

Back Pain Prevalence in US Industry and Estimates of Lost Workdays

ABSTRACT

Objectives. Back pain is the most common reason for filing workers' compensation claims and often causes lost workdays. Data from the 1988 National Health Interview Survey were analyzed to identify high-risk industries and to estimate the prevalence of work-related back pain and number of workdays lost.

Methods. Analyses included 30074 respondents who worked during the 12 months before the interview. A case patient was defined as a respondent who had back pain every day for a week or more during that period.

Results. The prevalence of lost-workday back pain was 4.6%, and individuals with work-related cases lost 101.8 million workdays owing to back pain. Male and female case patients lost about the same number of workdays. Industries in high-risk categories were also identified for future research and intervention, including those seldom studied.

Conclusions. This study provides statistically reliable national estimates of the prevalence of back pain among workers and the enormous effect of this condition on American industry in terms of lost workdays. (*Am J Public Health*. 1999;89:1029-1035)

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Back pain is the most common reason for the filing of workers' compensation claims in the United States. It accounts for about one fourth of all claims^{1,2} and one third of total compensation costs.³ Back pain, which results in about 40% of absences from work, is second to only the common cold as the most frequent cause for sick leave.³ In 1990, estimates of the cost of back pain in the United States ranged from \$50 billion to \$100 billion.⁴

An analysis of data from the National Health Interview Survey (NHIS) estimated that in a given 1-year period, there are about 22.4 million cases of back pain that last a week or more (prevalence: 17.6%), and these cases were estimated to result in a total of about 149 million lost workdays.⁵ That analysis, however, included all back pain. Therefore, we conducted further analyses of work-related back pain and issues regarding workday loss.

Because lost workdays is a well-defined outcome and a good surrogate for disease severity, the results of this study should aid in assessments of the seriousness of the problem. The previous analysis of NHIS data identified occupations that present high risk for back pain⁵; in this study, however, we aimed at identifying high-risk industries to better define the target for research and intervention.

Methods

The NHIS is conducted annually by the National Center for Health Statistics (NCHS). The purpose of the survey, which involves a probability sample of noninstitutionalized civilians living in the United States, is to estimate national health statistics. Each year, various supplements are added to allow examination of special topics. In 1988, the National Institute for Occupational Safety and Health (NIOSH) and the Bureau of Labor Statistics cosponsored the Occupational Health Supple-

ment, which included a "work history" section and sections on various diseases and conditions, including back pain.⁶ From each family in each participating household (some households had more than 1 family), a household member 18 years or older was randomly selected for the interview; proxy respondents were not accepted. Complete documentation on the NHIS, as well as the survey questionnaire, is available from the NCHS.⁶⁻⁸

We defined a "worker" as a respondent who answered yes to the following question: "During the past 12 months, that is since [a specific date] a year ago, did you work at any time at a job or business, not counting work around the house?" Unpaid work in a family business or farm was included. From responses to this question, 30074 workers were identified, representing 127 million working people across the United States. A "case patient" was defined as a respondent who reported having back pain in any anatomical location every day for a week or more during the study period (i.e., the 12-month period before the interview), with the pain not entirely related to menstruation. Such reports led to identification of 5256 cases, projecting to about 12.5 million male and 9.9 million female case patients.⁵

Three-digit 1980 Bureau of the Census industry codes⁹ were used to code the indus-

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tries of employment. Most analyses were limited to "major industries" (defined as industry groups with a specific 3-digit Bureau of the Census code that employed more than 0.5% of the total working population of either sex) to ensure that estimates were based on sufficient observations. Among the 230 industry groups with specific 3-digit codes, 59 were identified as major industries for men (each with more than 349 000 male workers) and 48 were so identified for women (each with more than 290 000 female workers). Each case patient was asked to determine whether his or her back pain was "work related" (defined as caused by work activities) and, if so, to identify the job in which the activities were performed.

To estimate the prevalence of work-related back pain, we calculated a ratio with the total number of workers in an industry as the denominator and the number of patients attributing back pain to that industry as the numerator.⁶ We also calculated a prevalence ratio with the overall prevalence of work-related back pain as the denominator and the prevalence in a given industry as the numerator.⁵ In most cases, "high-risk industries" referred to the major industries with the 15 highest prevalence ratios.

Number of lost workdays was addressed by the question "During the past 12 months, how many full days did you miss from work because of back pain?" About 98% of the interviewed case patients responded to this question. A case in which an individual had lost workdays because of back pain during the study period was classified as a "lost-workday case." Survey Data Analysis (SUDAAN)¹⁰ software was used in conducting data analyses. In accordance with the practice of the NCHS,⁸ we report statistics for the US population that we estimated by applying a weighting factor to each respondent; we do not report survey results directly.

