

Association Between Self-reported Childhood Sexual Abuse and Adverse Psychosocial Outcomes

Results From a Twin Study

Elliot C. Nelson, MD; Andrew C. Heath, DPhil; Pamela A. F. Madden, PhD; M. Lynne Cooper, PhD; Stephen H. Dinwiddie, MD; Kathleen K. Bucholz, PhD; Anne Glowinski, MD; Tara McLaughlin, PhD; Michael P. Dunne, PhD; Dixie J. Statham, MCP; Nicholas G. Martin, PhD

Background: Increased risk for serious adverse outcomes has been associated with a history of childhood sexual abuse (CSA). Whether these risks are directly attributable to CSA rather than family background remains controversial.

Methods: Structured psychiatric telephone interviews were conducted from February 1996 to September 2000 with both members of 1991 same-sex pairs (1159 female and 832 male pairs) from a young adult Australian volunteer twin panel (mean [SD] age, 29.9 [2.5] years). A binary composite CSA variable was constructed from responses to 5 component questions. The association between CSA and adverse psychosocial outcomes was examined, controlling for family background.

Results: A history of CSA, reported by 16.7% of the women and 5.4% of the men, was more common among those reporting parental alcohol-related problems. Significantly increased risk was observed in women reporting a history of CSA for subsequently occurring major depression, suicide attempt, conduct disorder, alcohol

dependence, nicotine dependence, social anxiety, rape after the age of 18 years, and divorce; most similar risks reached statistical significance in men. The greatest risks were associated with CSA involving intercourse. Childhood sexual abuse–negative twins (ie, those who denied having experienced CSA) from CSA-discordant pairs compared with other CSA-negative individuals had increased risk for many adverse outcomes suggesting correlated family background risk factors. Childhood sexual abuse–positive members (ie, those who reported having experienced CSA) of CSA-discordant pairs had significantly greater risk for all 8 examined adverse outcomes than their co-twins.

Conclusions: Self-reported CSA was associated with increased risk for adverse outcomes, controlling for family background. Family background risk factors also were associated with adverse outcome risk. Discordant pair analysis seems to provide an effective means of controlling for family background risk factors.

Arch Gen Psychiatry. 2002;59:139-145

From the Department of Psychiatry, Washington University School of Medicine, St Louis, Mo (Drs Nelson, Heath, Madden, Bucholz, Glowinski, and McLaughlin); Department of Psychology, University of Missouri–Columbia (Dr Cooper); Finch University of the Health Sciences–The Chicago Medical School, North Chicago, Ill (Dr Dinwiddie); Queensland University of Technology, Kelvin Grove, Australia (Dr Dunne); and Queensland Institute of Medical Research, Brisbane, Australia (Ms Statham and Dr Martin).

INCREASED RISK for serious negative outcomes has been reported for individuals with a history of childhood sexual abuse (CSA).¹⁻³ However, 2 major methodological issues, ascertainment or selection bias and confounding aspects of the family environment (eg, parental alcoholism), complicate interpretation of reported associations. Many investigations have relied on samples ascertained via agency involvement¹⁻⁴ (with CSA of greater severity occurring in more problematic family environments) or from clinical populations^{1-3,5} (with higher rates of psychiatric illness and greater functional impairment). Still, general population studies have confirmed findings from these samples including increased risk for psychiatric illness (anxiety disorders,⁶⁻¹¹ depression,^{6,7,9,10,12-14} alcohol abuse and/or dependence,^{6,7,9-11,14,15} drug

abuse and/or dependence,^{6,7,10} eating disorders,^{7,14,16} conduct disorder,⁶⁻¹⁰ and borderline personality disorder¹⁷) and other adverse outcomes (suicide attempt,^{6,14} current smoking,¹⁸ sexual revictimization,^{16,19,20} and relationship problems^{12,14,16,20,21}) associated with self-reported CSA. Most studies have used retrospective designs (ethically mandated interventions preclude entirely naturalistic, prospective approaches), and are, therefore, subject to retrospective reporting bias. One study⁶ that assessed psychiatric diagnoses prospectively during adolescence and CSA history (required to have occurred before the age of 16 years) retrospectively at the age of 18 years found increased rates of subsequently occurring psychiatric disorders, particularly when CSA involved intercourse.

Disentangling direct CSA effects from family background risk factors has proved

SUBJECTS AND METHODS

SUBJECTS

Subjects were members of the young adult cohort of the Australian Twin Register, a volunteer twin panel born between January 1, 1964, and December 31, 1971. Almost all were registered with the panel between 1980 and 1982 by their parents in response to approaches either through school systems or mass media appeals. All data reported herein are from a comprehensive assessment completed from February 1996 through September 2000 by trained lay interviewers. Verbal consent was first obtained from participants as per the protocol approved by the institutional review boards of Washington University, St Louis, Mo, and Queensland Institute of Medical Research, Brisbane, Australia. Of 4010 pairs that could be traced, interviews were completed with both members of 2765 pairs (69% pairwise response rate) and 1 member of an additional 735 pairs. The most common reasons for nonparticipation included refusal by twin, incapacitation and/or death, and lack of available contact information. Singletons, 661 opposite-sex pairs, and pairs in which either member gave no response to CSA items or responded problematically (see the "Assessment of CSA" section) were excluded from analyses reported herein. The current sample included the remaining monozygotic and dizygotic same-sex pairs ($N = 1991$) in which both twins responded to at least 1 CSA component question. The sample was 58.2% female and had a mean (SD) age of 29.9 (2.5) years. Twins were asked for the "age at which they first lived apart" rather than whether they were raised together. The 19 individuals (0.5%)

who reported having first lived apart before the age of 14 years included both members of only 3 pairs. Because of the ambiguous wording and the relatively few like-sex twin pairs involved, no twin pairs were excluded on this basis.

