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Sociodemographic Characteristics, Life Stressors, and Peptic Ulcer

A Prospective Study

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The role of psychosocial factors in peptic ulcer remains controversial. We have investigated the relationship between socioeconomic status, concrete stressors, and ulcers in a longitudinally followed, population-based cohort, taking confounding risk factors into account. A total of 6,928 adults completed the Alameda County Study's baseline questionnaire in 1965; 4,595 ulcer-free on enrollment responded again in 1973–1974. Reported cases of "stomach or duodenal" ulcer during the year before each of the two surveys were examined with relation to 1965 characteristics: 288 subjects reported ulcers at baseline, and 104 reported new ulcers on follow-up. Sociodemographic characteristics associated with incident ulcers (age-adjusted) were, in women, low education, a blue-collar household, overcrowding, unemployment, marital strain, and children's problems; in men, nonwhite race. Prevalent ulcers were associated in women with sociability and children's problems; in men, with blue-collar occupation, low education, financial difficulties, marital strain, children's problems, and a sense of failure. Adjustment for smoking, alcohol, chronic bronchitis, arthritis, liver disease, and skipping breakfast weakened but did not eliminate these associations; adjustment for socioeconomic status further attenuated the associations of specific problems. Low socioeconomic status and concrete life difficulties are associated with peptic ulcer in the general population cross-sectionally and prospectively after adjustment for major physical risk factors, lending credence to a relationship between psychological stress and peptic ulcer.

Key Words: Cohort study—Educational level—Employment—Ethnic groups—Family characteristics—Peptic ulcer—Psychological stress—Socioeconomic factors.

Does life stress have an influence on peptic ulcer? Sixty years of research have been insufficient to create a consensus (1). Several case-control studies have found ulcer patients to recall more life events and difficulties than control groups (2–5), but other studies have been negative (6–8), and all are irremediably retrospective. Epidemiologic studies have suggested associations with low socioeconomic status (0–11) and with such specific stressors as nonwhite race (9), family difficulties (12), and demanding work (13), but they have usually been cross sectional and have rarely controlled for confounders.

The Alameda County Study, which was designed to study behavioral, social, psychologic, and economic influences on health, has followed for nearly 30 years the physical health and well-being of a population sample of a single county in California, while documenting in detail the psychosocial characteristics of its subjects (14); information was gathered from the outset regarding peptic ulcer, but has not been previously examined. This ongoing investigation provides a unique data set for evaluating the relationship between life stressors and socioeconomic status to peptic ulcer in a prospective fashion. We have therefore examined the demographic and social characteristics of Alameda County residents in 1965 that are associated with concurrent peptic ulcer or that predict its subsequent development between 1966 and 1973, exploring the possible confounding or mediating effects of a variety of physical risk factors.

MATERIALS AND METHODS

Population

The Alameda County Study, described in detail elsewhere (14,15), began in 1965 with the mailing of a 23-page questionnaire to a stratified random sample of the adult inhabitants of Alameda County, California (>20 years of age, or >16 if married). Of the 8,038 questionnaires, responses were eventually obtained for 6,928 (86.2%), 3,158 men and 3,770 women, after repeated contact of nonresponders by mail, by

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telephone, and in person. Nonrespondents were older than respondents and were somewhat more likely to be white and male (14). The first follow-up of the cohort was performed in 1973–1974, when panel members not known to be dead were mailed a similar second questionnaire. Of 6,246 mailed questionnaires, 4,864 were eventually answered, corresponding to 85% of located respondents; the total loss to follow-up for vital status between the first and the second surveys was 4.4%.

The 1965 questionnaire included assessment of subjects' health, marriage, families, and work, a broad range of psychological scales, and several medical care variables. Among the information collected at each mailing was the presence of "stomach or duodenal ulcer" ("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 1973–1974 the informant was also asked, "What year did it start?"

All individuals responding "yes" in 1965 were considered to have prevalent ulcers, whereas all those responding "no" or who did not answer the ulcer item made up the comparison group for cross-sectional analyses.

For identification of subjects known to have developed ulcers subsequent to baseline, data from the 1965 and 1973–1974 questionnaires were combined to define a group of individuals at risk among the 1973–1974 respondents: individuals were excluded who either had had a prevalent ulcer in 1965, or reported having an ulcer in 1973–1974 but recalled an onset before 1966 (even if they had not reported an ulcer on the baseline questionnaire). Among this at-risk population, all reporting an ulcer in 1973–1974 were considered to be new cases; these will be referred to as incident ulcers.