In summary, we evaluated 3 outcomes: cases (instances in which a worker had at least 1 episode of nonmenstrual back pain lasting for a week or more during the study period), work-related cases (instances in which a case patient attributed the back pain to work activities), and lost-workday cases (instances in which a case patient lost workdays owing to back pain during the study period).

Results

Prevalence of Work-Related Back Pain and High-Risk Industries

As shown in Table 1, among major industries for men, lumber and building material retailing involved the highest risk and con-

TABLE 1—Prevalence and Number of Work-Related Back Pain Cases in the 15 Highest Risk Major Industries, by Sex: National Health Interview Survey, 1988

Industry (Bureau of the Census Industry Code)	Respondents ^a	Cases	Prevalence, % (SE)	Prevalence Ratio ^b
Male workers				
Lumber and building material retailing (580)	75	87 000	23.9 (5.6)	2.2
Crude petroleum and natural gas extraction (042)	107	106 000	22.0 (3.5)	2.1
Sawmills, planing mills, and millwork (231)	69	74 000	21.7 (6.1)	2.0
Grocery stores (601)	254	237 000	18.7 (3.1)	1.8
Construction (060)	1550	1 339 000	17.8 (1.2)	1.7
Trucking service (410)	335	271 000	17.6 (2.5)	1.6
Furniture and home finishing stores (632)	76	67 000	16.9 (4.4)	1.6
Agricultural production, crops (010)	200	151 000	16.7 (3.4)	1.6
Auto and home supply stores (620)	75	63 000	16.7 (5.5)	1.6
Blast furnaces, steelworks, rolling and finishing mills (270)	95	75 000	16.6 (4.2)	1.6
Miscellaneous repair services (760)	77	59 000	16.4 (4.8)	1.5
Groceries and related products (550)	139	116 000	16.4 (4.2)	1.5
Agricultural production, livestock (011)	223	167 000	15.7 (2.5)	1.5
Furniture and fixtures (242)	101	79 000	15.5 (5.0)	1.5
Automotive repair shops (751)	184	137 000	15.5 (3.2)	1.4
Female workers				
Nursing and personal care facilities (832)	416	243 000	16.4 (2.2)	2.4
Beauty shops (772)	200	114 000	14.9 (3.4)	2.2
Motor vehicles and motor vehicle equipment, manufacturing (351)	91	44 000	13.5 (4.1)	2.0
Services to dwellings and other buildings (722)	128	57 000	12.8 (3.7)	1.9
Hotels and motels (762)	186	94 000	12.8 (2.3)	1.9
US Postal Service (412)	86	34 000	10.8 (4.0)	1.6
Agricultural production, crops (010)	74	33 000	10.8 (3.7)	1.6
Grocery stores (601)	381	174 000	10.7 (1.9)	1.6
Miscellaneous manufacturing industries (391)	94	35 000	10.3 (3.7)	1.5
Hospitals (831)	1001	331 000	9.1 (1.0)	1.4
Eating and drinking places (641)	917	303 000	8.7 (1.1)	1.3
Apparel and accessories, except knit (151)	197	65 000	8.6 (2.0)	1.3
Drug stores (642)	92	31 000	8.5 (4.1)	1.3
Yarn, thread, and fabric mills (142)	86	29 000	8.4 (4.5)	1.2
Private households (761)	343	88 000	7.8 (1.9)	1.2

Note. A major industry was defined as an industry group with a specific 3-digit Bureau of the Census code that employs at least 0.5% of the total working population of either sex.

^aActual number of respondents in each industry.

^bDenominator is overall prevalence in each sex, which was 10.7% (SE = 0.3%) for male workers and 6.7% (SE = 0.2%) for female workers.

struction included the most cases. Among major industries for women, nursing and personal care facilities involved the highest risk and hospitals comprised the most cases. Grocery stores and agricultural production, crops were ranked among the top 10 by both sexes. Results showed that workers of different sexes in the same industry may have very different risks. For example, construction ranked 5th among men (prevalence: 17.6%) but ranked last among women (prevalence: 0.8%), and motor vehicles and motor vehicle equipment, manufacturing ranked 3rd among women (prevalence: 13.5%) but ranked 28th among men (prevalence: 9.5%).

Demographic Characteristics and Lost Workdays

About 26% of the cases were lost-workday cases. This proportion was similar for

men and women (Table 2). The overall prevalence of back pain was 17.6%,⁵ and thus the prevalence of lost-workday back pain was approximately 4.6% (26% × 17.6%). Work-related cases involved a higher proportion of lost workdays (30.1%; SE = 1.0%) than did non-work-related cases (21.4%; SE = 1.0%).