ASSESSMENT OF CSA

The current analyses focus on 5 questions about CSA (**Table 1**) from which, consistent with other reports,¹⁹ a composite CSA variable was developed for use in further analyses. Data from 43 pairs were excluded from all analyses because at least 1 twin endorsed a CSA item (other than having been raped, see "Assessment of Outcome Measures and Covariates" section) but reported an onset age of 18 years or older for all endorsed CSA items. Data from 8 pairs, in which 9 of 13 CSA-positive individuals failed to provide an age of CSA occurrence, were retained in the analyses. Childhood sexual abuse was considered to have involved intercourse if respondents reported having been raped before the age of 18 years. Missing data on the occurrence of rape ($n = 4$) or its onset and recency ($n = 4$) in 8 CSA-positive subjects led to their exclusion from analyses incorporating either CSA involving intercourse or rape at the age of 18 years or older.

ASSESSMENT OF OUTCOME MEASURES AND COVARIATES

A standardized psychiatric diagnostic assessment, an adaptation of the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA),²⁵ was administered via telephone. The interview enabled lifetime *DSM-IV*²⁶ diagnoses of major depressive disorder, conduct disorder, and alcohol and/

challenging since traditional case-control designs may inadequately control for family background overestimating the effects of CSA. Investigators^{6,7,14,16,20,21} who have used statistical controls for family environment have reported that risks associated with CSA involving intercourse remained significant, but were much reduced in magnitude; results for less severe CSA were more unclear. A meta-analysis of studies in college student samples argued that CSA has limited importance beyond that attributable to the family environment.²²

Investigators^{23,24} have recently examined these issues in twin pairs, focusing on those discordant for CSA. Because twins share family background risk factors, within-pair differences in CSA-discordant pairs are assumed to have resulted either from CSA, or less plausibly, from risk factors correlated with CSA that are not shared by pair members. A mailed questionnaire survey assessed CSA history in Virginia female like-sex pairs²⁴ in whom psychopathologic status had been previously assessed. In discordant pairs, the twin reporting CSA involving intercourse had significantly increased risk of depression, alcohol dependence, and having 2 or more psychiatric disorders. An interview study²³ in the older Australian twin panel found a significant difference in adverse outcomes between CSA-positive (ie, those individuals who reported having experienced CSA) and CSA-negative (ie, those who denied having experienced CSA)

co-twins only for suicidal ideation in male subjects. Because almost every odds ratio (OR) exceeded unity in both studies, the relatively few discordant pairs may have limited power to detect differences. Both samples^{23,24} contained largely middle-aged respondents who were considerably removed from the age of CSA occurrence. The Australian study²³ determined CSA status from a single question about forced sexual activity.

The twin study design provides a means of distinguishing direct CSA effects from correlated family background effects. If CSA-correlated family background effects influence outcomes, then significantly higher risk would be expected for nonabused twins whose co-twins were abused than for members of pairs where neither was abused. The Australian study²³ found significantly increased risk for nonabused individuals with CSA-positive co-twins only for social phobia in women and conduct problems in men; confidence intervals (CIs) were broad because of the small sample sizes. The Virginia study²⁴ instead controlled for a limited range of parental variables concluding that family background risk factors play a relatively unimportant role in the observed associations.

Using data from a new, younger Australian twin sample, with a more thorough CSA assessment, we examined the extent to which CSA outcome associations are determined by correlated family background risk fac-

or nicotine dependence. Nondiagnostic sections included questions about marital history, contemplated or attempted suicide, traumatic events, parental alcohol-related problems, family background, and “social anxiety” (≥ 1 social fear causing impairment in functioning). Rape occurring at the age of 18 years or older was included as an outcome measure.¹⁹ Divorce was examined conditional on having been married. Onset information was obtained for all outcomes other than divorce.

Maternal and paternal alcohol-related problems were assessed by a single question asked about each parent. Other measures of family background risk factors included as control variables in some analyses were (1) parental fighting, coded positive if parents “often” fought or argued in the twin’s presence; (2) parental conflict, coded positive with report of “a lot” of conflict and tension between parents when the twins were between the ages of 6 and 13 years; (3) stepparent presence, that is, having been raised by a stepparent or adoptive parent during part of childhood; (4) neglect, a composite variable reflecting any positive response to “serious neglect,” usually punished by either parent in a harsh nonphysical way, or necessary medical therapy not provided after injury; and (5) physical abuse, a composite variable reflecting any positive response to physical abuse, purposely hurt by an adult relative, or hit by either parent so hard that it “often” or “sometimes” hurt the next day. To minimize retrospective recall bias, covariates were coded to reflect a positive response by either twin.

