Article

Prospective Study of Depression and the Risk of Heavy Alcohol Use in Women

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Objective: The authors' goal was to determine whether depression is associated with a greater risk of heavy alcohol consumption in women.

Method: The study was based on a 1-year follow-up of the Baltimore cohort of the National Institute of Mental Health Epidemiologic Catchment Area project. The sample consisted of 1,383 women at risk for heavy alcohol use. History of depression and frequency of lifetime-experienced depressive symptoms were assessed at baseline, and incident cases of heavy drinking were identified 1 year later. After calculating descriptive statistics for the sample, the authors developed a series of logistic regression models to estimate the risk of heavy drinking at follow-up associated with depression status.

Results: The initial estimate of the risk for heavy drinking in women with a history of depressive disorder was 2.60 times greater than the risk in women with no history of depressive disorder. This estimate did not change markedly after adjustment for age, history of antisocial personality disorder, or father's history of heavy drinking (relative risk=2.2). A higher frequency of depressive symptoms was also found to be associated with an elevation in the risk for heavy alcohol use (relative risk=1.09).

Conclusions: These results add to other evidence that depression must be considered in the assessment of vulnerability for heavy alcohol use in women. Further research is needed to clarify the mechanisms of the observed association and to discover whether detection and effective treatment of depression might reduce risk of later alcohol problems.

(Am J Psychiatry 2000; 157:751–758)

Surveys have uniformly shown that men consume more alcohol than women and experience more drinking-related problematic consequences (1). As a result, early research has tended to focus on alcohol problems in men. However, there has been an increasing focus on drinking patterns and practices among women. Research shows that the observed discrepancy in alcohol intake between the sexes is minimized when gender differences in ethanol absorption are taken into account (2, 3). An analysis of population-based data from the National Longitudinal Alcohol Epidemiologic Survey (3) revealed that the proportion of heavy drinking occasions that led to intoxication was higher in women than men. This and other studies (4–7) suggest that the effect of heavy alcohol use on women's behavior and physiology is especially serious. An important part of the effort to prevent alcohol use disorder in women and its severe impact on their health and well-being is the identification and elucidation of factors influencing heavy drinking in women.

Depression has been observed to coincide with alcohol problems. Large community-based investigations based on data from the National Institute of Mental Health (NIMH) Epidemiologic Catchment Area (ECA) surveys (8, 9), the National Longitudinal Alcohol Epidemiologic Survey (10), and the National Comorbidity Survey (11) have demonstrated that the rate of comorbid depression and alcohol disorders exceeds the rate expected by chance in the general population. Furthermore, these studies found the association between depression and alcohol disorders to be higher in women than in men (8, 10, 11). Although these studies appear to identify a relationship between depression and alcohol disorders, particularly in women, they do not clarify the temporal nature of this association. It has been suggested that depression-like symptoms in patients with alcohol problems are transient, alcohol-induced effects that neither predate alcohol abuse nor persist beyond it (12). However, it is also possible that depression could increase the likelihood of subsequent heavy alcohol use. Few studies have specifically addressed this hypothesis, but evidence has emerged suggesting that, in women, depression tends to come before alcohol problems. From comorbidity research, Helzer and Pryzbeck (8) reported that major depression in alcoholic women usually preceded onset of alcoholism, while the opposite was true for men. Hesselbrock et al. (13) found that depression preceded alcoholism in 65% of female patients in alcohol treatment. Wilsnack et al. (14) conducted an analysis of women's drinking patterns over time and found that heavy drinking tended to begin after, not before, problems with depression. A later study by Wilsnack et al. (15) also noted

that recently experienced depression predicted chronic problem drinking in women.

The present study investigates whether depression could be a risk factor for heavy alcohol use in women, applying a classic prospective epidemiologic design to the analysis of data from a large, population-based sample. We hypothesized that a history of depression would increase the likelihood of heavy episodic drinking. We also hypothesized that an increase in the number of lifetime-experienced depressive symptoms would be associated with risk for heavy drinking among women. Information on the history of other psychiatric disorders as well as parental history of depression and drinking problems was also available. Therefore, it was possible to assess the role of these factors (in addition to that of sociodemographic characteristics) in the relationship between depression and alcohol use and to adjust for potential confounders.

