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The Importance of Conduct Problems and Depressive Symptoms in Predicting Adolescent Substance Use

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The current study assessed the relative importance of conduct problems and depressive symptoms, measured at two ages (11 and 15), for predicting substance use at age 15 in an unselected birth cohort of New Zealand adolescents. Among males, when the relative predictive utility of both conduct problems and depressive symptoms was assessed, only pre-adolescent depressive symptoms were found to predict multiple drug use 4 years later. No predictive relation was found between early symptomatology and later substance use among females. The strongest association between predictors and substance use emerged between age 15 multiple drug use and concurrent conduct problems for both males and females. Finally, both conduct problems and depressive symptoms at age 15 were also found to be associated with concurrent "self-medication" among females.

The study of adolescent substance use has yielded results on a host of variables which, when considered on their own, are found to be predictive of substance use. These variables span a broad range of domains, such as parental and peer substance use, expectations and belief regarding sub-

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stance use, and psychopathology, among others. A few studies have moved beyond efforts to simply predict substance use, and have attempted to develop explanatory models of the behavior; in this process, relations *between predictors* have begun to be considered (see Johnson, Marcos, & Bahr, 1987). The current study was an attempt to further improve our understanding of adolescent substance use by assessing the importance of the relation between two frequently cited correlates of substance use—namely, depressive symptoms and conduct problems.

One of the most consistently reported findings in the study of juvenile delinquency is the positive relation between conduct problems and substance use (e.g., Ensminger, Brown, & Kellam, 1982; Jessor & Jessor, 1977; Windle, 1990). For example, using data from the National Longitudinal Study of Youth, Windle (1990) found that early nondrug-related delinquency predicted later substance use, even after the effects of early substance use had been controlled. The association between substance use and antisocial behavior appears to be genuine and robust, and, indeed, some theorists consider the two sets of behaviors simply to be different expressions of a single underlying "problem behavior syndrome" (Jessor & Jessor, 1977).

A similar association has been reported between depression and substance use (Braught, Brakarsh, Follingstad, & Berry, 1973; Jacobs & Ghodes, 1987; Windle & Miller, 1990). Windle and Miller (1990) carried out a three-stage study of the relation between problem drinking and depression in adults convicted of driving while intoxicated. In addition to significant cross-sectional correlations, these authors report that assessments of depression predicted later problem drinking, *and* problem drinking predicted later depression. Jacobs and Ghodes (1987) compared adolescent male solvent abusers with nonabusers, and reported that significantly more abusers were depressed than were nonabusers.

A third empirically documented relation exists between depression and conduct problems (Carlson & Cantwell, 1980; Geller, Chestnut, Miller, Price, & Yates, 1985; Puig-Antich, 1982). For example, Carlson and Cantwell (1980) reported that among an outpatient population ranging in age from 7 to 17 years old, 29% of those subjects diagnosed as having an affective disorder also met DSM-III criteria for attention deficit disorder or conduct disorder. Puig-Antich (1982) reported that successful treatment of major depression was followed by a decrease in conduct disorder behaviors among a group of prepubertal boys.

Given these documented relations, it is somewhat surprising that the relative importance of conduct problems and depressive symptoms in predicting substance use among adolescents has not been previously assessed. The current study endeavored to address this issue by assessing the relative

usefulness of conduct problems and depressive symptoms for predicting substance use. Three specific hypotheses were tested:

1. The relation between adolescent conduct problems and substance use is mediated by the effects of concurrent depressive symptoms. It is predicted that if the relation between conduct problems and substance use is *not* mediated by the effects of depressive symptoms, that relation will remain significant when levels of depressive symptoms are controlled.
2. The relation between adolescent depressive symptoms and substance use is mediated by the effects of concurrent conduct problems. If the relation between depressive symptoms and substance use is *not* mediated by conduct problems, that relation will remain significant when levels of conduct problems are controlled.
3. The effects of conduct problems and depressive symptoms on substance use are independent. If conduct problems and depressive symptoms act independently to predict adolescent substance use, both relations will remain significant when controlling for the other set of symptoms.

Finally, analyses were conducted to assess the relations between conduct problems and depressive symptoms in predicting "self-medication" among a small subset of girls who stated that they used drugs or alcohol to make themselves "feel better."