DATA ANALYSIS

Primary statistical analyses were performed using SAS²⁷ and the Stata Statistics and Data Analysis Package (version 6.0).²⁸

An α level of .05 was required for statistical significance. The robust variance estimator option in Stata (Stata Corp, College Station, Tex) was used to obtain 95% CIs adjusted for the statistical nonindependence of twin-pair observations. Childhood sexual abuse risk associated with the respondents’ responses to questions about their parents’ problematic drinking was examined. To investigate possible reporting bias, a logistic regression was performed that examined CSA risk via the use of dummy variables coded to represent respondents’ and co-twins’ responses to parental drinking items.

Comparisons were made between the age at onset of outcomes and CSA occurrence. Survival analysis was performed separately by gender using Cox proportional hazards regression models to calculate hazard ratios representing the risks for adverse outcomes associated with prior occurrence of CSA. Logistic regression models that controlled for gender were fitted to test for indirect, family background contributions to the associations between outcome measures and the respondent’s and co-twin’s CSA histories. These analyses used dummy variables coded to represent whether respondents reported CSA involving intercourse and for CSA-negative respondents, whether the co-twin was CSA-positive. Members of pairs in which neither twin reported CSA served as the control group for these analyses. Analyses were then repeated including family background variables. Conditional logistic regression was used to determine the relative risks for adverse outcomes in the CSA-positive vs CSA-negative members of discordant twin pairs. Additional conditional logistic analyses were performed to determine whether estimates of inpair risk differed by gender, zygosity (ie, monozygote or dizygote), or whether CSA involved intercourse.

tors vs direct CSA effects. The sample includes both female and male like-sex twin pairs; the examined negative outcomes were not limited to psychiatric disorders.

RESULTS

All putative CSA component items were more commonly endorsed by women (Table 1). Of 477 subjects who endorsed at least 1 of these items, 67 (14.0%) endorsed 1 item, 156 (32.7%) 2, 190 (39.8%) 3, 59 (12.4%) 4, and 5 (1.0%) 5; the mean (SD) was 2.54 (0.92) items. The Cronbach α coefficient values were 0.79 (overall and women) and 0.75 (men). Given very good internal consistency, the overlap of endorsement across these nonmutually exclusive items, and the report’s focus on comparison of discordant pairs, a dichotomous composite variable representing endorsement of at least 1 of these items, henceforth referred to as CSA, was deemed appropriate for use in further analyses. Prevalence rates for CSA were 16.7% and 5.4% for women and men, respectively.

A history of CSA was reported by 31.9% of those reporting vs 11.1% of those denying maternal alcohol-related problems (OR, 3.75; 95% CI, 2.62-5.36) and 19.5% reporting vs 9.5% denying paternal alcohol-related problems (OR, 2.32; 95% CI, 1.85-2.91). When co-twins’ reports were also incorporated into a logistic model, the ORs for self-reported CSA were as follows: for both twins

reporting maternal alcohol-related problems, OR 3.09 (95% CI, 1.79-5.33); respondent only reported maternal alcohol-related problems, OR 4.50 (95% CI, 2.79-7.25); and co-twin only reported maternal alcohol-related problems, OR 2.08 (95% CI, 1.19-3.65). Similar values for paternal alcohol-related problems were as follows: both twins reporting 2.62 (95% CI, 2.00-3.45); respondent only, OR 1.87 (95% CI, 1.31-2.68); and co-twin only, OR 1.25 (95% CI, 0.83-1.87). The fact that CSA was more strongly correlated with the respondent’s report of maternal alcohol-related problems (Wald $\chi^2_1=8.47$, $P=.004$) with a similar trend for paternal alcohol-related problems (Wald $\chi^2_1=3.59$, $P=.06$) indicates that a mild retrospective recall bias is contributing to the associations.

Childhood sexual abuse began early (mean [SD] age at onset 10.8 [4.06] years), generally preceding the onset of adverse outcomes. Childhood sexual abuse onset predated that of social fears by a mean of 1.7 years (95% CI, 0.3-3.1) and suicide attempt by a mean of 8.9 years (95% CI, 7.1-10.7). Childhood sexual abuse’s onset similarly predated the onset of each of the following examined psychiatric disorders: conduct disorders by a mean of 1.7 years (95% CI, 0.4-3.0); major depressive disorder by a mean of 10.3 years (95% CI, 9.3-11.2); alcohol dependence by a mean of 10.5 years (95% CI, 9.4-11.6); and nicotine dependence by a mean of 10.6 years (95% CI, 9.7-11.4).

