and Human Genetics* **9**, 978–984.

Jacob T, Windle M, Seilhamer RA, Bost J (1999). Adult children of alcoholics: drinking, psychiatric, and psychosocial status. *Psychology of Addictive Behaviors* **13**, 2–21.

Kandel DB (2002). *Stages and Pathways of Drug Involvement: Examining the Gateway Hypothesis*. Cambridge University Press: New York.

Kuperman S, Schlosser SS, Lindral J, Reich W (1999). Relationship of child psychopathology to parental alcoholism and antisocial personality disorder. *Journal of the American Academy of Child and Adolescent Psychiatry* **38**, 686–692.

Lieb R, Merikangas KR, Hofler M, Pfister H, Isensee B, Wittchen H-U (2002). Parental alcohol use disorders and alcohol use and disorders in offspring: a community study. *Psychological Medicine* **32**, 63–78.

Loukas A, Zucker RA, Fitzgerald HE, Krull, JL (2003). Developmental trajectories of disruptive behavior problems among sons of alcoholics: effects of parent psychopathology, family conflict, and child undercontrol. *Journal of Abnormal Psychology* **112**, 119–131.

Marmorstein NR, Iacono WG (2005). Longitudinal follow-up of adolescents with late-onset antisocial behavior: a pathological yet overlooked group. *Journal of the American Academy of Child and Adolescent Psychiatry* **44**, 1284–1291.

Merikangas KR, Dierker LC, Szatmari P (1998). Psychopathology among offspring of parents with substance abuse and/or anxiety disorders: a high-risk study. *Journal of Child Psychology and Psychiatry* **39**, 711–720.

Milberger S, Faraone SV, Biederman J, Chu MP, Feighner JA (1999). Substance use disorders in high-risk adolescent offspring. *American Journal on Addictions* **8**, 211–219.

Ohannessian CM, Hesselbrock VM, Kramer J, Kuperman S, Bucholz KK, Schuckit MA, Nurnberger JI (2005). The relationship between paretnal psychopathology and adolescent psychopathology: an examination of gender patterns. *Journal of Emotional and Behavioral Disorders* **13**, 67–76.

Reich W, Welner Z (1988). *Diagnostic Interview for Children and Adolescents – Revised: DSM-III-R Version* (*DICA-R*). Washington University: St. Louis.

Robins LN, Baber T, Cottler LB (1987). Composite International Diagnostic Interview: Expanded Substance Abuse Module.

Robins LN, Wing J, Wittchen HU, Helzer JE, Babor TF, Burke J, Farmer A, Jablenski A, Pickens R, Regier DA, Sartorius N, Towle LH (1988). The Composite International Diagnostic Interview. *Archives of General Psychiatry* **45**, 1069–1077.

Schuckit MA, Smith TL, Radziminski S, Heyneman EK (2000). Behavioral symptoms and psychiatric diagnoses among 162 children in nonalcoholic or alcoholic families. *American Journal of Psychiatry* **157**, 1881–1883.

Spitzer RL, Williams JBW, Gibbons M, First MB (1987), *Structured Clinical Interview for DSM-III-R Personality Disorders* (*SCID II*). Biometrics Research Division, New York State Psychiatric Institute: New York.

Stanger C, Higgins ST, Bickel WK, Elk R, Grabowski J, Schmitz J, Amass L, Kriby KC, Seracini AM (1999). Behavioral and emotional problems among children of cocaine- and opiate-dependent parents. *Journal of the American Academy of Child and Adolescent Psychiatry* **38**, 421–428.