Childhood Maltreatment as a Risk Factor for Adult Cardiovascular Disease and Depression

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Background: Traumatic experiences in childhood are linked to adult depression and cardiovascular disease. Depression is twice as common in women than men, and depression after cardiovascular events is more common in women than men. However, sex differences in these relationships have not been comprehensively investigated using a nationally representative sample in which demographic factors related to these illnesses can be controlled.

Method: Data come from the Part 2 sample of the U.S. National Comorbidity Survey, a nationally representative sample containing over 5000 adults. Relationships between childhood maltreatment (sexual abuse, physical abuse, neglect), adult depression (DSM-III-R), and cardiovascular disease were examined using multiple logistic regression models with a specific emphasis on the evaluation of sex differences.

Results: Childhood maltreatment was associated with a significant increase in cardiovascular disease for women only and with a significant increase in lifetime depression for both genders. A history of childhood maltreatment removed the natural protection against cardiovascular disease for women and depression for men. Although depression and cardiovascular disease were correlated, depression did not contribute to the prediction of cardiovascular disease in women when controlling for history of childhood maltreatment.

Conclusions: Gender is important in evaluating potential psychiatric and physical correlates of childhood maltreatment. Maltreatment is a potent risk factor for cardiovascular disease in women and for depression in both women and men. Effective clinical assessment should recognize the role of childhood abuse or neglect in adult health and disease. Research on the consequences of childhood maltreatment should focus on both psychiatric and physical outcomes.

(J Clin Psychiatry 2004;65:249–254)

Received May 19, 2003; accepted Dec. 11, 2003. *From Women's Health Research at Yale and Department of Psychiatry, Yale University School of Medicine, New Haven, Conn.*

The authors report no financial or other support of this work.

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By the year 2020, it is estimated that disability worldwide will be determined largely by depression and heart disease.[1] Multiple studies indicate a high rate of co-occurrence between these illnesses[2,3] and suggest that they may share common risk factors, such as life stress.[4–6] The purpose of the current study is to examine whether early life stress, in the form of childhood maltreatment, is a risk factor for the development of depression and cardiovascular disease in adulthood. Gender differences in these relationships are examined, because women and men have notably different rates of prevalence for both depression[7] and cardiovascular disease,[8] and it has been suggested that responses to childhood stress may differ in women and men.[9]

Reviews of the literature have consistently shown that exposure to traumatic stress is associated with subsequent psychiatric and physical health problems, as measured by adverse health reports, increased medical utilization, morbidity, and later mortality.[5] However, most studies either have focused on exclusively male or female samples or have not directly examined gender differences when investigating the relationship between traumatic events and long-term psychiatric and physical outcomes. Furthermore, with few exceptions (e.g., Martin et al., 2000[10]), studies of long-term correlates of traumatic events have focused on either psychiatric or physical health, but not both. Finally, many existing studies have used convenience samples from which only limited generalizations can be made.

Severe childhood stress has been postulated to be one of the most robust risk factors for the development of adult depression, as demonstrated in community and clinical samples as well as in animal studies.[11,12] Weiss and colleagues[9] have argued that biological changes occurring as a result of childhood stress may be long lasting, may differ between women and men, and may create a greater biological vulnerability to depression in women. With regard to stress and cardiovascular disease, increased levels of physiologic reactivity represent one of the most consistent physical health findings in trauma survivors. In a recent meta-analysis, Buckley and Kaloupek[13] report that stress-related disorders are associated with elevated levels of basal heart rate and diastolic blood pressure, which they suggest may result from an adaptation

to a chronic stress condition. Over time, it is possible that such an adaptation could provide enough strain to the cardiovascular system as to affect cardiovascular health. Gender differences in this hypothesized relationship have not yet been tested.

Although the mechanisms by which depression and cardiovascular disease are linked are not yet established, ample evidence suggests a relationship between depression and heart disease. Depression has been found to predict morbidity and mortality from coronary heart disease,[2] as well as measures of carotid atherosclerosis,[14] and Ferketich and colleagues[2] suggest that there are sex differences in these relationships. Furthermore, in a sample of individuals who underwent coronary artery bypass surgery, women reported more symptoms of depression 6 to 8 weeks post-surgery than did men.[15] Our long-standing interest in the interaction of stress and gender as each relates to depression and cardiovascular disease (e.g., Maciejewski et al., 2001[6]; Caulin-Glaser, et al., 1991[16]; Mazure and Maciejewski, 2003[17]), coupled with these findings, suggests the need for a closer examination of the factors involved in the relationship between depression and cardiovascular disease, with a focus on sex differences.