Method

ECA Program

A total of 18,572 adults 18 years old or older, selected by probability sampling of census tracts and households in five U.S. communities, participated in the ECA program (16). To assess the occurrence of psychiatric disorders, baseline interviews were administered between 1980 and 1984, with follow-up interviews at all five sites approximately 1 year later. Institutional review board approval was obtained at each site. Further details on recruitment, survey procedures, and methods of identification of psychiatric and substance use diagnoses have been described elsewhere (17–19).

Baltimore ECA Cohort

In Baltimore, the target population consisted of the household residents of three contiguous sections of East Baltimore, a total area including about 175,000 adult residents (20). Approximately 4.5% of about 90,000 households in East Baltimore were sampled, and close to 95% of those sampled participated. From the participating households, 4,281 adults were designated for study, and 3,481 (81.3%) completed interviews. A total of 2,159 (62.0%) of these were women. Of the 3,481 household residents interviewed in Baltimore at baseline, 50 died during the 1-year follow-up period, 477 refused interview at follow-up, and 186 did not participate for other reasons. A total of 2,768 subjects (79.5% of the original study group) participated in follow-up interviews in 1982; 1,741 (62.9%) of these subjects were women.

Study Sample

For this investigation, we included only women who completed both the baseline and follow-up interviews at the Baltimore site for whom there was information available regarding criteria for depression, depressive symptoms, alcohol use, and alcohol abuse and dependence (N=1,671 [96.0% of those followed up]). Women who reported heavy alcohol use at baseline (N=252) were excluded to restrict the outcome to incident heavy alcohol use. Then, to remove the possibility of a past alcohol disorder influencing heavy drinking at follow-up, women who were diagnosed as having a history of alcohol disorders at baseline (N=36) were also eliminated. The final number of female participants at risk for incident heavy alcohol use was 1,383.

Measures Assessed

Both baseline and follow-up interviews contained the question, "During the past month, about how many different times did you have five or more drinks?" The women who reported having consumed five or more drinks at a time at least once during the past month at the follow-up interview were considered positive for the outcome of heavy episodic drinking; those who reported not having done so were not considered heavy alcohol consumers.

The NIMH Diagnostic Interview Schedule (DIS) (19) was used to assess the occurrence of mental disorders and symptoms. The DIS is a structured interview with good reliability and acceptable validity (19) that may be administered by trained nonclinicians to elicit information for assessment according to DSM-III. For this analysis, women who met DSM-III criteria for either lifetime major depressive episode, dysthymia, or depressive syndrome at the baseline interview were considered positive for a history of depression. Depressive syndrome, a subclinical manifestation of depression, has been defined in previous ECA investigations as 2 weeks of dysphoria with allied symptoms from three of eight symptom groups occurring for any amount of time (21). As in the diagnosis of major depressive episode, exclusions are made for recent grief. The reference group in our study (women with no history of depression) was defined as including individuals not meeting any of the above criteria.

The effect of depression was also studied as a continuous variable. A series of questions in the DIS establishes the presence or absence of 16 different depressive symptoms, which are then used to diagnose DSM-III depressive disorders. The symptoms include, among others, difficulty falling asleep or staying asleep, psychomotor agitation, diminished ability to concentrate or think, and feelings of worthlessness and guilt. In this investigation, we counted having experienced dysphoria for 2 weeks or more as an additional symptom. Thus, each study subject was assigned a value from 0 to 17 at baseline for number of lifetime-experienced depressive symptoms.

As part of the baseline ECA interview, information was gathered on age, race or ethnicity, years of education completed, current marital status, and current employment status. Through use of the DIS, information on lifetime history of DSM-III mental disorders other than depression was obtained. The specific disorders included in our study were antisocial personality disorder, cognitive impairment (assessed by the DIS but not a DSM-III diagnosis), obsessive-compulsive disorder, panic disorder, phobic disorder, somatization disorder, schizophrenic disorders (schizophrenia and schizophreniform disorder), and illicit drug disorders. At follow-up, respondents were asked whether their natural mother or father had suffered from depression and if either had been heavy drinkers, either periodically or on a continuous basis. Four variables were included in our study to indicate whether depressed mood and heavy alcohol use were reported for a subject's biological mother and father.