Two primary sets of analyses were carried out. First, the predictive power of early conduct problems and depressive symptoms (measured at age 11) on later substance use (measured at age 15) was assessed. Second, because it was possible that concurrent symptomatology would have a different relation to substance use than does early symptomatology, the relations between concurrent conduct problems and depressive symptoms, and substance use (all measured at age 15) were assessed. Because the relation between conduct problems, depressive symptoms, and substance use may differ by gender, all analyses were carried out separately for boys and girls.

METHODS

Subjects

Subjects for this study were the members of an unselected New Zealand birth cohort, who have been studied extensively since their births as

part of the Dunedin Multidisciplinary Health and Development Study. The history of the study and sample have been described in detail by Silva (1990). Briefly, the cohort consists of all children born at Queen Mary Hospital in Dunedin, New Zealand, between April 1, 1972, and March 31, 1973, who were still living in the province of Otago when the longitudinal study began in 1975. At that time, 1139 of the 1649 live births met that criterion and thus were eligible for inclusion; 1037 participated. The sample has been reassessed with a diverse battery of psychological, medical, and sociological measures every 2 years since then.

Data collected when subjects were 11 and 15 years old were used for this study. Data for 752 subjects (355 females, 397 males) were included in the age 11 analyses. In the age 15 analyses, data for 956 subjects (464 females, 492 males) were included.[4]

At age 15, 69.9% of the subjects were living in homes with both natural parents present; 56 (5.8%) were living in homes in which the natural mother was absent, and 228 (23.8%) were living in homes in which the natural father was absent. Socioeconomic status (SES) was assessed using the Elley and Irving (1972) scale designed for use in New Zealand. The scale ranged from 1 to 6, with 1 representing the highest SES level (e.g., architect, lawyer), and 6 representing the lowest SES level (e.g., farm laborer, janitor.) When subjects were 15 years old, 4.2% of mothers and 10.4% of fathers were reported to hold occupations which would place them in the highest SES category; 5.7% of mothers and 3.8% of fathers were classified as being in the lowest SES category. Prevalence rates for DSM-III disorders in the Dunedin sample have been found to be comparable to rates found in other large-scale epidemiological studies (see Anderson, Williams, McGee, & Silva, 1987; McGee, Feehan, Williams, Partridge, Silva, & Kelly, 1990).

Measures

Depressive Symptomatology. Symptoms of depression were assessed when subjects were 11 years old using the Diagnostic Interview Schedule for Children—Child Version (DISC-C; Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982). The DISC-C was administered to the subjects by a child psychiatrist. Items tapped DSM-III symptoms for the major diagnostic cate-

[4]Data were collected for 925 subjects at age 11, and 976 subjects at age 15. However, only subjects who had data present on all variables were used in this study, accounting for the difference in the sample sizes between ages 11 and 15. For the analyses involving age 11 data, any subjects missing data at age 11 *or* 15 were excluded; for analyses involving only age 15 data, only those subjects missing data at that age were excluded.

gories, and were scored as *no* (0), *sometimes* (1), and *yes* (2). Results are fully described by Anderson *et al.* (1987). Four subscales from the DISC-C have been previously constructed: Inattention–Hyperactivity, Conduct–Oppositional Behavior, Anxiety, and Depression. These subscales were described by Williams, McGee, Anderson, and Silva (1989). The present study used scores from the Depression scale to measure symptoms of depression at age 11. For females, age 11 depression scores ranged from 0 to 25, with a mean of 4.72 (SD = 4.28); for males, age 11 scores ranged from 0 to 33, with a mean of 4.56 (SD = 4.77).

Due to time constraints during the age 15 assessments, a modified version of the DISC-C was administered (see McGee *et al.* 1990). At age 15, the DISC-C was administered to the subjects by psychologists. Again, DISC-C items were used to construct a depression subscale. For females, age 15 depression scores ranged from 0 to 48, with a mean of 4.28 (SD = 7.69); for males, age 15 scores ranged from 0 to 46, with a mean of 2.43 (SD = 5.16).

Conduct Problems. At age 11, scores on the DISC-C Conduct–Oppositional Behavior subscale were used to assess conduct problems. For females, age 11 scores had a mean of 2.72 (SD = 2.37), with scores ranging from 0 to 16. Male scores at age 11 had a mean of 3.70 (SD = 3.74), ranging from 0 to 29.