During the study period, each case patient (with or without lost workdays) missed an average of 6.8 (SE = 0.5) workdays because of back pain, and male and female patients lost similar numbers of workdays (Table 2). Work-related cases involved more lost workdays on average (9.2 days; SE = 0.8 days) than did non-work-related cases (4.9 days; SE = 0.6 days). Whereas the average number of workdays lost by each worker (with or without back pain) was only 1.2, each patient with a lost-workday case (regardless of whether it was work related) lost an average of 26.3 workdays. About 78% of patients

TABLE 2—Number and Proportion of Lost-Workday Back Pain Cases and Average Number of Workdays Lost by Each Patient, by Sex: National Health Interview Survey, 1988

Group	Men			Women		
	No. of Cases	Lost-Workday Cases, % (SE)	Lost Workdays, Mean (SE)	No. of Cases	Lost-Workday Cases, % (SE)	Lost Workdays, Mean (SE)
Race/ethnicity						
Aleut, Eskimo, or American Indian	59 000	41.0 (12.4)	2.4 (1.1)	30 000	30.6 (10.1)	2.8 (1.5)
Asian or Pacific Islander	28 000	19.1 (7.6)	12.3 (7.6)	26 000	16.6 (6.7)	6.1 (4.1)
Black	310 000	35.4 (3.8)	9.3 (2.1)	358 000	39.4 (3.7)	15.2 (4.2)
White	2 792 000	25.4 (1.0)	6.7 (0.7)	1 981 000	23.5 (1.1)	5.7 (0.7)
Age, y						
18–24	346 000	23.0 (3.1)	6.9 (2.2)	338 000	23.6 (3.1)	5.0 (1.5)
25–34	1 075 000	30.3 (1.9)	8.5 (1.3)	749 000	27.1 (2.0)	6.1 (1.4)
35–44	961 000	27.4 (1.9)	5.4 (1.1)	631 000	24.7 (1.9)	7.4 (1.6)
45–54	510 000	24.8 (2.4)	6.9 (1.5)	446 000	27.0 (2.4)	8.8 (1.8)
55–64	283 000	22.4 (3.0)	7.3 (2.2)	205 000	20.3 (2.7)	4.4 (1.2)
65–74	64 000	18.0 (4.6)	5.8 (4.1)	45 000	19.2 (5.2)	9.3 (4.6)
>74	9 000	13.1 (8.3)	6.2 (3.9)	0	0.0 (0.0)	0.0 (0.0)
Total	3 248 000	26.4 (1.0)	6.9 (0.7)	2 414 000	25.0 (1.0)	6.6 (0.7)

Note. A lost-workday back pain case was defined as a case in which a patient with back pain reported missing at least 1 workday because of back pain in the 12-month study period.

with lost-workday cases missed 20 or fewer workdays, and 51% lost 5 or fewer workdays. At the other end of the distribution, about 10% missed work for 3 months or more, and 6% missed work for 6 months or more.

Male patients aged 25 to 34 years and female patients aged 65 to 74 years had the most workday loss. For both sexes, patients aged 25 to 34 years had the largest proportion of lost-workday cases, and those older than 74 years had the smallest proportion (Table 2). Among the major racial groups, Asian or Pacific Islander men and Black women had the most lost workdays (Table 2). The Asian or Pacific Islander group had the smallest proportion of lost-workday cases among both sexes, whereas men in the Aleut, Eskimo, or American Indian group and Black women had the largest proportions (Table 2).

Industry and Lost Workdays

Of the 149.1 million workdays lost as a result of back pain, 101.8 million (68%) were lost by individuals with work-related cases. In the major industries among men, construction involved the most lost-workday cases (1 765 000) and the electronic computing equipment category involved the most workdays lost per case (28.9 days; including patients with and without lost workdays) (Table 3). In the major industries among women, the category with the most lost-workday cases was elementary and secondary schools (760 000); the US Postal Ser-

vice category had the most workday losses per case (61.5 days). Grocery stores ranked among the top 10 and hospitals, banking, and eating and drinking places ranked among the top 15 major industries with the most average lost workdays among both sexes; however, men and women in the same industry may differ significantly in terms of workday loss. For example, the US Postal Service category involved the highest average number of workdays lost per case (61.5 days) among women, but male case patients missed an average of only 1.9 days (data not shown in tables).

When the proportion of work-related lost-workday cases was used as an indicator of prevalence of severe cases among men, the furniture and fixtures category included the largest proportion (52.2%; SE = 13.3%), and patients with lost-workday cases missed an average of 9.5 (SE = 3.3) workdays (Table 4). Among women, the US Postal Service category also involved the largest proportion (74.4%; SE = 10.7%), and patients with lost-workday cases missed an average of 82.7 (SE = 26.8) workdays. This proportion may likewise differ extensively between men and women in an industry. In the US Postal Service category, 74.4% of female case patients had lost workdays (ranked 1st), as opposed to only 28.4% of male case patients (ranked 27th). Seven of the top 15 high-risk industries among women (Table 1), but only 4 among men, were also among the top 15 in regard to largest proportions of lost-workday cases (Table 4).

