



## **Original article**

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## Prevalence and occupational associations of neck pain in the British population

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**Objectives** This study determined the prevalence of neck pain and its relation to occupation and occupational activities in the general population.

**Methods** A questionnaire was mailed to 21 201 subjects aged 16–64 years, randomly selected from the patient registers of general practices in England, Scotland, and Wales, and to 993 subjects randomly selected from pay records of the armed services. Information was collected on occupation, workplace physical activities, neck pain in the past week and year, headaches, and feelings of tiredness or stress. Associations were explored by logistic regression, the resultant odds ratios being converted to prevalence ratios (PR).

**Results** Among 12 907 respondents, 4348 and 2528 reported neck pain in past year (1421 with pain interfering with normal activities) and week, respectively. Symptoms were the most prevalent among male construction workers [past week and year 24% and 38% (pain interfering with activities 11%), respectively], followed by nurses, armed services members, and the unemployed. Generally the age-standardized prevalence of neck pain varied little by occupation. Work with arms above the shoulders for >1 hours/day was associated with a significant excess of symptoms [PR 1.3–1.7 (women) and 1.2–1.4 (men)], but no associations existed for typing, lifting, vibratory tool use, or professional driving. Stronger neck-pain associations were found with frequent headaches (PR 2.3–2.8) and frequent tiredness or stress (PR 2.2–2.5) than with occupational activities.

**Conclusions** The data provide evidence against a strong association between neck pain and the examined occupational physical activities. They suggest that psychosocial factors may be more important.

**Key terms** causes, community, neck pain, occupational, prevalence, work-related.

Neck pain is common in the general population. Depending on the exact case definition, the lifetime prevalence for adults has been reported to range from 26% to 71% (1–4), the 1-year prevalence from 12% to 34% (4–8), and the point prevalence from 10% to 22% (3, 8–10). Often the pain is persistent, and in surveys in Norway and Sweden, 14–19% of the subjects reported symptoms lasting longer than 6 months in the previous year (2, 7).

In view of this high prevalence, it is important to identify the main determinants of neck pain and, especially, the risk factors that are potentially modifiable. Occupational activities have sometimes been implicated as causes of neck disorders (11–14). A recent re-

view concluded there was “some evidence” for a relation between neck pain and several factors, including neck flexion, arm force, arm posture, duration of sitting, twisting or bending, hand-arm vibration, and workplace design (12); while the National Institute for Occupational Health (NIOSH) in the United States concluded that there was “strong evidence” for an association between neck complaints and static loading of the neck-shoulder musculature at work, as well as “suggestive evidence” for risks from continuous arm and hand movements and forceful work involving the same muscle groups (13).

The studies cited in support of these conclusions were predominantly cross-sectional, and they were all based in industry, among a relatively small number of

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occupations. By contrast, occupational risk factors for neck pain have seldom been examined among people sampled from the general community, and in this setting the findings have been less consistent. In Finland, the risk of chronic neck pain was found to be higher among agricultural and industrial workers than among professionals (1), but the opposite pattern was observed in a survey of Hong Kong Chinese (4). In a 2nd Finnish study, there were no clear-cut differences between blue-collar and white-collar workers (5), whereas, in a Norwegian survey, the frequency of neck complaints was similar in groups with different levels of educational attainment (although risk by occupation was not specifically examined) (15).

Even less is known about the association of neck pain with specific occupational activities in the general population, but Makela et al (1) reported that physical and mental stress are associated with neck symptoms in Finns, and Westerling et al (6) made a similar observation (concerning neck-shoulder problems) for Swedes. More information is required on risk factors for neck pain in the general population, and the specific role of occupation and work activities in the occurrence of disease.

Recently, we conducted a large community-based survey in Great Britain, and, among other things, collected information about pain in various regions of the body, including the neck, occupational activities, and indices of psychosocial stress (16). This process provided an opportunity for us to assess the prevalence of neck pain by occupation and its association with physical activities in the workplace.

### **Subjects and methods**

In 1997–1998, we mailed a questionnaire to 21 201 men and women aged 16–64 years and selected at random from the patient registers of 34 general practices in England, Scotland, and Wales and to 993 subjects randomly selected from the central pay records for serving members of the British armed services (16). The study was undertaken primarily to assess national patterns of exposure to vibration and associated health complaints, and the questionnaire included items on employment status and occupation, performance of certain activities in an average workday, exposure in the past week to sources of vibration, smoking habits, frequency of headaches and feelings of tiredness or stress, and symptoms of neck pain in the past week and past year (17).