Table 1. Component Childhood Sexual Abuse (CSA) Questions, Endorsement Rates, and Risk by Gender*

CSA Questions	Women (n = 2318)	Men (n = 1664)	Risk by Gender, OR (95% CI)
Before age 18 years were you ever forced into sexual intercourse or any other form of sexual activity?	14.2	3.9	4.10 (3.05-5.49)
Before you were 16 years old, were there any sexual contacts between you and anyone other than a family member who was 5 or more years older than you were? By sexual contact I mean their touching your sexual parts, you touching their sexual parts, or sexual intercourse.†	4.2	2.8	1.52 (1.03-2.23)
Before you were 16 years old, were there any sexual contacts between you and any family members, like a parent or stepparent, grandparent, uncle, aunt, brother or sister, or cousin? By sexual contact I mean their touching your sexual parts, you touching their sexual parts, or sexual intercourse.‡	6.8	0.9	7.94 (4.34-14.53)
How about event 5 [You were raped (Someone had sexual intercourse with you when you did not want to, by threatening you or using some degree of force.)]?§	5.6	1.3	4.63 (2.88-7.42)
Apart from event 5 did event 6 [You were sexually molested (someone touched or felt your genitals when you did not want them to)] ever happen to you?	12.5	4.0	3.45 (2.54-4.67)
Composite CSA variable¶	16.7	5.4	3.51 (2.70-4.55)

*All values are given as percentages unless otherwise indicated. OR indicates odds ratio; CI, confidence interval.

†Coded positively in the present context where subjects responded to a follow-up question that contact was “ever forced.”

‡Coded positively in this context where subjects responded to further questions that contact involved either an adult or the use of force by a child.

§Coded positively in this context when rape was reported to have occurred before the age of 18 years and included in analyses as CSA involving intercourse.

||Description in parentheses not read by interviewer to protect confidentiality (appeared in list form in a booklet mailed before the interview to which interviewers directed respondents at the beginning of this section). Traumatic event questions were skipped when respondents had misplaced their booklets.

¶Binary variable with the presence of any positively coded above item defined as CSA.

When survival analysis was used to examine the risk for adverse outcomes subsequent to reported CSA occurrence, significantly increased hazard ratios were found in women for all examined outcomes and in men for all but divorce and social anxiety (**Table 2**). The highest risks were for conduct disorder, suicide attempt, and rape at the age of 18 years or older.

Adverse outcome risks were examined as a function of the extent of CSA reported by the respondent (whether intercourse was involved) and, in CSA-negative respondents, whether the co-twin reported having experienced CSA. As demonstrated by the ORs reflecting their comparison to individuals from CSA-negative concordant pairs (**Table 3**), those reporting a history of CSA involving intercourse had the highest risks for all examined adverse outcomes, which were significantly greater than those for either group of CSA-negative respondents and exceeding those for individuals positive for CSA not involving intercourse for all outcomes other than major depression and social anxiety. Their risks were highest for conduct disorder, suicide attempt, and rape at the age of 18 years or older with respective ORs of 14.53 (95% CI, 8.58-24.60), 14.64 (95% CI, 9.18-23.34), and 10.03 (95% CI, 5.66-17.81) vs individuals from CSA-negative concordant pairs. Those reporting a history of CSA not involving intercourse had significantly higher risks for all adverse outcomes other than divorce when compared with individuals from CSA-negative concordant pairs. Consistent with the hypothesis of a significant family background effect, CSA-negative respondents whose co-twin was CSA-positive also had significantly higher risks for all adverse outcomes other than major depression and divorce when compared with members of CSA-negative concordant pairs. The risks for CSA-positive individuals for whom abuse did not involve intercourse exceeded those for CSA-negative, co-twin-positive individuals only for major depression and social

anxiety. When these analyses were repeated controlling for family background variables, ORs were attenuated to varying degrees but the aforementioned pattern largely remained. Despite controlling for these family background variables, increased risk was still observed for CSA-negative, co-twin-positive individuals for 5 of 8 outcomes.

When conditional logistic regression was used to examine the relative risks for adverse outcomes in the CSA-positive vs the CSA-negative members of CSA-discordant pairs, increased risks were noted for all of the examined adverse outcomes (**Table 4**). Odds ratios for this intrapair comparison ranged from 1.56 for major depression (95% CI, 1.06-2.29) and alcohol dependence (95% CI, 1.01-2.40) to 7.50 (95% CI, 1.72-32.80) for divorce. Three separate discordant pair analyses (results not given) that examined whether estimates of intrapair risk differed by gender, zygosity, and the extent of CSA (if intercourse was involved) reported by the CSA-positive pair member found no significant differences.

COMMENT

In this large twin study, we found that individuals reporting a history of CSA had increased risk for subsequently occurring adverse outcomes of depression, suicide attempt, conduct disorder, alcohol and/or nicotine dependence, social anxiety, rape after the age of 18 years old, and divorce. Our data suggest that CSA occurs in the context of family background risk factors that contribute to adverse outcome risk. We provide strong evidence that CSA is associated with substantial risk not explained by these factors.