Baseline Variables

Potential physical risk factors examined included smoking (never, former, and current), alcohol use (light = 1–45, moderate = 46–80, heavy = ⩾81 drinks per month for men; light = 1–30, moderate = 31–60, heavy = ⩾61 drinks/month for women), "often" or "always" skipping breakfast, arthritis or rheumatism, chronic liver disease, and chronic bronchitis. Subjects were classified as having been out of the labor force, continuously employed full- or part-time, or ever unemployed during the previous 2 years, and a respondent's household was considered white-collar or blue-collar according to the head of household's occupation.

Education was classified as having or not having a high school diploma; race as white or nonwhite (65.7% of nonwhites being black); housing occupancy density as <0.75 person per room, 0.75 to one person per room, or more than one person per room; and geographic neighborhood, for the 2,592 subjects resident in the city of Oakland, as located or not located in a federally identified poverty area. The relationship of total family income to the number of persons in the household was classified as adequate, marginal, or inadequate using federal standards, and the number of addresses inhabited during the previous 5 years was recorded. All women who were not currently married and who either reported having children 3–19 years of age at home (the questionnaire did not ask about younger children) or were <40 years of age and reported ever having had a child were considered to be single mothers.

Sociability (frequency of contact with close friends and relatives) and the broader Alameda County Study Social Network Index (16), which also includes marital status and membership in organized groups, were dichotomized as high or low.

Subjects had been asked whether they were satisfied with their financial status, job, marriage, and children and, if not, whether this bothered them very much. A "sense of failure" variable combined all four items into a single variable characterizing all individuals who reported being bothered by failure in any of the four areas.

Composite scales (14) measured financial strain (three items), marital strain [eight items, e.g. "Does your (wife/husband) give you as much understanding as you need?"], and problems with minor children (13 problems, such as "gets into trouble at school," and what help had been sought). Subjects were also asked whether they had lived with both of their own biological parents until the age of 15 and whether they thought their parents' marriage had been at all unhappy.

Statistical Methods

All analyses were performed separately for men and women. Crude frequencies were first tabulated for all variables in relation to prevalent ulcer and to incident ulcer, with calculation of unadjusted ORs. Every variable with any suggestion of a univariate association was further examined in two cross-sectional and prospective logistic regression analyses designed to determine the role of physiologic confounders or mediators. In each case, a first logistic regression model included age in addition to the variable in question, and a second model included age, smoking, and all other relevant physical risk factors. The relevance of a potential risk factor in a particular model was determined by its univariate association with ulcer so that the specific factors adjusted for beyond age and smoking vary between men and women and between cross-sectional and prospective analyses.

For each demographic or social characteristic associated with ulcer after age adjustment, a final logistic regression model was constructed that included all measures of socioeconomic status associated with ulcer in univariate age-adjusted analyses as well as all relevant physical risk factors.

Various methods of adjusting for age were taken into consideration. A model including age and age^2 as continuous variables best fit the cross-sectional data, whereas a categorical division of age at baseline best captured the age distribution of incident ulcer cases (<40, 40–59, and ⩾60 years for women, and <25, 25–39, 40–49, and ⩾50 years for men). Adjustment for age in the prospective analysis was therefore performed by introducing dummy variables to compare the rates of ulcer development for subjects in each of the higher age groups for each sex as compared with the lower rates for the youngest subjects.

Most other variables were dichotomized, but smoking, unemployment, problems with children, and marital strain were trichotomized. Dummy variables again used the category anticipated to be at lowest risk for comparison: smokers and exsmokers versus nonsmokers; the unemployed, and those not in the labor force, versus those steadily employed during the preceding 2 years; the unmarried, and those with marital strain, versus those currently happily married; those without children 3–19 years of age, and those whose children had problems, versus parents of non-problem children.

RESULTS

Peptic Ulcers at Baseline and at Follow-up

Of the 6,928 respondents to the 1965 questionnaire, 288 reported having had an ulcer during the previous year, for a prevalence rate of 4.2% overall (3.3% for

women, 5.2% for men). Prevalence was 1.8% for respondents ≤30 years of age, 4.1% for those 31–44, 5.5% for those 45–64, and 5.2% for those ≥65.

