

## PSYCHOSOCIAL PREDICTORS OF DEPRESSION

### PROSPECTIVE EVIDENCE FROM THE HUMAN POPULATION LABORATORY STUDIES

GEORGE A. KAPLAN,<sup>1</sup> ROBERT E. ROBERTS,<sup>2</sup> TERRY C. CAMACHO,<sup>1</sup> AND JAMES C. COYNE<sup>3</sup>

Kaplan, G. A. (Human Population Laboratory, California Dept. of Health Services, Berkeley, CA 94704), R. E. Roberts, T. C. Camacho, and J. C. Coyne. Psychosocial predictors of depression: prospective evidence from the Human Population Laboratory studies. *Am J Epidemiol* 1987;125:206-20.

The association between status attributes, personal resources, life stress, physical health, and occurrence of depressive symptoms nine years later was assessed by the 1965 Human Population Laboratory survey of a random sample of 6,928 adults in Alameda County, California, and by a subsequent follow-up survey in 1974. In multiple logistic analyses, depressive symptoms at baseline, low education, physical disability or presence of chronic conditions, poor perceived health, personal uncertainty, residential move, job loss, money problems, anomie, and social isolation were independently associated with increased risk of depressive symptoms at the nine-year follow-up. Age, low income, ethnicity, marital status, separation or divorce, and health practices at baseline were unrelated to depressive symptoms. These results underscore both the multifactorial nature of depression and the importance of prospective analyses of depressive phenomena.

#### depression; longitudinal studies

In this paper, we report results from a longitudinal study of the antecedents of high levels of depressive symptoms in an urban community. Our objective is to reexamine the epidemiology of depressive symptoms by using data from a large, community-based, prospective survey; by employing an analytic framework which includes many of the major psychosocial factors purported to increase the risk of depressive symptoms; and by using statistical procedures that permit simultaneous

examination of the relative contributions of these factors to this increased risk.

The choice of variables in our analyses is based on an emerging consensus that depressive phenomena are multifactorial in origin, almost certainly resulting from the lifelong interaction of biologic, psychologic, and socioenvironmental factors (1). In this report, we consider factors taken from four classes of psychosocial variables which have been examined in previous studies: status attributes, personal resources, life stress, and physical health. For example, status attributes such as age, sex, education, marital status, income, and ethnicity have been implicated as having etiologic significance (2-7). Personal resources or limitations reflected in other measures of psychologic state, coping, social support or social connections, and health behaviors have also been considered in previous studies (4, 8-10). Stress associated with acute

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<sup>1</sup> Human Population Laboratory, State of California, Department of Health Services, 2151 Berkeley Way, Annex 2, Room 211, Berkeley, CA 94704. (Reprint requests to Dr. George A. Kaplan.)

<sup>2</sup> University of Texas Medical School, Department of Psychiatry and Behavioral Sciences, 6431 Fannin, Houston, TX.

<sup>3</sup> Institute for Social Research, University of Michigan, Ann Arbor, MI.

events or chronic situations requiring adaptive changes are also thought to be important factors in the chain of events leading to depression (11-17). Finally, poor health or deleterious changes in health status are thought to be associated with heightened risk of depression (4, 6).

Varying amounts of consensus support the etiologic role of particular factors within these four classes of variables. Several recent reviews point out that the risk of depression is greater for women, for the young, for the poor, and for the separated or divorced (3-6). The cumulative evidence on the relationship of these status attributes to depression, however, is not as monolithic as much of the literature would suggest. There are a number of studies that do not come to these conclusions with respect to age (18), sex (19-25), marital status (7, 26), or ethnicity (21, 25).

The evidence with respect to life stress is also uneven. Two recent reviews summarize the results of about 12 community studies in which stressful life events of an acute nature are moderately correlated with elevated scores on self-report symptom checklists indicative of depressive symptomatology (4, 10). A number of other studies do not find evidence for such an association (16). Chronic stressors or life strains also have been examined, and the evidence is somewhat stronger for their role in the etiology of depression (15, 26-28). The possibility that depression might lead to higher levels of life stressors or influence the retrospective report of life events makes the interpretation of these mostly cross-sectional results difficult.

Although much attention has been paid to the relationship between the presence or absence of personal resources and risk of depression, little conclusive evidence is available (18). Personality as a risk factor for depression has been of considerable interest in the mental health field, but recent reviews of the epidemiology of depression suggest that little attention has been given to the relationship between personality and depression (4, 6). With a few exceptions

(15, 29, 30), there has also been little work on the relationship between coping and depression. Of particular significance is the lack of prospective data on the role of coping in the etiology of depression. Cross-sectional associations between coping and depression would not be surprising. Much more attention has been paid to the role of social connection and social support in the epidemiology of depression (10, 31, 32), and the evidence indicates an important role for such factors. It is not clear, however, if social support and social connections operate directly in their association with the risk of depression or if, instead, they operate indirectly as "buffers," protecting against the impact of other factors which would otherwise increase risk of depression. Again, the cross-sectional nature of most of the studies in this area calls for caution in interpretation of effects.

