Psychosocial Predictors of Hypertension in Men and Women

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Background: Psychosocial stressors have been shown to predict hypertension in several cohort studies; patterns of importance, sex differences, and interactions with standard risk factors have not been fully characterized.

Methods: Among 2357 adults in a population sample of Alameda County, California, free of hypertension in 1974, 637 reported in 1994 having ever used antihypertensive medication (27.9% of the men and 26.3% of the women). The effects of baseline psychosocial, behavioral, and sociodemographic factors on the incidence of treated hypertension were examined using multiple logistic regression.

Results: Low education, African American race, low occupational prestige, worry about job stability, feeling less than very good at one's job, social alienation, and depressive symptoms each had significant (P < .05) age-adjusted associations with incident hypertension. Associations were weakened by adjustment for body mass index, alcohol consumption, smoking status, and leisure time physical activity, especially the associations of anomy and depression, which persisted in women but not in men. In multivariate models, job insecurity (odds ratio, 1.6), unemployment (odds ratio, 2.7), and low self-reported job performance (odds ratio, 2.1) remained independent predictors of hypertension in men, whereas low-status work (odds ratio, 1.3) was an independent predictor of hypertension in women.

Conclusions: In the general population, low occupational status and performance and the threat or reality of unemployment increase the likelihood of developing hypertension, especially among men, independent of demographic and behavioral risk factors. Psychological distress and social alienation may also increase hypertension incidence, especially in women, chiefly through an association with health risk behaviors.

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LABORATORY STRESSORS and real-life difficulties such as job strain1,2 and job dissatisfaction3 can lead to elevations in blood pressure, and stress or distress have been reported in some4-7 but not all8 cohorts to predict the subsequent incidence of sustained hypertension. However, the relative importance of various types of psychosocial factors in the general population remains largely undefined; sex differences in patterns of predictors have been little studied; and interactions with standard hypertension risk factors have not been fully characterized.

The Alameda County Study, a longitudinal investigation of behavioral, social, psychological, and economic influences on health, provided the opportunity to examine the effects of a variety of psychosocial factors on the development of hypertension in men and women in the general population over many years of follow-up. The breadth of the information available on these subjects also permitted evaluation of the confounding and mediating roles of most known sociodemographic and behavioral risk factors for hypertension.

RESULTS

Of the 2357 respondents to the 1974 survey who provided information regarding hypertension on the 1994 questionnaire, 637 (27.1%) reported having ever taken prescription medications for hypertension, 349 (26.3%) of 1326 women and 288 (27.9%) of 1031 men. All the psychosocial factors studied, except unemployment, were significant predictors of incident hypertension in age-adjusted analyses for the entire population. In sex-specific analyses, unemployment, worry about losing one's job, and feeling less than very good at doing one's job were predictors only in men; anomy and depressive symp-
PARTICIPANTS AND METHODS

At its first survey in 1965, the Alameda County Study distributed 8038 questionnaires to a stratified random sample of the adult inhabitants of a single county in California and obtained completed questionnaires from 6928 individuals (3158 men and 3770 women). In 1974, 4864 of these panel members completed a similar second questionnaire (85% of located respondents), of whom 2730 (93% of located respondents, 79% of the subjects not known to be dead) completed a third questionnaire in 1994. Details of sampling and follow-up methods have been reported elsewhere.9

In the 1960s, hypertension was diagnosed in relatively few Americans,10 but by the early 1970s, the number of Americans receiving antihypertensive treatment had doubled,11 meaning that a higher proportion of what we would now consider the hypertensive population was receiving treatment. Because underdiagnosis is more widespread among minority groups,11,12 this shift could lead to artifactual associations of hypertension incidence between 1965 and 1974 with race or socioeconomic status. Hypertension incidence is therefore analyzed herein for the 1974-1994 period, when the problem of differential ascertainment is expected to be somewhat less severe.

Respondents were asked the following question in 1965 and 1974 regarding current “high blood pressure or hypertension”: “Here is a list of medical conditions that usually last for some time. Have you had any of these conditions during the past 12 months?” In 1994, the wording was different: “. . . Have you ever had any of these conditions? Have you ever taken medicines prescribed for it?” Excluding subjects who had reported hypertension in 1965 or 1974, those who had ever taken prescribed antihypertensive medications by 1994 were considered to have incident hypertension.

Two potential psychological predictors of hypertension were examined in the 1974 questionnaire: the 18-item Alameda County Study depression scale13 and McCloskey and Schaar’s 9-item scale measuring “anomy,” the psychological equivalent of the sociological concept of anomie, social discontent, or alienation; a typical item is, “The trouble with the world today is that most people really don’t believe in anything.”14 Several work-related stressors were studied: current unemployment, worry about being able to keep one’s present job, feeling only average or not very good at “the kind of work you usually do,” and having a low-status job (clerical, sales, or blue collar, as opposed to white collar, professional, or managerial). Education was recorded in years of schooling, and race/ethnicity was classified as white, African American, or other.