The occupations of the respondents were coded to the latest revision of the Standardized Occupational

Classification (SOC90), and SOC unit groups were combined into higher orders sharing similar occupational exposures, according to a scheme proposed by the Health and Safety Executive (18).

Information on exposure to occupational sources of vibration came from questions about the use of 39 listed vibratory tools and 26 listed vehicles and machines at work in the past week and from 2 open questions about other sources of exposure that were classified by a vibration specialist (MG), an occupational hygienist (BP), and an occupational physician (KP). In addition, subjects were asked whether an average workday in their job involved (i) lifting or moving weights of  $\geq 20$  lbs ( $\geq 10$  kg) by hand, (ii) lifting or moving weights of  $\geq 56$  lbs ( $\geq 25$  kg) by hand, (iii) work with the hands above shoulder height for  $>1$  hour, or (iv) using a computer keyboard or typewriter for  $>4$  hours.

The questionnaire included a modified version of the Standardized Nordic Questionnaire of Musculoskeletal Symptoms (19) and provided 3 alternative definitions of neck pain. These were pain lasting a day or longer during (i) the past 7 days and (ii) the past 12 months, and (iii) during the past 12 months with the addition that it also prevented the respondent from carrying out his or her normal activities (eg, job, housework, hobbies). In addition, questions were posed about tingling or numbness in the upper limb for at least 3 minutes during (i) the past 7 days and (ii) the past 12 months.

Altogether 22 415 subjects were selected for study, but 221 (1%) were excluded on their general practitioners' advice so that 22 194 questionnaires were mailed to 21 201 subjects from general practices and 993 members of the armed forces. Usable responses were obtained from 12 907 subjects (58% response rate overall or 61% among those who could be contacted). The response rate was higher for the women than for the men (67% versus 52%) and tended to be higher at older ages. Seventy-three percent of the respondents were in a paid job or were self-employed in the week preceding the completion of the questionnaire, and for these persons the mix of occupations was similar to that in the 1991 national census (20), except that the sampling design led to overrepresentation of the defense sector. Most of the subjects who had a job (9084 of 9368) had worked during the past week. Additional information on response patterns has been provided elsewhere (16).

Analyses of prevalence by occupation were directly standardized for age, using the age distributions of men and women in the whole sample as the standards. Associations of neck symptoms with risk factors were examined by logistic regression, and the findings were expressed as prevalence ratios (PR) with associated 95% confidence intervals (95% CI). These were derived from the corresponding odds ratios according to a formula proposed by Zocchetti et al (21).

**Table 1.** Prevalence of neck pain by age, gender, social class, and smoking habits.

Characteristic	Men			Women		
	Pain in past week (%)	Pain in past year (%)	Pain preventing activity in past year (%)	Pain in past week (%)	Pain in past year (%)	Pain preventing activity in past year (%)
Age (years)						
16—24	12.8	25.7	6.3	19.1	34.2	7.6
25—34	16.2	30.8	8.8	15.9	29.3	10.0
35—44	16.7	32.6	10.6	19.9	35.7	12.9
45—54	19.5	33.5	10.3	26.3	40.8	14.3
55—65 <sup>a</sup>	23.0	34.3	11.9	26.4	38.9	15.9
Social class <sup>b</sup>						
I—IIINM	14.0	28.7	7.4	19.5	35.8	11.3
IIIM—V	17.9	32.4	7.8	21.8	34.3	9.1
Unemployed	25.2	36.3	17.5	23.7	36.5	15.4
Armed Forces	17.7	33.6	10.4	20.9	35.8	9.0
Smoking						
Never	14.7	28.3	7.7	18.1	32.5	10.0
Ever	20.8	34.9	11.7	25.4	39.6	15.1

<sup>a</sup> Includes 33 men and 39 women who were 64 years of age when the questionnaire was mailed but who were 65 years of age when it was completed.

<sup>b</sup> Coded according to Office of Population Census Surveys (OPCS), but based on SOC90 (the latest revision of the Standardized Occupational Classification).