To clarify many of the above issues, we present results from a longitudinal study of the psychosocial antecedents of high levels of depressive symptoms in an urban community. The data are from a prospective study of a large, representative sample of Alameda County, California, residents first surveyed in 1965 by the Human Population Laboratory of the California Department of Health Services.

## MATERIALS AND METHODS

### *Study population*

The data in this report come from ongoing studies conducted by the Human Population Laboratory in Alameda County, California. In 1965, 8,023 noninstitutionalized adults (aged 20 years and over, or 16 years and over if ever married) in 4,452 housing units were selected on the basis of a stratified systematic sample of Alameda County housing units. The sampling procedures are discussed in greater detail in Hochstim (33) and Berkman and Breslow (34). Completed questionnaires were received from 6,928 (86 per cent) of the respondents. When compared with respondents, the nonrespondent group contained

more older people, males, whites, and single or widowed persons. This original group of 6,928 persons included 3,158 men and 3,770 women, aged 16-94 years.

In 1974, an attempt was made to recontact those who responded in 1965. Vital status of the 1965 respondents was ascertained by means of a computerized record linkage to the state of California's registry of deaths and through attempted contacts with the respondents or references previously supplied by them. Only 302 (4.4 per cent) of the original panel members were lost to follow-up over this nine-year period. After these previous respondents were located, questionnaires were placed with them, personally or by mail, depending on location, and vigorous efforts to maximize response were followed (34). Completed questionnaires were received from 4,864 (85.1 per cent) of the 5,714 surviving respondents who were located.

Further information on the tracing, mortality ascertainment, and differences between panel members who participated in 1965-1974 and those who participated only in 1965 is presented in Belloc and Arellano (35), Wiley and Camacho (36), and Berkman and Breslow (34). For purposes of the present analysis, the population at risk varies from 6,871 to 3,769, depending on whether the analyses refer to the 1965-only group, the 1965-1974 panel, and inclusion or exclusion of depressed persons at baseline.

### Measures

*Depressive symptoms.* The measure of depressive symptoms used here has been utilized in several other studies (37, 38) (table 1). It was constructed in the following manner: A set of 40 items ostensibly relating to depression was selected from a larger pool of questionnaire items dealing with varied aspects of psychologic distress. That is, items were selected dealing with mood disturbance, negative self-concept, loss of energy, problems with eating and sleeping, trouble with concentration, and psychomotor retardation or agitation (39). A fur-

ther criterion for selection was that the items be contained in both the 1965 and 1974 questionnaires. These 40 items then were rated independently by 10 clinical researchers (psychiatrists and psychologists) in terms of their presumed usefulness in ascertaining whether a subject was depressed. From their ratings, half of the items were eliminated. The homogeneity of the remaining set of items was assessed by item-total correlations and measures of internal consistency reliability (40). From these results, two of the 20 items were eliminated. A score is generated by assigning one point for each true or false answer which is indicative of a "depressed" response and for each "often" or "never" response (whichever is appropriate). The remaining 18 items (see table 1) have item-total correlations ranging from 0.18 to 0.45 and acceptable internal consistency reliability. Coefficient alpha was 0.77 for the total sample, 0.75 for males, and 0.77 for females. Reliabilities using the Spearman-Brown split-half procedure were 0.77 for the total sample, 0.74 for males, and 0.79 for females (37). For our purposes, a high level of depressive symptoms is classified as a total symptom score 1 standard deviation or more above the mean depression

TABLE 1  
*Items in Human Population Laboratory depression index (37, 38)*

Felt depressed or very unhappy
Appetite poor
Trouble getting to sleep or staying asleep
Felt lonely or remote from other people
Felt on top of the world
Felt too tired even to do things I enjoy
Little enjoyment from leisure time
Less energy than other people
Felt pleased about accomplishing something
Felt bored
Felt so restless, could not sit still long
Felt left out, even in a group
Felt excited or interested in something
Hard to feel close to others
Never satisfied with performance
Cannot relax easily
Bothered by getting tired in a short time
Felt vaguely uneasy without knowing why

score for the total sample, in this case, five symptoms or more.