Nonpsychosocial hypertension risk factors assessed in 1974 were body mass index (calculated as weight in kilograms divided by the square of height in meters), smoking status, alcohol use in drinks per month, and leisure time physical activity rated on a scale of 0 to 16. Having had a “medical checkup” during the 2 years before the follow-up survey was also included in the adjustment variables to control for diagnostic bias related to health care access or use.

In a preliminary phase, univariate analyses were performed on a broad range of variables against hypertension incidence between 1965 and 1974 to generate hypotheses for testing in 1974-1994. This screened out a series of psychosocial factors that were not associated with hypertension during the earlier time period: difficulty relaxing, overall life or job dissatisfaction, lack of sleep, low per capita household income, subjective financial strain, household crowding, problems with dependent children, marital strain, and weak social connections.

Logistic regression analysis (SAS software package; SAS Institute, Cary, NC) was used to determine the associations of 1974 variables with development of hypertension by 1994, both in the entire study population and in men and women separately. The univariate age-adjusted association of each variable with incident hypertension was determined first. Psychosocial factors that were significantly associated in men, women, or the sample as a whole were then examined with adjustment for the set of behavioral risk factors. Finally, all individually associated variables were entered into a single multivariate model to determine the independence of the predictors in fully adjusted analyses.

Age, body mass index, physical activity, alcohol consumption, anomy, and depression were treated as continuous variables. Dummy variables were used for education (high school diploma, 9-11 years of schooling, and <9 years of schooling vs any college attendance), smoking (ex-smoker and <1-pack, 1-pack, and >1-pack-per-day smokers vs never-smokers), unemployment (unemployed and not in the labor force [including homemakers] vs currently employed), race (African American and other nonwhite vs white), and job status (low-status job and not in the labor force vs higher-status job).


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In these analyses of a longitudinally followed population sample, several measures of life stress predicted the incidence of treated hypertension during the subsequent 20 years, especially in men. The patterns of psychosocial predictors were different in the 2 sexes, with work-related stressors being more prominent in men and subjective psychological distress being more prominent in women. In multivariate models with all potential hypertension risk factors, including education and ethnicity (the only important risk factors missing from the Alameda County Study are salt intake and family history), several work-related stressors proved to be independent predictors of hypertension.

Two measures of subjective distress, depression and social alienation, were significantly associated with incident hypertension in age-adjusted univariate analyses. When behavioral risk factors were taken into account, these associations remained significant only in women, however, and subjective distress dropped entirely out of the fully adjusted multivariate models.

These results are consistent with prospective associations between psychosocial factors and hypertension reported by previous investigators. In the Normative Aging Study, there was a significant negative association between emotional stability and the incidence of hypertension in a male population, controlling for baseline blood pressure, education, and alcohol consumption. Adjustment was not made for the ethnic and behavioral factors, which accounted for most of the association of psychological distress with hypertension in our data.

Analyses from the National Health and Nutrition Examination Survey I Epidemiologic Follow-up Study found anxiety and depression to predict later incidence of hypertension and especially of prescription treatment for hypertension. This association persisted in African Americans and older whites after adjustment for education, cigarette smoking, body mass index, alcohol use, and several other risk factors. Depression and anxiety, therefore, are important psychosocial markers of hypertension risk.
indicators in some but not all studies. Blood pressure reported to be related to suppressed anger; in at least one prospective study, as have other work-related stressors, predicted hypertension more strongly in men than in women in these data as in those of other investigators, despite a similar overall incidence of hypertension by sex; only 1 work-related stressor, having a low-status job, was a more important predictor in women than in men. Indicators of subjective distress and low educational attainment, on the other hand, were more predictive of hypertension in women than in men. The greater impact of stress on the development of hypertension in men compared with women may be related to sex differences in cardiovascular stress reactivity. It may also be conjectured that the threat or reality of unemployment could be particularly devastating for men, for psychological and/or practical reasons.

There have been hints in the literature of such differential risk factor patterns, ie, men appearing more sensitive to work-related threats to their autonomy, and women to difficulties in relationships with family and friends. The association between job strain and raised ambulatory blood pressure has been found chiefly in men, although job strain was associated with gestational hypertension in one study.