The association of CSA with risk for negative outcomes has been extensively documented.^{1-21,23,24} In survival analyses, we observed consistently elevated hazard ratios affirming that CSA is associated with increased

Table 2. Prevalence Rates for Adverse Outcomes by Childhood Sexual Abuse (CSA) History and Hazard Ratios Reflecting the Risk for Outcomes Associated With Previously Occurring CSA*

Examined Association	Women (n = 2318)			Men (n = 1664)		
	CSA–	CSA+	HR (95% CI)	CSA–	CSA+	HR (95% CI)
Major depression	27.7	49.1	1.91 (1.59-2.31)	19.8	35.6	1.87 (1.27-2.76)
Suicide attempt	2.6	13.7	4.12 (2.78-6.10)	2.5	13.3	5.42 (2.83-10.38)
Conduct disorder	1.2	9.8	6.62 (3.55-12.33)	9.6	28.9	2.48 (1.21-5.06)
Alcohol dependence	11.8	28.9	2.98 (2.31-3.83)	28.8	38.9	1.67 (1.18-2.37)
Nicotine dependence	24.3	42.2	1.92 (1.58-2.34)	30.4	54.4	2.19 (1.61-2.97)
Social anxiety	8.7	18.6	1.89 (1.31-2.73)	7.9	13.3	0.88 (0.33-2.37)
Rape, aged ≥18 y	2.5	9.3	3.58 (2.31-5.54)	0.1	3.3	26.65 (4.39-161.74)
Divorce	5.4	12.7	2.53† (1.62-3.94)	5.7	11.6	2.19† (0.83-5.78)

*All values are given as percentages unless otherwise indicated. Minus sign indicates that the individual denied having experienced CSA; plus sign, that the individual reported having experienced CSA; HR, hazard ratio; and CI, confidence interval.

†The odds ratio rather than the HR was supplied since the age at divorce was not obtained.

Table 3. Adverse Outcomes as a Function of the Childhood Sexual Abuse (CSA) History of Respondent and Co-twin*

Outcome	Controlling Only for Gender				Controlling for Gender and Family Environmental Factors†			
	Resp CSA+ and Intercourse+ (n = 150)	Resp CSA+ and Intercourse– (n = 319)	Resp CSA– and Co-twin CSA+ (n = 283)	Resp CSA– and Co-twin CSA– (n = 3222)	Resp CSA+ and Intercourse+ (n = 150)	Resp CSA+ and Intercourse– (n = 319)	Resp CSA– and Co-twin CSA+ (n = 283)	Resp CSA– and Co-twin CSA– (n = 3222)
Major depression	2.88‡ (2.07-4.00)	2.35§ (1.82-3.03)	1.42 (1.09-1.86)	1.00	1.81‡ (1.27-2.59)	1.83§ (1.40-2.40)	1.14 (0.85-1.52)	1.00
Suicide attempt	14.64‡ (9.18-23.34)	3.34 (2.06-5.42)	2.57 (1.46-4.55)	1.00	8.81‡ (5.29-14.66)	2.44 (1.44-4.15)	1.96 (1.08-3.55)	1.00
Conduct disorder	14.53‡ (8.58-24.60)	3.89 (2.47-6.11)	2.90 (1.79-4.71)	1.00	7.69‡ (4.43-13.36)	2.46 (1.46-4.15)	1.85 (1.06-3.24)	1.00
Alcohol dependence	4.23‡ (2.92-6.12)	2.15 (1.60-2.90)	1.68 (1.24-2.29)	1.00	3.46‡ (2.37-5.06)	1.81 (1.34-2.46)	1.43 (1.03-1.97)	1.00
Nicotine dependence	4.26‡ (2.98-6.08)	1.93 (1.48-2.50)	1.75 (1.34-2.28)	1.00	3.51‡ (2.42-5.08)	1.68 (1.27-2.21)	1.54 (1.17-2.04)	1.00
Social anxiety	2.90‡ (1.92-4.37)	1.87§ (1.32-2.63)	1.14 (0.76-1.73)	1.00	1.83‡ (1.16-2.88)	1.43 (0.99-2.07)	0.90 (0.58-1.38)	1.00
Rape, aged ≥18 y	10.03‡ (5.66-17.81)	3.33 (1.84-6.04)	2.50 (1.25-5.02)	1.00	9.94‡ (5.39-18.32)	3.28 (1.79-6.01)	2.50 (1.23-5.12)	1.00
Divorce	6.38‡ (3.73-10.93)	1.32 (0.73-2.38)	1.17 (0.61-2.26)	1.00	6.03‡ (3.40-10.70)	1.20 (0.66-2.17)	1.10 (0.57-2.10)	1.00

*All values are given as odds ratio (95% confidence interval). Odds ratios and 95% confidence intervals were derived from comparisons to twins from pairs where the respondent and co-twin both denied CSA. Resp indicates respondent; plus sign, that the individual reported having experienced CSA; minus sign, that the individual denied having experienced CSA; and ellipses, does not apply.

†The factors include gender, maternal and paternal alcohol-related problems, parental conflict, parental fighting, stepparent, neglect, and physical abuse all coded as pair maximum value.

‡Risk observed for CSA + and intercourse + respondents was significantly greater than that for CSA – and co-twin CSA + respondents.

§Risk observed for CSA + and intercourse – respondents was significantly greater than that for CSA – and co-twin CSA + respondents.

||Risk observed for CSA + and intercourse + respondents was significantly greater than that for CSA + and intercourse – respondents.

risk for subsequently occurring negative outcomes in women and men; hazard ratios were highest for conduct disorder, rape after the age of 18 years, and suicide attempt. We relaxed the criterion that outcomes must occur subsequent to CSA in further analyses to facilitate comparisons within our report and with the literature, and because of onset-determination issues (eg, less severe CSA often predated CSA involving intercourse).