Discussion

Prevalence of Work-Related Back Pain and High-Risk Industries

We found that the statistics on work-related back pain and lost workdays estimated from data in the NHIS Occupational Health Supplement are fairly consistent with findings from other studies. Most surveys on American workers have not determined whether back pain is work related. A study on workers' compensation in 26 states found only 0.86 claim per 100 workers for back injuries.¹ Patients awarded workers' compensation should be regarded as having work-related cases; most workers' compensation studies would underestimate risk levels, however, because some patients might not receive compensation. One report indicated that about 50% of patients with a back pain episode did not seek medical care,¹¹ and another estimated that only about 10% of patients with low-back pain episodes were awarded workers' compensation.¹²

Nationwide studies on work-related back pain in other countries are quite limited; in the few such investigations reported, estimated prevalence rates have ranged from 0.19% to 26.4%.^{13–17} The prevalence in the United States is not extremely low or high relative to these estimates.

High-Risk Industries

To evaluate how extensively the high-risk industries identified by the NHIS Occu-

TABLE 3—Top 15 Major Industries With the Highest Average Number of Workdays Lost for Each Work-Related Back Pain Case, by Sex: National Health Interview Survey, 1988

Industry (Bureau of the Census Industry Code)	No. of Lost- Workday Cases	Workdays Lost per Case, Mean (SE)
Male workers		
Electronic computing equipment (322)	18 000	28.9 (26.9)
Services to dwellings and other buildings (722)	21 000	28.3 (22.3)
Soaps and cosmetics (192)	17 000	26.0 (23.0)
Auto and home supply stores (620)	34 000	17.8 (13.2)
Horticultural services (021)	29 000	16.7 (13.1)
Grocery stores (601)	104 000	14.9 (8.2)
Agricultural production, livestock (011)	32 000	14.9 (9.4)
National security and international affairs (932)	46 000	13.9 (11.9)
Insurance (711)	38 000	13.4 (7.7)
Justice, public order, and safety (910)	86 000	13.3 (9.6)
Newspaper publishing and printing (171)	38 000	12.1 (4.7)
Hospitals (831)	64 000	12.0 (6.1)
Banking (700)	14 000	11.3 (7.9)
Eating and drinking places (641)	96 000	10.4 (6.5)
Printing, publishing, and allied industries, except newspaper (172)	46 000	9.6 (5.5)
Female workers		
US Postal Service (412)	42 000	61.5 (25.1)
Social services, n.e.c. (871)	37 000	29.9 (13.1)
Beauty shops (772)	38 000	14.2 (13.2)
Grocery stores (601)	79 000	12.1 (7.8)
Miscellaneous manufacturing industries (391)	22 000	12.0 (9.5)
Banking (700)	85 000	11.5 (7.7)
Apparel and accessories, except knit (151)	24 000	10.1 (6.0)
Miscellaneous entertainment and recreation services (802)	16 000	9.9 (7.8)
General government, n.e.c. (901)	9 000	9.5 (7.6)
Private households (761)	28 000	9.5 (7.4)
Nursing and personal care facilities (832)	87 000	8.7 (2.6)
Hospitals (831)	203 000	8.6 (3.2)
Eating and drinking places (641)	128 000	8.6 (3.3)
Business management and consulting service (732)	24 000	8.5 (5.2)
Apparel and accessory stores, except shoe (630)	35 000	8.1 (4.7)

Note. A major industry was defined as an industry group with a specific 3-digit Bureau of the Census code that employs at least 0.5% of the total working population of either sex. A lost-workday back pain case was defined as a case in which a patient with back pain reported missing at least 1 workday owing to back pain in the 12-month study period. n.e.c. = not elsewhere classified.

pational Health Supplement had been studied, we used "back pain," "back injury," and "back injuries" as keywords to search for reports on high-risk industries in the National Institute for Occupational Safety and Health Information System (NIOSH), a database on occupational safety and health (available at www.cdc.gov/niosh/nioshtic.html). Among the 1263 abstracts and papers reviewed, 243 identified their study populations by industry and focused on 1 or several industries. We coded the industries with US Bureau of the Census codes and allowed for situations in which articles covered more than 1 industry.

The 10 most frequently studied industries were coal mining (28 studies); hospitals (27); construction (20); national security and international affairs (16); blast furnaces, steelworks, rolling and finishing mills (11);

motor vehicles and motor vehicle equipment (10); US Postal Service (9); agricultural production, crops (8); unspecified metal industries (7); and aircraft and parts (7). Six of these industries were among the top 10 high-risk industries for at least 1 sex. Coal mining was not a major industry for either sex and therefore was not listed in the tables. But the prevalence of back pain cases among male workers in this industry was 20.0%, higher than that of the fourth highest risk industry for men.