The current study examines the role of childhood maltreatment (defined as child sexual abuse, child physical abuse, or child neglect) as a risk factor for adult depression and cardiovascular disease in a nationally representative sample. We hypothesize that a history of childhood maltreatment will increase the odds of depression and cardiovascular disease in adulthood. Because of our previous research indicating differential response to stressors in men and women, we examine sex differences in these relationships, predicting that childhood maltreatment will have a larger impact on depression in women and on cardiovascular disease in men. Finally, if childhood maltreatment is found to be associated with adult cardiovascular disease, a model will be tested to determine if this is a direct effect or if it is due to the already established link between depression and cardiovascular disease. We hypothesize that a history of depression will at least partially account for the relationship between childhood maltreatment and cardiovascular disease.

METHOD

The data for the present study are drawn from the National Comorbidity Survey (NCS),[18] which was designed to study the distribution, correlates, and consequences of psychiatric disorders in a nationally representative sample of the U.S. population. The survey was based on a stratified, multistage, area probability sample of individuals aged 15 to 54 years in the noninstitutionalized civilian population.[18] From 1990 through 1992, the NCS surveyed 8098 persons. After study procedures were fully explained, written informed consent was obtained from all respondents and from parents of minors. The response rate was 82.4%. All 8098 respondents were administered the Part 1 interview that also included a modified version of the Composite International Diagnostic Interview (CIDI),[19,20] a structured interview administered by nonclinician interviewers. The Part 1 data also provide information about the course of disorders, including ages at onset for each of the 14 psychiatric disorder diagnoses. Part 2 includes a more thorough assessment of risk factors and secondary diagnoses not included in the core diagnostic interview. The Part 2 sample consists of 5877 subjects, including all respondents aged 15 to 24 years (99.4% completed Part 2), all others who screened positive in Part 1 for a lifetime diagnosis of any psychiatric disorder (98.1% completed Part 2), and a random sample of the remaining respondents (99% completed Part 2). Further details about the NCS are provided elsewhere.[18,21]

The NCS data were weighted to adjust for variation in within-household and between-household probabilities of selection and differential nonresponse. These weights also make the Part 2 data approximate the national population distributions of the cross-classification of age, sex, race or ethnicity, marital status, education, living arrangements, region, and urbanicity as defined by the 1989 U.S. National Health Interview Survey.[22] All the analyses conducted for the present study use the NCS Part 2 weighted sample, excluding subjects under the age of 18 years, as the purpose of this investigation was to test the relationship between childhood events and adult health. Sample sizes (N_w) presented refer to the sum of the weights. The study weighted sample consisted of approximately 50% (N_w = 2696) women and 50% (N_w = 2697) men. Those respondents with childhood onset (before age 18 years) of depression or dysthymia were excluded in analyses for depressive disorders, because we were only interested in investigating the connection between childhood maltreatment and subsequent physical and psychological disorders. If childhood onset of depressive disorders had been allowed in these analyses, it is possible that some instances of depression that predated the child maltreament (e.g., depression at age 14, sexual abuse at age 16) would have been included, which would serve to muddle the results. Thus, exclusion of childhood depressive disorders left a sample size of 5308 for analyses related to depression. Furthermore, those participants with missing data on the childhood maltreatment variable were excluded from analyses examining the impact of childhood maltreatment on adult disorders.

Measures

Diagnoses of psychiatric disorders. The NCS diagnostic interview is a modified version of the CIDI.[19,20,23] The CIDI diagnostic program yielded diagnoses of 14 psychiatric disorders based on DSM-III-R criteria. Field trial

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data have confirmed the reliability and validity of CIDI diagnoses.[24] For the purposes of this study, we were interested in examining only depressive disorders, and the diagnoses of depression and dysthymia were grouped together into one variable for depressive disorders. Only lifetime diagnoses with adult onset (age 18 years or later) are considered.