In the comparison of outcomes as a function of the respondent's and co-twin's CSA history, the highest risks for adverse outcomes were associated with CSA involving intercourse, a replication of other reports.^{6,7,10,16,21,24} With control for family background risk factors, these risks were diminished to varying degrees but remained significant. In-

dividuals who reported CSA not involving intercourse had increased risk for all outcomes except divorce; significance was retained (other than for social anxiety) with control for family background risk factors.

The results of comparisons involving CSA-negative individuals whose co-twins were CSA-positive deserve further discussion. These individuals displayed significantly greater risk for most outcomes than members of CSA-negative pairs, strong evidence that the family backgrounds of those who experience CSA are also, on average, associated with considerable risk. However, despite controlling for family background risk factors that included parental alcohol-related problems, fighting, and conflict, presence of a stepparent, physical abuse, and ne-

Table 4. Within-Pair Comparison of Adverse Outcome Risks in Childhood Sexual Abuse (CSA)–Positive vs CSA-Negative Members of 283 Same-Sex Discordant Pairs*

Outcome (No. of Doubly Discordant Pairs)	Within-Pair Risk	
	OR	95% CI
Major depression (110)	1.56	1.06-2.29
Suicide attempt (41)	2.73	1.37-5.44
Conduct disorder (32)	3.00	1.35-6.68
Alcohol dependence (87)	1.56	1.01-2.40
Nicotine dependence (119)	1.71	1.18-2.47
Social anxiety (50)	2.33	1.27-4.27
Rape, aged ≥ 18 y (32)	2.56	1.18-5.52
Divorce (17)	7.50	1.72-32.80

*OR indicates odds ratio; CI, confidence interval.

glect, many of these risks retained significance. Moreover, few significant differences were found with comparison to CSA-positive, intercourse-negative respondents. A recent examination²⁹ found that unreliability in CSA reporting largely consisted of false-negative reports in CSA-positive individuals. Similar reporting problems in our sample might explain these findings, particularly if CSA false-negative respondents were more forthcoming about psychosocial outcomes. The closeness of twin relationships could have further blurred distinctions if the nonabused twin's supportiveness led to greater co-twin resiliency at some personal cost. Alternatively, the pattern of risks retaining significance in CSA-negative, co-twin-positive individuals suggests that we may have inadequately controlled for familial risk factors associated with impulsivity and substance abuse. Because all ORs were higher (though not significantly so) for CSA-positive, intercourse-negative individuals than CSA-negative, co-twin CSA-positive individuals, the lack of significance for these comparisons may have resulted from limited power.

In discordant pairs analyses, we observed significantly greater risk for all 8 examined adverse outcomes in CSA-positive respondents vs their CSA-negative co-twins. Because data from CSA false-negative reports would reduce risk estimates, our values are likely conservative. Despite the aforementioned finding of greater risks associated with CSA involving intercourse, we observed no significant heterogeneity of conditional ORs as a function of CSA severity in these discordant pair analyses. Greater levels of family background risk factors occurring in association with CSA involving intercourse may have contributed to our difficulty distinguishing risks associated with less severe CSA. Discordant pair analysis appears to provide an effective means of controlling for family background risk factors across a range of CSA severity.

Two prior twin studies^{23,24} used discordant pair analyses to estimate the association between CSA history and negative outcomes. Although few comparisons reached significance in either report, the ORs for the same outcomes essentially fall within our study's 95% CIs. Presumably, because these studies included considerably fewer discordant pairs, their power to detect differences was limited. One investigation²³ also found no significant zygosity effect in discordant pair analyses.

General population studies^{6,7,14,16,20,21} have attempted to control for family background factors by identifying important predictors and entering them as control variables in regression models. They typically have reported risks for adverse outcomes associated with CSA to be preserved but considerably decreased in magnitude. This approach may have been overly conservative with considerable correlation of predictor variables (collinearity), including CSA history, limiting significance. In controlling for family background risk factors, we accepted either twin's report of their presence to minimize retrospective recall bias. By definition, this approach could not alter discordant pair analysis results. As noted, we found evidence persisted for family background effects notwithstanding the inclusion of control variables into the logistic models.

Despite our cutoff for CSA (age 18 years) being the highest limit used commonly,³ our sample's mean age of CSA occurrence (10.8 years) is similar to values previously reported.^{2,3,11,30,31} The prevalence of CSA in our sample is consistent with that for contact CSA in general population samples.^{2,3,30-35} Our rates for CSA involving intercourse were essentially identical to those in a New Zealand study.³² Previous reports have also found higher CSA rates associated with parental alcoholism^{2,3,32,33,35} and female gender^{3,8,10,23,30-32,34} with smaller gender differences when abuse involved extrafamilial perpetrators.³⁰

Associations between self-reported CSA and earlier smoking initiation and heavier tobacco use have previously been reported.³⁶ A positive relationship has been found between the total number of adverse childhood experiences and risk for subsequent smoking behavior.¹⁸ Our finding that, controlling for family background risk factors, self-reported CSA is associated with significantly increased nicotine-dependence risk is a logical extension of these results.^{5,18,36}

Our results must be interpreted in the context of potential biases from the following sources: (1) retrospective reporting, (2) CSA definition, (3) sample selection, and (4) assumptions made in control for family background. A bias would result from the use of retrospective self-report data if individuals currently experiencing problems were more likely to recall prior abuse, resulting in an inflation of the observed associations. However, a recent examination²⁹ of the stability of CSA reports found no relationship between variations in reports and psychiatric status before, during, or after the reported abuse. The greater CSA risk observed with respondents' vs co-twins' report of parental alcohol-related problems could indicate greater willingness for CSA survivors to acknowledge negative aspects of childhood. Onset-dating inaccuracies may have occurred, but would not be expected to systematically bias results.