Of the 4,864 respondents to the follow-up questionnaire, 245 reported an ulcer during the previous year. Seventy-eight also had had ulcers in 1965, and an additional 63 recalled in 1973–1974 that their ulcer problem had begun before 1966, leaving 104 incident ulcers in 4,595 individuals at risk (55 among women, 49 among men).

The crude distribution of all study variables in men and women of the Alameda County Study cohort is presented in Table 1.

Sociodemographic Stressors and Incident Ulcer: Adjustment for Physical Risk Factors

A variety of life stressors were age-adjusted predictors of incident ulcers in women (Table 2): low education, household crowding, unemployment, marital strain, children's problems, and living in a blue-collar household. Adjustment for physical risk factors significantly associated with incident ulcer (arthritis, chronic bronchitis, liver disease, heavy drinking, cigarette smoking, and skipping breakfast) weakened these associations only slightly.

In men (Table 3), the only baseline social or demographic characteristic that predicted incident ulcer after adjustment for age was nonwhite race. Further adjustment for the entire set of significant physical risk factors (smoking, arthritis, and skipping breakfast) did not appreciably change this increased risk, although the lower limit of the 95% confidence interval (CI) did drop below unity.

Specific Life Stressors and Incident Ulcer: Adjustment for Socioeconomic Status

Because indicators of low socioeconomic status were prospectively associated with ulcers even after adjustment for physical risk factors, further logistic regression models were constructed (Table 4) to assess whether specific life stressors even weakly associated with ulcer owed that association solely to being markers of low socioeconomic status. The specific adjustment variables added to the sets of physical risk factors were education, blue- versus white-collar household, and household crowding.

Among men, the association of incident ulcer with nonwhite race was not changed by taking socioeconomic status into account in addition to physical risk factors, whereas the weak associations with unemployment and low mobility became still weaker.

For women, socioeconomic status adjustment weakened all the associations of specific life problems with incident ulcer. In particular, the OR for developing an ulcer in case of unemployment decreased from 2.4 to 1.9, and the OR in case of problems with children decreased from 2.7 to 2.3.

TABLE 1. *The Alameda County Study cohort: distribution at baseline (1965) of potential physical, demographic, and social risk factors for peptic ulcer*

	Women (n = 3,770) (%)	Men (n = 3,158) (%)
Heavy drinker	139 (3.7)	290 (9.2)
Moderate drinker	354 (9.4)	418 (13.3)
Skips breakfast	1,346 (35.8)	1,052 (33.4)
Arthritis	652 (17.3)	357 (11.4)
Liver disease	22 (0.6)	16 (0.5)
Chronic bronchitis	134 (3.6)	104 (3.3)
Ex-smoker	422 (11.3)	666 (21.2)
Current smoker	1,497 (40.2)	1,554 (49.5)
Blue-collar occupation[a]	404 (22.3)	1,595 (54.0)
Husband with blue-collar occupation[b]	1,742 (53.3)	—
Blue-collar household	1,781 (49.4)	1,595 (54.0)
Less than adequate income	1,100 (31.1)	761 (25.1)
Less than high school education	1,374 (36.6)	1,098 (34.9)
Nonwhite race	712 (18.9)	592 (18.8)
Lives in poverty area[c]	497 (32.9)	411 (34.9)
No health insurance	637 (17.2)	433 (13.9)
Did not move, last 5 years	1,618 (44.4)	1,318 (42.9)
More than 0.75 person/room	1,103 (29.2)	987 (31.6)
More than one person/room	269 (7.1)	222 (7.1)
Housewife	1,804 (47.9)	—
Single mother	267 (7.1)	—
Three or more children	1,261 (33.9)	975 (31.3)
Highly sociable	1,753 (47.6)	1,490 (48.3)
Low social network index	1,894 (51.4)	1,239 (40.2)
Financially worse than expected	836 (22.9)	815 (26.3)
High financial strain	1,932 (51.3)	1,551 (49.1)
Not fully satisfied with job[a]	614 (33.8)	1,154 (39.1)
Dissatisfied with job[a]	105 (5.8)	214 (7.2)
Doing worse in any area and bothered by it	688 (18.4)	604 (19.2)
Lost a parent during childhood	1,182 (31.4)	959 (30.4)
Parents had unhappy marriage	759 (23.7)	528 (19.4)
Not in labor force last 2 years	2,156 (57.2)	559 (17.7)
Any time unemployed last 2 years	607 (16.5)	746 (23.9)
Not married	1,149 (30.7)	618 (19.8)
Marital strain	564 (15.1)	431 (13.8)
No children aged 3–19	2,120 (56.5)	1,799 (57.3)
Children aged 3–19, with problems	944 (25.2)	705 (22.5)

The number of individuals varies slightly among variables because of unanswered items.
[a] Subjects in labor force only.
[b] Ever married, women only.
[c] Oakland residents only.