Measures of physical disorders. Assessments of physical health outcomes were drawn from a self-report questionnaire in the Part 2 health section of the survey, measuring 15 health categories. The questions are answered "yes" or "no," thus evaluating the respondent's self-reported presence/absence of the specific physical illness "in the past year." For the purpose of this study, we were interested in examining only those health outcomes related to cardiovascular disease. Thus, the categories of high blood pressure/hypertension, heart attack, and stroke were grouped together as one variable representing cardiovascular disease.

Childhood maltreatment measures. Childhood maltreatment was assessed retrospectively, on the basis of 4 questions contained in the life event history section of the NCS: (1) You were raped (someone had sexual intercourse with you when you did not want to by threatening you or using some degree of force), (2) You were sexually molested (someone touched or felt your genitals when you did not want them to), (3) You were physically abused as a child, and (4) You were seriously neglected as a child. The 2 sexual assault items were used only if the event occurred before the age of 18; these 2 items were then combined into a new "sexually abused as a child" variable. We will refer to respondents who reported these types of childhood maltreatment as having experienced childhood sexual abuse, childhood physical abuse, or childhood neglect.

Statistical Analyses

The results reported below are presented in the form of prevalence (%) and odds ratios (ORs). Odds ratios estimated by multiple logistic regression were used to assess the effects of childhood maltreatment, and sex differences in these effects, on adult depressive disorders and cardiovascular disease. Demographic correlates of physical and mental health response variables were included in models used to assess "adjusted" estimates of the effects of childhood maltreatment, and sex differences in these effects, on depressive disorders and cardiovascular disease. All analyses were conducted using SAS version 8.2[25] procedures that allowed for the inclusion of weighting variables.

RESULTS

Characteristics of the current sample are shown in Table 1, indicating the gender (female vs. male) estimated prevalence for demographic categories. Women were significantly more likely to be African American, be separated/widowed/divorced, have a lower annual income ($0–$19,999), and have some college education (13–15 years). Women were less likely than men never to have been married, to be in the highest income bracket, or to have an education level of 16 years of school or more.

Table 1. Demographic Characteristics of Participants (N = 5393)[a]

Characteristic	Women (N_w = 2696, 49.9%)	Men (N_w = 2697, 50.0%)	OR	95% CI
Age, mean (SD), y	33.4 (10.7)	32.9 (10.8)	1.003	0.998 to 1.009
Race, %				
White	75.1	78.0	1.00	Reference[b]
Black	12.6	10.1	1.31*	1.10 to 1.55
Hispanic	8.7	8.6	1.06	0.87 to 1.28
Other	3.6	3.4	1.09	0.81 to 1.46
Marital status, %				
Married/cohabit	66.4	64.5	1.00	Reference[b]
Separated/widowed/ divorced	14.3	10.1	1.37***	1.16 to 1.63
Never married	19.3	25.5	0.74***	0.64 to 0.84
Annual income, %				
$0–$19,999	27.7	21.0	1.31***	1.13 to 1.53
$20,000–$34,999	24.9	24.8	1.00	Reference[b]
$35,000–$69,999	34.7	38.5	0.90*	0.78 to 1.03
$70,000+	12.7	15.7	0.81***	0.67 to 0.96
Education, %				
Less than 12 y	14.0	15.8	0.86+	0.73 to 1.01
12 y	38.6	37.3	1.00	Reference[b]
13–15 y	27.2	23.2	1.13***	0.99 to 1.30
16+ y	20.2	23.8	0.82**	0.71 to 0.95

[a]Data from the National Comorbidity Survey.[18]
[b]95% confidence interval does not apply to the category of the characteristic used as a basis of comparison for the purpose of constructing odds ratios.
+p < .10; *p < .05; **p < .01; ***p < .001.
Abbreviations: CI = confidence interval, N_w = weighted sample size, OR = odds ratio.

Unadjusted bivariate chi-square analyses show that women and men have significantly different rates for cardiovascular and depressive disorders in the overall sample: higher rates of cardiovascular disorders in men (χ^2 = 13.31, df = 1, N_w = 5393; p < .001) and higher rates of depressive disorders in women (χ^2 = 96.99, df = 1, N_w = 5393; p < .001). The prevalence of cardiovascular and depressive disorders by gender and presence/absence (+/–) of childhood maltreatment (CM) is shown in Table 2. Each cell of this table shows the proportion of respondents (separated by gender and presence/absence of childhood maltreatment history) who report depressive or cardiovascular disorders. Within the CM+ and CM– categories, we compared gender prevalence for each health outcome using a chi-square test. Because of the large sample sizes in these analyses, we have great power to detect differences between genders and childhood maltreatment categories. Within the CM+ group, women and men do not differ significantly in rates of either cardiovascular (χ^2 = 0.27, df = 1, N_w = 635; p = .60) or de-