Comparison of these 18 items with those contained in other brief symptom checklists such as the Langner 22-item index (41), the Center for Epidemiologic Studies Depression Scale (42), the Health Opinion Survey (43), and the Symptom Check List—90 (44) suggests that these various measures can be considered conceptually equivalent. Indeed, most such symptom checklists probably tap a common underlying dimension and, as a result, can be expected to correlate about as highly as their reliabilities permit (5). In fact, our own research indicates that the Human Population Laboratory 18-item index is correlated 0.66 with the Beck Depression Inventory (45) in an outpatient clinical population. This correlation is about as high as can be expected based on the reliability of these two instruments.

*Independent variables.* Seventeen variables are included in this analysis based on previous studies indicating their significance in the etiology of depressive symptoms or their importance as potential confounders. These variables fall conceptually into the four domains discussed earlier: status attributes, represented by age, sex, education, income, ethnicity, and marital status; personal resources, measured by anxiety, personal uncertainty, social isolation, and health behaviors such as smoking, alcohol consumption, leisure time physical activity, relative weight, and usual sleep patterns; life stress, measured by death of a spouse, loss of a job, residential move, money problems, and divorce or separation; and physical health, represented by reports of perceived level of health as well as by reported presence of particular conditions, symptoms, and ailments. A complete list of these variables and their measurement and scoring is presented in table 2.

#### *Analyses*

Our analysis of the 1965 factors associated with depressive symptoms in 1974 pro-

ceeded in several ways. First, we examined the simple relationships between age, sex, and ethnicity and the prevalence of high levels of depressive symptoms in 1965 in both the total sample of 1965 respondents and in the group who were both 1965 and 1974 respondents. Although our interest was primarily in the factors that predicted the presence of depressive symptoms in 1974 in those not classified as depressed in 1965, these first analyses were necessary to establish the comparability between our data and other reports. We then moved to multivariate analyses of the contribution of various independent variables to the prediction of new cases in 1974. These analyses were carried out using multiple logistic regression techniques (46). The multiple logistic model allowed us to examine the independent contribution of particular variables in 1965 to the prediction of high levels of depressive symptoms in 1974, while controlling for other variables. Using this model, we first examined the association between age, ethnicity, sex, income, education, perceived health, and physical health status and high levels of depressive symptoms in 1974 in a model simultaneously containing these seven predictors. Then, the association of each of the remaining variables with high levels of depressive symptoms was considered with simultaneous adjustment for the seven variables previously considered. A final model was utilized in which the variables that were significantly ( $p < 0.05$ ) associated with high levels of depressive symptoms were simultaneously considered with the first seven.

## RESULTS

### *Prevalence*

The prevalence of high levels of self-reported depression (per 100) for the total sample of 1965 respondents ( $n = 6,871$ ) is presented in table 3. The age-adjusted rates show that the highest prevalence rates are for black females, followed by nonblack females, black males, and nonblack males.

TABLE 2  
Measures in analysis

Variable	Category	Remarks
Depressive symptoms	0 = Noncase 1 = Case (1 standard deviation above mean)	Roberts and O'Keefe (37); Roberts (38)
Status attributes		
Age (years)	0 = 16-39* 1 = 40-59 2 = ≥60	
Sex	0 = Male 1 = Female	
Education (years)	0 = 0-8 1 = 9-12 2 = >12*	
Income	0 = Adequate and very adequate*  1 = Marginal 2 = Inadequate	1965 family income adjusted for family size (33)
Ethnicity	0 = Nonblack 1 = Black	
Social resources		
Marital status	0 = Married* 1 = Single 2 = Previously married	
Social network participation	0 = Not isolated 1 = Isolated	Based on extent and frequency of contact with friends and relatives (72). Isolated responses (0-2 contacts) on at least two of three questions
Psychologic resources		
Anomy	0 = Low (0-4) 1 = High (5-9)	Based on McClosky and Schaar (50) and Berkman (19)
Personal uncertainty	0 = Low (7-11) 1 = High (12-14)	Based on Berkman and Breslow's factor analysis of Human Population Laboratory items (34)
Physical health status		
Physical health spectrum	1 = Disability 2 = Chronic conditions 3 = Symptoms 4 = No problems*	} Based on self-reports (73)
Perceived health	1 = Excellent 2 = Good 3 = Fair 4 = Poor	
Stressors		
Death of spouse	0 = No 1 = Yes	} Presence in 1965-1974
Separation/divorce	0 = No 1 = Yes	
Residential move	0 = No 1 = Yes	
Job loss	0 = No 1 = Yes	
Money problems	0 = No 1 = Yes	
Health practices index		
Smoking history	0 = Ever 1 = Never	} Based on Kaplan and Camacho (48) 0 = 3-5 practices 1 = 0-2 practices
Weight	0 = Extreme overweight or underweight 1 = Moderate weight	
Leisure time physical activity	0 = Inactive 1 = Active	
Alcohol consumption	0 = Moderate 1 = Heavy or none	
Sleeping patterns	0 = Other 1 = 7-8 hours usually	

\* Reference category.

