Long-Term Back Problems and Physical Work Exposures in the 1990 Ontario Health Survey

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ABSTRACT

Objectives. This study sought to provide data on the relationship of work exposures to long-term back problems in a population survey.

Methods. The Ontario Health Survey in 1990 used a representative population sample of the province. It included data on long-term back problems, occupational activity, and physical work exposures. The current study examined relationships between these variables.

Results. The prevalence of long-term back problems was 7.8% in working-age adults. It generally increased with age. Long-term back problems were more prevalent in blue-collar occupations and among those not working, as well as among people with less formal education, smokers, and those overweight. Physical work exposures—awkward working position, working with vibrating vehicles or equipment, and bending and lifting—were all associated with a greater risk of back problems. The number of simultaneous physical exposures was monotonically related to increased risk.

Conclusions. Within the limitations of the data and assuming the relationship to be causal, about one quarter of the excess back pain morbidity in the working population could be explained by physical work exposures. (*Am J Public Health.* 1996; 86:382–387)

Introduction

Musculoskeletal disorders are one of the major health problems in Western societies. In population surveys of self-reported symptoms, only respiratory infections are more common.[1] The National Health and Nutrition Examination Survey (NHANES I) in the United States found that the overall prevalence of musculoskeletal symptoms in people aged 25 to 74 years was about 30%. Among those symptoms, back problems were the most common, with a prevalence of about 15%.[2] About 2% to 3% of the adult population reported long-term disability from back problems.[3]

Occupational factors such as heavy manual work, static working postures, and vehicle driving are risk indicators of long-term back pain.[4,5] Other significant risk indicators are socioeconomic (e.g., higher age, lower education), psychological (e.g., stress), and behavioral (e.g., smoking).[6,7] The burden of disability owing to low back pain has increased in recent decades in Western countries.[8] The increase is more than could be attributed to the changing structure of the population.[9]

The Ontario Health Survey, a provincial population survey in Canada, was conducted in 1990 by the Ontario Ministry of Health.[10] Questions about long-term back symptoms were included in a household-based interview while questions concerning physical occupational exposures were included in a self-administered questionnaire.[10] The population prevalences of back problems in the survey have been reported recently.[11,12] In people aged 16 years and over, the prevalence of any back problem was 11.0%[11] and that of long-term back problems was 8.1%.[12]

This study reports the prevalences of reported long-term back problems in occupational groups and by physical work exposures. The relative risk of back pain was estimated in white- and blue-collar occupations, controlling for confounding factors such as age, sex, and smoking.

Material and Methods

Study Design and Occupational Classifications

The Ontario Health Survey 1990 was a household-based population survey whose target group was all residents outside institutions and Indian reserves in Ontario, Canada. In all, 35 479 households and 61 239 people (49 164 over 12 years of age) were sampled.[10] The occupation of each person was recorded during the interview, and data on occupational physical exposures were collected from the questionnaires. The response rate was 87.5% to the interview and 77.5% to the questionnaire.

The Standard Occupational Classification (1980) was used to form nine occupational categories of all respondents between 16 and 64 years of age.[13] The total sample size was 38 540, which represented a population of 6 500 000 people

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TABLE 1—Total Sample and the Risk Estimation Data Set and Their Population Estimates, by Standard Occupational Classification: Ontario Health Survey Respondents, Ages 16 to 64 Years

Occupational Group	Total Sample				Risk Estimation Data Set[a]		
	Sample Size	Population Estimate	All, %[b]	Working, %[b]	Sample Size	Population Estimate	Working, %[b]
Managerial, administrative, professional	9 150	1 710 000	26.3	32.2	6 216	1 161 000	36.3
Clerical	5 040	946 000	14.6	17.8	3 050	544 000	17.0
Sales	2 620	462 000	7.1	8.7	1 640	287 000	9.0
Services	3 950	633 000	9.7	11.9	2 210	352 000	11.0
Primary (farmers, miners)	1 530	141 000	2.2	2.7	820	79 000	2.5
Processing	4 600	741 000	11.4	13.9	2 590	395 000	12.4
Construction	1 980	312 000	4.8	5.9	1 110	171 000	5.4
Transportation	1 180	181 000	2.8	3.4	680	101 000	3.2
Materials handling and other crafts	1 090	190 000	2.9	3.6	610	105 000	3.3
Not working	6 940	1 076 000	16.6	. . .			
Missing data	460	109 000	1.7	. . .			
Total	38 540	6 500 000	100.1	100.1	18 920	3 195 000	100.1
Total (working)	31 140	5 315 000	81.8				