## Results

Altogether, 4348 subjects (34% of all respondents) reported neck pain in the past 12 months, 1421 (11%) reporting neck pain that had interfered with their normal activities, and 2528 (20%) reported neck pain in the past 7 days. The proportions reporting neck pain were similar among those replying at the 1st invitation and those requiring a reminder (20% versus 19% for neck pain in the past week, 34% versus 32% for neck pain in the past year, and 11% versus 11% for disabling neck pain in the past year). Table 1 shows the prevalence of neck complaints by age, gender, and social class, and also their relation to smoking habits. In general, neck pain was more common among the women than the men, and symptoms became more prevalent with increasing age. For the men, reports were also more common among the blue-collar workers (social classes IIIM, IV, and V) than among the white-collar workers (social classes I, II and IIINM). However, the differences were not marked, and this pattern was not apparent for the women. Symptoms were most often reported by the subjects who were unemployed. In particular, among the unemployed men, the prevalence of disabling neck pain during the past 12 months was more than twice that of those who were employed. Disabling neck pain was also more common in the armed forces, and the rates of symptoms were generally higher for subjects who had been smokers.

Neck pain was significantly associated with pain at other bodily sites, and also with numbness or tingling in the upper limb in the past week, and with headaches and reports of frequent tiredness or stress. Table 2 summarizes these associations for neck pain in the past

**Table 2.** Association of neck pain with symptoms at other sites and tiredness or stress. (PR = prevalence rate ratio, 95% CI = 95% confidence interval)

	Neck pain in past week			
	Men		Women	
	PR <sup>a</sup>	95% CI	PR <sup>a</sup>	95% CI
Pain in past week				
Shoulder(s)	5.9	5.4—6.5	6.4	5.8—7.0
Elbow(s)	2.6	2.3—2.9	3.0	2.7—3.3
Wrist(s)-hand(s)	2.9	2.6—3.2	3.1	2.8—3.3
Hip(s)	2.9	2.6—3.2	2.7	2.5—3.0
Knee(s)	2.5	2.2—2.7	2.6	2.3—2.8
Troublesome low back in past year <sup>b</sup>	2.1	1.9—2.3	2.1	1.9—2.3
Numbness or tingling in upper limb in past week <sup>c</sup>	2.6	2.4—2.9	2.5	2.3—2.8
Frequent headaches	2.8	2.5—3.1	2.3	2.1—2.5
Frequent tiredness or stress	2.2	2.0—2.4	2.5	2.3—2.8

<sup>a</sup> Adjusted for age (in 5 strata) and smoking (ever versus never).

<sup>b</sup> Back pain that made it difficult or impossible to put on shoes, stockings, or tights.

<sup>c</sup> Lasting at least 3 minutes.

week, but similar associations were found for neck pain in the past year, and for neck pain that limited activity in the past year (data not presented). The strongest relationship was between neck and shoulder pain (PR 5.9—6.4). Otherwise, the associations were all of similar magnitude. In particular, neck pain was no more strongly related to numbness or tingling in the upper limbs or to elbow or hand-wrist pain than to pain in the lower limbs.

Table 3 shows the age-standardized prevalence of neck pain by occupation. The analysis was restricted to occupational groupings for which there were at least 150

**Table 3.** Age-standardized prevalence<sup>a</sup> of neck pain by occupation.

Occupation <sup>b</sup>	Number in occupation <sup>c</sup>	Neck pain (%)		
		Past week	Past year	Preventing activity in past year
<i>Men</i>				
Construction	248	24.4	38.5	10.6
Road transport operatives	225	19.3	36.1	7.3
Teaching	150	18.1	34.9	9.9
Security & protective services	721	17.9	31.3	9.1
Metal processing	472	17.7	34.9	7.5
Farming, fishing & forestry	198	17.3	31.5	6.3
Other processing	450	17.1	29.6	7.3
Managerial	539	16.2	30.2	9.2
Selling	225	15.4	32.6	6.8
Electrical processing	180	15.2	33.5	8.4
Other education & welfare	154	14.8	24.3	5.7
Clerical	313	13.7	22.1	6.1
Professional & supporting management	329	12.5	27.7	7.2
Science & engineering	400	11.3	28.4	6.0
All other occupations	882	16.5	29.8	7.7
<i>Women</i>				
Secretarial	356	24.8	39.2	13.0
Cleaners	193	20.4	35.7	7.0
Other education & welfare	193	20.2	34.5	13.6
Clerical	669	20.1	34.8	9.0
Catering	210	19.8	31.4	8.8
Selling	343	19.4	33.1	9.0
Managerial	261	19.3	36.0	11.9
Care	325	19.0	33.4	8.6
Professional & supporting management	220	18.3	36.3	13.2
Nursing	245	17.1	35.5	14.8
Teaching	230	16.5	35.7	9.4
All other occupations	633	21.9	36.6	11.0

