

Sex Differences in the Relationship Between Social Support and Risk for Major Depression: A Longitudinal Study of Opposite-Sex Twin Pairs

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Objective: Compared to men, women have larger and more intimate social networks and higher rates of major depression. Prior studies have suggested that women are more sensitive to the depressogenic effects of low social support, but most of these studies had substantial methodologic limitations.

Method: In two interview waves at least 1 year apart, 1,057 pairs of opposite-sex dizygotic twin pairs ascertained from a population-based register were assessed. The authors predicted risk of major depression in the year before the wave 2 interview from levels of social support assessed at wave 1.

Results: Women reported higher levels of global social support than their twin brothers. Global social support at wave 1 predicted risk for major depression at wave 2 significantly more strongly in fe-

male than in male members of these pairs, and the same effect was seen when the analysis controlled for the history of major depression in the year prior to wave 1. Women were more sensitive than men to the depressogenic effects of low levels of social support, particularly from the co-twin, other relatives, parents, and spouses. Levels of social support did not explain the sex difference in risk for major depression.

Conclusions: Emotionally supportive social relationships are substantially more protective against major depression for women than for men. While these effects cannot explain sex effects on the prevalence of major depression, they do suggest important sex differences in pathways of risk. Clarification of the nature of the causal links between low social support and depression in women is needed.

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Social support has been widely studied both in the specific area of mental health and in the social sciences more broadly (1). The quality of social relationships predicts general health and mortality (2), psychiatric symptoms and disorders (3, 4), and the emotional adjustment to stress (3).

An interest in gender differences in the relationship between social support and major depression can be derived from four sets of observations. First, many studies suggest an inverse relationship between social support and risk for major depression (5). Second, compared to men, women have larger social networks and are more emotionally involved in those networks (6). Third, women have consistently been shown to have higher rates of major depression than men (7, 8). Finally, a number of prior studies have examined gender differences in the association between social support and psychopathology. Most (9–13) but not all (14) indicated that women are more sensitive than men to the pathogenic effects of low levels of social support. These prior studies have had a number of methodologic limitations, including small sample size, biased sampling, limited measures of social support, symptomatic rather than diagnostic outcome measures, and cross-

sectional designs that make it difficult to determine causal relationships.

In this study, we used a unique sample for the study of gender differences—opposite-sex fraternal twin pairs—ascertained from a population-based twin registry. With a longitudinal design, we examined the relationship between baseline levels of social support, assessed for six key social relationships and the general level of social integration, and the risk for future episodes of major depression as assessed at a later interview.

Method

Sample

This report is based on data collected in the first and second waves of interviews of male-male and opposite-sex twins from the Virginia Adult Twin Study of Psychiatric and Substance Use Disorders (15). These pairs were ascertained from the Virginia Twin Registry, which was formed by a systematic search of all Virginia birth certificates since 1918. Subjects from multiple births are matched by name and birth date to state records to obtain addresses and telephone numbers. Twins were eligible for participation in this study if one or both twins were successfully matched and were born between 1940 and 1974. Of 9,417 individuals eligible for the first wave, 6,814 (72.4%) had completed interviews. At least 1 year after the completion of the wave 1 interview,

which was performed in most instances by telephone, we contacted the twins again and attempted to schedule a wave 2 interview. Of the individuals eligible for the wave 2 interview, 5,629 (82.6%) were successfully interviewed. When possible, this interview was completed face to face (79.4% of the interviewed sample). After a full explanation of the research protocol, signed informed consent was obtained prior to all face-to-face interviews, and verbal consent was obtained prior to all telephone interviews.

The current report is based on 1,057 opposite-sex dizygotic twin pairs in which both members completed both the wave 1 and wave 2 interviews. At the time of the wave 2 interview (1994–1998), these subjects were from 21 to 58 years old (mean=36.4, SD=8.9). For this sample, the mean number of months between the wave 1 and wave 2 interviews was 19.0 (SD=9.0). The interviewers had a master's degree in a mental health-related field or a bachelor's degree in this area plus 2 years of clinical experience. They received 40 hours of classroom training plus regular individual and group review sessions. Two senior staff reviewed each interview for completeness and consistency. The two members of each twin pair were interviewed by different interviewers, who were blind to clinical information about the co-twin.