At age 15, items used in the construction of the Conduct–Oppositional Behavior subscale were contained in the Self-Report Early Delinquency instrument (SRED, described fully in Moffitt & Silva, 1988). This 29-item scale assessed frequency of involvement in illegal behavior over the previous year. Items were coded as *never* (0), *once or twice* (1), or *three or more times* (2). For the purposes of constructing the age 15 conduct problems scale for this study, responses to the 24 *nonsubstance use* items were summed. For females, scores on this scale had a mean of 2.86 (SD = 3.70), ranging from 0 to 21; for males, the mean conduct problem score was 3.47 (SD = 5.26), ranging from 0 to 45.

Identification of Groups. Depressive symptom (DS) and conduct problem (CP) groups were defined at ages 11 and 15 on the basis of extreme scale scores. Groups were defined separately for males and females. At both ages, subjects scoring 1.5 standard deviations above the mean for *same-sex peers* on the relevant subscales were identified as exhibiting depressive symptomatology or conduct problems. Using this definition, 33 females and 24 males were included in the DS group at age 11, and 32 females and 28 males were included in the CP group at age 11. Thirty-six males and 42 females were included in the DS group at age 15; 34 males and 48 females were included in the CP group at age 15.

Substance Use. Substance use was measured at age 15 using five items from the SRED. The five items assessed how often in the last year the subject had (1) used marijuana, (2) sniffed glue, (3) used other drugs, (4) bought or drank alcohol, or (5) drank alcohol at school. The items were coded *never* (0), *once or twice* (1), and *three times or more* (2). For marijuana, glue sniffing, and other drug use, a subject was considered a user if they reported any use at all during the last year (that is, a response of 1 or 2). A subject was considered a user of alcohol if they reported buying or drinking alcohol three or more times during the last year *or* if they reported drinking at school once or more.

On the basis of responses to the five substance use items from the SRED, four substance use groups were formed: nonusers (subjects who reported no substance use during the last year; n = 762, 364 females), alcohol users (subjects who reported only alcohol use during the last year; n = 50, 23 females), marijuana/glue users (subjects who reported only use of a single substance other than alcohol; n = 49, 25 females), and multiple users (subjects who reported use of more than one substance; n = 95, 52 females).

Analyses

Logistic regression analyses were used to assess the relative strength of conduct problems and depressive symptoms in predicting membership in a substance use group. At each age, three logistic regression analyses were carried out for each of the three substance use outcome groups (alcohol use only, marijuana/glue use only, multiple drug use). In the first two analyses, CP group membership and DS group membership were entered separately into logistic regression analyses. Then, in order to assess the *relative* strength of the independent variables in predicting substance use, a third logistic regression was carried out in which both independent variables were entered. This analysis indicated whether conduct problems and depressive symptoms (1) operated independently, or (2) shared variance with each other in relation to substance use outcomes.

Effects of Missing Data

Two analyses were undertaken to assess the effects of missing data. First, there were 20 subjects who had data present on the age 11 conduct problem and depressive symptoms scales, but who did not have data present on the age 15 substance use variable. Those subjects were compared on conduct problem and depressive symptom scores with those subjects

who had data present at both assessment periods. Analysis of variance (with presence vs. absence at the age 15 assessment as the independent variable) revealed no group differences on either conduct problem or depressive symptom scale scores ($p > .25$ for both.)

Second, 207 subjects were found to have data missing at age 11, but present at age 15. The distribution of those subjects missing data at age 11 across the four substance use groups at age 15 was examined. A nonsignificant chi square ($p > .60$) indicated that those subjects missing data at age 11 did not differ from the remainder of the sample in terms of their distribution across the substance use groups.

RESULTS

Odds ratios (ORs) and adjusted odds ratios (AORs) for risk of age 15 substance use are presented by age in Tables I and II. The ORs represent the risk for substance use outcomes when each of the predictors (DS and CP group membership) is considered *individually.* The AORs represent the risk for substance use outcomes when the effects of the *other* predictor are statistically controlled.