Statistical Analysis

To characterize the study sample and to identify potential confounders of the relationship between depression and heavy alcohol use, women with and without a history of depression were compared in terms of sociodemographic characteristics, baseline-identified history of psychiatric disorders, and reported parental history of depressed mood and heavy drinking. Women who did or did not report heavy drinking were also compared in terms of baseline characteristics. We then calculated crude risk estimates for heavy alcohol use by entering baseline variables (including depression) by themselves into separate logistic regression equations predicting heavy alcohol use at follow-up. Summary tests for multinomial variables (i.e., age, race, marital status) were examined first, followed by tests for individual categories only if the overall test was significant.

TABLE 1. Baseline Sociodemographic and Psychopathologic Characteristics of 56 Women Who Did and 1,327 Who Did Not Report Heavy Drinking in the Month Before 1-Year Follow-Up in the Epidemiologic Catchment Area Program Baltimore Site, 1981–1982, With Relative Risk Estimates of Heavy Alcohol Use Based on Initial Logistic Regression Analyses

Baseline Characteristic	Women Who Reported Heavy Drinking		Women Who Did Not Report Heavy Drinking		Estimated Relative Risk	95% CI	p[a]
	N	%	N	%			
History of depressive disorder[b]							
Yes	8	14.3	80	6.0	2.60	1.19–5.68	0.02
No[c]	48	85.7	1,247	94.7	1.00		
Number of depressive symptoms[d]					1.12	1.04–1.19	0.004
Age (years)[e]							
18–29	23	41.1	334	25.2	12.40	2.90–52.98	0.001
30–44	15	26.8	288	21.7	9.38	2.17–41.33	0.003
45–54	6	10.7	134	10.1	8.06	1.61–40.42	0.01
55–64	10	17.9	211	15.9	8.53	1.85–39.31	0.006
≥65[c]	2	3.6	360	27.1	1.00		
Race/ethnicity[f]							
American Indian	1	1.8	25	1.9			
Asian/Pacific Islander	0	0.0	9	0.7			
Black	23	41.1	500	37.7			
Hispanic	1	1.8	9	0.7			
White	31	55.4	784	59.1			
Education							
12 or more years	29	51.8	640	48.2	1.15	0.68–1.97	0.60
Less than 12 years[c]	27	42.8	687	51.8	1.00		
Marital status[g]							
Divorced	7	12.5	123	9.3	1.40	0.62–3.15	0.42
Married	18	32.1	531	40.0	0.71	0.40–1.26	0.24
Never married	16	28.6	262	19.8	1.62	0.90–2.95	0.11
Separated	11	19.6	113	8.5	2.62	1.32–5.22	0.006
Widowed	4	7.1	297	22.4	0.27	0.10–0.74	0.01
Employment							
Working for pay	24	43.6	399	30.8	1.74	1.01–3.00	0.05
Not working for pay[c]	31	56.4	896	69.2	1.00		
Psychiatric disorders[h]							
Antisocial personality	2	3.6	6	0.5	8.28	1.63–42.01	0.01
Cognitive impairment[i]	0	0.0	16	1.2			
Obsessive-compulsive disorder	2	3.6	47	3.6	1.01	0.28–4.25	0.99
Panic	2	3.6	17	1.3	2.90	0.65–12.87	0.16
Phobias	22	39.3	370	27.9	1.67	0.97–2.90	0.06
Somatization[i]	0	0.0	1	0.1			
Schizophrenic disorder	3	5.4	22	1.7	3.34	0.97–11.52	0.06
Illicit drug use disorder	5	8.9	37	2.8	3.41	1.29–9.04	0.01
Parental history							
Heavy drinking[j]							
Mother	5	59.4	58	4.5	2.21	0.85–5.77	0.10
Father	11	22.9	199	15.9	1.57	0.79–3.13	0.20
Depressed mood[k]							
Mother	6	11.5	149	11.2	0.97	0.41–2.31	0.95
Father	2	4.3	76	6.3	0.66	0.16–2.79	0.58