Females are at 1.50 greater risk of reporting high levels of depressive symptoms than are males ( $p < 0.0001$ ), and blacks are at 1.28 times the risk of nonblacks ( $p < 0.01$ ).

Because our prospective analyses of the factors associated with 1974 depressive symptoms are by necessity restricted to those who responded both in 1965 and 1974, it is important to compare the total sample of 1965 respondents with this subsample. The prevalence of high levels of depressive symptoms in 1965 for this restricted sample of 4,864 respondents is presented in table 4. The age-adjusted rates show the same pattern of rates as for the total sample. The highest rate is for black females followed by nonblack females, black males, and non-black males. Blacks are at 1.37 times the risk of having high levels of depressive symptoms as are nonblacks ( $p < 0.025$ ), and females are at 1.67 the risk of males ( $p < 0.001$ ).

*Prediction of depressive symptoms in 1974*

Table 5 presents the first multivariate analysis in which we examined the ability

TABLE 3

*Prevalence of depression in 6,871 Alameda County adults, 1965: 1965 respondents (cases/100)*

Age (years)	Males		Females	
	Blacks	Nonblacks	Blacks	Nonblacks
16-39	14.8	9.9	19.3	15.6
40-59	12.2	13.3	15.1	15.5
≥60	28.6	16.0	22.1	26.7
Age-adjusted rate	16.3	12.3	18.2	17.6

TABLE 4

*Prevalence of depression in 4,864 Alameda County residents, 1965: respondents in 1965 and 1974 (cases/100)*

Age (years)	Males		Females	
	Blacks	Nonblacks	Blacks	Nonblacks
16-39	14.5	7.8	21.6	13.4
40-59	11.6	10.6	14.3	15.4
≥60	20.0	10.6	25.8	17.2
Age-adjusted rate	14.1	9.2	19.2	14.7

TABLE 5

*Prediction of high levels of depressive symptoms in nine-year (1965-1974) follow-up of Alameda County residents: multiple logistic analyses*

Variable	Approximate relative risk	95% confidence interval
Age (years)		
16-39	1.00	
40-59	0.75	0.61-0.92
≥60	0.56	0.37-0.85
Sex		
Male	1.00	
Female	1.18	0.96-1.46
Education		
High	1.00	
Medium	1.53	1.16-2.02
Low	1.86	1.36-2.55
Income		
Adequate and very adequate	1.00	
Marginal	1.20	0.90-1.60
Inadequate	1.46	1.24-1.72
Ethnicity		
Nonblack	1.00	
Black	1.18	0.90-1.56
Baseline physical health		
No problems	1.00	
Disabled (no/yes)	3.19	2.19-4.64
Chronic conditions (one or more)	1.62	1.20-2.19
Symptoms (one or more)	2.36	1.06-1.90
Perceived health (poor/excellent)	3.50	2.01-6.10
Plus (entered one at a time)*		
Marital status		
Married	1.00	
Single	1.04	0.71-1.52
Previously married	1.22	0.88-1.69
Personal uncertainty (no/yes)	2.20	1.76-2.74
Anomy (no/yes)	1.60	1.19-2.16
Acute events		
Separation/divorce (no/yes)	1.37	1.01-1.85
Residential move (no/yes)	1.45	1.16-1.82
Loss of job (no/yes)	1.78	1.30-2.43
Death of spouse (no/yes)	1.57	1.03-2.38
Money problems (no/yes)	1.45	1.07-1.96
Social isolation (no/yes)	2.80	2.06-3.81
Health practices (3-5/0-2 practices)	1.30	0.84-1.45

\* When there is simultaneous adjustment for age, sex, education, income, ethnicity, and physical health status.

of various measures to predict high levels of depressive symptoms in 1974. In this analysis, we excluded all respondents who in 1965 were classified as having a high level of depressive symptoms ( $n = 3,977$ ). In subsequent analyses of this subgroup, there were small changes in the total number at risk, depending on missing data for

the particular variables included. As described earlier, we first examined the simultaneous contribution of age, sex, education, income, ethnicity, and physical health to the prediction of high levels of depressive symptoms in 1974. Table 5 shows the results of such an analysis. The approximate relative risk associated with each variable represents the increased risk of being classified as having high levels of depressive symptoms associated with moving from one category of that variable to the next. For multicategorical variables, dummy variables were constructed which represent the increased risk associated with the specified category compared with the reference category indicated in table 2.