[a]Risk estimation data set = those who answered all of the questions used in risk estimation (seven questions on physical exposures, age, sex, smoking, and education).
[b]Percentage from population estimates.

TABLE 2—Prevalence of Reported Physical Work Exposures (%) among the Respondents (n = 18 920) in the Ontario Health Survey, by Occupational Groups

Physical Work Exposure	Administrative/ Professionals	Clerks	Sales	Services	Primary	Processing	Construc-tion	Transport	Materials Handling	All	Missing Data (Nonresponse Rate)
Sitting more than 1/2 workday	53	57	32	17	18	18	14	53	25	46	23
Driving more than 1/2 workday	6	3	16	7	21	6	17	63	10	12	31
Bending and lifting more than 50 times a day	10	11	16	24	45	34	45	22	35	23	29
Frequent lifting of more than 50 lb	8	5	8	9	32	21	40	21	22	15	31
Frequent lifting of less than 50 lb	14	17	25	33	47	41	46	30	42	34	30
Operating vibrating vehicles and equipment[a]	2	2	3	6	33	17	23	29	14	8	9
Working with back in awkward position[a]	9	11	7	15	23	24	31	14	20	14	9

[a]Yes = always or often.

(Table 1); this sample was used to calculate population prevalences of long-term back pain.

The risk estimates (odds ratios) for different determinants of back pain were calculated using a data set with full information about sex, age, smoking, education, occupation, and physical work exposures. Because of missing data, this reduced the total number of the available sample from the original 31 140 to 18 920 (Table 1). The occupational distribution of the respondents in the risk estimation data set was very similar to that of the original sample, and the results are not believed to have been severely distorted by the reduction in sample size.

The first three occupational groups (professional, clerical, and sales) were designated white-collar occupations, and the rest (service, primary occupations, and industry) were designated blue-collar occupations. About 58% of those who were working (63% in the risk estimation data set) belonged to the white-collar group.

Long-Term Back Problems and Physical Exposures

In the interview, respondents were asked to indicate long-term physical health problems from a list of 19 options. One such option was "serious trouble with back pain." Respondents were also asked if there was any limitation "in the kind or

TABLE 3—Crude Population Estimates and Prevalences of Long-Term Back Problems in Ontario Health Survey Respondents Ages 16–64 Years (n = 38 540), by Selected Variables