[a] Wald statistic, df=1.
[b] History of depressive disorder includes DIS/DSM-III-defined major depressive episode, depressive syndrome, or dysthymia, excluding grief.
[c] Reference category.
[d] Lifetime-experienced symptoms 0–16 from the DIS. The 17th symptom is defined as the presence of dysphoria for 2 or more weeks.
[e] Overall test for age: Wald statistic=1,186, df=4, p=0.02.
[f] Overall test for race/ethnicity was not statistically significant (Wald statistic=124, df=4, p=0.87), so tests for individual race/ethnicity categories are not presented.
[g] Overall test for marital status: Wald statistic=1,455, df=4, p=0.006.
[h] Each category under this heading was referenced to all others in these bivariate analyses.
[i] Relative risk estimate was not possible to determine because there were no incident cases for this category.
[j] Parental history refers to the biological parents. The reference group for each category under this heading includes all those reporting an absence of parental heavy drinking.
[k] Parental history refers to the biological parents. The reference group for each category under this heading includes all those reporting an absence of parental depressed mood.

Separate multivariate analyses were performed for the categorical (analysis a) and continuous (analysis b) depression variables. In each analysis, we sequentially entered groups of variables into a logistic regression equation, resulting in a series of models. Then, to create the final models, the last model of each series was reevaluated for model parsimony and fit, and variables eliminated in earlier stages were retested for inclusion. Variables were added to models using forward stepwise variable selection (SPSS 6.1) (22). Tested variables were retained if their Wald statistic was significant at the level of p<0.10 or, for the final models, if they improved the model chi-square to the level of p<0.10. Interaction between selected variables was examined by introducing appro-

TABLE 2. Estimated Relative Risk of Heavy Alcohol Use Based on Multiple Logistic Regression Analyses of Baseline Characteristics, Including History of Depressive Disorder, Among 56 Women Who Did and 1,327 Who Did Not Report Heavy Drinking in the Month Before 1-Year Follow-Up in the Epidemiologic Catchment Area Program Baltimore Site, 1981–1982[a]

		Model 1a			Model 2a		
Baseline Characteristic	Reference Category	Estimated Relative Risk	95% CI	p[b]	Estimated Relative Risk	95% CI	p[b]
History of depressive disorder[c]	History absent	2.24	1.40–3.60	≤0.05	2.26	1.02–4.98	≤0.05
Age 18–44 years	Age ≥45 years	2.23	1.26–3.97	<0.01	2.24	1.26–4.00	<0.01
Marital status: separated	All others	1.32	0.89–1.96	n.s.	1.32	0.89–1.97	n.s.
Psychiatric disorder: antisocial personality	Antisocial personality disorder absent				1.27	1.00–1.61	≤0.05
Parental history: heavy drinking by father	History absent						

[a] For model 1a, χ^2=14.7, df=3, p<0.01; for model 2a, χ^2=17.3, df=4, p<0.001; for model 3a, χ^2=23.4, df=5, p<0.001; for model 4a, χ^2=22.0, df=4, p<0.001.
[b] Wald statistic, df=1.
[c] History of depressive disorder includes DIS/DSM-III-defined major depressive episode, depressive syndrome, or dysthymia, excluding grief.

TABLE 3. Estimated Relative Risk of Heavy Alcohol Use Based on Multiple Logistic Regression Analyses of Baseline Characteristics, Including Number of Depressive Symptoms, Among 56 Women Who Did and 1,327 Who Did Not Report Heavy Drinking in the Month Before 1-Year Follow-Up in the Epidemiologic Catchment Area Program Baltimore Site, 1981–1982[a]