Several striking results appear in table 5. By far, the strongest predictors of high levels of depressive symptoms are those variables associated with physical health problems. Respondents who reported some disability in 1965 and who did not have high levels of depressive symptoms at that time had over a threefold risk of reporting high levels of depressive symptoms at the nine-year follow-up period compared with those who reported no health problems in 1965. The same pattern of increased risk also was associated, at a reduced but significant level, with other health problems such as the presence of self-reported chronic conditions or symptoms. Similarly, those who reported "poor" perceived health were at 3.5 times the risk at follow-up when compared with those who reported "excellent" health, even when simultaneous adjustment for the other measures of physical health status was carried out. Although these measures of physical health status are based on self-reports, other analyses (47-49) have shown them to be strongly related to subsequent mortality, thus confirming their validity as measures of health status.

The age- sex- and ethnicity-specific prevalence rates of high levels of depressive symptoms in tables 3 and 4 showed highest rates for those who were oldest. However, our multivariate analyses of those who had

high levels of depressive symptoms in 1974 but not in 1965 present a different picture. When there is control for sex, education, income, ethnicity, and physical health status, increasing age is significantly associated with decreased risk in the follow-up period. Thus, those 60 years or older are actually at 0.56 (95 per cent confidence interval 0.37-0.85) the risk of those 16-39 years.

The results in table 5 also show the strong influence of education and income. Respondents with low education (0-8 years) or medium education (9-11 years) are at increased risk when compared with those who have 12 years or more of education. Similarly, inadequate income based on family income adjusted for family size and compared with governmental standards for 1965 is associated with an increased risk of high levels of depressive symptoms over the nine-year period.

The results in table 5 do not confirm the associations shown earlier between either sex or ethnicity and risk of high levels of depressive symptoms. Females who did not report high levels of depressive symptoms in 1965 are not at significantly increased risk compared with males of developing high levels of depressive symptoms in 1974, nor are blacks when compared with non-blacks. This latter result persists in other analyses when we use three ethnicity categories: black, white, and other (including Hispanics). These findings (also discussed below) demonstrate the importance of controlling for other status attributes and physical health status when examining the association between sex or ethnicity and depressive symptoms.

Table 5 shows the results for the other variables being considered when there is simultaneous adjustment for age, sex, education, income, ethnicity, and physical health status. Social isolation at baseline exerts a strong influence on the presence in 1974 of high levels of depressive symptoms. Those who did not report high levels of depressive symptoms in 1965 but were classified as socially isolated based on their

responses to questions about extent and frequency of contacts with others were at an almost threefold risk of reporting high levels of depressive symptoms in 1974 when compared with those who were not classified as socially isolated in 1965. Similarly, those scoring 1 standard deviation or more above the mean on the measure of personal uncertainty (34) were also at substantially increased risk. High numbers of anomic responses (50) were also associated with a significantly increased risk, although at a lower level.

The reported presence of various stressors such as separation/divorce, residential move, loss of a job, death of a spouse, or money problems was also associated with increased risk of high levels of depressive symptoms in 1974 for those who did not so report in 1965. Examination of the 95 per cent confidence intervals for these items, however, shows that the lower boundaries of the intervals are extremely close to 1.0, except for the risk associated with loss of a job. Neither variations in marital status nor the practice of low numbers of health practices is associated with any increased risk.

In the analyses presented in table 5, we examined the influence on the occurrence of depressive symptoms in 1974 of a number of variables, taken one at a time, with simultaneous adjustment for age, sex, education, income, ethnicity, and physical health status. This was done to give us some idea of the nature of the association between these items and the outcome with controls for important variables and also to avoid some of the problems associated with collinearity which arise with large numbers of intercorrelated variables. It is, however, of some interest to examine a model that includes all these variables and thus simultaneously adjusts for each. Table 6(a) presents the results of such an attempt. Generally speaking, the pattern of results is very much the same. Age, low education, presence of disability or chronic conditions, poor perceived health, social isolation, residential move, loss of job, money problems, personal uncertainty, and anomy continue

to be significantly associated with increased risk. Sex, ethnicity, health practices, and marital status continue to have no significant association with this outcome. The role of inadequate income is diminished, possibly reflecting the strong association between measures of inadequate income and other variables such as acute stressors. Finally, the association between depressive outcome and separation/divorce or death of a spouse is no longer significant.