	Population Estimate		Prevalence	
	Total	With Symptoms	%	95% CI
All	6 500 000	508 000	7.8	7.2, 8.4
Sex				
Male	3 237 000	260 000	8.1	7.2, 9.0
Female	3 263 000	248 000	7.6	6.8, 8.4
Age group				
16–24 y	1 290 000	41 000	3.2	2.3, 4.1
25–34 y	1 656 000	99 000	6.0	5.0, 7.0
35–44 y	1 601 000	133 000	8.3	7.1, 9.5
45–54 y	1 081 000	135 000	12.5	10.7, 14.3
55–64 y	872 000	100 000	11.5	9.6, 13.4
Education				
Primary or some secondary	2 052 000	215 000	10.5	9.3, 11.7
Completed secondary or some postsecondary	2 585 000	188 000	7.3	6.3, 8.2
Completed postsecondary	1 796 000	103 000	5.7	4.7, 6.7
Not stated	67 000	. . .	. . .	[b]
Household income				
Low income[a]	588 000	73 000	12.4	10.0, 14.8
<$50 000	2 101 000	179 000	8.5	7.4, 9.6
>$50 000	2 930 000	182 000	6.2	5.4, 7.0
Not stated	881 000	74 000	8.4	6.7, 10.0
Occupational categories				
Professionals, clerical and sales	3 118 000	200 000	6.4	5.6, 7.2
Services, primary occupations and industry	2 198 000	185 000	8.4	7.3, 9.3
Not working	1 076 000	116 000	10.8	9.1, 12.5
Not stated	109 000	. . .	. . .	[b]
Occupational groups				
Professionals	1 710 000	118 000	6.9	5.8, 8.0
Clerical	946 000	54 000	5.7	4.4, 7.0
Sales	461 000	28 000	6.1	4.1, 8.1
Services	633 000	50 000	7.9	6.0, 9.8
Primary occupations	141 000	. . .	. . .	[b]
Processing	741 000	66 000	9.0	7.1, 10.9
Construction	312 000	26 000	8.5	5.7, 11.3
Transportation	181 000	21 000	11.4	7.3, 15.5[c]
Materials handling	190 000	13 000	6.6	3.4, 9.7[c]
Not working	1 076 000	116 000	10.8	9.1, 12.5
Not stated	109 000	. . .	. . .	[b]
Smoking				
Current	1 750 000	184 000	10.5	9.2, 11.8
Occasional	516 000	40 000	7.8	5.7, 9.9
Not smoking	3 793 000	250 000	6.6	5.9, 7.3
Not stated	441 000	34 000	7.8	5.5, 10.0
Body mass index				
<20 kg/m^2	640 000	35 000	5.5	3.9, 7.1
20–	2 835 000	175 000	6.2	5.4, 7.0
25–	943 000	79 000	8.4	6.8, 10.0
27+	1 500 000	172 000	11.5	10.0, 13.0
Not stated	582 000	47 000	8.1	6.1, 10.1

Note. CI = confidence interval.
[a]$12 000–$29 999, depending on family size.
[b]Very high sampling variability (coefficient of variation > 25.0%), estimate not releasable.
[c]High sampling variability (coefficient of variation = 16.6– 25.0%), unreliable estimate; note wide confidence intervals.

amount of activity [they could] do because of a long-term physical or mental condition or health problem," and the main causes of that limitation were recorded. If a back problem led to either a long-term health problem or a limitation in activity, the respondent was considered to have a long-term serious and/or disabling back problem, which was used as an outcome indicator in this study.[12]

Seven items in the questionnaire's occupational health section concerned physical work exposures relevant to back pain (for questions, see Table 2). The proportion of missing data for the first five of these items was 23% to 31%. The nonrespondents tended to be older, male, and more often engaged in manual occupations, suggesting some relationship with exposure status. Nonresponse to physical exposure questions did not seem to be related to back pain status since long-term back pain was only slightly more prevalent in nonresponders (7.8%) than in responders (7.4%).

Statistical Methods

The population prevalences of long-term back pain were calculated by using weighted estimates. Weights were provided by Statistics Canada to make the sample representative of the population and to correct for nonresponse.[10] The design effect corrected for the intercorrelation of study variables within households and public health units (cluster effect). The numerical estimate of the design effect was provided by Statistics Canada (4.95 in this study).[13]

To analyze the association between risk indicators and outcome, logistic regression was used.[14] The risk estimates were adjusted for sex, age (five 10-year categories), and smoking (two categories). In calculating the risk estimates, the age groups, physical work exposures, and exposure index score values were all treated as dummy variables with reference to the first category in each group. Relative weights (mean = 1) and design effect were used in estimating the relative risks.

Results

The overall prevalence of long-term back problems was 7.8% in the working-age population, which gives an estimate of about half a million people suffering from long-term back problems in the province of Ontario (Table 3). There was only a small difference in prevalence between men and women. The highest prevalence of back problems was observed in the two oldest age groups. Primary education, low-income, blue-collar occupations or unemployment, smoking, and obesity were all related to higher prevalence.