TABLE 2. *Baseline characteristics versus incident peptic ulcer in women, Alameda County Study, 1966–1973: adjustment for physical risk factors*

	Adjusted for			
	Age		Age + all physical risk factors	
	OR	95% CI	OR	95% CI
Physical risk factors				
Arthritis	2.3	1.2–4.6	2.4	1.2–4.6
Liver disease	8.4	1.8–39.1	10.3	2.1–50.1
Chronic bronchitis	2.8	1.1–7.3	2.5	0.9–6.5
Heavy drinking	2.3	0.9–6.0	1.9	0.7–5.1
Doesn't eat breakfast every day	1.9	1.1–3.4	1.7	0.9–2.9
As versus never smoked				
Ex-smoker	1.4	0.5–3.6	1.4	0.5–3.6
Current smoker	2.2	1.2–4.1	1.8	1.0–3.4
Demographic and social characteristics				
Less than high school education	2.2	1.2–3.8	2.0	1.1–3.5
Blue-collar occupation of husband	2.0	1.1–3.5	1.8	1.0–3.3
Blue-collar household	2.2	1.3–4.0	2.1	1.1–3.7
More than one person/room	2.6	1.2–5.6	2.8	1.3–6.1
Has no health insurance	1.7	0.8–3.3	1.6	0.8–3.1
Lives in poverty area	1.3	0.5–3.7	1.3	0.5–3.8
Single mother	1.6	0.7–3.8	1.3	0.5–3.2
Doing worse in any area and bothered by it	1.4	0.7–2.6	1.2	0.6–2.2
As versus steady employment				
Not in labor force	1.9	0.9–4.0	2.0	1.0–4.2
Any time unemployed	2.7	1.2–6.3	2.4	1.0–5.6
As versus happy marriage				
Not married	0.9	0.4–1.9	0.8	0.4–1.6
Marital strain	1.7	1.0–3.3	1.6	0.8–3.0
As versus children at home without problems				
No children at home aged 3–19	1.7	0.7–4.4	1.4	0.5–3.7
Children with problems	3.1	1.3–7.6	2.7	1.1–6.6

Multiple logistic regression with all variables categorized. Age = <40 + 40 – 59 + ≥60. Physical risk factors = current and former smoking, arthritis, liver disease, chronic bronchitis, heavy drinking, and skipping breakfast.

Sociodemographic Stressors and Prevalent Ulcer: Adjustment for Physical Risk Factors

Ulcers were described more by women who reported problems with their children (age-adjusted OR 2.0, 95% CI 1.0–3.8) or a high sociability level (OR 1.5, 95% CI 1.0–2.1), associations unaltered by further adjustment for the significant physical risk factors, chronic bronchitis, arthritis, and liver disease. Among men, the likelihood of reporting an ulcer was elevated in those who did blue-collar work (OR 1.5, 95% CI 1.1–2.1), had not graduated from high school (OR 1.9, 95% CI 1.3–2.6), had a sense of failure (OR 2.2, 95% CI 1.5–3.1), or were experiencing financial strain (OR 1.5, 95% CI 1.1–2.0), problems with their children (OR 2.0, 95% CI 1.2–3.2), or marital strain (OR 1.9, 95% CI 1.3–2.8). The association with blue-collar employment was somewhat weakened (OR 1.3) by adjustment for significant physical risk factors (smoking, skipping breakfast, arthritis, and liver disease), but the other four associations remained unchanged.

DISCUSSION

We found that two major indicators of low socioeconomic status, blue-collar household and failure to graduate from high school, were prospectively associated with peptic ulcer in a large population sample, even when a variety of potential physical confounders were taken into account. Several specific chronic stressors—nonwhite race, household crowding, problems in raising children, and unemployment—also increased the risk of developing ulcers in men or in women, only partially due to an association with low socioeconomic status.