<sup>a</sup> The prevalence estimates were directly standardized according to the age distribution of the whole male-female sample.

<sup>b</sup> As defined in reference 24.

<sup>c</sup> Maximum number — a few respondents did not answer all of the questions.

**Table 4.** Risk of neck pain by occupational activity. (PR = prevalence rate ratio, 95% CI = 95% confidence interval, +ve = positive for symptoms)

Occupational activity	Past week			Past year			Preventing activity in past year		
	%+ve	PR <sup>a</sup>	95%CI	%+ve	PR <sup>a</sup>	95%CI	%+ve	PR <sup>a</sup>	95%CI
<i>Men</i>									
Average workday									
Lifting weights									
≤ 10 kg	18.1	1.0	-	31.1	1.0	-	10.8	1.0	-
10–25 kg	15.4	0.9	0.7–1.0	33.0	1.0	0.9–1.1	7.6	0.7	0.6–1.0
> 25 kg	21.1	1.1	1.0–1.3	37.7	1.1	1.0–1.2	10.7	1.0	0.8–1.2
Work with hands above shoulder height for >1 hour	23.8	1.4	1.2–1.6	42.0	1.3	1.1–1.4	11.6	1.2	1.0–1.5
Use of keyboard for >4 hours	16.0	0.9	0.8–1.1	31.4	1.0	0.9–1.1	8.1	0.8	0.6–1.0
Past week:									
Occupational exposure to hand-arm vibration	19.2	0.9	0.8–1.1	36.7	1.0	0.9–1.1	10.0	1.0	0.8–1.2
Occupational exposure to whole-body vibration	18.5	1.0	0.9–1.2	35.6	1.1	1.0–1.2	9.4	0.9	0.8–1.1
<i>Women</i>									
Average workday									
Lifting weights									
≤ 10 kg	21.8	1.0	-	36.5	1.0	-	12.6	1.0	-
10–25 kg	26.9	1.1	0.9–1.3	44.2	1.1	1.0–1.3	13.3	1.0	0.7–1.2
> 25 kg	26.8	1.1	0.9–1.4	42.5	1.1	0.9–1.3	19.6	1.4	1.1–1.8
Work with hands above shoulder height for >1 hour	41.0	1.7	1.3–2.1	56.6	1.4	1.2–1.6	20.3	1.3	0.9–1.9
Use of keyboard for >4 hours	23.3	1.2	1.0–1.3	39.7	1.1	1.1–1.2	12.3	1.0	0.8–1.2
Past week:									
Occupational exposure to hand-arm vibration	28.5	1.2	0.9–1.5	46.6	1.2	1.0–1.4	15.0	1.1	0.7–1.5
Occupational exposure whole-body vibration	21.8	1.0	0.8–1.1	38.4	1.0	0.9–1.1	12.3	0.9	0.7–1.2

<sup>a</sup> The PR values were mutually adjusted and also adjusted for age (in 5 strata), smoking history (ever versus never), reports of frequent headaches (yes versus no) and reported feelings of frequent tiredness or stress (yes versus no).

subjects, and these were ranked according to the prevalence of neck pain in the past week. For comparison, the prevalence of neck pain in all other occupations combined is also given. Among the men, neck pain was the most prevalent among the construction workers (24% of whom had symptoms in the past week, 38% in the past year, and 11% in the past year to a degree that interfered with normal activities). Male teachers also featured highly in each of the rankings. Overall, however, the differences in the prevalence between the occupational groups were modest.

Among the women the highest prevalence of symptoms was found for secretarial jobs, but again there was little difference between occupations. More variation occurred, however, in the proportion of cases with pain that interfered with everyday activities. Such disability was the most common among the nurses, although this group had a relatively low prevalence of neck pain in the past week.