The level of internal consistency displayed by component items, coupled with the necessity of a binary measure for discordant pair analyses, provide adequate rationale for our composite CSA variable. Although consistent with other studies,^{19,20} our use of a cutoff date (respondents' 18th birthday) before which forced intercourse was considered CSA and after which, rape at the age of 18 years old or older would have included abuse persisting into adulthood under both categories, amplifying the association with rape after the age of 18 years. We required conservatively that contact be forced if it

involved either another child within the family or someone outside the family at least 5 years older. Those who have suggested²² that males suffer less consequences after CSA may object to combining data across gender, however, we found no evidence for a significant gender effect.

A selection bias may have arisen from the panel's initial recruitment since parents aware of abuse may have been less likely to volunteer their twins. The similarities of CSA prevalence and characteristics to other reports^{2,3,30-35} suggest that this bias was limited. Similarly, it is unlikely that telephone assessment introduced any substantial bias over face-to-face³² approaches. Our exclusion of pairs in which either twin was not interviewed could have eliminated the most severely abused individuals reducing the magnitude of effects attributed to CSA. A post hoc examination including data from same-sex twins with noninterviewed co-twins revealed that CSA-positive women were actually more likely to belong to pairs where both twins were interviewed; no significant differences were observed for male subjects.

We controlled for family background risk factors between rather than within pairs to minimize reporting bias. However, the CSA-positive twin may have received a larger dose of trauma or differentially negative treatment. Alternatively, additional stressors may have had a larger influence on either twin. Our approach could have biased estimates in either direction. Finally, we cannot infer a causal link from results for CSA-discordant pairs. It remains possible that other unmeasured risk factors, for which the twins are discordant, predict both increased risk of CSA and other outcomes.

In the largest sample of CSA-discordant same-sex pairs thus evaluated, we observed significantly greater risk for all 8 examined adverse outcomes in CSA-positive respondents vs their co-twins. The most straightforward interpretation of our results is that there is a direct association between CSA and risk for adverse outcomes. We also provide evidence that family background risk factors contribute increased negative outcome risk. These findings demonstrate the considerable potential of sibling studies for dissecting the direct and correlated family background effects associated with CSA.

Accepted for publication June 26, 2001.

This work was supported by grants AA00277 (Dr Nelson) and AA07728, AA10249, and AA11998 (Dr Heath) from the National Institutes of Health, Bethesda, Md, and grants 941177 and 981351 (Dr Martin) from the Australian National Health and Medical Research Council, Canberra.

Corresponding author and reprints: Elliot C. Nelson, MD, Washington University School of Medicine, Department of Psychiatry, 40 N Kingshighway, Suite 1, St Louis, MO 63108 (e-mail: nelson@psychiatry.wustl.edu).