Assessment

Social support was assessed in the wave 1 interview by 24 items, the first five of which recorded the frequency of attendance at meetings of "clubs or other organizations," attendance at "church or other religious services," and social contact with the co-twin, friends, and other relatives. Eighteen items assessed the quality of social support received from six classes of relationships: spouse, co-twin, children, parents, other relatives, and friends. Three questions were asked for each relationship: "How much does your X listen to you if you need to talk about your worries or problems?" "How much does your X understand the way you feel and think about things?" and "How much does your X go out of their way to help you if you really need it?" The first two questions address *emotional* support, that is, the communication of caring and concern, while the last question reflects *instrumental* support, the provision of relevant material goods, such as transportation, money, or physical assistance (16). The final item assesses the presence and number of *confidants*.

During both the wave 1 and wave 2 interviews, we assessed the occurrence over the last year of 14 individual symptoms representing the disaggregated nine criteria in category A for major depression in DSM-III-R (e.g., two items for criterion A4 to assess insomnia versus hypersomnia). For each reported symptom, interviewers probed to ensure that it was due neither to physical illness nor to medication. The respondents and interviewers then aggregated the symptoms reported for the previous year into syndromes formed of co-occurring symptoms. The diagnosis of major depression was made by a computer algorithm incorporating the DSM-III-R criteria, except criterion B2 (which excludes depressive syndromes considered to be "uncomplicated bereavement"). In 375 twins who were interviewed twice by different interviewers with a mean interinterview interval of 30 days (SD=9), the interinterview reliability of the diagnosis of major depression in the last year was good (17): the kappa value was 0.68, with a 95% confidence interval (CI) of 0.57–0.80, and the tetrachoric correlation was 0.92 (95% CI=0.86–0.98).

Statistical Analysis

Some individuals lacked one, two, or three categories of social relationships (e.g., spouse, children, or parents [if both had died]) and so were missing all appropriate items. When total social support was assessed, we simply examined the mean responses for the categories that were available. When individual factors were examined, such individuals were considered to have missing data.

We began with a principal components factor analysis of the social support items for the individuals with no missing data ($N=671$). The scree plot revealed a large first factor (eigenvalue=5.11) accounting for 21.3% of the total variance and six additional factors with eigenvalues greater than unity (2.35, 2.06, 1.63, 1.57, 1.35, and 1.21, respectively). Together these seven factors accounted for 63.7% of the total variance. With a varimax rotation, the seven factors were clearly interpretable as 1) quality of relationship and frequency of contact with co-twin, 2) quality of relationship with other relatives, 3) quality of relationship with friends, 4) quality of relationship with parents, 5) quality of relationship with spouse, 6) quality of relationship with children, and 7) social integration, reflecting frequency of contact with friends and other relatives, frequency of attendance at religious and non-religious meetings, and number of confidants.

The first principal component had positive loadings on all items, indicating that it reflected the general tendency to have infrequent and nonsupportive versus frequent and supportive social contacts. Since a single factor accounting for over 20% of the total variance can be considered a dominant factor (18), we began our analyses with this first principal component, which we termed "global social support." If positive results were obtained with the first principal component, we planned to examine individual factor-derived scales obtained from the seven-factor solution.

Prior to analyses, both the global and individual factor social support scores were standardized across sex to a mean of zero and a standard deviation of unity. If some but not all items were missing (<0.7% of respondents for all scales), we standardized the responses from the items that were present. Differences in the standardized social support scores between the male and female members of the opposite-sex pairs were evaluated by paired t tests. For subscales, this was feasible only when both members of the pair reported results for those items (e.g., both had spouses, children, or parents who were alive). The mean difference score (Δ) for the opposite-sex pairs reflects the signed average difference in standard deviation units of social support after the score of the male member was subtracted from that of the female member.

Our main analyses attempted to predict the occurrence of major depression in the year prior to the wave 2 interview as a function of the level of social support as assessed at wave 1. Our first approach to this used standard logistic regression in which the dichotomous dependent variable was the presence or absence of one or more depressive episodes assessed at wave 2. To correct for the twin-pair structure of the data, these analyses were conducted in PROC GENMOD in SAS (19) by using general estimating equations. For the analyses of the seven social support factors, we selected, from the 2,114 members of the 1,057 pairs, individuals who had complete data for the relevant items. In addition, to take advantage of the twin structure of the data and confirm key results, we also examined this question using paired (or conditional) logistic regression by means of PROC PHREG (19). In these analyses of the social support factors, we included only twin pairs in which both members had complete data on the relevant items. In such regressions, the dependent variable was obligatorily the sex of the twin member. The interaction between sex and social support in the prediction of major depression was, in these analyses, actually reflected in the interaction of social support and major depression in the prediction of sex.