In the previous multiple logistic analyses, we controlled for the presence of former high levels of depressive symptoms by the exclusion of those with high levels in 1965. To examine the impact of this exclusion, we present in table 6(b) the results of another analysis in which the baseline group ( $n = 4,291$ ) includes those previously excluded and in which 1965 depressive status is included as an independent variable. The results in table 6(b) show, perhaps not surprisingly, that the strongest predictor of a high level of depressive symptoms in 1974 is a high level in 1965. Those with high levels in 1965 were at a fourfold risk of reporting high levels in 1974 when compared with those who were not so classified in 1965. Virtually the same pattern of results emerges from this analysis as from the previous ones. What is most important is that the pattern of results is quite similar whether or not we include those with high levels of depressive symptoms at baseline and control statistically for baseline status.

To examine further the discrepancy between the cross-sectional and prospective analyses, we examined the 1965 prevalence of high levels of depressive symptoms in a multiple logistic analysis. This analysis is based on the group of respondents for whom both 1965 and 1974 data were available ( $n = 4,839$ ; 614 cases). When the only variables in the model are those associated with age, sex, and ethnicity, the obtained results are virtually identical to those from the age-adjusted rates presented earlier. Females are at 1.67 (95 per cent confidence interval 1.40-1.99) the risk of males, and



TABLE 6

Prediction of new cases of depression in nine-year (1965-1974) follow-up of Alameda County residents: multiple logistic model with all variables included\*

Variable	Model a		Model b	
	Approximate relative risk	95% confidence interval	Approximate relative risk	95% confidence interval
Case in 1965			4.10	3.23-5.19
Age (years)				
16-39	1.00		1.00	
40-59	0.72	0.55-0.95	0.88	0.70-1.11
≥60	0.91	0.60-1.36	1.06	0.75-1.50
Sex				
Male	1.00		1.00	
Female	1.09	0.87-1.37	1.15	0.94-1.40
Education				
High	1.00		1.00	
Medium	1.07	0.80-1.42	1.08	0.85-1.39
Low	1.59	1.17-2.16	1.60	1.23-2.07
Income				
Adequate or better	1.00		1.00	
Marginal	0.97	0.71-1.33	0.92	0.70-1.22
Inadequate	1.17	0.82-1.67	1.08	0.79-1.47
Ethnicity				
Nonblack	1.00		1.00	
Black	1.21	0.85-1.73	1.02	0.75-1.40
Baseline health				
No problems	1.00		1.00	
Disabled	3.00	2.01-4.48	2.60	1.84-3.67
Chronic conditions	1.56	1.13-2.15	1.42	1.07-1.89
Symptoms	1.31	0.96-1.78	1.27	0.96-1.67
Perceived health (poor/excellent)	2.80	2.31-3.39	2.44	2.08-2.86
Marital status				
Married	1.00		1.00	
Single	0.95	0.64-1.41	1.07	0.76-1.49
Previously married	1.12	0.79-1.59	1.12	0.83-1.51
Personal uncertainty	1.81	1.42-2.30	1.71	1.39-2.10
Anomy	1.35	1.04-1.74	1.29	1.04-1.59
Acute events				
Separation/divorce	0.94	0.67-1.30	0.98	0.74-1.29
Residential move	1.28	1.01-1.62	1.21	0.99-1.49
Loss of job	1.47	1.07-2.04	1.42	1.07-1.88
Death of spouse	1.46	0.95-2.26	1.51	1.03-2.21
Money problems	2.02	1.53-2.67	2.07	1.64-2.63
Social isolation	2.63	1.94-3.58	2.08	1.61-2.69
Health practices	1.11	0.85-1.47	1.08	0.86-1.36

\* Both models a and b include simultaneous adjustment for all variables. Model a excludes those persons with high levels of depressive symptoms in 1965, and model b includes them.

blacks are at 1.39 (95 per cent confidence interval 1.07-1.80) the risk of nonblacks. Thus, the discrepancies between the earlier prevalence results and the results for prediction of symptom level in 1974 are not due to the use of different analytic techniques. They are most likely due to either

the presence of other covariates or a basic difference in the cross-sectional association between these 1965 variables and prevalence in 1965 and the prospective association between these 1965 variables and depressive symptoms in 1974. To examine this further, we added the same covariates

included in table 6 to the multiple logistic analysis of the 1965 prevalence data ( $n = 4,437$ ; 552 cases). The increased risk for females is maintained in this analysis, their being at 1.33 the risk of males (95 per cent confidence interval 1.07–1.66), a value somewhat lower than the previous result. For blacks compared with nonblacks, there is a striking change—they are at a significantly decreased risk (relative risk = 0.68; 95 per cent confidence interval 0.47–0.99). This reversal, with the addition of other covariates, has been reported in other studies (28).