REFERENCES

- Kendall-Tackett KA, Williams LM, Finkelhor D. Impact of sexual abuse on children: a review and synthesis of recent empirical studies [review]. *Psychol Bull.* 1993;113:164-180.
- Holmes WC, Slap GB. Sexual abuse of boys: definition, prevalence, correlates, sequelae, and management [review]. *JAMA.* 1998;280:1855-1862.
- Fergusson DM, Mullen PE. *Childhood Sexual Abuse: An Evidence-Based Perspective.* Thousand Oaks, Calif: SAGE Publications Inc; 1999.
- Jasinski JL, Williams LM, Siegel J. Childhood physical and sexual abuse as risk factors for heavy drinking among African-American women: a prospective study. *Child Abuse Negl.* 2000;24:1061-1071.
- Schulte JG, Dinwiddie SH, Pribor EF, Yutzy SH. Psychiatric diagnoses of adult male victims of childhood sexual abuse. *J Nerv Ment Dis.* 1995;183:111-113.
- Fergusson DM, Horwood LJ, Lynskey MT. Childhood sexual abuse and psychiatric disorder in young adulthood, II: psychiatric outcomes of childhood sexual abuse. *J Am Acad Child Adolesc Psychiatry.* 1996;35:1365-1374.
- Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. Childhood sexual abuse and mental health in adult life. *Br J Psychiatry.* 1993;163:721-732.
- Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the US National Comorbidity Survey. *Arch Gen Psychiatry.* 1995;52:1048-1060.
- Silverman AB, Reinherz HZ, Giaconia RM. The long-term sequelae of child and adolescent abuse: a longitudinal community study. *Child Abuse Negl.* 1996;20:709-723.
- Kessler RC, Davis CG, Kendler KS. Childhood adversity and adult psychiatric disorder in the US National Comorbidity Survey. *Psychol Med.* 1997;27:1101-1119.
- Spak L, Spak F, Allebeck P. Sexual abuse and alcoholism in a female population. *Addiction.* 1998;93:1365-1373.
- Bifulco A, Brown GW, Adler Z. Early sexual abuse and clinical depression in adult life. *Br J Psychiatry.* 1991;159:115-122.
- Bushnell JA, Wells JE, Oakley-Browne MA. Long-term effects of intrafamilial sexual abuse in childhood. *Acta Psychiatr Scand.* 1992;85:136-142.
- Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. The long-term impact of the physical, emotional, and sexual abuse of children: a community study. *Child Abuse Negl.* 1996;20:7-21.
- Spak L, Spak F, Allebeck P. Factors in childhood and youth predicting alcohol dependence and abuse in Swedish women: findings from a general population study. *Alcohol Alcohol.* 1997;32:267-274.
- Fleming J, Mullen PE, Sibthorpe B, Bammer G. The long-term impact of childhood sexual abuse in Australian women. *Child Abuse Negl.* 1999;23:145-159.
- Johnson JG, Cohen P, Brown J, Smailes EM, Bernstein DP. Childhood maltreatment increases risk for personality disorders during early adulthood. *Arch Gen Psychiatry.* 1999;56:600-606.
- Anda RF, Croft JB, Felitti VJ, Nordenberg D, Giles WH, Williamson DF, Giovino GA. Adverse childhood experiences and smoking during adolescence and adulthood. *JAMA.* 1999;282:1652-1658.
- Wyatt GE, Guthrie D, Notgrass CM. Differential effects of women's child sexual abuse and subsequent sexual revictimization. *J Consult Clin Psych.* 1992;60:167-173.
- Fergusson DM, Horwood LJ, Lynskey MT. Childhood sexual abuse, adolescent sexual behaviors and sexual revictimization. *Child Abuse Negl.* 1997;21:789-803.
- Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. The effect of childhood sexual abuse on social, interpersonal and sexual function in adult life. *Br J Psychiatry.* 1994;165:35-47.
- Rind B, Tromovitch P, Bauserman R. A meta-analytic examination of assumed properties of child sexual abuse using college samples. *Psychol Bull.* 1998;124:22-53.
- Dinwiddie S, Heath AC, Dunne MP, Bucholz KK, Madden PA, Slutske WS, Bierut LJ, Statham DB, Martin NG. Early sexual abuse and lifetime psychopathology: a co-twin-control study. *Psychol Med.* 2000;30:41-52.
- Kendler KS, Bulik CM, Silberg J, Hettema JM, Myers J, Prescott CA. Childhood sexual abuse and adult psychiatric and substance use disorders in women: an epidemiological and co-twin control analysis. *Arch Gen Psychiatry.* 2000;57:953-959.
- Bucholz KK, Codoret R, Cloninger CR, Dinwiddie SH, Hesselbrock VM, Nurnberger JI Jr, Reich T, Schmidt I, Schuckit MA. A new semi-structured psychiatric interview for use in genetic linkage studies: a report on the reliability of the SSAGA. *J Stud Alcohol.* 1994;55:149-158.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.* Washington, DC: American Psychiatric Association; 1994.
- SAS Institute Inc. *SAS/STAT Software: Changes and Enhancements for Release 6.12.* Cary, NC: SAS Institute Inc; 1996.
- Stata Corp. *Stata Statistical Software: Release 6.0.* College Station, Tex: Stata Corp; 1999.
- Fergusson DM, Horwood LJ, Woodward, LJ. The stability of child abuse reports: a longitudinal study of the reporting behavior of young adults. *Psychol Med.* 2000;30:529-544.
- Finkelhor D, Hotelling G, Lewis IA, Smith C. Sexual abuse in a national survey of adult men and women: prevalence, characteristics, and risk factors. *Child Abuse Negl.* 1990;14:19-28.
- Fleming JM. Prevalence of childhood sexual abuse in a community sample of Australian women. *Med J Aust.* 1997;166:65-68.
- Fergusson DM, Lynskey MT, Horwood LJ. Childhood sexual abuse and psychiatric disorder in young adulthood, I: prevalence of sexual abuse and factors associated with sexual abuse. *J Am Acad Child Adolesc Psychiatry.* 1996;34:1355-1364.
- Fleming J, Mullen P, Bammer G. A study of potential risk factors for sexual abuse in childhood. *Child Abuse Negl.* 1997;21:49-58.
- MacMillan HL, Fleming JE, Trocme N, Boyle MH, Wong M, Racine YA, Beardslee WR, Offord DR. Prevalence of child physical and sexual abuse in the community: results from the Ontario Health Supplement. *JAMA.* 1997;278:131-135.
- Vogeltanz ND, Wilsnack SC, Harris TR, Wilsnack RW, Wonderlich SA, Kristjansson AF. Prevalence and risk factors for childhood sexual abuse in women: national survey findings. *Child Abuse Negl.* 1999;23:579-592.
- Springs FE, Friedrich WN. Health risk behaviors and medical sequelae of childhood sexual abuse. *Mayo Clin Proc.* 1992;67:527-532.