		Model 1b			Model 2b		
Baseline Characteristic	Reference Category	Estimated Relative Risk	95% CI	p[b]	Estimated Relative Risk	95% CI	p[b]
Number of depressive symptoms[c]		1.10	1.02–1.18	≤0.05	1.10	1.02–1.18	≤0.05
Age 18–44 years	Age ≥45 years	2.18	1.22–3.88	<0.01	2.20	1.23–3.92	<0.01
Marital status: separated	All others	1.30	0.87–1.96	n.s.	1.31	0.88–1.94	n.s.
Psychiatric disorder: antisocial personality	Antisocial personality disorder absent				1.26	1.00–1.60	≤0.05
Parental history: heavy drinking by father	History absent						

[a] For model 1b, χ^2=16.2, df=3, p<0.01; for model 2b, χ^2=19.7, df=4, p<0.001; for model 3b, χ^2=24.7, df=5, p<0.001; for model 4b, χ^2=23.4, df=4, p<0.001.
[b] Wald statistic, df=1 for each test.
[c] These are lifetime-experienced symptoms 0–16 from the DIS. The 17th symptom is defined as the presence of dysphoria for 2 or more weeks.

priate product terms into the regressions. If information was missing for a subject on a particular variable, that subject was excluded from calculation of the risk estimate for that variable but included for all others. Assumptions of the logistic regression model were checked by plotting diagnostic statistics (22). All tests for statistical significance were two-tailed. The final models were designed to provide statistical control of important confounders while estimating the association between depression and heavy alcohol use.

Results

Description of the Sample at Baseline

Of the 1,383 women in our sample, 88 (6.4%) reported a history of major depression, dysthymia, or depressive syndrome. The mean number of lifetime-experienced depressive symptoms for these women was 1.8 (range=0–10). The women with a history of depression tended to be younger than those with no history of depression and were more likely to be divorced, separated, or never married. Depressed women were also more likely to report a history of other psychiatric disorders and illicit drug disorders, as well as a parental history of heavy drinking and depressed mood.

Bivariate Analyses

Initial analyses revealed that for women who were diagnosed with major depression, depressive syndrome, or dysthymia at baseline, the estimated relative risk of heavy drinking at follow-up was 2.60 (95% confidence interval [CI]=1.19–5.68, Wald statistic=5.72, df=1, p=0.02) (Table 1). A higher number of reported lifetime-experienced depressive symptoms also was positively associated with greater risk of heavy alcohol use (estimated relative risk=1.12, 95% CI=1.04–1.19, Wald statistic=8.25, df=1, p=0.004). In separate bivariate analyses, age, marital and employment status, and specific current or lifetime mental disorders were associated with heavy drinking at follow-up (Table 1).

Multiple Logistic Regression

Results from the multiple logistic regression analyses are summarized in Table 2 (analysis with history of depressive disorders) and Table 3 (analysis with number of depressive symptoms). To begin the multiple regression analyses, terms for age, race, education, marital status, employment status, and, on the basis of previous research (23), an interaction term for race and education were entered into a logistic regression equation with heavy alcohol use as the dependent variable. Only age and marital status (specifically, being separated) were retained as significant predictors of heavy alcohol use.

After the introduction of the variables history of depressive disorder and number of depressive symptoms (in separate analyses, models 1a and 1b, respectively) into the

Model 3a			Model 4a		
Estimated Relative Risk	95% CI	p[b]	Estimated Relative Risk	95% CI	p[b]
2.16	0.97–4.80	≤0.05	2.22	1.00–4.92	≤0.05
2.29	1.28–4.09	<0.01	2.35	1.32–5.21	<0.01
1.32	0.88–1.97	n.s.			
1.29	1.02–2.70	≤0.05	1.29	1.02–1.63	≤0.05
1.13	1.04–1.24	<0.01	1.13	1.04–1.24	<0.01

Model 3b			Model 4b		
Estimated Relative Risk	95% CI	p[b]	Estimated Relative Risk	95% CI	p[b]
1.09	1.01–1.18	≤0.05	1.09	1.01–1.18	≤0.05
2.25	1.26–4.03	<0.01	2.31	1.29–4.12	<0.01
1.30	0.87–1.95	n.s.			
1.28	1.01–1.63	≤0.05	1.28	1.02–1.62	≤0.05
1.13	1.04–1.24	<0.01	1.13	1.04–1.24	<0.01

best-fitting model with sociodemographic characteristics, both depression variables were retained. At this stage in the analysis, the possibility of an interaction between depression and age was tested by forcibly entering product terms for age and depression in the models (data not shown). In both models, interaction estimates were not significant and failed to improve the model chi-square. These terms, therefore, were not included in either model.

