Special Article

# CUMULATIVE IMPACT OF SUSTAINED ECONOMIC HARDSHIP ON PHYSICAL, COGNITIVE, PSYCHOLOGICAL, AND SOCIAL FUNCTIONING

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## ABSTRACT

***Background*** Although the relation between low income and poor health is well established, most previous research has measured income at only one time.

***Methods*** We used income information collected in 1965, 1974, and 1983 from a representative sample of adults in Alameda County, California, to examine the cumulative effect of economic hardship (defined as a total household income of less than 200 percent of the federal poverty level) on participants who were alive in 1994.

***Results*** Because of missing information, analyses were based on between 1081 and 1124 participants (median age, 65 years in 1994). After adjustment for age and sex, there were significant graded associations between the number of times income was less than 200 percent of the poverty level (range, 0 to 3) and all measures of functioning examined except social isolation. As compared with subjects without economic hardship, those with economic hardship in 1965, 1974, and 1983 were much more likely to have difficulties with independent activities of daily living (such as cooking, shopping, and managing money) (odds ratio, 3.38; 95 percent confidence interval, 1.49 to 7.64), activities of daily living (such as walking, eating, dressing, and using the toilet) (odds ratio, 3.79; 95 percent confidence interval, 1.32 to 9.81), and clinical depression (odds ratio, 3.24; 95 percent confidence interval, 1.32 to 7.89) in 1994. We found little evidence of reverse causation — that is, that episodes of illness might have caused subsequent economic hardship.

***Conclusions*** Sustained economic hardship leads to poorer physical, psychological, and cognitive functioning. (N Engl J Med 1997;337:1889-95.)



THE relation between low income and poor health is well established.[1-5] Groups whose incomes are low are disproportionately exposed to social and psychological conditions that may have negative effects, while also possessing fewer economic resources to manage these circumstances.[6] Low income may affect health directly through inadequate housing and sanitation or indirectly through threatening, socially disrupted neighborhoods and the promotion of behavior and psychosocial characteristics that are deleterious to health.[7-9]

Most previous research has measured income at only one time. This method may fail to capture the health effects of sustained exposure to low income or to account for transitions into and out of low-income groups. There is considerable volatility in income over a lifetime, with 26 to 39 percent of people 45 to 65 years of age having income reductions of 50 percent or more at least once in an 11-year period.[10] These rises and falls in income are more pronounced for those at the bottom of the income distribution, who are less likely to have stable employment.[11] Failure to account for such income dynamics could result in an underestimate of the true association between income and health status.[12]

We used income information collected in 1965, 1974, and 1983 as part of the Alameda County Study to examine the cumulative effect of sustained economic hardship among members of the cohort who were alive in 1994. The outcome measures represented important functional aspects of day-to-day living, including physical, psychological, social, and cognitive functioning.

## METHODS

### Study Population

We used information collected from the Alameda County Study, a population-based prospective investigation of predictors of health and functioning in a representative sample of adults in Alameda County, California. Full details of the sample in 1965 (6982 respondents) and 1974 (4864 respondents) have been published previously.[13] In 1983, a random sample of 50 percent of the 1974 respondents who were not known to be dead in 1982 were enrolled in a third period of data collection (a total of 1799 respondents). In 1994, a fourth period of data collection was conducted for the 1974 respondents. Of the 3161 subjects who were known to be alive, 3005 were located; 2935 were able to participate, and 205 refused to participate, leaving a sample of 2730. Response rates for all periods were high, with 86, 85, 87, and 93 percent responding in 1965, 1974, 1983, and 1994, re-

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spectively. The results presented here are based on information on income, risk factors, and prevalent diseases gathered in 1965, 1974, and 1983 and levels of physical, psychological, cognitive, and social functioning in 1994. All analyses are restricted to the 1799 respondents who were part of the random 50 percent sample enrolled in 1983. Of these 1799 subjects, 362 had died and 151 were lost to follow-up between 1983 and 1994, leaving a possible sample of 1286. Analyses excluded subjects who had missing data on income (130 respondents) or covariates (29) in 1965, 1974, or 1983. In addition, between 3 and 43 respondents had missing information on measures of function, leaving a total sample of between 1081 and 1124, depending on the functional outcome. There were no significant differences in demographic, health, or other risk factors between subjects with missing data at base line and those without missing data (data not shown). The maximal sample included 325 women and 263 men who were 45 to 64 years of age in 1994, 273 women and 224 men who were 65 to 84 years old, and 29 women and 10 men who were 85 or older in 1994.