The review showed that many studies have targeted high-risk industries. Certain of the top 5 high-risk industries, however, had not been extensively studied. Among those for men, construction, crude petroleum and natural gas extraction, and grocery stores were covered by 20, 5, and 4 studies, respectively, whereas only 1 study covered

sawmills, planing mills, and millwork and none covered lumber and building material retailing. Among high-risk industries for women, motor vehicles and motor vehicle equipment and nursing and personal care facilities were covered by 10 and 3 studies, respectively; however, only 1 study covered hotels and motels, and none covered beauty shops or services to dwellings and other buildings.

Among the 10 most frequently studied industries, only national security and international affairs was not a high-risk industry for either sex. It was covered by 16 studies (ranked fourth), but all of these studies involved military personnel, who were excluded from the NHIS. Therefore, the results should not be considered as conflicting with those of the NHIS Occupational Health Supplement. The high risks among men in the lumber and building material retailing classification and among women in the beauty shops and hotels and motels classifications have generally not been recognized.

The 3-digit Bureau of the Census codes provide detailed classifications of industries, but workers in the same industry might have different risks. In some cases, high-risk workers would be better identified through occupations. For example, although our review showed only 3 studies on the industry of nursing and personal care facilities, many studies have been conducted on various occupations within this industry.⁵ When workplaces are designated for research or intervention, they are usually defined by industry. However, workers are better defined by occupation or by a subgroup of workers in a workplace when such efforts are implemented by unions. Therefore, it is important to identify both occupations and industries involving high levels of risk.

Lost Workdays

Because, according to our definition, all case patients had at least 1 episode of back pain lasting for a week or more and thus were more likely to experience lost workdays than patients not fitting the definition, the proportion of lost-workday cases (26%) was probably an overestimation. The high proportion of lost-workday cases found among patients with work-related cases could also have been overestimated as a result of information bias. In comparison with the NHIS Occupational Health Supplement prevalence of 30.1%, other studies have found that 9% to 29.2% of back pain patients experience sickness absences within a given year.^{18,19}

On the other hand, the overall prevalence of lost-workday back pain (4.6%) could be an underestimation because patients with

TABLE 4—Top 15 Major Industries With the Largest Proportion of Work-Related Lost-Workday Back Pain Cases, by Sex: National Health Interview Survey, 1988

Industry (Bureau of the Census Industry Code)	Lost- Workday Cases, % (SE)	Workdays Lost per Lost-Workday Case, Mean (SE)
Male workers		
Furniture and fixtures (242)	52.2 (13.3)	9.5 (3.3)
Horticultural services (021)	46.6 (13.5)	35.8 (24.5)
Newspaper publishing and printing (171)	45.9 (11.2)	26.3 (9.3)
National security and international affairs (932)	39.8 (11.8)	34.8 (28.4)
Security, commodity brokerage, and investment companies (710)	36.9 (13.9)	10.0 (8.1)
Hospitals (831)	36.4 (7.4)	32.9 (14.5)
Grocery stores (601)	36.3 (6.7)	41.1 (21.5)
Auto and home supply stores (620)	35.9 (14.5)	49.7 (29.4)
Pulp, paper, and paperboard mills (160)	35.7 (15.0)	4.0 (0.9)
Guided missiles, space vehicles and parts (362)	35.6 (14.6)	6.1 (1.7)
Justice, public order, and safety (910)	35.1 (6.4)	37.8 (26.1)
Machinery, except electrical, n.e.c. (331)	34.7 (9.9)	5.2 (1.2)
Automotive repair shops (751)	34.4 (10.9)	7.0 (2.2)
General government, n.e.c. (901)	34.2 (16.3)	24.0 (14.5)
Electronic computing equipment (322)	32.9 (13.0)	87.8 (72.6)
Female workers		
US Postal Service (412)	74.4 (10.7)	82.7 (26.8)
Social services, n.e.c. (871)	48.7 (11.6)	61.4 (24.0)
Business management and consulting service (732)	44.2 (15.7)	19.3 (9.8)
Printing, publishing, and allied industries, except newspaper (172)	40.7 (8.4)	15.9 (5.8)
Miscellaneous manufacturing industries (391)	40.4 (15.8)	29.8 (22.2)
Drug stores (642)	36.8 (16.4)	6.0 (2.5)
Yarn, thread, and fabric mills (142)	35.8 (8.4)	19.3 (5.3)
Miscellaneous entertainment and recreation services (802)	34.0 (14.2)	29.0 (15.7)
Hospitals (831)	32.8 (4.2)	26.2 (8.3)
Telephone (wire and radio) (441)	32.8 (9.0)	8.9 (5.1)
Child day care services (862)	32.0 (9.7)	8.5 (3.5)
Nursing and personal care facilities (832)	29.1 (5.4)	29.1 (7.2)
Electronic computing equipment (322)	29.0 (12.0)	5.2 (1.2)
Apparel and accessory stores, except shoe (630)	28.6 (7.8)	28.3 (15.5)
Grocery stores (601)	28.3 (6.7)	42.8 (24.8)