From the analyses examining the influence of other mental disorders, only antisocial personality disorder was retained (models 2a and 2b). Estimates of risk associated with depression were essentially unaffected. On the basis of previous research (24), the interaction between depression and illicit drug disorders was examined by introducing a product term for these variables into the regression. The parameter estimate of this term was not statistically significant, and the interaction variable was not retained in the model.

After terms for parental mood and drinking were introduced into the analyses, only a history of father's heavy drinking was retained (models 3a and 3b). The estimate for depression was observed to decrease somewhat after this variable was added, although other estimates of risk in the model were largely unchanged.

The term for being separated was dropped from the final models because it failed to improve model fit (models 4a and 4b). Variables previously excluded from the models were then tested again for inclusion into the model; p values for Wald statistics were not statistically significant, and none of the terms improved the chi-square for model fit at $p<0.10$, so none were included. The final models (models 4a and 4b) included terms for depression as well as age, history of antisocial personality disorder, and father's history of heavy drinking as independent variables predicting heavy drinking at follow-up. Adjusted for the other characteristics in the final model, the estimated risk for women with major depression, depressive syndrome, and/or dysthymia was 2.22 greater than the risk for women without such a history (95% CI=1.00–4.92, Wald statistic=3.84, df=1, p=0.05). In other words, a history of depressive disorder was estimated to be associated with a more than two-fold increase in the likelihood of heavy drinking at follow-up. The adjusted relative risk associated with an incremental number of lifetime-experienced depressive symptoms was estimated to be 1.09 (95% CI= 1.01–1.18, Wald statistic=5.39, df=1, p=0.02). This is interpreted to indicate that, with other characteristics held constant, the likelihood of incident heavy drinking in women is estimated to increase by about 9% with each additional depressive symptom.

Discussion

There are several plausible interpretations of these findings. It is possible that the more depressive symptoms a woman is suffering from, the more compelled she may be to relieve these symptoms through drinking. Self-medication has been proposed as a mechanism for depression's influence on heavy alcohol use (9). This hypothesis is supported by research showing that drinking-related expectations affect drinking levels (25). Reports from patients with alcohol disorders note that those with comorbid depression believe drinking can provide relief of depressive symptoms, suggesting that alcohol is used to relieve dysphoric states (26). Unfortunately, this may turn into a vicious cycle for some, since experimental evidence has demonstrated that alcohol consumption relieves dysphoria over the short-term but not for longer periods (27). At some point, heavy alcohol consumption may aggravate depression by causing other problems for the drinker and may also intensify depressed states.

Alternatively, if an individual is depressed, she might not be as aware as she might otherwise be of matters concerning her health and safety, including alcohol consumption. In other words, the more distressing are the depressive symptoms that are experienced (which include, among others, feelings of worthlessness and loss of interest and pleasure in things usually cared about), the less conscious one might be of the quantity of alcohol consumed and about the impact of drinking on health, on the ability to function in society, and on the ability to carry out responsibilities. Depressive symptoms could contribute to

a greater potential for reckless or self-endangering behavior in the form of excessive drinking. Society tends to regard heavy drinking in women with less tolerance than in men, which may help to explain the lower frequency of heavy drinking among women. A woman with numerous depressive symptoms, however, is probably less sensitive to societal norms or may find herself less able to conform to them. Feelings of helplessness could contribute to a loss of control over drinking.

It should also be noted that the associations reported here do not necessarily indicate a causal mechanism. Depression and the tendency to drink heavily may be caused by a common factor in certain individuals. The present study attempted to control for confounders affecting both depression and alcohol use and looked at this relationship prospectively. However, there may be unidentified factors such as personality traits or poor social skills, either inherited or environmentally influenced, that underlie both conditions (9). As described in a study of female twins (28), there may be a genetic factor involved in a predisposition to both heavy alcohol use and depression that was not adequately controlled for by the parental history variables. More study of psychiatric genetics is needed for firm conclusions to be drawn regarding this possibility.