Table 4 summarizes the association of neck pain with occupational activities. This analysis was restricted to the men and women who were employed, and the prevalence ratios (PR) were mutually adjusted, as well as being adjusted for age, smoking, and frequent headaches and tiredness or stress. Work with the hands above shoulder height for >1 hour a day was associated with a significant excess of neck pain among the women (PR 1.3–1.7) and to a less extent among the men (PR 1.2–1.4). For both genders the risk was greatest for reports of neck pain in the past week. By contrast, no consistent associations were found with the use of a keyboard for >4 hours in an average workday or with occupational exposure to vibration (including professional driving). In addition, there was no clear relation to lifting, apart from a PR of 1.4 (95% CI 1.1–1.8) for neck pain preventing activity among the women who lifted the heaviest weights. Similar risks were found in an analysis that did not adjust for the psychosocial variables; also risk estimates were found to be similar for those who responded with and without a reminder (data not presented).

## Discussion

We found that neck pain is common in the community. This finding confirms the results of an earlier British study (22) and several surveys from other countries (1–10, 14, 23). Symptoms were associated with complaints of pain at other bodily sites, neurological symptoms in the upper limbs, and headaches, tiredness and stress. Symptoms were more common for women, smokers, and the unemployed. The differences between blue-collar and white-collar occupations were small, although

for the men associations were found with work in the construction industry and work with the hands above shoulder height.

Our study sample was large and included men and women from general practices across the country. As such, it is likely to have been fairly representative of the national population. In Great Britain almost everyone registers with a general practitioner from the National Health Service, apart from members of the armed services, who were sampled separately.

A disadvantage of using a postal questionnaire was the relatively low response rate of 58%. The distribution of occupations among the respondents was similar to that in the population at large (as evidenced by census information), and the analysis accounted for differential response rates by age and gender (by standardization and stratification). However, this level of response raises the possibility that the prevalence of neck pain may have been exaggerated if symptomatic subjects returned the questionnaire more readily than those who were symptom-free. In addition, the associations of neck pain with occupational activities could have been biased if exposed subjects with symptoms responded preferentially, and associations with occupation could have been biased if, within certain occupations, those with neck pain responded more readily. We consider these possibilities unlikely, however, in the context of a survey that was conducted primarily for other purposes. (Only 3 items on neck pain were included as part of a 24-page questionnaire about occupational exposures to vibration.) Furthermore, the prevalence of neck pain among the people who responded to the questionnaire with and without a reminder were similar, as were the associations with occupational risk factors, and therefore an absence of differential response was suggested.

Another potential source of error was inaccuracy in the information obtained about symptoms and occupational activities. The Nordic questionnaire has been widely used, and it is reported to have good repeatability and validity (19, 24). We have found, similarly, that questions about pain in the neck and at other bodily sites are repeatable when re-tested at an interval of a week (25). Self-estimates of occupational exposure may be subject to more error, and this possibility would generally lead to an underestimation of the strength of association with neck pain. But the information about occupational activities came from questions that had previously been tested and found reliable. The validity of self-reported occupational exposures to vibration had been assessed against direct observation and information supplied by employers (26), while the section of the questionnaire on physical activities was based on questions used and validated elsewhere (27, 28). Another possibility is that people whose work entailed an activity that was made more difficult by neck pain were

more aware of the activity or the symptom and therefore were more likely to report them. If so, the effect would have been to exaggerate the risk estimates.

Given that relatively few associations were found with occupational activities, a more important limitation of the study was its cross-sectional design. Analysis was based only on current occupation, and it is possible that some subjects with neck disorders caused by work were no longer in the job that had given rise to the problem. The high prevalence of disabling neck pain among unemployed men would be consistent with selection of this sort, although it could simply reflect difficulty in obtaining and keeping a job in the presence of disabling disease, irrespective of whether work contributed to the illness. It is also conceivable that unemployed people are more aware of symptoms and have a lower threshold for reporting them. We cannot exclude the possibility that risks from occupational activities have been underestimated because of selective transfer away from hazardous jobs. However, to have an important effect, such redeployment would have to be extensive.