Note. A major industry was defined as an industry group with a specific 3-digit Bureau of the Census code that employs at least 0.5% of the total working population of either sex. A lost-workday back pain case was defined as a case in which a patient with back pain reported missing at least 1 workday because of back pain in the 12-month study period. n.e.c. = not elsewhere classified.

back pain lasting less than a week were excluded. Although there are no reliable US estimates with which to make comparisons, the prevalence of work-related cases involving workday loss estimated by the NHIS Occupational Health Supplement was compatible with the findings in other countries.¹⁸⁻²⁰

While exclusion of patients with back pain lasting less than a week might lead to overestimation of the number of lost workdays per case, exclusion of patients who missed work for the entire study period would lead to underestimation. The average number of lost workdays per case shown in this study (6.8) is comparable with those in similar studies²¹ but lower than that for compensated patients.²²⁻²⁵ Most compensated

patients had lost some workdays, but most noncompensated patients had not. In a study conducted by Leavitt et al., only 8% of compensated back pain patients did not miss any workdays.²⁶ Eligibility requirements for compensation may also have contributed to the difference.

Likewise, it is difficult to determine whether the average number of workdays lost per worker (1.2) is an underestimation or overestimation, although the rate is similar to the 1.4 workdays reported by another study conducted in the United States.²⁷ In comparison with other countries, the average number of workdays lost per worker (1.2 days) or per case (6.8 days) estimated in the NHIS Occupational Health Supplement is not extreme. A United Kingdom study showed that male and

female manual workers with back pain lose an average of 3.1 and 1.3 workdays, respectively, each year owing to back pain.²⁸ In Sweden, it has been shown that 2.56 workdays are lost annually by each worker because of back pain.²⁹ In general, compensated patients evidence more lost workdays, usually more than 30.^{13,15,16,20,30}

Because workers with back pain lasting for less than a week and those who missed work for the entire study period were not included in our analyses, the total number of lost workdays was underestimated. Although the NHIS Occupational Health Supplement projected the loss of 101.8 million workdays by patients with work-related cases, the National Safety Council estimated a total of only 75 million lost workdays in 1988 resulting from all work injuries combined.³¹ One study suggested that the lost workdays attributable to occupational injuries have been far underestimated.²⁵ On the basis of that study's estimate that back injuries accounted for 31% of the 420 million workdays lost in 1986, the number of workdays lost because of compensable occupational back injuries would have been approximately 130 million in 1986.²⁵ Because the NHIS Occupational Health Supplement excluded cases situated at both the short and long ends of the duration, this figure is in fact compatible with our estimate. Back pain also accounts for large numbers of lost workdays in other countries.^{15,20,32}

Strengths and Limitations of the Study

The 1988 NHIS Occupational Health Supplement was one of the few nationwide studies on the prevalence of back pain in the United States.³³⁻³⁵ Its strengths, contributions, and limitations have been documented.³⁶ In short, as a result of its large representative sample, it provided the most accurate national estimates and could provide industry-specific estimates in great detail. Because case definitions differ among the surveys, comparison of results is difficult. The prevalence estimated by the Occupational Health Supplement did not conflict with estimates from other studies; however, some indicators of the effects of back pain may be underestimated by other studies, especially those based on workers' compensation.

Validity of self-reported information is a major uncertainty in our analyses. For example, if a larger proportion of a group of workers (e.g., in an industry or an age stratum) were more "sensitive" to pain or more likely to attribute their back pain to work activities, an overestimated prevalence of back pain would be reported. These potential recall biases need to be evaluated in further studies and should be kept in mind when interpreting the

data from the NHIS Occupational Health Supplement.

As a result of the design of the questionnaire, respondents with back pain lasting for less than a week during the study period and patients who missed work for the entire study period were excluded from our analyses. A previous study showed that about 33% of men and 17% of women who suffered from low back pain had the symptom for fewer than 8 days altogether in the 1-year study period.³⁷ Other studies have shown that patients missing more than 6 months of work constitute only about 5% to 10% of all compensated or disabled patients but are responsible for a substantial amount of compensation and health care costs.^{15,20,38} Therefore, whereas exclusion of long-term cases might have caused only a slight underestimation of the case number, it could have resulted in a substantial underestimation of workday loss and associated economic impacts.