### DISCUSSION

The results presented above underscore the multifactorial origins of depressive symptoms, with status attributes, personal resources, life stress, and physical health contributing significantly to the risk of high levels of symptoms at the nine-year follow-up. High symptom level in 1965 was the most powerful predictor of high symptom level in 1974. Other investigators also have reported results congruent with this finding (51, 52). A number of other variables are strongly associated with 1974 status. Physical health problems represented by either poor perceived health or the presence of disabilities or chronic conditions add substantially to the risk of high levels of depressive symptoms in 1974 whether or not the respondents reported high levels at baseline. Our results on physical health problems as a risk factor are congruent with evidence from a wide variety of studies, which suggest that an increased risk of depression is associated with a variety of other medical and psychiatric disorders (53). One explanation for this association is that depression probably represents a nonspecific affective response to the complex physical and psychologic stresses imposed by serious health problems (54).

The relationship between status attributes and risk is uneven. Low education in 1965 is significantly associated with symptom status in 1974 in all analyses, and this

association remains unchanged whether those with high symptoms in 1965 are included or excluded in the logistic models. Comparison of tables 5 and 6 shows that the heightened risk associated with low education is not changed appreciably when there is adjustment for other psychosocial factors. Thus, the increased risk associated with low education is not due to confounding effects from these other factors. The pattern of results is not the same for the increased risk associated with low income. Table 5 shows that those whose income, adjusted for family size, was judged inadequate in 1965 are at significantly increased risk of high levels of depressive symptoms in 1974. When there is adjustment for other psychosocial factors, one at a time, there is no appreciable change in the risk associated with inadequate income. Inspection of table 6, however, shows that this association between inadequate income and risk of depressive symptoms becomes nonsignificant when there is simultaneous adjustment for a wide range of psychosocial variables. A possible interpretation of this pattern of results is that high levels of personal uncertainty, anomie, social isolation, and high frequency of negative life events represent one of the pathways by which inadequate income exerts its impact on depressive status. That these factors do not entirely eliminate the increased risk associated with inadequate income when they are included one at a time in the logistic model may imply that there is an ecologic clustering of these variables that, taken as a set, represents the consequences of inadequate income over time.

The absence of sex and ethnicity effects would at first seem to be counter to prevailing wisdom; however, as pointed out earlier, there is a considerable amount of data that are consistent with the results found here. Similarly, we find that increasing age is associated with decreased risk of high levels of depressive symptoms. In understanding this result, as well as the results for sex and ethnicity, it is well to keep in mind that these analyses involve adjust-

ment for a substantial number of covariables. In studies in which there is no opportunity to assess the impact of a broad range of psychosocial variables, researchers may mistakenly attribute the increased risk associated with these variables to sex, ethnicity, or age effects.

Personal resources represent a strong predictor of high levels of depressive symptoms in these analyses. Those who are socially isolated are at substantially increased risk in all the analyses that were carried out. That this increased risk operates even when there is adjustment for psychologic measures and for the presence of acute and chronic stressors would support the argument for a direct rather than a buffering role for social support or connections. This conclusion, however, should be tempered by the methodological difficulties involved in the simultaneous assessment of measures in these areas (55). Personal uncertainty, a variable that is conceptually related to "coherence" (56), "hardiness" (57), and various measures of predictability and control (58), also is strongly associated with risk of high levels of depressive symptoms. We have argued elsewhere (47) that this factor represents a measure of coping. Presumably, individuals who see the world as incoherent and unpredictable and feel helpless and uncertain are less able to mobilize personal or social resources to cope with new demands. That the increased risk of depression associated with personal uncertainty remains even when there is adjustment for social isolation suggests a lack of internal resources rather than resources derived from associations with other people. Although we do not have data to confirm this interpretation, it is reasonable to suggest that individuals who score high on this variable would tend to appraise more situations as threatening and be less successful at mobilizing internal resources to deal with these perceived threats.

Life stress, represented by both acute and chronic strain, represents an additional factor significantly associated with risk of high levels of depressive symptoms. The strong-

est effect is seen when considering job loss and money problems, and it is noteworthy that this association is significant even when there is adjustment for income level. In general, the pattern of results associated with the other life events is variable, with rather weak effects which disappear in some analyses. Because these life events were retrospectively reported in 1974 for each year since 1965, it is possible that either retrospective biases in recall or influences of depressive status in 1974 on these reports may account for the generally weak finding for separation/divorce. On the other hand, these results may simply parallel other reports that found weak associations of life events with other outcomes (59).