### Assessment of Sustained Economic Hardship

We calculated the number of times between 1965 and 1983 that subjects reported total household incomes that were less than 200 percent of the federal poverty level for that year (the study definition of economic hardship); the results ranged from 0 (never below 200 percent) to 3 (below 200 percent in 1965, 1974, and 1983). The respective income cutoffs for 200 percent of the poverty level in 1965, 1974, and 1983 were $6,634, $11,000, and $20,356 for a four-person household.[14] Income was self-reported, pretax household income from all sources at each period of data collection between 1965 and 1983, recorded in income categories. The category midpoint was adjusted for family size and used to identify households with incomes that were less than 200 percent of the poverty level, based on U.S. Census information for the relevant year.[14]

### Assessment of Functional Outcomes

Physical functioning was assessed with three commonly used measures of functional status: activities of daily living,[15] instrumental activities of daily living,[16] and a physical performance scale developed by Nagi.[17] These scales are based on Likert-type self-reports of the difficulty involved in walking, bathing, brushing hair or teeth, eating, dressing, moving from bed to chair, and using the toilet (activities of daily living); cooking, shopping, doing housework, using the telephone, and managing money (independent activities of daily living); and pushing or pulling, lifting, getting up from a crouch or bend, reaching, stooping, standing up, walking up stairs, and handling small objects (Nagi performance scale). Subjects were classified as having reduced physical functioning in 1994 according to the activities-of-daily-living scale (82 of 1124 subjects, or 7.3 percent) and the independent-activities-of-daily-living scale (164 of 1116 subjects with data available, or 14.7 percent) if they reported difficulties with two or more items, and according to the Nagi scale (130 of 1108 subjects with data available, or 11.7 percent) if they reported difficulties with five or more items.

Psychological functioning was assessed in terms of depression, cynical hostility, and optimism. Depression was measured on the basis of scores on 12 items that used the diagnostic symptom criteria for a major depressive episode outlined in the *Diagnostic and Statistical Manual of Mental Disorders,* third edition, revised (DSM-III-R).[18] Eighty-seven of 1120 subjects with data available (7.8 percent) with the highest scores were classified as clinically depressed. Depressive symptoms were measured with a scale developed in the Alameda County Study that has predictive validity for various outcomes.[19] Subjects with scores of 5 or more on the 18-item scale were classified as having symptoms of depression; 140 of 1121 subjects (12.5 percent) met this criterion. Cynical hostility was measured with a seven-item subgroup of the Cook–Medley hostility scale that is predictive of carotid atherosclerosis.[20] Subjects with scores of more than 18 on the 28-point scale (found in 23.4 percent of the subjects) were classified as having cynical hostility. Optimism was measured with the Life Orientation Test.[21] A total of 245 of 1090 subjects (22.5 percent) had scores lower than 17 on a 24-point scale and were categorized as lacking optimism about the future. Both the cynical-hostility scale and the Life Orientation Test have been used in clinical and epidemiologic studies and are internally consistent, reliable, and predictive of health outcomes in a variety of populations.[20,22]

Cognitive function was assessed by four Likert-type questions about self-reported difficulties in remembering things, paying attention, finding the right word, and forgetting where things were placed. Those with difficulties with two or more of these tasks were classified as having cognitive difficulties; 128 of 1116 subjects (11.5 percent) met the criteria. The degree of social isolation was based on the number of contacts with friends or close friends subjects had each month; 204 of 1108 subjects (18.4 percent) with data available who had fewer than two contacts a month were classified as being socially isolated.[23]

### Assessment of Covariates

Smoking history, consumption of beer, wine, and liquor, physical activity, and body-mass index (the weight in kilograms divided by the square of the height in meters) were assessed by questionnaire in 1965, 1974, and 1983.[24] Among all subjects, smoking was calculated in terms of pack-years of exposure. Physical activity was measured according to the frequency of activities such as walking, swimming, participation in exercise programs and vigorous sports, gardening, and fishing. To account for changes in body-mass index, physical activity, and alcohol consumption over time, we measured the number of periods in which participants were in the group with the highest risk. For instance, we divided body-mass index into quartiles for each period and counted the number of periods (0, 1, 2, or 3) in which the subject was in the highest quartile between 1965 and 1983.