In estimates of workday loss, high-risk industries were identified according to the industry in which each case patient worked during the study period, which was not necessarily the industry causing the back pain. However, no information was available for determining what fraction of the workday loss could be attributed to which industry in such cases. Because we limited the analyses to major industries, we could not identify high-risk industries with relatively small numbers of workers. Furthermore, some of the estimates for major industries are still unstable. For example, whereas sawmills, planing mills, and millwork had the third highest prevalence of work-related back pain among men, the prevalence had a 95% confidence interval covering the overall prevalence of male workers which means that the increase in risk was not statistically significant.

Such estimates need to be validated by studies with large numbers of workers in a given industry. Such studies are also needed to evaluate whether there are high-risk subpopulations within a given industry. Because the NHIS Occupational Health Survey is cross sectional, similar periodic surveys are needed to monitor problem trends.

Conclusions

Our analyses have confirmed that back pain is a major health problem among American workers and that its economic and health impacts might be larger than previously estimated. For example, in 1995, when the median weekly wage (for 5 workdays in most cases) was \$467,³⁹ the workdays lost due to back pain could be estimated as worth

approximately \$14 billion (\$149 million \times \$467 \div 5). The impact of back pain can be reduced through intervention strategies such as training, job redesign, work environment engineering, job replacement, and immediate medical attention.⁴⁰⁻⁴⁴ We have identified the industries at high risk, which may benefit the most from such efforts. In addition to the high-risk industries that were not well recognized (e.g., lumber and building material retailing, beauty shops, and hotels and motels), industries in which men and women had very different risks (e.g., construction, motor vehicles and motor vehicle equipment, and US Postal Service) should also be studied further. If the differences are attributable to differences in job tasks, comparing job tasks may lead to identification of risk factors for back pain.

The magnitude of the back pain problem is so large that even a 1% reduction in overall prevalence (from 17.6% to 16.6%) could considerably reduce morbidity and save billions of dollars. Therefore, it is important to pursue a national strategy to minimize work-related back pain. In addition, future research and intervention efforts should be focused on high-risk jobs among both male and female workers. \square

Contributors

H.-R. Guo planned the detailed steps of the study, analyzed the data, and wrote the report. S. Tanaka coordinated the study, developed the data analysis strategies, and gathered comments from experts. W.E. Halperin conceived the idea of the study, laid out the structure and focus of the data analysis, and helped interpret the data. L. L. Cameron obtained the National Health Interview Survey data as well as other materials used in the study and helped analyze and interpret the data. All 4 authors took part in preparing each of the successive drafts that led to the final version of the paper.

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References

- Klein BP, Jensen RC, Sanderson LM. Assessment of workers' compensation claims or back strains/sprains. *J Occup Med*. 1984;26:443-448.
- Workers' Compensation Back Pain Claim Study. Boca Raton, Fla: National Council on Compensation Insurance; 1993.
- Labar G. A battle plan for back injury prevention. *Occup Hazards*. 1992;11:29-33.
- Frymoyer JW, Cats-Baril WL. An overview of the incidence and costs of low back pain. *Orthop Clin North Am*. 1991;22:263-271.
- Guo H-R, Tanaka S, Cameron LL, et al. Back pain among workers in the United States: national estimates and workers at high risk. *Am J Ind Med*. 1995;28:591-602.
- Park CH, Wagener DK, Winn DM, Pierce JP. Health conditions among the currently employed: United States. *Vital Health Stat 10*. 1993;No. 186. DHHS publication PHS-93-1514.
- Adams PF, Hardy AM. Current estimates from the National Health Interview Survey: United States, 1988. *Vital Health Stat 10*. 1989;No. 173. DHHS publication PHS-89-1501.
- Massey JT, Moore TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985-1994. *Vital Health Stat 2*. 1989;No. 110. DHHS publication PHS-89-1384.
- US Bureau of the Census. *Alphabetical Index of Industries and Occupations, 1980 Census of Population, Final Edition*. Washington, DC: US Dept of Commerce; 1982.
- Research Triangle Institute. *Software for Survey Data Analysis (SUDAAN), Version 5.30*. Research Triangle Park, NC: Research Triangle Institute; 1990.
- Reisbord LS, Greenland S. Factors associated with self-reported back-pain prevalence: a population-based study. *J Chron Dis*. 1985;38:691-702.
- Chaffin DB. Manual materials handling—the cause of over-exertion injury and illness in industry. *J Environ Pathol Toxicol*. 1979;2:31-66.
- Broberg E. *Ergonomic Injuries at Work*. Stockholm, Sweden: Swedish National Board of Occupational Safety and Health; 1984. Report no. 1984:3E.
- Swane O. National prevention of musculoskeletal workplace injury: Denmark—a summary. *Ergonomics*. 1987;30:181-184.
- Gervais M, Hebert P. *Statistical Summary of Back Injuries*. Quebec City, Quebec, Canada: Institute de recherche en sante et en securite du travail du Quebec; 1987.
- Burry HC, Gravis V. Compensated back injury in New Zealand. *N Z Med J*. 1988;101:542-544.
- Liira JP, Shannon HS, Chambers LW, Haines TA. Long-term back problems and physical work exposures in the 1990 Ontario Health Survey. *Am J Public Health*. 1996;86:382-387.
- Gyntelberg F. One year incidence of low back pain among male residents of Copenhagen aged 40-59. *Dan Med Bull*. 1974;21:30-36.
- Anderson JAD. Epidemiological aspects of back pain. *J Soc Occup Med*. 1986;36:90-94.
- Abenhaim L, Suissa S. Importance and economic burden of occupational back pain: a study of 2,500 cases representative of Quebec. *J Occup Med*. 1987;29:670-674.
- Praemer A, Furner S, Rice DP. *Musculoskeletal Conditions in the United States*. Park Ridge, Ill: American Academy of Orthopaedic Surgeons; 1992.
- McGill CM. Industrial back problems: a control program. *J Occup Med*. 1968;10:174-178.
- Leonard SA. The role of exercise and posture in preventing low back injury. *Am Assoc Occup Health Nurses J*. 1990;38:318-322.
- Trimble W, Gergely L, Ingalls T, Fograscher J. *1991 Compensable Occupational Injury and Illness Statistics*. Columbus, Ohio: Ohio Bureau of Workers' Compensation; 1992.
- Oleinick A, Guire KE, Hawthorne VM, et al. Current methods of estimating severity for