Methodological Considerations

Our study has several methodological strengths: it examines objective real-life difficulties, surveys a sample of the general population, and has a prospective design. Many psychiatric case series (17) and case-control studies (2–5) have suggested an association between distressing experiences and ulcers, but as cross-sectional studies they are flawed by confounding due to the distressing effects of disease (18) and by patients' penchant for overestimating the trials and tribulations they experienced just before falling ill (19). Only two previous prospective studies have reported subjective stress to be associated with later ulcer development: one found that persons who reported being "under any strain, stress, or pressure" were 1.8 times as likely to develop duo-

TABLE 3. *Baseline characteristics versus incident peptic ulcer in men, Alameda County Study, 1966–1973: adjustment for physical risk factors*

	Adjusted for			
	Age		Age + all physical risk factors	
	OR	95% CI	OR	95% CI
Physical risk factors				
Arthritis	2.7	1.2–6.2	2.6	1.1–6.0
Doesn't eat breakfast every day	1.8	1.0–3.3	1.4	0.8–2.6
As versus never smoked				
Ex-smoker	1.1	0.4–3.3	1.1	0.4–3.2
Current smoker	3.0	1.4–6.5	2.8	1.3–6.2
Demographic and social characteristics				
Less than high school education	1.4	0.8–2.7	1.1	0.6–2.2
Blue-collar occupation	1.6	0.9–2.8	1.3	0.7–2.3
More than 0.75 person/room	1.4	0.8–2.6	1.2	0.7–2.2
Less than adequate income	0.9	0.5–1.4	0.9	0.6–1.5
Nonwhite race	1.9	1.0–3.7	1.8	0.9–3.5
Did not move, 1961–1965	1.7	0.9–3.2	1.6	0.8–3.1
Lives in poverty area	1.4	0.5–3.8	1.1	0.4–3.2
Highly sociable	1.6	0.9–3.0	1.6	0.9–2.9
As versus steady employment				
Not in labor force	0.6	0.1–1.8	0.7	0.2–2.4
Any time unemployed	1.4	0.8–2.7	1.3	0.7–2.4

Multiple logistic regression with all variables categorized. Age = <25 + 25 – 39 + 40 – 49 + ≥50 (for poverty area analyses, to avoid empty cells, age <40 + 40 – 49 + ≥50). Physical risk factors = current and former smoking, arthritis, and skipping breakfast.

denal ulcers over the next 13 years (20), and the other found men with family problems or marital strain more likely to have ulcers 5 years later (21).

The principal methodological weakness is our inability to confirm ulcer diagnoses: some subjects may rather have nonulcer dyspepsia, a disorder with a less controversial relation to stress (22,23). Certainly it may be argued that the anatomic basis of dyspepsia is not always relevant (24) and that epidemiologic studies relying on self-report (9,25) have furnished much of our current knowledge of ulcer risk factors. It is nonetheless comforting to find that patients' reports of ulcer diagnoses have been shown to correspond reasonably well to those of their physicians. The best evidence may be a study of the entire population of a Swedish town (26), where not only self-styled ulcer patients but also

TABLE 4. *Baseline demographic and social characteristics versus incident peptic ulcer, Alameda County Study, 1965–1973: adjustment for socioeconomic status*

	Adjusted for			
	Physical risk factors		Physical risk factors + SES	
	OR	95% CI	OR	95% CI
Women[a]				
No health insurance	1.6	0.8–3.1	1.4	0.7–2.8
Single mother	1.3	0.5–3.2	1.3	0.5–3.2
Doing worse in any area and bothered by it	1.2	0.6–2.2	1.0	0.5–2.0
Any time unemployed	2.4	1.0–5.6	1.9	0.8–4.7
Marital strain	1.6	0.8–3.0	1.2	0.6–2.4
Children with problems	2.7	1.1–6.6	2.3	0.9–5.7
Men[b]				
Nonwhite race	1.8	0.9–3.5	1.8	0.9–3.7
Did not move, 1961–65	1.6	0.8–3.1	1.5	0.8–3.1
Lives in poverty area	1.1	0.4–3.2	1.0	0.3–2.8
Highly sociable	1.6	0.9–2.9	1.6	0.9–3.0
Any time unemployed	1.3	0.7–2.4	1.2	0.6–2.3

[a] Physical risk factors: age, smoking, arthritis, liver disease, chronic bronchitis, heavy drinking, skipping breakfast. Measures of socioeconomic status: education, occupation of head of household, and household crowding.
[b] Physical risk factors: age, smoking, arthritis, skipping breakfast. Measures of socioeconomic status: education, occupation, and household crowding.

