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Epidemiology of Acute Low Back Injury in Employees of a Large Home Improvement Retail Company

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Acute low back injuries are described in a cohort of about 31,000 material handlers employed in all Home Depot, Inc., retail stores in California from 1990 through 1994. With over 87 million work hours, incidence density rates, rate ratios, and confidence intervals are given by age, sex, length of employment, and job-lifting requirements. Injuries are further described by lost work days, activity at time of injury, work restrictions, and time frames. The unadjusted low back injury rate per million work hours was 1.6 times higher for men compared with women, and rates were highest for those less than 25 years of age, those with less than 2 years of current job experience, and employees with the greatest materials lifting and handling job requirements. These findings in unadjusted rates and rate ratios persisted when each was adjusted through a Poisson regression model, with the exception of sex. The adjusted risk ratio for males was reversed with significantly higher risk in females when the rate ratio was adjusted for age, lifting intensity, and length of job experience. Injuries were most commonly associated with lifting activities and, while injury occurrence was highest from 10 a.m. to 4 p.m., rates were greatest during those hours when the store was closed to retail activities. Merchandise stocking that requires heavy and frequent materials handling is done during these hours. Fewer injuries than expected were reported on weekends, days with considerably less materials handling activities. *Am J Epidemiol* 1997;146:637–45.

incidence; low back pain; musculoskeletal system; workplace; wounds and injuries

It is commonly acknowledged that back injury is the most serious health problem experienced by most of the world's workforce and that the lumbosacral region is the most common anatomic site diagnosed with injury (1–3). In the United States, between 10 and 17 percent of the adult population over age 25 experience an episode of back pain each year (4, 5), and 70–80 percent of the US adult population will have low back pain at least once in their lives (6).

Back injuries account for 21 percent of all compensable work injuries and 33 percent of all costs for occupational injuries (7). One researcher (8) estimated that the total costs of low back injuries in 1990 ranged from $25 to $100 billion. The cost for compensable low back pain increased dramatically in the decade of the 1980s (9).

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Abbreviations: Cal/OSHA, California Occupational Safety and Health Administration; CI, confidence interval; RR, rate ratio.

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Occupations with high reported low back injury occurrence include nurses and hospital workers (10–14), farmers (15, 16), miners (17), truck drivers (18–24), and material handlers (25) among many others (26–28). Activities that appear to be associated with a back injury episode include lifting (11, 17, 21, 25, 26, 29–31), carrying (21, 26, 29), and bending or twisting (30–33) independently or in combination with one another.

The diagnosis of low back injury is elusive because of the absence of objective measures of physical damage in most cases as well as an insidious onset. Nonspecificity in diagnosis is reflected in the variety of terms used to describe, define, or classify the entity. Descriptions include low back pain (34–36), back sprain or strain (37), low back injury (26), or low back pain syndrome (38). Diagnosis is based on patients' reports of symptoms, and few objective diagnostic criteria are available. Failure of specificity of definition and inconsistency in diagnostic criteria have hampered epidemiologic studies of low back injury and prohibited cross-study comparison of findings.

A number of reports in the scientific literature over the past two decades have measured general exposures or risk factors associated with low back injury. The exposures or risk factors reported to be associated with

risk of back injury include manual labor (16, 26, 30, 39–44), jobs involving vibration (18, 20, 21, 24, 28, 41), repetitive tasks (45–47), age (8, 23, 35, 48), sex (23, 35, 48), height and weight (23, 35, 48), smoking (22–24, 35, 48, 49), alcohol use (45, 48), and medical history and/or psychological stress (8, 21–23, 31, 42).

Not all exposures or factors have been consistently studied, and none have addressed questions of sex-specific factors of intensity (dose) of exposure, length of experience, and time of onset of injury in a cohort of employees largely engaged in material handling activities.

The objective of this current study was to evaluate the occurrence of medically diagnosed low back injury in a large cohort of employees with regard to age, sex, job-lifting intensity, and length of employment, as well as lost work days, activity at time of onset of injury resulting in work restrictions, and hour and day of injury.