- occupational injuries and illnesses: data from the 1986 Michigan Comprehensive Compensable Injury and Illness Database. *Am J Ind Med.* 1993;23:231-252.
26. Leavitt SS, Johnston TL, Beyer RD. The process of recovery: patterns in industrial back injuries. *Ind Med.* 1971;40:7-14.
 27. Nachemson AL. The lumbar spine: an orthopaedic challenge. *Spine.* 1976;1:59-71.
 28. Anderson JAD. Shoulder pain and tension neck and their relation to work. *Scand J Work Environ Health.* 1984;10:435-442.
 29. Andersson GBJ. Epidemiologic aspects of low-back pain in industry. *Spine.* 1981;6:53-60.
 30. Magora A, Taustein I. An investigation of the problem of sick-leave in the patient suffering from low back pain. *Ind Med Surg.* 1969;38:398-408.
 31. *Accident Facts.* Chicago, Ill: National Safety Council; 1989.
 32. Stubbs D. Ergonomics and back pain. *Occup Health.* 1991;42:82-85.
 33. Leigh JP, Sheetz RM. Prevalence of back pain among fulltime United States workers. *Br J Ind Med.* 1989;46:651-657.
 34. Cunningham LS, Kelsey JL. Epidemiology of musculoskeletal impairments and associated disability. *Am J Public Health.* 1984;74:574-579.
 35. Deyo RA, Tsui-Wu Y-J. Descriptive epidemiology of low-back pain and its related medical care in the United States. *Spine.* 1987;12:264-268.
 36. Lalich NR, Sestito JP. Occupational health surveillance: contribution from the National Health Interview Survey. *Am J Ind Med.* 1997;31:1-3.
 37. Biering-Sørensen F. Low back pain in a general population of 30-, 40-, 50-, and 60-year-old men and women: study design, representativeness, and basic results. *Dan Med Bull.* 1982; 29:289-299.
 38. Cohen JE, Goel V, Frank JW, Gibson ES. Predicting risk of back injuries, work absenteeism, and chronic disability. The shortcomings of pre-placement screening. *J Occup Med.* 1994;36: 1093-1099.
 39. US Bureau of the Census. *Statistical Abstract of the United States: 1995.* 115th ed. Washington, DC: US Dept of Commerce; 1995.
 40. Snook SH. Approaches to the control of back pain in industry: job design, job replacement, and education/training. *Spine State Art Rev.* 1987;2:45-59.
 41. Fitzler SL, Berger RA. Attitudinal change: the Chelsea Back Program. *Occup Health Safety.* 1982;51:24-26.
 42. Donchin M, Woolf O, Kaplan L, Floman Y. Secondary prevention of low back pain. A clinical trial. *Spine.* 1990;15:1317-1320.
 43. Garg A, Owen B. Reducing back stress to nursing personnel: an ergonomic intervention in a nursing home. *Ergonomics.* 1992;35:1353-1375.
 44. Feldstein A, Valanis B, Vollmer W, Stevens N, Overton C. The back injury prevention project pilot study: assessing the effectiveness of Back Attack, an injury prevention program among nurses, aides, and orderlies. *J Occup Med.* 1993;35:114-120.

Ergonomics and the Dental Care Worker

Edited by Denise C. Murphy, DrPH, COHN

With foreword by William R. Maas, D.D.S., M.P.H., Chief Dental Officer, U.S. Public Health Service

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