a sample of healthy adults were subjected to gastroscopy. Using these strict criteria, self-report overestimated lifetime prevalent peptic ulcer by no more than 15% for men and 20% for women (false-negative results were 1.3% and 0.2%, respectively). The study of Anda et al. (20) offers additional reassurance: the association observed between perceived stress and ulcer incidence was nearly identical when case ascertainment was based on patient say-so as when it was documented by hospital discharge diagnoses (risk ratio = 1.8 and 1.9, respectively). Finally, in another study using data collected in the same period as ours, 73% of self-reported ulcers active in the preceding 2 weeks could be confirmed in medical records covering the previous year (27); given the discrepancy in the time frames and the vagaries of chart review, the actual agreement should be even higher.

We examined the pattern of our ulcer cases to shed light on the question of diagnostic accuracy. The overall 1965 prevalence rate proved to agree with that of studies of medically confirmed ulcer (26,28), as did the age-specific prevalence rates (9,29), age and sex distributions (9), and pattern of associations with smoking, arthritis (a stand-in for nonsteroidal antiinflammatory drug use), and liver disease (30). When the 1973–1974 data were used to calculate an approximate cumulative incidence rate, the resulting 0.27% per year was close to rates reported in the literature (11,31) despite being by definition an underestimate (item wording excluded ulcers that resolved before 1973); there is no reason to expect this limitation to bias the associations with sociodemographic stressors, however, and the ulcer diathesis usually entails frequent relapses (32) over 10 years or more (33–35).

Socioeconomic Status

Despite its popular image as a malady of harried business executives, peptic ulcer is more commonly associated in empirical studies with low education, income, and occupational status (2,3,6,9,29,36–38). The general pattern of higher morbidity, disability, and mortality in lower socioeconomic groups (39,40) has been conjectured to reflect class-related differences in adverse health-risk behaviors such as smoking (41) and, specific to peptic ulcer, in on-the-job energy expenditure (30), work stress (13,42,43), and *Helicobacter pylori* exposure (44). The available evidence is largely cross-sectional, however, and several studies have failed to find a prospective association between low socioeconomic status (45) or job stress (45,46) and peptic ulcer. We in fact found low education and living in a blue-collar household to be significant risk factors for developing peptic ulcer, even after adjustment for major physical risk factors.

Among specific stressors, a history of recent unemployment nearly tripled a woman's age-adjusted risk of ulcer during the subsequent 8 years, supporting an association previously reported only for dyspepsia (47). With adjustment for socioeconomic status, this association decreased considerably, suggesting that unemployment owes its ulcerogenic effect largely to the inordinate burden it places on the working class.

Nonwhite men developed ulcers at twice the rate of white men; previously reported data on this point are mixed (9,29,48,49). In the present study, as in some others (50), nonwhite race was not simply a proxy for low socioeconomic status in predicting poorer health outcomes.

Miscellaneous Risk Factors

We confirmed several widely accepted physical risk factors for ulcer [cigarette smoking, arthritis, liver disease, bronchitis, and heavy drinking (30)] and identified a novel one: skipping breakfast. The latter, biologically plausible as a prolongation of the nocturnal fast period, was accounted for only in part by an association with cigarette smoking. Marital problems (12,38) and difficulties in raising children also proved to be risk factors, but an unhappy childhood (51), divorce (32,37), and social isolation (3,16,52) did not.

CONCLUSIONS

Although psychology has lately tended to be overshadowed by microbiology in explaining the genesis of peptic ulcer, the suspicion that life stress might trigger peptic has not been entirely blotted out. Our findings nourish that suspicion: low socioeconomic status and several concrete life difficulties do predispose to ulcer development in the general population.

In the case of peptic ulcer, the "mind-body" connection makes sense. Stress could favor ulcers either through psychoneuroendocrine mechanisms [stress can greatly increase gastric acid secretion (53,54)] or via behavior changes: increased smoking, increased drinking (55), and perhaps irregular meals. Our findings lend some support to both hypotheses because adjustment for health risk behaviors reduced the predictive value of life stress in part—but only in part.

We conclude that objective, observable life difficulties, such as low socioeconomic status and unemployment, contribute to the etiology of at least some ulcers and that their contribution cannot be explained away by the differential distribution of known risk factors. These findings lend credence to the concept of a relationship between psychological stress and peptic ulcer.

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