### Table 2. Psychosocial Predictors of Incident Treated Hypertension in the Alameda County Study, Adjusted for Nonpsychosocial Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>All Subjects</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended college</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;9 y of schooling</td>
<td>0.8 (0.9-1.2)</td>
<td>1.2 (0.7-2.1)</td>
<td>0.5 (0.2-0.9)</td>
</tr>
<tr>
<td>9-11 y of schooling</td>
<td>1.2 (0.9-1.7)</td>
<td>1.4 (0.9-2.1)</td>
<td>1.0 (0.6-1.7)</td>
</tr>
<tr>
<td>High school diploma only</td>
<td>1.3 (1.1-1.6)</td>
<td>1.4 (1.1-1.9)</td>
<td>1.2 (0.9-1.7)</td>
</tr>
<tr>
<td>White</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1.5 (1.0-2.1)</td>
<td>1.4 (0.9-2.3)</td>
<td>1.6 (0.9-2.8)</td>
</tr>
<tr>
<td>Other ethnicity</td>
<td>0.9 (0.6-1.3)</td>
<td>0.9 (0.6-1.3)</td>
<td>0.9 (0.6-1.3)</td>
</tr>
<tr>
<td>White collar, managerial, or professional job</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clerical, sales, or blue collar worker</td>
<td>1.5 (1.2-1.8)</td>
<td>1.5 (1.1-2.0)</td>
<td>1.2 (0.9-1.6)</td>
</tr>
<tr>
<td>Not in labor force</td>
<td>0.8 (0.6-1.1)</td>
<td>1.0 (0.7-1.3)</td>
<td>0.6 (0.3-1.2)</td>
</tr>
<tr>
<td>Not worried about keeping job</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worry about keeping job</td>
<td>1.3 (1.0-1.6)</td>
<td>1.0 (0.7-1.5)</td>
<td>1.5 (1.1-2.1)</td>
</tr>
<tr>
<td>Not in labor force</td>
<td>0.9 (0.7-1.1)</td>
<td>1.0 (0.7-1.3)</td>
<td>0.7 (0.3-1.3)</td>
</tr>
<tr>
<td>Very good or excellent at doing job</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average or not good at doing job</td>
<td>1.4 (0.9-2.0)</td>
<td>1.1 (0.7-1.8)</td>
<td>2.0 (1.1-3.8)</td>
</tr>
<tr>
<td>Not in labor force</td>
<td>0.9 (0.7-1.1)</td>
<td>1.0 (0.7-1.3)</td>
<td>0.6 (0.3-1.2)</td>
</tr>
<tr>
<td>Employed</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>1.5 (0.9-2.4)</td>
<td>0.9 (0.4-1.8)</td>
<td>2.3 (1.0-5.1)</td>
</tr>
<tr>
<td>Not in labor force</td>
<td>0.9 (0.7-1.1)</td>
<td>1.0 (0.7-1.3)</td>
<td>0.6 (0.3-1.2)</td>
</tr>
<tr>
<td>Anomy score, per point</td>
<td>1.03 (0.99-1.08)</td>
<td>1.05 (1.01-1.09)</td>
<td>1.02 (0.95-1.07)</td>
</tr>
<tr>
<td>Depression score, per point</td>
<td>1.90 (0.96-1.05)</td>
<td>1.03 (1.00-1.08)</td>
<td>0.95 (0.89-1.02)</td>
</tr>
</tbody>
</table>

*Risk factors were assessed in 1974; hypertension was reported in 1994. Data are given as odds ratios (95% confidence interval) adjusted for age, body mass index, medical checkups, alcohol consumption, smoking status, and leisure time physical activity."
Because of the limitations of the Alameda County Study data set, these analyses addressed only treated hypertension, not measured blood pressure, as an end point. An attempt was made to correct for the inability to include undiagnosed blood pressure elevations by controlling for recourse to medical care (“checkups”) during the period before the follow-up survey. Hypertension diagnosis and awareness also significantly increased during the period of this study, due in large part to the efforts of the National High Blood Pressure Education Program, and diagnosis of hypertension we were able to control to some extent studying a population of survivors. The extreme for access to care. Various reasons underlying undertreatment, including lack of insurance coverage (reported by 5.4% of Alameda County Study subjects in 1974), act indirectly through the final common pathway of poor access to health care.

It should be noted that the present analyses are of necessity limited to the association of psychosocial factors with hypertension incidence. These factors might actually have an impact on the pathologic factors related to hypertension above and beyond affecting the onset of hypertension. Because many of the subjects with the most severe incident hypertension will have died from complications such as coronary heart disease or stroke, we are to some extent studying a population of survivors. The rates of incident hypertension reported in these analyses are therefore likely to underestimate the true incidence rates. There is no obvious reason, however, to expect differential death rates in hypertensive persons.

Differential access to medical care is of great importance in socioeconomic patterns of hypertensive disease in the United States. In this study of psychosocial predictors of hypertension we were able to control to some extent for access to care. Various reasons underlying undertreatment, including lack of insurance coverage (reported by 5.4% of Alameda County Study subjects in 1974), act indirectly through the final common pathway of poor access to health care.

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according to psychosocial characteristics, so this limitation should introduce no systematic bias.

In conclusion, psychosocial stressors at baseline increase the 20-year risk of developing hypertension in the general population, particularly in men. An association of hypertension with global distress (social alienation and depression) is found only in women, and is largely accounted for by patterns of health risk behaviors. Work-related stressors (in women, low-status job; in men, concerns about job performance and the threat or reality of unemployment) predict incident hypertension independent of a wide range of potential behavioral and sociodemographic risk factors.

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