Antisocial personality disorder was found to be a significant factor in incident heavy drinking in both the bivariate and multivariate analyses. This disorder has been reported to be comorbid with alcohol disorders at high rates (8), especially in women (11). In the current study, antisocial personality disorder appears to precede and increase the likelihood of heavy episodic drinking in women, although the risk estimate decreased substantially when adjusted for other variables. A history of heavy drinking in a woman's father also conferred a low but significant risk of heavy alcohol use. The introduction of this variable into the multiple logistic regression model lowered the risk estimates for depression, suggesting that it may explain some of the association between depression and heavy alcohol use.

Although most studies tend to group divorced and separated women into the same marital status category, we categorized them separately. We found that women who reported being separated as their marital status appeared to be at greater risk for incident heavy alcohol use, an association that persisted after adjustment for age (but vanished after introduction of variables for depression, confirming that depression and being separated are strongly associated). In contrast, no significant association between being divorced and incident heavy drinking was found, either in the bivariate or multivariate analyses. It is possible that separation entails a different type of psychiatric distress due to the unresolved nature of the marital relationship, which might lead to heavy drinking among these women. However, it is noteworthy that 14 (11.3%) of the 124 women who reported being separated at baseline reported that their marital status had changed to divorced by the follow-up interview.

There are limitations to the present study that should be discussed. One limitation is the small number of incident heavy drinking cases (N=56) on which the analyses are based. As a result, the categorical (history of depression) analysis rests on a small number of incident cases of heavy drinking among the depressed subjects (N=8) and may need to be interpreted with caution. As mentioned at the start of this article, heavy drinking is generally uncommon in women and is significantly less common than in men; this may account for difficulty in studying heavy alcohol use in the general female population. Therefore, future investigators may wish to use larger sample sizes or use a lower threshold of number of drinks per episode to define heavy drinking in women, as some researchers (29) have recommended.

The number of women with antisocial personality disorder was small (N=8). Therefore, the findings regarding antisocial personality disorder should also be interpreted with caution. Antisocial personality disorder is not as common a mental disorder as depression, for example, and so the small number of cases in our sample are to be expected. Despite this problem, our statistically significant results pertaining to this disorder and heavy drinking are still in line with findings from other studies (8, 11).

A second limitation to our study is that the outcome measure of heavy alcohol use was based on self-report. Since subjects were asked about their drinking patterns of the previous month, it is probable that recall is less of a problem than it might have been for questions covering, for example, the past 6 months or year. However, it is possible that depression and other psychopathology affect self-report of heavy drinking. If depressed women are more likely to overreport heavy drinking, then the association may be overestimated. On the other hand, if depressed women are more likely to underreport heavy drinking than those without depression, this indicates that the association reported in this work is still valid and could be underestimated.

Another limitation concerns the fact that the measure of heavy alcohol use covered only the previous month. It is possible that a study subject had been using alcohol heavily just before the month preceding baseline and therefore was not truly at risk for incident heavy alcohol use. Similarly, it is possible that some subjects drank heavily during the follow-up interval but not during the month before the follow-up interview and thus were not classified as incident cases. Assessing drinking patterns during a longer time period could potentially address this problem, but issues related to valid recall would then become a greater concern. Additionally, in our study, the outcome measure was drinking heavily on one or more occasions. Future studies may wish to limit their outcome measure to more frequent episodes of heavy drinking or

examine heavy drinking in combination with other alcohol-related problems.

In previous analyses of the Baltimore ECA sample (30), parental history of depression and heavy drinking appeared to be associated with DSM-III alcohol disorders, but subjects with alcohol disorders also were less likely to provide family information. Analysis of our own sample revealed that women who were heavy drinkers at follow-up were more likely to have missing information regarding their father's history of heavy drinking than women who were not heavy drinkers at follow-up. If a majority of the fathers of those heavy drinkers with missing information actually had a positive history of alcohol problems, then the effect of parental history on a woman's heavy drinking at follow-up may have been underestimated.