Prediction from Age 11 Symptoms. As can be seen in Table I, no relation was found between age 15 alcohol use and CP or DS group membership for either males or females. For males, both conduct problems and depressive symptoms predicted marijuana/glue use when considered inde-

Table I. Odds Ratios for CP and DS Group Membership at Age 11 on Substance Use Groups at Age 15[a]

	Alcohol		Marijuana/glue		Multiple	
	OR	AOR	OR	AOR	OR	AOR
Males						
CP	1.81	1.53	4.17[b]	2.82	3.74[b]	2.85
DS	2.39	2.16	5.52[b]	4.01	4.95[c]	3.95[b]
Females						
CP	1.37	2.30	2.19	1.76	2.06	1.70
DS	2.63	3.29	2.30	1.89	2.17	1.82

[a]CP = conduct problem group: 28 males, 32 females; DS = depressive symptom group: 24 males, 33 females; OR = odds ratios; AOR = adjusted odds ratios.
[b]$p < .05$.
[c]$p < .01$.

Table II. Odds Ratios for CP and DS Group Membership at Age 15 on Substance Use Groups at Age 15[a]

	Alcohol		Marijuana/glue		Multiple	
	OR	AOR	OR	AOR	OR	AOR
Males						
CP	12.69[b]	12.94[b]	5.08	4.82	48.57[b]	48.27[b]
DS	1.38	1.62	2.70	2.58	7.32[b]	7.23[b]
Females						
CP	10.35[b]	9.25[b]	5.59[b]	4.28[c]	29.30[b]	28.30[b]
DS	2.98	2.14	3.54[c]	2.71	2.97[c]	1.21

[a]CP = conduct problem group: 34 males, 48 females; DS = depressive symptom group: 36 males, 42 females; OR = odds ratios; AOR = adjusted odds ratios.
[b]$p < .01$.
[c]$p < .05$.

pendently. However, when considered simultaneously, neither predictor attained significance at the .05 level.

As was the case for marijuana/glue use, for males both CP group membership and DS group membership at age 11 significantly predicted multiple drug use at age 15 when considered independently. However, when both variables were entered in the logistic regression analysis, only the DS group remained a significant predictor of substance use.

For females no relation was found between group membership at age 11 and later substance use of any type. It appears that the linkage between early mental health problems and later substance use was different for males and females in this sample.

Association with Age 15 Symptoms. Next, the relations between CP and DS group membership at age 15 and substance use were considered. As can be seen in Table II, strong relations were found between group membership at 15 and multiple drug use. Among males, both CP and DS group membership significantly increased the risk for multiple drug use when considered univariately. When these effects were considered together, the strength of the relations remained virtually identical, suggesting that the effects of conduct problems and depressive symptoms operate *independently* of one another in predicting multiple drug use.

A different pattern of results was seen for females at age 15. First, a stronger relation was seen between group membership and marijuana/glue use, with both DS and CP group membership associated with use. The effect for conduct problems remained significant when the two factors were assessed simultaneously, while the effect for depressive symptoms dropped to nonsignificance.

A very similar pattern was seen for multiple drug use. While both groups were associated with multiple drug use in the univariate analyses, only the effect for the CP group remained significant in the multivariate analysis. These results again point to conduct problems as the more important correlate of drug use when the co-occurrence of conduct problems and depressive symptoms among adolescent females is taken into account.[5]

Self-Medication. As part of the mental health interview at age 15, subjects were asked whether they had used drugs or alcohol in the last year in order to make themselves "feel better." A positive response to this item was used to define a group of adolescents as "self-medicators." In order to further examine the relation between conduct problems, depressive symptoms, and substance use, logistic regression analyses were carried out to predict risk for reported self-medication. Very few males responded positively to this item, so these analyses were carried out only for females. Among the females assessed at age 11, 19 (5.35%) were classified as self-medicators at age 15. Of those assessed at age 15, 29 (6.25%) were defined as self-medicators.

The same strategy used in the previous analyses was employed to assess the importance of conduct problems and depressive symptoms in predicting self-medication. Results of these analyses are shown in Table III.

Table III. Odds Ratios for Risk of Self-Medication at Age 15 Among Adolescent Females[a]

	Self-medication	
	OR	AOR
Age 11		
CP	1.98	1.41
DS	2.82	2.53
Age 15		
CP	11.00[b]	8.13[b]
DS	7.96[b]	5.10[b]

[a]OR = odds ratios; AOR = adjusted odds ratios; CP = conduct problem group; DS = depressive symptom group.
[b]$p < .001$.