Table 2. Prevalence of Cardiovascular and Depressive Disorders by Gender and History of Childhood Maltreatment (CM)

	CM+ Women		CM– Women		CM+ Men		CM– Men	
Health Outcome	n_w/N_w	%	n_w/N_w	%	n_w/N_w	%	n_w/N_w	%
Cardiovascular disorders[a]	10/464	2.1	5/2186	0.2	2/172	1.4	39/2485	1.6
Depression/dysthymia[b]	171/437	39.1	443/2163	20.5	54/162	33.2	283/2459	11.5

[a]Smaller sample size due to missing values in CM.
[b]Smaller sample size due to missing values in CM and to exclusion of subjects diagnosed with depression at an age younger than 18 years.
Abbreviations: n_w = the weighted sample of women or men with cardiovascular or depressive disorders within each CM+ or CM– group; N_w = the weighted sample of all women or men within each CM+ or CM– group. Symbols: + = presence, – = absence.

Table 3. Odds Ratios for the Presence of Adult Cardiovascular and Depressive Disorders by Gender and History of Childhood Maltreatment (CM)[a]

Odds Comparison	Cardiovascular Disorders	Depressive Disorders
A) CM+ Women:CM– Women	8.79***	2.38***
B) CM+ Men:CM– Men	0.90	3.79***
C) A:B	9.77**	0.63*

[a]Adjusted for age, ethnicity, marital status, education, and income.
*p < .05; **p < .01; ***p < .001.
Symbols: + = presence, – = absence.

pressive disorders ($\chi^2 = 1.76$, df = 1, $N_w = 599$; p = .18). However, within the CM– group, women report higher rates of depressive disorders ($\chi^2 = 70.1$, df = 1, $N_w = 4622$; p < .001), while men report higher rates of cardiovascular disorders ($\chi^2 = 22.2$, df = 1, $N_w = 4671$; p < .001).

Because cardiovascular disease is more prevalent for both men and women as they age, the current sample is somewhat unrepresentative of traditional cardiovascular disease groups. For this reason, we chose to investigate the presence of cardiovascular disease in women and men by age. There were only 2 men and 3 women respondents younger than 30 years of age with cardiovascular disease. In this sample, the mean age for women with cardiovascular disease is 38.9 years (SD = 9.5), whereas the mean age for men with cardiovascular disease is 44.4 years (SD = 7.4). A t test statistic (t = –2.26, df = 73, p < .05) shows a significant age difference between genders diagnosed with cardiovascular disease, with an earlier onset for women than for men.

The results from multiple logistic regression analyses examining sex differences in the impact of childhood maltreatment on presence of cardiovascular and depressive disorders in adulthood are displayed in Table 3. These analyses were adjusted for baseline gender differences in age, ethnicity, marital status, education, and income. Significantly greater odds ratios are demonstrated for CM+ women, who report an almost 9-fold increase in cardiovascular disorders compared with CM– women. Furthermore, a history of childhood maltreatment is associated with increased odds of depressive disorders in both men and women. When the odds ratios for men and women are compared with one another, significant sex differences are present in which childhood maltreatment is associated with greater odds of cardiovascular disorders for women only and is associated with greater odds for depression more so in men than in women.

Additional analyses were conducted to understand more fully the relationships between childhood maltreatment, depression, and cardiovascular disease in women, given the specific impact of childhood maltreatment on cardiovascular disease only in women. In fact, there is a significant bivariate correlation between depressive and cardiovascular disorders in women ($\chi^2 = 6.62$, df = 1, $N_w = 2862$; p < .01). Results of logistic regression analyses demonstrate that, even when controlling statistically for depression, CM+ women have significantly higher odds for cardiovascular disorders than CM– women (OR = 5.5, p < .001). Using the same model, when childhood maltreatment history is entered first into the regression, adult depressive disorders represent no additional risk factor for cardiovascular disorders in women (OR = 0.5, p = .19).