Results

Effect of Sex on Social Support

Within the opposite-sex twin pairs, the female twins reported significantly higher levels of global social support than did their twin brothers; the mean difference in standard deviation units (Δ) was 0.34 ($t=9.01$, $df=1056$,

TABLE 1. Relationship Between Measures of Social Support and Risk for Subsequent Depressive Episodes in Men and Women From Opposite-Sex Twin Pairs

Dimension of Support at Wave 1	Number of Individual Twins ^a	Number of Twin Pairs ^b	Risk of Depression in Year Preceding Wave 2 ^c						
			Odds Ratio ^d			Difference Between Sexes			
			Male and Female	Female	Male	Association		Significance	
						Standard Odds Ratio	Paired Odds Ratio	Standard Analysis	Paired Analysis
Global	2,114	1,057	0.74***	0.60***	0.95	0.63	0.64	<0.001	<0.001
Co-twin	2,114	1,057	0.90	0.77**	1.14	0.68	0.73	0.004	0.01
Other relatives	2,106	1,049	0.79***	0.68***	0.96	0.71	0.68	0.007	0.001
Friends	2,109	1,052	0.90	0.84*	0.98	0.85	0.84	0.21	0.19
Parents	1,413	951	0.74***	0.65***	0.88	0.73	0.75	0.01	0.02
Spouse	1,434	541	0.90	0.79**	1.17	0.68	0.66	0.01	0.054
Children	947	340	0.93	0.85	1.08	0.78	0.66	0.20	0.08
Social integration	2,114	1,057	0.85*	0.80*	0.93	0.86	0.86	0.24	0.25

^a With usable data for standard analyses.^b With usable data from both members for paired analyses.^c The wave 2 interview occurred at least 1 year after the wave 1 interview.^d Controlled for sex and age.* $p < 0.05$. ** $p < 0.01$. *** $p < 0.0001$.

$p < 0.0001$). Of the seven social support factors, the female twins reported significantly higher levels of support from other relatives ($\Delta = 0.33$, $t = 8.18$, $df = 1052$, $p < 0.0001$), support from friends ($\Delta = 0.37$, $t = 8.88$, $df = 1053$, $p < 0.0001$), support from children ($\Delta = 0.43$, $t = 5.87$, $df = 338$, $p < 0.0001$), and social integration ($\Delta = 0.51$, $t = 12.78$, $df = 1056$, $p < 0.0001$). The male twins reported higher levels of support from their spouses ($\Delta = -0.22$, $t = 3.85$, $df = 539$, $p < 0.0001$) and co-twins ($\Delta = -0.05$, $t = 1.72$, $df = 1,056$, $p = 0.09$). No substantial difference was seen in the reported levels of social support the two twins received from their parents ($\Delta = 0.02$, $t = 0.59$, $df = 949$, $p = 0.55$).

Effect of Social Support on Risk for Subsequent Depression: Men and Women Together

Controlling for age and gender in a standard logistic regression, we first examined the impact of our social support measures obtained at the wave 1 interview on risk for depressive episodes in the year prior to our wave 2 interview. These results—expressed in odds ratios—reflect the impact of social support on risk for major depression averaged across men and women. Since our social support measures were standardized, odds ratios of 0.90 and 0.70 mean that for every increase of one standard deviation in the social support score, the risk for major depression is reduced 10% and 30%, respectively.

As seen in Table 1, higher levels of global social support were strongly related to reduced risk for subsequent depressive episodes (odds ratio = 0.74, 95% CI = 0.65–0.83, $z = 4.88$, $p < 0.0001$). We then examined the seven individual social support factors in the same manner. Three of these factors (support from other relatives, support from parents, and social integration) had odds ratios of approximately 0.80 and were significantly related to lower risk for major depression. The other four dimensions were, when assessed in both men and women, weakly and nonsignificantly related to reduced risk for depression (the odds ratios were approximately 0.90).