Prevalent diseases in 1965, 1974, and 1983 were assessed by self-report; the diseases assessed have been demonstrated in this population to be strongly associated with an increased risk of death.[25] At each period, participants were asked whether they either currently had or had ever had heart trouble, chest pain, hypertension, a stroke, breathing difficulties, chronic bronchitis, diabetes, asthma, arthritis, back pain, or cancer. For each subject we counted the number of periods (0, 1, 2, or 3) in which each condition was present and included it as a continuous variable in all analyses.

### Statistical Analysis

We assessed associations between economic hardship and functioning with multivariate logistic regression,[26] using the Proc Logistic procedure in SAS version 6.12[27] on a Sun workstation. Associations were examined in models that were adjusted for both age and sex and in models that were adjusted separately for age, sex, and risk factors and for age, sex, and prevalent diseases. We assessed the association between mortality and economic hardship with time-dependent proportional-hazards regression using the PHREG procedure in SAS version 6.12.[28]

## RESULTS

Table 1 shows the demographic, behavioral, and health characteristics of the subjects according to the duration of economic hardship (income less than 200 percent of the poverty level). Table 2 presents the results of logistic-regression analyses of the association between the duration of economic hardship and functioning. In models adjusted for age and sex, there were strong, significant, graded associations between the number of periods of econom-

ic hardship and all measures of functioning except social isolation. We found no systematic differences in the pattern of associations between sustained economic hardship and functioning between women and men or between subjects who were 65 years of age or older and those who were under 65 (data not shown).

For physical functioning, subjects whose incomes were less than 200 percent of the poverty level in 1965, 1974, and 1983 had 3.79 times (95 percent confidence interval, 1.32 to 9.81) the odds of having difficulties with activities of daily living in 1994 of those who had no history of economic hardship. Additional adjustment for the number of pack-years of smoking, body-mass index, levels of alcohol consumption, and physical activity reduced the odds ratio to 2.86 (95 percent confidence interval, 1.00 to 8.24). Adjustment for age, sex, and prevalent diseases resulted in an odds ratio of 2.95 (95 percent confidence interval, 1.02 to 8.58). Similar results were obtained when associations between sustained economic hardship and other functional outcomes (e.g., independent activities of daily living and the Nagi performance scale) were adjusted for these risk factors.

There were equally strong, graded relations between sustained economic hardship and measures of psychological and cognitive functioning. For instance, as compared with subjects with no history of economic hardship, subjects with three episodes of economic hardship between 1965 and 1983 had 3.24 times (95 percent confidence interval, 1.32 to 7.89) the sex- and age-adjusted odds of meeting the DSM-III-R criteria for depression. Similarly, the group with the longest history of economic hardship had greater odds of having high levels of depressive symptoms (odds ratio, 4.56; 95 percent confidence interval, 2.07 to 10.07), being cynically hostile (odds ratio, 5.09; 95 percent confidence interval, 2.40 to 10.86), lacking optimism (odds ratio, 5.68; 95 percent confidence interval, 2.73 to 11.83), and having greater self-reported difficulties with cognitive functioning (odds ratio, 4.60; 95 percent confidence interval, 2.06 to 10.32) in 1994.

Table 3 shows complete models for the associations between reduced activities of daily living and economic hardship adjusted separately for risk factors and prevalent diseases. In addition to sustained economic hardship, smoking, body-mass index, and histories of diabetes, arthritis, and back pain were all significantly associated with the outcome.

**TABLE 1.** CHARACTERISTICS OF 1124 PARTICIPANTS IN THE ALAMEDA COUNTY STUDY ACCORDING TO THE DURATION OF ECONOMIC HARDSHIP, 1965 TO 1983.