[5]In order to assess the possibility that the pattern of results seen here was due to differential impact of family background factors, each logistic regression was rerun, with a measure of early family adversity entered first. The family adversity index was composed of measures administered at birth or at the age 3 assessments, and included such factors as socioeconomic status, family size, and mother's marital status at the time of the child's birth (see Stanton, McGee, & Silva, in press). Inclusion of the family adversity index in the logistic regressions produced no differences in the patterns of results seen at either age.

As can be seen, consistent with results in the previous analyses, neither conduct problems nor depressive symptoms at age 11 significantly increased risk for self-medication at age 15, either univariately or multivariately. Both conduct problems and depressive symptoms at age 15 significantly predicted self-medication univariately, again consistent with the previous results. However, when considered simultaneously, both CP group membership and DS group membership remained significant predictors of self-medication. Recall that, when multivariate analyses were carried out on the substance use variables, only CP group membership emerged as a significant predictor of female substance use. This result suggests that substance use for the purposes of self-medication may be a slightly different phenomenon than general "recreational" substance use.

DISCUSSION

The primary purpose of the current study was to assess the relation between conduct problems and depressive symptoms as predictors of adolescent substance use. Three hypothesized relations between these problems were tested. Our results indicate that the nature of this relation varies as a function of age, gender, and substance used.

For males, univariate analyses revealed that both conduct problems and depressive symptoms at age 11 predicted later marijuana/glue and multiple drug use. However, when the utility of the two predictors was assessed simultaneously, it was found that depressive symptoms were more important for predicting later substance use. This finding supports the hypothesis that, among this group, the relation between early conduct problems and substance use is mediated by the effects of depressive symptoms.

For females, significant relations between symptoms and substance use were found only for symptoms assessed at age 15. When assessed simultaneously, conduct problems emerged as the most important predictors of substance use, supporting the hypothesis that the relation between depressive symptoms and substance use was mediated by the effects of conduct problems.

These results are surprising in that they point to the relative importance of pre-adolescent depressive symptoms in predicting later substance use among boys, but the relative importance of a contemporaneous association between conduct problems and substance use among girls. However, while an emphasis has been placed on the importance of effects of depression among males in predicting substance use, it should be noted that the strongest relation found in this study was between conduct problems at age 15 and multiple drug use. These results are clearly consistent with literature

indicating a strong relation between conduct problems and substance use (e.g., Windle, 1990).

The findings of the current study raise questions regarding the results of previous studies reporting links between *early* conduct problems and later substance use (e.g., Ensminger *et al.*, 1982; Windle, 1990). Windle (1990) found that delinquency at age 14 predicted substance use 5 years later for both genders. Our data found no evidence of a relation between early conduct problems (after controlling for depressive symptoms) and later substance use for either males or females; however, early depressive symptoms did predict later substance use for males. Thus, it is possible that the relation between conduct problems and later substance use found by these earlier studies may have been due to the association between depressive symptoms and antisocial behavior.

A second explanation of the apparent inconsistency between these studies may relate to the ages of subjects assessed in each study. For example, the groups assessed in the Windle (1990) study were older than those assessed here. It is possible that the mechanisms linking conduct problems and later substance use emerge only during mid- to late adolescence (for both males and females), while the mechanisms linking depressive symptoms and later substance use develop in late childhood, and then only for males. Data currently being collected as part of the age 18 assessments of the Dunedin Health and Development Study will allow us to further assess this hypothesis.

This study also briefly assessed the relation between conduct problems, depressive symptoms, and self-medication among adolescent females. Due to small group sizes, the results generated by these analyses should be viewed with some caution. Nonetheless, the findings do pose interesting questions which warrant further investigation. Of particular interest is why females with conduct problems feel the need to use drugs or alcohol to make themselves "feel better," independent of their depressive symptoms. It is possible that these girls experience significant distress which is not expressed as depressive symptoms, but rather appears as anxiety or anger.

In summary, while the results of this study were consistent with other studies indicating that conduct problems were strongly related to concurrent substance use in mid-adolescence, the findings were surprising in that they revealed the importance of early depressive symptoms in predicting substance use among males, and the relative *lack* of importance of depressive symptoms in predicting substance use among females. This study demonstrates that the assessment of co-occurrence of these symptoms should be incorporated as an integral part of any effort to causally model adolescent substance use, or to develop programs designed to reduce risk for substance use.

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