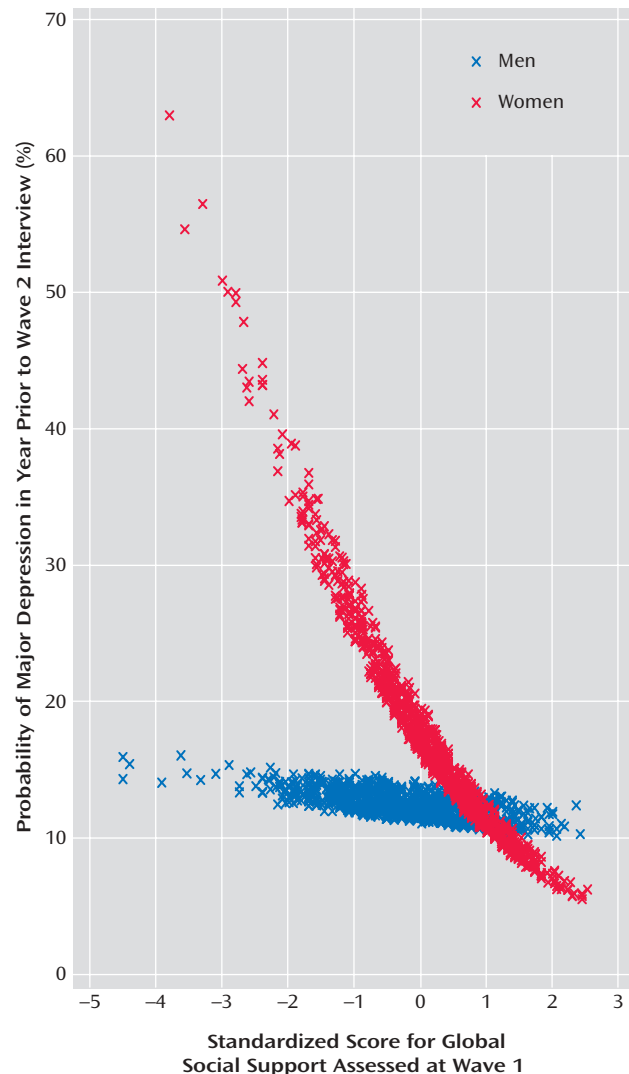
Effect of Social Support on Risk for Subsequent Depression: Men and Women Separately

We next examined the impact of social support on risk for subsequent depression separately in the male and female members of these opposite-sex twin pairs and then tested, in two different ways, the significance of the difference in these relationships. The first method to test for sex differences used standard logistic regression, in which we assessed the significance of the interaction between gender and social support in the prediction of depression. The second approach, theoretically more elegant and statistically more powerful, utilized paired or conditional logistic regression and compared the male and female member of each pair with each other, thereby controlling for their shared genetic and environmental backgrounds.

In women, a higher level of global social support was strongly related to a reduced risk for major depression (odds ratio = 0.60, 95% CI = 0.51–0.74, $z = 5.88$, $p < 0.0001$), while in men, the relationship was modest and nonsignificant (odds ratio = 0.95, 95% CI = 0.78–1.14, $z = 0.57$, $p = 0.57$) (Table 1, Figure 1). In women, six of the seven individual social support factors (all but support from children) were associated with a significantly reduced risk for subsequent major depression. By contrast, in men, none of the seven factors predicted the probability of a future depressive episode.

The relationship between global social support and risk for depression was significantly stronger in women than in men when assessed by either standard logistic regression (odds ratio = 0.63, 95% CI = 0.49–0.82, $z = 3.48$, $p = 0.0005$) or paired logistic regression (odds ratio = 0.64, 95% CI = 0.50–0.81, $z = 3.66$, $p = 0.0003$). The two methods agreed that significant differences in the relationship between social support and major depression were seen for four of the individual social support factors (support from co-twin, other relatives, parents, and spouses). In general, the results of the two regression methods for de-

FIGURE 1. Risk for Major Depression in Men and Women From Opposite-Sex Twin Pairs in the Year Before the Wave 2 Interview as Predicted From the Level of Global Social Support at Wave 1^a