| CHARACTERISTIC | NO. OF TIMES INCOME WAS <200% OF POVERTY LEVEL | | | |
|---|---|---|---|---|
| | 0 (N=691) | 1 (N=273) | 2 (N=125) | 3 (N=35) |
| Mean age (yr) | 64.9 | 63.4 | 65.2 | 63.7 |
| Female sex (%)* | 51.5 | 57.5 | 68.0 | 82.9 |
| White race (%)* | 89.2 | 81.3 | 65.6 | 54.3 |
| Smoking (mean pack-yr) | 17.8 | 17.6 | 15.5 | 14.8 |
| No. of times in highest quartile of alcohol consumption (%)* | | | | |
| 0 | 56.2 | 68.1 | 72.0 | 65.7 |
| 1 | 19.5 | 15.4 | 10.4 | 25.7 |
| 2 | 11.9 | 10.3 | 13.6 | 8.6 |
| 3 | 12.5 | 6.2 | 4.0 | 0.0 |
| No. of times in highest quartile of body-mass index (%) | | | | |
| 0 | 65.9 | 61.9 | 56.8 | 45.7 |
| 1 | 14.6 | 16.5 | 15.2 | 20.0 |
| 2 | 8.5 | 9.5 | 10.4 | 11.4 |
| 3 | 11.0 | 12.1 | 17.6 | 22.9 |
| No. of times in lowest quartile of physical activity (%)* | | | | |
| 0 | 62.5 | 54.6 | 52.8 | 34.3 |
| 1 | 21.0 | 22.0 | 20.8 | 14.2 |
| 2 | 10.9 | 13.9 | 15.2 | 31.4 |
| 3 | 5.6 | 9.5 | 11.2 | 20.0 |
| Free of prevalent disease during all 3 periods (%) | | | | |
| Heart trouble | 94.1 | 93.8 | 92.0 | 88.6 |
| Chest pain | 80.6 | 78.4 | 73.6 | 68.6 |
| Hypertension | 73.4 | 72.9 | 68.8 | 71.4 |
| Stroke | 99.3 | 98.9 | 96.8 | 100.0 |
| Diabetes | 95.8 | 95.6 | 94.4 | 85.7 |
| Chronic bronchitis | 92.2 | 91.2 | 89.6 | 82.9 |
| Breathing difficulties | 79.6 | 78.4 | 70.4 | 65.7 |
| Cancer | 96.8 | 97.1 | 99.2 | 91.4 |
| Asthma | 93.3 | 93.0 | 93.6 | 91.4 |
| Back pain | 47.7 | 44.7 | 43.6 | 52.9 |
| Arthritis* | 70.8 | 67.8 | 60.8 | 80.0 |

*$P<0.001$ for the overall differences among the groups (by the chi-square test).

### Reverse Causation

We examined reverse causation — the possibility that poor health and functioning caused economic hardship and not vice versa — in three ways. First, we examined associations between sustained economic hardship and functioning in a sample restricted to 982 subjects who were less than 50 years of age in 1965 and who had no reduction in physical functioning. In this subgroup any association between sustained economic hardship and subsequent poor functioning could not be due to illness at base line, because the prevalence of physical and cognitive dysfunction was extremely low in this age group. The magnitude and pattern of associations with functioning were virtually identical to those in the whole sample (data not shown).

Second, we restricted the sample to 2307 subjects who reported excellent or good health in 1965 and examined the effects of economic hardship in 1965 on levels of functioning in 1994, after adjustment for pack-years of smoking, body-mass index, physical activity, alcohol consumption, and prevalent diseases in 1965. Economic hardship in 1965 was a signifi-

**TABLE 2.** ODDS RATIOS FOR REDUCED LEVELS OF PHYSICAL, PSYCHOLOGICAL, COGNITIVE, AND SOCIAL FUNCTIONING IN 1994 ACCORDING TO WHETHER THERE WAS SUSTAINED ECONOMIC HARDSHIP BETWEEN 1965 AND 1983.