DISCUSSION

The results of the current study demonstrate that a reported history of childhood abuse or neglect is associated with an almost 9-fold increase in cardiovascular disorders in women, as well as a significant increase in the odds of lifetime depressive disorders for both men and women. While significantly related for both genders, the relationship between childhood maltreatment and lifetime depression was significantly stronger in men. Although correlational, these results suggest that maltreatment in childhood can have long-term negative psychiatric and physical health correlates for 2 of the most globally disabling conditions, cardiovascular disease and depression.

Current findings indicate sex differences in the relationships between childhood maltreatment and adult psychiatric and physical health problems. However, the directions of the sex differences were contrary to our initial hypotheses. Although women have been shown to have twice the rate of depressive disorders than men,[7] and men have higher rates of cardiovascular disease than premenopausal women,[8] these expected patterns were found in this sample only when looking at the specified group of individuals who did not report a history of childhood

maltreatment. When examining the group of men and women with a history of childhood maltreatment, these expected sex differences were not present. In survivors of childhood maltreatment, there was no sex difference in the prevalence of adult cardiovascular disease or depression. Thus, it appears that the respective protection for these disorders in each sex may be compromised after the experience of childhood maltreatment. Furthermore, analysis by age appears to indicate that the presence of childhood maltreatment not only may increase risk for cardiovascular disease, but may also be associated with a younger age of onset of cardiovascular disease in women. Future research is needed to determine the factors that explain the direction of sex differences found in this study.

Contrary to expectations based on the literature on the association between depression and impaired cardiovascular health, we did not find support for the hypothesis that the increased odds for cardiovascular disease in women reporting a history of childhood maltreatment would be at least partially accounted for by a history of depression. In fact, we found no evidence that depression added anything to the model examining the impact of childhood maltreatment on cardiovascular disorders for women. This suggests that researchers and clinicians investigating the depression–cardiovascular disease link may also wish to incorporate measures of trauma history into their models for a more complete picture.

Although the results of this study are compelling with respect to the adverse health outcomes related to childhood maltreatment, and suggestive of potentially important sex differences in both physical and psychiatric health disorders, the specific pathways by which childhood abuse and neglect may be related to adult health are unknown. Childhood maltreatment may be related to adverse health outcomes in adulthood through chronic stress on the cardiovascular system, impairment of the immune system, and/or alterations in neurologic functioning (e.g., the hypothalamic-pituitary-adrenal axis).[26,27] Future studies, especially those using a prospective methodology, are necessary to determine the most important variables mediating the relationship between childhood maltreatment and adult health. Such studies should also emphasize those risk factors that may differ between women and men, such as gonadal hormones and behavioral variables related to emotion-focused or avoidant coping with trauma.[9,28]

The current study is also limited by the 1-item indicators used to assess the various forms of childhood maltreatment. Although the questions used to assess childhood sexual abuse were behaviorally specific, the 2 items for childhood physical abuse and childhood neglect required the respondent to judge whether or not their experiences fit into those categories without any behavioral anchors. However, these questions have been deemed acceptable in other published studies.[21,29] In addition, the physical health conditions are based solely on self-report and have not been confirmed by medical records or examination. For this reason, the results should not be considered conclusive but should be used to inform future investigations in which clinical diagnoses of cardiovascular disease can be made. Furthermore, because the age of the sample was limited to the 18- to 54-year range, it is unknown if these results would generalize to older men and women. Also, because of the age of the sample, the number of women with known cardiovascular disease was relatively low, indicating a need for replication of the finding that women with a history of childhood maltreatment were 9 times more likely to have cardiovascular disease.

Despite the limitations of this study, the use of a large, nationally representative sample in which women and men could be compared on both psychiatric and physical health variables provides insight into the long-term correlates of childhood maltreatment. For this reason, several recommendations for future directions can be made. First, within secondary prevention efforts for girls known to have experienced abuse or neglect in childhood or adolescence, special attention should be shown to the prevention of risk factors that may eventually be associated with cardiovascular disease, such as smoking and obesity. All children, boys and girls, who have experienced childhood maltreatment should also be carefully screened for symptoms of depression. Moreover, within the context of tertiary care, the assessment of a history of childhood maltreatment in women with cardiovascular disease and both men and women with depressive disorders is recommended. Finally, we suggest that all researchers interested in the long-term psychiatric and physical health correlates of childhood abuse and neglect incorporate a consideration of sex differences into analyses of the response to such traumatic events.

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