Sitting was the most frequent physical exposure reported, particularly in professional, clerical, and sales occupations (Table 2). Frequent light lifting (less than 50 lb) was common in all but professional and clerical occupations. Bending and lifting, working with vibrating machines, and working in awkward positions were most frequent in industrial occupations. Primary occupations and construction involved the most heavy lifting (more than 50 lb).

Age, sex, smoking, physical exposures, and occupational categories were included in the logistic regression model. Among the working population, the probability of having long-term back problems was higher in older age groups, in smokers, and in blue-collar occupations (Table 4). Of the physical exposures, bending and lifting, working with vibrating machines, and working with the back in an awkward position were all related to increased risk of back pain after controlling for age, sex, and smoking in both white- and blue-collar occupations. Lifting light objects was also associated with back problems in blue-collar occupations. A physical exposure index of the simultaneous exposures to three high-risk physical work exposures (bending and lifting, working with vibrating machines, and working in awkward positions) showed a trend of increasing risk with an increasing number of such exposures. When the physical exposure index was allowed for in addition to age, sex, and smoking, the back pain risk in blue-collar occupations was reduced to a nonsignificant level. The distribution of reported simultaneous exposure to three high-risk physical work exposures is shown in Figure 1. Combined exposures were more common in service and industrial occupations.

TABLE 4—Adjusted Odds Ratios of Long-Term Back Problems in Ontario Health Survey Respondents, by Occupation and Physical Work Exposure

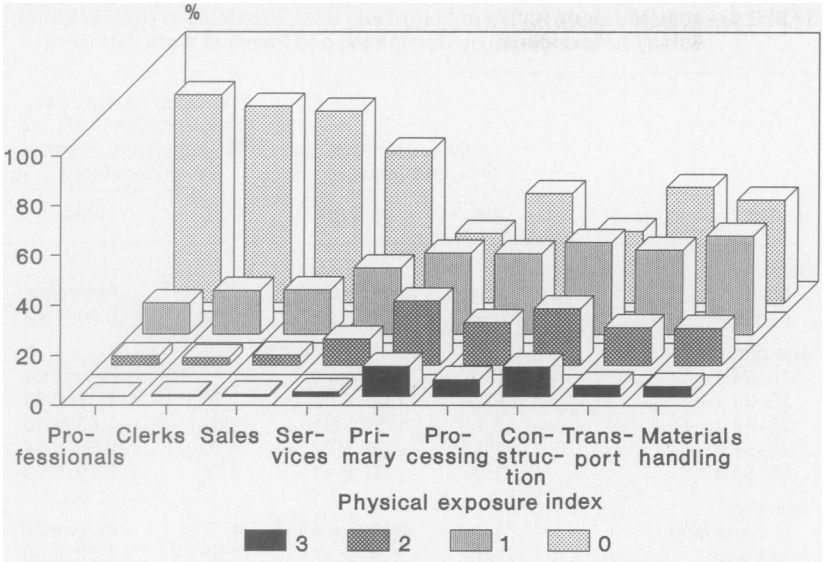
	Adjusted for Age, Sex, and Smoking		Adjusted for Age, Sex, Smoking, Occupational Category, and Physical Exposure Index	
	OR	95% CI	OR	95% CI
Sex				
Male	1	Reference	1	Reference
Female	0.96	0.75, 1.25	1.12	0.86, 1.42
Age group				
16–24 y	1	Reference	1	Reference
25–34 y	1.57	1.00, 2.50	1.70	1.07, 2.69
35–44 y	2.47	1.59, 3.84	2.82	1.80, 4.40
45–54 y	3.60	2.28, 5.72	4.23	2.65, 6.74
55–64 y	3.19	1.86, 5.48	3.78	2.19, 6.53
Smoking				
Nonsmoking	1	Reference	1	Reference
Smoking	1.69	1.31, 2.17	1.55	1.20, 2.00
Occupational categories[a]				
White-collar occupations	1	Reference	1	Reference
Blue-collar occupations	1.37	1.05, 1.79	1.07	0.80, 1.44
Physical exposures, white-collar occupations[a]				
No exposure	1	Reference		
Sitting	1.08	0.71, 1.63		
Driving	1.15	0.71, 1.86		
Bending and lifting	1.66	1.13, 2.44		
Lifting heavy objects	1.02	0.65, 1.59		
Lifting light objects	1.36	0.92, 2.01		
Operating vibrating vehicles or equipment	1.71	1.09, 2.67		
Working with back in an awkward position	1.90	1.25, 2.80		
Physical exposure, blue-collar occupations[a]				
No exposure	1	Reference		
Sitting	0.86	0.67, 1.11		
Driving	1.28	0.89, 1.84		
Bending and lifting	1.65	1.25, 2.18		
Lifting heavy objects	1.28	0.91, 1.81		
Lifting light objects	1.46	1.12, 1.89		
Operating vibrating vehicles or equipment	1.84	1.25, 2.72		
Working with back in an awkward position	2.33	1.72, 3.15		
Physical exposure index[b]				
0 (68%)[c]	1	Reference	1	Reference
1 (21%)	1.43	1.05, 1.96	1.41	1.02, 1.94
2 (8%)	2.52	1.71, 3.72	2.45	1.63, 3.68
3 (3%)	3.30	1.82, 5.96	3.18	1.72, 5.81