| MEASURE ASSESSED AND NO. OF TIMES INCOME WAS <200% OF POVERTY LEVEL* | ADJUSTED FOR AGE AND SEX | | ADJUSTED FOR AGE, SEX, AND RISK FACTORS† | | ADJUSTED FOR AGE, SEX, AND PREVALENT DISEASES‡ | |
|---|---|---|---|---|---|---|
| | ODDS RATIO (95% CI)§ | P VALUE | ODDS RATIO (95% CI)§ | P VALUE | ODDS RATIO (95% CI)§ | P VALUE |
| **Reduced physical functioning** | | | | | | |
| Difficulty with IADL (n=1116) | | | | | | |
| 1 | 1.41 (0.94–2.13) | 0.10 | 1.29 (0.85–1.97) | 0.24 | 1.34 (0.88–2.05) | 0.17 |
| 2 | 1.62 (0.95–2.75) | 0.08 | 1.42 (0.82–2.47) | 0.21 | 1.23 (0.70–2.17) | 0.47 |
| 3 | 3.38 (1.49–7.64) | 0.003 | 2.64 (1.14–6.28) | 0.03 | 2.93 (1.24–6.92) | 0.01 |
| Difficulty with ADL (n=1124) | | | | | | |
| 1 | 1.49 (0.85–2.59) | 0.16 | 1.39 (0.78–2.47) | 0.26 | 1.37 (0.77–2.44) | 0.29 |
| 2 | 1.85 (0.95–3.61) | 0.07 | 1.66 (0.83–3.33) | 0.16 | 1.43 (0.70–2.92) | 0.32 |
| 3 | 3.79 (1.32–9.81) | 0.01 | 2.86 (1.00–8.24) | 0.05 | 2.95 (1.02–8.58) | 0.05 |
| Difficulty with Nagi performance scale (n=1108) | | | | | | |
| 1 | 1.47 (0.93–2.31) | 0.10 | 1.31 (0.81–2.11) | 0.27 | 1.38 (0.85–2.23) | 0.53 |
| 2 | 2.54 (1.50–4.30) | <0.001 | 2.33 (1.33–4.08) | 0.002 | 2.05 (1.16–3.62) | 0.01 |
| 3 | 2.88 (1.20–6.94) | 0.02 | 1.93 (0.77–4.88) | 0.16 | 2.45 (0.93–6.48) | 0.07 |
| **Reduced psychological functioning** | | | | | | |
| DSM-III-R criteria for clinical depression (n=1120) | | | | | | |
| 1 | 1.01 (0.58–1.76) | 0.96 | 0.97 (0.55–1.71) | 0.92 | 0.97 (0.55–1.69) | 0.91 |
| 2 | 1.72 (0.91–3.29) | 0.10 | 1.68 (0.87–3.23) | 0.12 | 1.54 (0.81–3.00) | 0.19 |
| 3 | 3.24 (1.32–7.89) | 0.01 | 2.58 (1.01–6.59) | 0.05 | 3.20 (1.28–8.02) | 0.01 |
| Depressive symptoms (n=1121) | | | | | | |
| 1 | 1.75 (1.13–2.70) | 0.01 | 1.65 (1.05–2.59) | 0.03 | 1.72 (1.10–2.68) | 0.02 |
| 2 | 4.02 (2.48–6.54) | <0.001 | 4.00 (2.40–6.62) | <0.001 | 3.83 (2.31–6.46) | <0.001 |
| 3 | 4.56 (2.07–10.07) | <0.001 | 3.42 (1.48–7.93) | 0.004 | 3.89 (1.68–9.00) | 0.002 |
| Cynical hostility (n=1081) | | | | | | |
| 1 | 2.14 (1.52–3.00) | <0.001 | 2.05 (1.45–2.90) | <0.001 | 2.15 (1.52–3.03) | <0.001 |
| 2 | 3.24 (2.10–5.04) | <0.001 | 3.07 (1.96–4.80) | <0.001 | 3.16 (2.01–4.96) | <0.001 |
| 3 | 5.09 (2.40–10.86) | <0.001 | 4.11 (1.87–9.06) | <0.001 | 4.69 (2.17–10.13) | <0.001 |
| Lack of optimism (n=1090) | | | | | | |
| 1 | 1.48 (1.05–2.09) | 0.02 | 1.35 (0.95–1.92) | 0.09 | 1.41 (1.00–2.03) | 0.05 |
| 2 | 2.27 (1.46–3.52) | <0.001 | 2.08 (1.32–3.26) | 0.003 | 2.05 (1.31–3.23) | 0.002 |
| 3 | 5.68 (2.73–11.83) | <0.001 | 4.32 (2.02–9.24) | <0.001 | 5.52 (2.59–11.73) | <0.001 |
| **Reduced cognitive functioning** | | | | | | |
| Cognitive difficulties (n=1116) | | | | | | |
| 1 | 1.19 (0.74–1.90) | 0.47 | 1.19 (0.74–1.92) | 0.47 | 1.16 (0.72–1.87) | 0.55 |
| 2 | 2.28 (1.35–3.86) | 0.002 | 2.25 (1.31–3.87) | 0.003 | 2.13 (1.23–3.69) | 0.007 |
| 3 | 4.60 (2.06–10.32) | <0.001 | 3.77 (1.62–8.77) | 0.002 | 4.14 (1.79–9.61) | <0.001 |
| **Reduced social functioning** | | | | | | |
| Social isolation (n=1108) | | | | | | |
| 1 | 0.95 (0.65–1.38) | 0.79 | 0.91 (0.62–1.33) | 0.63 | 0.96 (0.66–1.40) | 0.84 |
| 2 | 1.33 (0.82–2.15) | 0.25 | 1.31 (0.80–1.93) | 0.69 | 1.27 (0.78–2.08) | 0.34 |
| 3 | 1.56 (0.68–3.57) | 0.29 | 1.19 (0.50–2.80) | 0.69 | 1.42 (0.61–3.04) | 0.42 |