People who reported neck pain in our survey tended also to report symptoms more frequently than the average in other parts of the body. To some extent this tendency may have occurred because of a shared underlying pathology. In particular, cervical spondylosis often causes symptoms in the shoulder and arm, as well as in the neck. However, the association may also reflect a generally lower threshold for some persons to report symptoms. Among the factors that can contribute to such a tendency are psychosocial influences. We found that neck pain was more common in subjects who complained of frequent tiredness and stress, and a similar relation has been found for pain at other anatomical sites (29). In a cross-sectional survey it is difficult to determine whether the pain precedes or follows the psychological symptoms, but longitudinal studies of back pain have suggested that stress is not simply a consequence of pain (30, 31).

Our findings provide some evidence for occupational influences on neck disorders, notably an excess of neck pain in male construction workers and of disabling neck pain in female nurses, and an association with work that involves using the hands above shoulder height. Studies from the construction industry lend support to some of these findings (32, 33). However, no association was found with lifting, use of vibratory tools, or professional driving, and, in general, the relation to work appeared to be weaker than that found for low-back pain in the same survey (34).

Many of the jobs with higher rates of neck pain were white-collar occupations. The excess among female secretaries is in accord with the results of industry-specific surveys (12–14) and with theories that neck pain may be caused by static loading of the neck muscles. Excess-

es were also seen among male teachers, female education and welfare workers, and (for troublesome neck pain) male managers — and it can be postulated that these excesses were caused by stress-related muscular tension. But the picture is not entirely consistent — female teachers were low in the rankings of occupations with neck pain in the past week; male education and welfare workers reported relatively little neck pain; and no excess risks were found for people who typed for >4 hours per day at work. This last finding contrasts with the findings of several industry-based surveys of computer users and data entry operators.

A relation has often been observed between work with the hands above shoulder height and shoulder pain (12, 13), and also with shoulder pain in the presence of neck pain (11); but a separate association with neck pain has seldom been described. Some subjects in our study may have confused these anatomically adjacent regions in their responses, although inquiry was made about both symptoms, and subjects often reported suffering both complaints. It seems likely on biomechanical grounds that disorders of these sites share causal factors, but further investigation is warranted with specific reference to neck disorders.

One particular focus of our survey was the accurate characterization of exposures to whole-body vibration and hand-transmitted vibration. The risk of neck pain from exposure to whole-body vibration has been little investigated, and the findings to date have been contradictory. Linton et al (35) reported odds ratios of 1.3 to 1.8 for neck pain for Swedish workers with exposure to vibration (the type of vibration was unspecified). However, in another Swedish investigation, subjects with neck pain did not report exposures to whole-body vibration more often than matched referents (36), and, in a study of professional drivers, neck pain was found to be more prevalent among bus drivers than among sedentary referents, but not more so than among truck drivers (37). The association between hand-transmitted vibration and neck pain has likewise seldom been considered, although, in 1 study, chronic neck pain, spondylosis, and spondyloarthritis were all more common in retired steelworkers who had used grinding tools than in matched white-collar referents (38). High prevalences of neck pain have also been found for dentists using high-speed drills and for foresters using chain saws (12), although ergonomic rather than vibratory factors may have underlain these associations. Our findings suggest that whole-body vibration and hand-transmitted vibration are not important causes of neck pain in the general population.

The relatively high proportion of neck pain interfering with activities that we found in the armed forces could have 1 of 2 explanations — either that physical activities pose a particular risk of neck injury among

military personnel or that workers tend to be declared unfit more readily than in other occupations. Our data did not help us to distinguish between these possibilities.

Our questionnaire did not cover all of the physical and psychosocial risk factors that may influence the occurrence of neck pain. For example, we did not inquire about neck flexion, or about arm and body posture, and therefore our findings do not exclude risks from these exposures. Nor did we specifically consider stressors that arise from work itself, such as job dissatisfaction and limited control over job content, although studies that have done so tend to report positive associations, emphasizing the importance of mental well-being as a determinant of neck pain (39, 40).

However, our study of 22 000 working-aged adults from the general population provides, with the exception of work with the hands above shoulder height, remarkably little evidence of an association between neck pain and physical activities in the workplace. Psychosocial factors seem to be a more important influence, in contrast to back pain, for which physical and psychosocial components are both important. The data provide an argument for directing intervention toward psychosocial measures, but, first, longitudinal studies should be conducted to elucidate the role of these factors more fully.

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