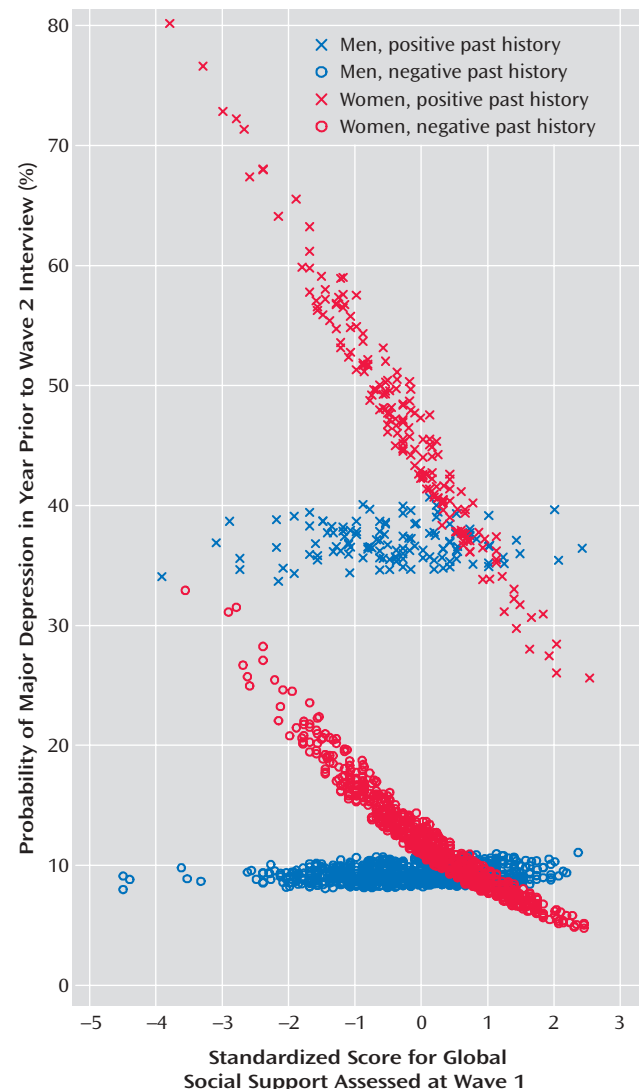


^a These risks are as predicted from a standard logistic regression (with age as a covariate) in which risk for depression was predicted from the main effect of global social support, the main effect of sex, and their interaction. The wave 2 interview occurred at least 1 year after the wave 1 interview.

termining the difference in the support-depression relationship between men and women agreed well with one another.

Since social support may be modified by the presence of or recent recovery from a depressive episode, part of the association between the level of social support measured at wave 1 and the presence of major depression in the year prior to wave 2 could be mediated by the history of major depression in the year prior to wave 1. We therefore repeated all the analyses just reviewed by controlling for the history of major depression in the year prior to the wave 1 interview. As expected, a history of major depression at wave 1 strongly predicted major depression at wave 2

FIGURE 2. Risk for Major Depression in Men and Women From Opposite-Sex Twin Pairs in the Year Before the Wave 2 Interview as Predicted From the Level of Global Social Support at Wave 1 Interview and From Past History of Depression^a



^a These risks are as predicted from a standard logistic regression (with age and history of major depression at the wave 1 interview as covariates) in which risk for depression was predicted from the main effect of global social support, the main effect of sex, and their interaction. Positive past history here means a history of one or more depressive episodes in the year prior to the wave 1 interview. The wave 2 interview occurred at least 1 year after the wave 1 interview.

(odds ratio=5.81, 95% CI=4.40–7.69, $z=12.32$, $p<0.0001$). Both global social support assessed at wave 1 (odds ratio=0.68, 95% CI=0.58–0.82, $z=4.10$, $p<0.0001$) and gender (odds ratio=1.35, 95% CI=1.04–1.73, $z=2.29$, $p=0.02$) remained significant predictors of risk of depressive episodes at wave 2. Most important, as illustrated in Figure 2, the interaction between social support and gender in the prediction of subsequent risk for major depression remained nearly unchanged in magnitude (odds ratio=0.67, 95% CI=0.51–0.87, $z=2.95$, $p=0.003$). The parallel interac-

tion obtained by using paired logistic regression was nearly identical (odds ratio=0.66, $\chi^2=11.2$, $df=1$, $p=0.0008$).

Effect of Global Social Support on Sex Differences in Prevalence of Major Depression

Can differences in social support explain any of the higher risk for major depression in females than in males? When we did not include social support in the model and controlled only for age, the odds ratio for the association between female sex and risk for an episode of major depression in the year preceding the wave 2 interview was 1.50 ($z=3.41$, $p=0.0006$). Adding global social support in the model increased this odds ratio to 1.67 ($z=4.04$, $p<0.0001$). These analyses suggest that if males and females were exposed to the same level of social support (e.g., if the level of social support among women decreased to that observed in men), then the difference in the prevalence of major depression between the sexes would be greater than is now observed.

Discussion

We sought to determine, in a longitudinal study of adult opposite-sex twin pairs, whether the relationship between social support and risk for major depression differed between the two sexes. Global social support robustly predicted risk for subsequent episodes of major depression in women, while in men the association was modest and nonsignificant. Analyzed by both standard and paired logistic regression, the magnitude of the association between global social support and risk for depression was significantly stronger in women than in men. These results were not influenced by controlling for the presence of episodes of major depression in the year prior to the wave 1 interview. When we examined individual dimensions of support, the levels of social support from the co-twin, other relatives, parents, and the spouse were more strongly associated with the risk for depression for the female than male members of these twin pairs.