*IADL denotes independent activities of daily living, ADL activities of daily living, and DSM-III-R *Diagnostic and Statistical Manual of Mental Disorders* (third edition, revised).

†The risk factors were the number of periods subjects were in the highest quartiles of body-mass index and alcohol consumption and the lowest quartile of physical activity and the number of pack-years of smoking.

‡Prevalent diseases consisted of heart trouble, chest pain, hypertension, stroke, diabetes, asthma, chronic bronchitis, breathing difficulties, back pain, arthritis, and cancer.

§The reference group is the subjects with no history of economic hardship. CI denotes confidence interval.

cant predictor of reduced physical, psychological, and cognitive functioning in 1994. Although these results mirrored the main findings, the associations were expectedly weaker. Odds ratios for reduced functioning ranged from 1.36 (95 percent confidence interval, 0.99 to 1.85) for depressive symptoms to 1.64 (95 percent confidence interval, 1.19 to 2.27) for cognitive difficulties.

Third, we restricted the sample to 197 subjects whose income was not derived from wages or salaries in 1965 or 1974 and who were in excellent or good health in 1965. Even in this small sample, sustained economic hardship had significant and, in many cases, graded associations with functional outcomes that were very similar to the patterns observed in the whole sample (Table 4). Even among

subjects whose income did not depend on wages, those with economic hardship in 1965, 1974, and 1983 had an odds ratio of 5.91 (95 percent confidence interval, 1.38 to 25.29) for difficulties on the Nagi performance scale (Table 4).

### Mortality

The associations reported here were evident even though subjects with incomes below 200 percent of the poverty level were more likely than those without economic hardship to have died during the study and therefore not to have been included in the analyses. Selective analysis of mortality with time-dependent covariate proportional-hazards regression, which allowed economic hardship to vary as a function of the length of survival, showed that subjects whose incomes were less than 200 percent of the poverty level were at increased risk for death over the 29-year study period, but this risk differed according to age. As compared with subjects of the same age without economic hardship in 1965, those who were 35 years of age with economic hardship had an age- and sex-adjusted relative risk of death of 1.70 (95 percent confidence interval, 1.29 to 2.22), and those who were 65 years of age with economic hardship had a relative risk of death of 1.29 (95 percent confidence interval, 1.16 to 1.43).

## DISCUSSION

Our results demonstrate strong, consistent, graded associations between sustained economic hardship from 1965 to 1983 and reduced physical, psychological, and cognitive functioning in 1994. The associations were not greatly attenuated after adjustment for risk factors or prevalent diseases, even though these covariates were related to many of the functional outcomes.

This study has several strengths. First, the findings were based on multiple measures of income over a 17-year period and show dose–response associations between the number of periods of economic hardship and important functional measures. Second, the graded associations were consistent across various measures of functional status, but there was no relation between sustained economic hardship and social isolation. This result is perhaps surprising, given other evidence that has generally shown that lower-income groups have less social support.[29,30] However, the associations may depend on the aspect of support that is measured and the reasons for the initiation of social contact.[13] The absence of an association between economic hardship and social functioning may have been because reduced functioning and higher levels of psychological distress translated into an increased need for social contacts to deliver help. Third, in additional analyses, these results were not sensitive to changes in the cutoff points that defined the functional outcomes (data not shown).