[a]White-collar occupations = professionals, clerical, and sales; blue-collar occupations = services, primary occupations, and industry.
[b]Index is the number of three physical exposures to which the individual is simultaneously subjected (bending and lifting, operating vibrating vehicles or equipment, and working with back in an awkward position).
[c]Percentage of subjects with exposure.

Discussion

The Ontario Health Survey was originally planned to give reliable estimates of health conditions and health-related behavior at the regional level.[10] In this study, we used data from the whole province to allow more detailed analysis by occupation and physical exposures.

The principal outcome of interest in this study, the long-term and/or disabling form of back pain, was determined from general questions about causes of serious long-term health problems and about limitations in activities as a result of long-term health problems. To be reported, a back problem probably had to be moderate to severe in grade and relatively recent or frequent in occurrence. As no other indicator for chronicity of the back problem (duration of pain, visiting health professional, use of medication) was used, recent serious back pain episodes might also have been reported, which would have increased the observed prevalence of back problems. In roughly half the subjects, the personal data were obtained from a proxy respondent, another member of the same household. The proxy effect may have slightly reduced the observed prevalence of back problems.



Note. The three physical exposures were defined as bending and lifting, operating vibrating vehicles and equipment, or working with back in an awkward position. Index is the number of the physical exposures to which the individual was simultaneously subjected.

FIGURE 1—Simultaneous exposure to three high-risk physical exposures, by occupational group.

The observed overall prevalence of long-term back pain found in the adult Canadian population, about 8%, is comparable with that found in some other health surveys.[15–17] However, in the Canada Health Survey of 1978–1979, the prevalence of serious trouble with back or spine was reported by 4% of respondents of both sexes,[18] and long-term disability due to back problems was reported by only 2% to 3% of the respondents in the 1983–1984 Canadian Health and Disability Survey.[3]

The Occupational Health Supplement of the 1988 National Health Interview Survey reported 1-year prevalence of back pain due to injury at work (total prevalence = 2.5%) or repeated activities at work (total prevalence = 4.5%).[19] Work-related back pain was reported more often by males and by employees in service, industrial, and construction occupations. In their reports of serious trouble with back pain, the respondents in the Ontario Health Survey may have included some acute and subacute episodes of work-related back pain, which may have slightly increased the reported prevalence of long-term back problems in this study.

In the Ontario Health Survey, the recording of occupation by those who were working was virtually complete, so the study is a reliable source of prevalence estimates of reported back pain by current occupation. As previously noted, the Standard Occupational Classification stratifies respondents into nine broad occupational categories.[13] However, the distribution of the workforce by occupational groups is uneven: nearly one third of the total is grouped into the first category (managerial and professionals), while other groups of interest are much smaller (Table 1).