These results are consistent with the prior literature. Interpersonal relationships are, on average, both more central to and more valued by women than by men (20, 21). The degree to which these sex differences are innate (due, for example, to sex-specific adaptive evolutionary strategies) or result from differential rearing remains a subject of debate (22, 23). In dealing with adversity, women are more likely to seek emotional support in their social network than are men (9, 24). Men may turn to their network, but interactions are likely to be focused on shared activities or "distractions" (24, 25).

Most prior studies examining sex effects on the relationship between social support and psychopathology in adolescents and adults showed the association to be stronger in females than in males (10–14, 26). We summarize two typical studies—both cross-sectional. Using question-

naires from 6,943 adolescents that contained self-report measures of social support and depressive symptoms, Schraedley et al. (12) showed that, compared to males, females reported significantly higher levels of social support, higher levels of depression, and significantly stronger relationships between social support and depression. Using responses to a telephone survey containing short screening scales for depressive symptoms and social support from 395 adults aged 45–75, Elliott found that women had higher levels of depressive symptoms and were more likely to report socially supportive relationships (11). Among women, the level of social support significantly predicted the level of depression, while among men no significant association was found.

The greater sensitivity of females to the impact of social support may not generalize to all outcomes. While the impact of low social support on the risk for major depression appears to be less pronounced in men than in women, males may be more sensitive to the adverse health effects of social isolation than are females (2). Sex differences in the impact of social support on emotional functioning, however, may not be confined to humans. In one study of rats (27), they were subjected to daily foot shock and housed individually or in same-sex groups. In the female but not the male rats, the behavioral and neurobiological effects of stress were attenuated by social housing.

Consistent with the prior literature (6, 9, 25) and a prior examination of different social support measures in this sample (28) was our finding of evidence of gender differences in the elicitation and provision of social support. Compared to their twin brothers, the female twins in the opposite-sex pairs reported significantly higher levels of global social support as well as social support from other relatives, friends, and children. In this sample, women elicited or received more social support from their network than did men. The only social relationships for which the men reported higher levels of social support were their interactions with their spouses (significantly) and co-twins (nonsignificantly). It is interesting that these were the relationships in which the sex of the network individual was obligatorily opposite that of the twin. Thus, in marital and perhaps in opposite-sex twin relationships, women also appear to provide more social support than do men.

Our results also address indirectly the nature of the association between social support and psychopathology. A large literature has examined whether high levels of social support act directly to reduce risk of illness or act indirectly by buffering the effect of adversity (29). At least in women, we here found a strong direct effect of social support on risk for major depression. Prior analyses of this sample showed no consistent evidence that a high level of social support buffered the impact of stressful life events on risk for major depression (30).

Although we found striking differences in the association of social support and major depression between the two sexes, these influences do not contribute to the excess rate of major depression in women. In fact, because women report higher levels of social support than do men, controlling for social support augments rather than diminishes the female preponderance in depression. However, these results do suggest important sex differences in etiologic mechanisms in depression. Difficulties in social relationships may be a more important part of the etiologic pathway to major depression in women than in men.

These results need to be interpreted in the context of four potential methodologic limitations. First, this sample consisted only of white twin pairs born in Virginia. We cannot determine whether these results would extrapolate to other groups. Second, our findings could have arisen because social support is much more reliably assessed in females than in males. However, we rule out this hypothesis because we also measured social support in our wave 2 interview, and the cross-wave correlations for social support were the same in men and in women (for both, $r=0.52$). Third, while our longitudinal design suggests that low social support is causally related to future risk of major depression, this cannot be rigorously demonstrated in observational studies. Our results cannot be plausibly explained by depressive episodes prior to the wave 1 interview, which both reduce social support and predict future depressive relapses, but they cannot rule out other noncausal hypotheses, such as a stable "third variable" (e.g., personality [31]) that predicts both low social support and future risk for major depression (32, 33). However, such a putative third variable would have to act on social support and risk for major depression much more potently in women than in men. Fourth, our assessment of social support was modest in length and focused on the emotional aspects of support. Perhaps we did not measure well the aspects of social relationships (e.g., companionship through shared activities) that men find most helpful (25).

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