**TABLE 3.** ADJUSTED ODDS RATIOS FOR REDUCED ACTIVITIES OF DAILY LIVING IN 1994 ACCORDING TO THE DURATION OF ECONOMIC HARDSHIP BETWEEN 1965 AND 1983.

| VARIABLE | ODDS RATIO | 95% CONFIDENCE INTERVAL | P VALUE |
|---|---|---|---|
| **Adjusted for age, sex, and risk factors*** | | | |
| Age† | 1.07 | 1.04–1.09 | <0.001 |
| Female sex | 1.27 | 0.75–2.15 | 0.37 |
| No. of times income <200% of poverty level | | | |
| 0‡ | 1.0 | — | — |
| 1 | 1.39 | 0.78–2.47 | 0.26 |
| 2 | 1.69 | 0.83–3.33 | 0.16 |
| 3 | 2.86 | 1.00–8.24 | 0.05 |
| No. of times in lowest quartile of physical activity | | | |
| 0‡ | 1.0 | — | — |
| 1 | 1.85 | 1.02–3.35 | 0.04 |
| 2 | 1.64 | 0.83–3.24 | 0.15 |
| 3 | 1.57 | 0.71–3.45 | 0.26 |
| No. of times in highest quartile of alcohol consumption | | | |
| 0‡ | 1.0 | — | — |
| 1 | 0.81 | 0.39–1.69 | 0.57 |
| 2 | 1.25 | 0.57–2.76 | 0.57 |
| 3 | 1.24 | 0.53–2.89 | 0.62 |
| No. of times in highest quartile of body-mass index | | | |
| 0‡ | 1.0 | — | — |
| 1 | 0.88 | 0.41–1.90 | 0.75 |
| 2 | 1.89 | 0.87–4.10 | 0.11 |
| 3 | 2.16 | 1.17–4.00 | 0.01 |
| Pack-years of smoking† | 1.01 | 1.00–1.02 | 0.01 |
| **Adjusted for age, sex, and prevalent diseases§** | | | |
| Age† | 1.06 | 1.03–1.08 | <0.001 |
| Female sex | 1.07 | 0.64–1.78 | 0.79 |
| No. of times income <200% of poverty level | | | |
| 0‡ | 1.0 | — | — |
| 1 | 1.37 | 0.77–2.44 | 0.29 |
| 2 | 1.43 | 0.70–2.92 | 0.32 |
| 3 | 2.95 | 1.02–8.58 | 0.05 |
| Cumulative index of prevalent diseases† | | | |
| Heart trouble | 1.05 | 0.62–1.76 | 0.86 |
| Chest pain | 1.13 | 0.79–1.61 | 0.51 |
| Hypertension | 1.21 | 0.89–1.65 | 0.23 |
| Diabetes | 1.74 | 1.12–2.71 | 0.01 |
| Stroke | 0.84 | 0.28–2.47 | 0.75 |
| Breathing difficulties | 1.28 | 0.91–1.79 | 0.15 |
| Asthma | 1.20 | 0.74–1.94 | 0.47 |
| Chronic bronchitis | 0.86 | 0.48–1.54 | 0.60 |
| Arthritis | 1.35 | 1.04–1.75 | 0.03 |
| Back pain | 1.29 | 1.02–1.64 | 0.03 |
| Cancer | 1.01 | 0.44–2.31 | 0.98 |

*The risk factors were the number of periods subjects were in the highest quartiles of body-mass index and alcohol consumption and the lowest quartile of physical activity and the number of pack-years of smoking.

†This is a continuous variable.

‡This is the reference group.

§Prevalent diseases consisted of heart trouble, chest pain, hypertension, stroke, diabetes, asthma, chronic bronchitis, breathing difficulties, back pain, and cancer.

**TABLE 4.** ODDS OF REDUCED LEVELS OF PHYSICAL, PSYCHOLOGICAL, COGNITIVE, AND SOCIAL FUNCTIONING IN 1994, ACCORDING TO WHETHER THERE WAS SUSTAINED ECONOMIC HARDSHIP BETWEEN 1965 AND 1983, AMONG SUBJECTS WHOSE INCOME WAS NOT DERIVED FROM WAGES OR SALARIES IN 1965 AND 1974 AND WHO REPORTED EXCELLENT OR GOOD HEALTH IN 1965.*