Respondents in blue-collar occupations and people who were not working reported higher prevalences of long-term back problems than white-collar employees. This compares well with the results of a population survey in California, in which respondents in service crafts and laborer occupations reported 1.3 to 1.6 times and those not working reported 1.7 times more frequent back pain during the previous year than did respondents in professional and clerical occupations. The prevalence of back pain in white-collar groups was 13% to 14% in this study.[20]

The high prevalence of back pain (10.8%) observed in the Ontario Health Survey in people who were at home, retired, or not working for other reasons raises the question about their previous exposure to physical risk factors. If these people were highly exposed, the risk estimates—based on the current exposures—would underestimate the true risk associated with previous occupations and exposures. This hypothesis was somewhat supported in an analysis of the previous jobs of those respondents who were not working and suffered from back pain (data not shown). A similar bias would have occurred if workers had moved from "heavy" occupations to "lighter" jobs because of back pain. However, occupationally active people tend to be healthier than people in the general population. Moreover, preexisting back pain from nonoccupational causes could select unskilled people out of the workforce, which would increase the prevalence of back pain in the nonworking population.

Low back pain is multifactorial in origin, and epidemiological studies identify several possible risk indicators. In general, the risk of low back pain seems to be determined by quality of work, body build, lifestyle, and health behavior.[21] In a population-based study of the risk indicators for nonspecific low back pain, prior back injury, occupational physical and mental stress, and smoking were all related to an increased risk.[21]

Smokers report more back pain than nonsmokers in surveys, and a causal relation has been suggested.[22,23] In this study, smokers reported a higher prevalence of back pain in all age groups. The effect of smoking on back pain did not change, even when the risk ratios were adjusted for factors such as education in logistic regression (data not shown). Thus, all risk estimates in this study were adjusted for smoking in addition to sex and age, as smoking was treated as an independent risk factor for back problems.

Repetitious or heavy mechanical loads and forces that exceed individual capacity are considered harmful to back structures. The mechanical stresses may be static (e.g., sitting or standing) or dynamic (e.g., bending or lifting), or a combination of these factors (e.g., driving, which involves both static posture and vibration).[4,24] The Ontario Health Survey exposure questions captured fairly well some of the known back pain risk indicators.

Musculoskeletal diseases are often considered to be work related by the workers themselves. Two thirds of men and about half of women attribute their musculoskeletal symptoms to work conditions.[25] However, back pain status does not affect the self-estimation of physical work exposures,[26] and workers' self-reporting of physical work exposures

agree fairly well with external observation.[27,28] In this study, both quantitative and qualitative aspects were combined in each question of physical exposures. The responses to physical exposures indicated reasonable face validity, as sitting was most common in office-type occupations and driving was most common in transportation. Bending, lifting, and working in awkward positions were reported most often in primary occupations and construction.

As already noted, the nonresponse rate to the first five exposure questions was relatively high (23% to 31%), and nonrespondents were somewhat more likely to be exposed. It is, however, unlikely that observed risk estimates could have been spuriously elevated by the selection of exposed cases to the study group. On the contrary, the risk estimates observed in this study may slightly underestimate the risk in whole working population.

In estimating the risk of back pain, allowing for the physical exposure index reduced the risk difference between blue- and white-collar occupations to a nonsignificant level. The physical exposures were also significant risk indicators of back pain within the blue-collar group. Three physical exposures—bending and lifting, working with vibrating tools, and working with the back in an awkward position—were associated with an increased probability of long-term back problems. The population attributable fraction of single and combined exposures to these three factors was 24% among the whole working population and 28% in blue-collar occupations.

Despite the cross-sectional design of the study, the evidence of increased risk of back pain in employees with single or combined physical exposures is congruent with results from previous studies and is convincing enough to warrant preventive actions in workplaces. A cross-sectional population study can give reliable estimates of the prevalence of back pain in different subgroups of people and can suggest risk indicators that can be tested in other epidemiological studies. □

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