Finally, the Baltimore ECA data did not contain sufficient information to allow an appropriate assessment of the influence of smoking, although previous research has suggested that depression may be linked to heavy and regular tobacco use or addiction (31, 32). In addition to the factors evaluated in this investigation, future research should examine disorders of legal substances other than alcohol (such as tobacco and caffeine) as potential confounders of the relationship between depression and alcohol use.

Notwithstanding these limitations, this study improves our understanding of the association between depression and alcohol use. The study uses data from a community-based sample, which avoids calculating risk estimates from a subset of the population that may have been preselected according to the nature and severity of their alcohol problems (e.g., a sample drawn from a treatment population). The study sample in the present examination was drawn from the general population without restriction to particular age, racial, or socioeconomic groups, suggesting that results are more widely applicable. Furthermore, the prospective epidemiologic design and study sample selection process permit conclusions to be made regarding the temporal nature of the relationship between depression and alcohol use in women.

An additional strength of this analysis involves the measures of depression, which included subjects who were diagnosed with depressive disorders based on DSM-III criteria (major depression and dysthymia), as well as those exhibiting a subclinical manifestation of depression (i.e., depressive syndrome). This ensured that the history of depressive disorder category did not leave out individuals who nearly missed strict criteria for major depressive episode, especially valuable since the DIS has been found to underascertain cases of major depression compared with clinical diagnosis (33). This also ensured a "cleaner" reference group. Symptoms from DSM-III were also examined, strengthening conclusions from the categorical analysis.

Finally, this investigation included other psychiatric disorders diagnosed according to DSM-III criteria, allowing the role of depression in alcohol abuse to be studied independently of other psychopathology. We also made an effort to control for parental history of both depressed mood and heavy drinking, important factors to consider in the relationship between depression and alcohol use.

In summary, we found that while age, history of antisocial personality, and report of heavy drinking in the participant's father were held constant, risk for heavy drinking was higher among women with a history of depressive disorder than among women with no history of depression. Risk for heavy drinking also rose with increasing reports of depressive symptoms. This type of research helps to elucidate the etiology of alcohol disorders in different segments of the population and thus could guide treatment approaches. It also has public health significance, since it may be possible to target preventive strategies to those at risk for harmful drinking behavior. Conclusions from this and future studies should help clarify theories regarding the evolution of alcohol disorders and may be applied to further the goals of effective prevention and treatment.

Presented at the 151st Annual Meeting of the American Psychiatric Association, Toronto, May 30–June 4, 1998. Received Dec. 14, 1998; revision received Aug. 9, 1999; accepted Nov. 18, 1999. From the Department of Epidemiology and the Department of Mental Hygiene, Johns Hopkins University School of Hygiene and Public Health; and the Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine. Address reprint requests to Dr. Crum, Welch Center for Prevention, Epidemiology, and Clinical Research, Johns Hopkins Medical Institutions, 2024 East Monument St., Suite 2-500, Baltimore, MD 21205-2223.

Supported by NIMH grant MH-47447. Dr. Crum was supported by Scientist Development Award for Clinicians AA-000168 from the National Institute on Alcohol Abuse and Alcoholism. Data gathering for the original surveys was supported by the NIMH Epidemiologic Catchment Area Program of the NIMH Division of Biometry and Epidemiology.

Acknowledgments

The principal investigators, coinvestigators, and grant award numbers during ECA data gathering were Jerome K. Myers, Myrna M. Weissman, and Gary L. Tischler at Yale University (MH-34224); Morton Kramer, Ernest Gruenberg, and Sam Shapiro at Johns Hopkins University (MH-33870); Lee N. Robins and John E. Helzer at Washington University (MH-33883); Dan Blazer and Linda George at Duke University (MH-35386); and Marvin Karno, Richard L. Hough, Javier I. Escobar, M. Audrey Burnam, and Dianne Timbers at the University of California, Los Angeles (MH-35865). At NIMH, principal collaborators during data gathering were Darrel A. Regier, Ben Z. Locke, William W. Eaton, Carl A. Taube, and Jack D. Burke, Jr.

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