| MEASURE ASSESSED AND NO. OF TIMES INCOME WAS <200% OF POVERTY LEVEL | ODDS RATIO† | 95% CONFIDENCE INTERVAL | P VALUE |
|---|---|---|---|
| **Reduced physical functioning** | | | |
| Difficulty with Nagi performance scale (n=193) | | | |
| 1 | 1.59 | 0.59–4.27 | 0.36 |
| 2 | 3.48 | 1.05–11.44 | 0.04 |
| 3 | 5.91 | 1.38–25.29 | 0.02 |
| **Reduced psychological functioning** | | | |
| Lack of optimism (n=186) | | | |
| 1 | 2.18 | 1.00–4.76 | 0.05 |
| 2 | 4.06 | 1.41–11.66 | 0.009 |
| 3 | 6.02 | 1.53–23.67 | 0.01 |
| **Reduced cognitive functioning** | | | |
| Cognitive difficulties (n=195) | | | |
| 1 | 1.41 | 0.52–3.82 | 0.50 |
| 2 | 0.82 | 0.16–4.08 | 0.81 |
| 3 | 3.97 | 0.86–18.33 | 0.08 |
| **Reduced social functioning** | | | |
| Social isolation (n=190) | | | |
| 1 | 1.16 | 0.39–3.46 | 0.79 |
| 2 | 2.21 | 0.60–8.09 | 0.23 |
| 3 | 2.53 | 0.57–11.27 | 0.22 |

*The associations for other measures of functioning not shown in the table were similar.

†The reference group is the group of subjects with no history of economic hardship, adjusted for age and sex.

Although the prospective, dose–response associations we observed may suggest a causal relation between sustained economic hardship and poor functioning, it was important to explore the possibility of reverse causation (i.e., that episodes of illness caused subsequent economic hardship and not vice versa). We addressed this issue in three ways. We examined associations between periods of economic hardship and functioning in a subgroup that was healthy at base line and found almost identical relations between more sustained economic hardship and reduced functioning. However, although this analysis showed that illness at base line could not account for the associations, it did not preclude the possibility that illness after base line caused subsequent economic hardship. We conducted another analysis examining only the effects of economic hardship in 1965 on functioning in 1994 in a subgroup that was healthy at base line. Any association between an income that was less than 200 percent of the poverty level in 1965 and functioning in 1994 would not rely on repeated episodes of low income that could have been the consequence of illness after base line. In this subgroup, one period of economic hardship in 1965 was a significant predictor of reduced physical, psychological, and cognitive functioning in 1994.

In a more stringent examination of the plausibility of reverse causation as an explanation for the findings, we again restricted the sample to subjects who reported excellent or good health in 1965 and whose income was not derived from wages or salaries. In this sample, episodes of illness were less likely to create economic hardship because the sources and level of income (e.g., partner's income, investments, welfare, and pensions) did not depend directly on the subject's health status. Sustained economic hardship had significant and in many cases graded associations with functional outcomes that were very similar to the patterns observed in the whole sample. Under certain conditions, episodes of illness may affect the ability to generate income,[31] but given the results of these analyses of subgroups we found very little evidence that reverse causation could explain the overall magnitude and pattern of the findings.

The associations were evident even though subjects with more sustained economic hardship between 1965 and 1983 were more likely to have died before the 1994 survey and to have been excluded from these analyses. This increased risk of death should have reduced the likelihood of finding associations between sustained economic hardship and functioning in those who survived until 1994.

Despite the fact that the measures of risk factors and prevalent diseases used in this study were related to the functional outcomes in multivariate models, they failed to attenuate the associations between sustained economic hardship and functioning. Caution should be exercised in interpreting this absence of confounding as evidence that the association between sustained economic hardship and functional status is largely independent of these factors, since it is reasonable to think of them as potentially intervening sources.[1,32] It is possible that the measures used here did not fully capture the cumulative effects of these risk factors and prevalent diseases. Furthermore, without information on the extent of measurement error, the degree and direction of potential bias involved in estimating residual multivariate associations cannot be predicted.[33]

Our results show the cumulative health effects of sustained economic hardship and have potentially important implications for public health, health care, and economic policy. People with sustained economic hardship are more likely to have poorer physical, psychological, and cognitive functioning that might benefit from medical intervention, but recent evidence shows they are less likely to receive such care.[34,35] It will be important to monitor these trends, especially in the light of the uncertainties surrounding welfare reform and transitions to managed care.[36]

Furthermore, increases in income inequality in the United States[37] suggest that larger proportions of the population, especially children, have been pushed into low-income groups, and economic policies that polarize the income distribution may have serious short-term and long-term health consequences.[38,39] In conclusion, sustained economic hardship leaves physical, psychological, and cognitive imprints that decrease the quality of day-to-day life.

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