One limitation to the current study is that we relied on self-reported symptoms of depression rather than on formal diagnosis based on a structured psychiatric interview. Clearly, the ideal study would include screening of a large population sample with a self-report measure of depression, to be followed up with a structured clinical interview. The significance of self-reported depressive symptomatology, however, should not be underestimated. High levels of such symptoms are extremely prevalent in a community sample (point prevalence estimates are in the general range of 20-25 per cent), and they are associated with considerable suffering. Self-reported symptoms are related to clinical depression and, as demonstrated by their ability to predict depressive symptomatology scores nine years later in the present study, must represent something more than a transient mood disturbance with no lasting implications. In the present study, risk of high levels of depressive symptoms in 1974 was monotonically related to the number of depressive symptoms reported in 1965. Link and Dohrenwend (5) suggest that about half of those who score high on a self-report measure of depression are clinically impaired. Other data suggest a relationship between self-reported symptoms and clinical diagnosis (60, 61). We, how-

ever, have an insufficient understanding of the relationship between self-report measures and the clinical syndrome of depression. Is impairment, as measured by elevated scores on a self-report measure, predictive of vulnerability to the clinical syndrome? That is, to what extent can self-reported symptoms be considered as pre-clinical or subclinical manifestations of the clinical syndrome and thus as risk factors for the more serious affective disorders? Indeed, there is some evidence that previous episodes of minor depression may complicate the course of later major depressive episodes (62).

Another limitation of the current study stems from the remittent nature of depression. Like symptoms of many other diseases, depressive symptoms come and go. In the present analyses, we have information on depressive symptoms at only two points in time, separated by nine years, and we do not know about changes in depressive state during the interim period. Thus, we are unclear about the pattern of relapse and recovery experienced during the follow-up period. Our data reveal that, over nine years, 78.3 per cent of the respondents never reported high levels of depressive symptoms, 6.4 per cent reported them at both times, 6.1 per cent reported them only in 1965, and 9.4 per cent only in 1974. A striking indication of the chronicity of high levels of depressive symptoms is that 51 per cent of those who reported high levels in 1965 reported similarly in 1974.

Consideration of the temporal nature of depressive symptoms raises a number of methodological issues that are applicable to other remittent conditions such as rheumatoid arthritis, peptic ulcer, hypertension, and migraine. Investigators (63-65) have suggested that analyses might be directed to the proportion of total observation time spent in a particular diseased state. These analyses, however, generally assume that successive episodes of disease are independent. With respect to depression, this is not a defensible assumption. In clinical populations, the probability of another episode

occurring, its length, and severity are influenced by previous episodes (51, 66, 67). In addition, such approaches cannot distinguish between individuals who spend an identical proportion of the time depressed but who differ in the length and number of episodes. The consequences of numerous short episodes of depression are likely to be considerably different from those associated with one long episode, even if the total proportion of the observation period spent in the depressed state is the same.

There is a need for community-based epidemiologic studies that assess depressive state periodically to identify the natural history of the disease and the factors, both biologic and psychosocial, that are associated with increased probability of relapse or recovery and the length and severity of depressive episodes. Such studies will need to consider the nonrepresentativeness of cases identified at various points in time stemming from length-biased sampling (68), which in this case would be associated with the proportion of the time in the observation interval that an individual is depressed. Extensions of the procedures proposed by Walter and Day (68) and by Begg and Larson (69) may prove useful in such analyses. Within the context of the present study, we are not able to say whether the predictive factors operate via influences on incidence, duration of episode, or probability of relapse/recovery. The substantial predictive role played by physical health and psychosocial factors in the present analyses is consistent with their potential role in influencing all three. Inclusion of those with high levels of depressive symptoms at baseline, however, did not lead to appreciable changes in the factors associated with subsequent risk of high levels of symptoms, which may indicate that the impact is largely through severity-related pathways. Those with inadequate income, poor health, or who are socially isolated may not have access to resources that would ameliorate their depressed state, leading to greater duration of depression. Similarly, it is reasonable to speculate that

the same lack of resources or presence of limitations might influence relapse rates.

Another limitation of the present research is that it does not examine biologic risk factors or family history of depressive disorders (1, 70, 71). Variables from both of these domains are implicated in the etiology and course of depression. Unfortunately, the Human Population Laboratory studies did not collect data on these questions. In fact, there have been no large-scale, community-based, epidemiologic surveys that have incorporated measures of biologic risk factors and very few that have systematically assessed family history of psychiatric disorders. Clearly, this is one direction future research should take.

In summary, psychosocial factors and physical health problems appear to be major and powerful predictors of high levels of depressive symptoms. It is of some importance that the increased risk of high levels of depressive symptoms associated with immutable characteristics such as sex and ethnicity appears to be due in large part to characteristics of the psychosocial environment that are associated with sex or ethnicity.

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