MATERIALS AND METHODS

Study design

The study involved a dynamic historical cohort, with members identified during the study period which began in some stores in January 1990 and involved all stores by July 1994. Employee work hours and employee-reported acute low back injury while at work were identified in the cohort of all persons employed at any time in the store study period by The Home Depot, Inc. (a national home improvement retail chain), and assigned to any retail store in California. Employee work hours while in administrative offices or distribution warehouses were excluded because the nature of job activities was considerably different from retail store work. There were no other exclusions to the cohort, which numbered about 31,000 different employees over the 5-year study period.

A total of 77 retail stores were open for business between 1990 and 1994 in California. Their employees (and work hours) form the study population. The study period was not the same length for employees in each store but depended on the opening and closing dates where appropriate. The study period began with the opening date for all stores open for the first time in 1993 or 1994. The study period for the remaining stores coincided with the date the company policy on mandatory use of low back supports was adopted, generally beginning January 1990, through the end of 1992.

Work exposure

Employee work hours were classified by age, sex, length of employment, and materials-lifting intensity determined from job title and ergonomic analyses (see below). This information plus name, social security number, and store number was provided on computer tapes by The Home Depot management for the study period. Personal identifiers were used to link individual employee work hours to each of the qualifying variables mentioned above. Work hours were aggregated across all variable domains.

Job title and materials-lifting/carrying intensity

Almost all store employees lift and/or carry consumer building or home improvement materials as part of their routine job tasks. There is, however, variation in the frequency, size, and weight of materials to be moved according to job title. Identical job titles are used in all stores in California. For the purposes of these analyses, job titles were categorized into one of three lifting or weight-carrying levels based on corporate safety management determination, ergonomic analysis undertaken in 1991 (49), and the investigators' empiric observations in 1993 and 1994. The amount or intensity of lifting exposure and most common job titles were classified as low, moderate, or high and are discussed below.

Low lifting/carrying intensity. Physical demands in an average workday never or seldom require lifting or carrying materials and, when required, items are seldom over 10 pounds (4.54 kg) in weight. Job titles in this level are somewhat heterogeneous and included managers, most clerks, computer operators, and loss prevention specialists.

Moderate lifting/carrying intensity. Physical demands in an average workday occasionally or frequently require lifting or carrying objects generally limited to less than 25 pounds (11.35 kg) in weight. Job titles are generally homogeneous and include cashiers and some supervisors.

High lifting/carrying intensity. Physical demands in an average workday frequently or continuously require lifting or carrying objects weighing mostly over 25 pounds and occasionally over 50 pounds (22.7 kg). Job titles are generally homogeneous and include mostly salespersons, truck drivers, janitors, and supervisors.

Other factors

Age and sex were derived from company personnel records. Hire date and termination date, if applicable, were used to determine length of employment with The Home Depot. Data on factors such as race, ethnicity, prior medical history, and prior injury history were not recorded in company personnel files.

Injury factors

All injury claim records with a date of occurrence during the store study period for *any* injury to the musculoskeletal elements of the trunk were provided by The Home Depot. These included injuries to the neck, shoulders, upper back, chest, ribs, thorax, mid-back, lower back, hip, pelvis, abdomen, groin, and buttocks. Each record was reviewed by two of the study investigators to verify inclusion criteria that included injury to the low back region, date of injury in the store study period, a first report of episode, a physician diagnosis, acute/abrupt onset, and occurrence while at work in a Home Depot retail store. Serious back injury was defined as any case resulting in 1 day or more of lost work because of injury.

Injury claim forms, which use the format of the California Occupational Safety and Health Administration (Cal/OSHA) Employer's Report of Occupational Illness or Injury, record descriptive variables including body part affected, type of injury (strain, sprain, pull, tear), name, social security number, age, sex, length of employment, job title, store number, date and time of injury, lost days from work, and work restrictions, if any. Injury forms are forwarded to the Department of Industrial Relations per state of California requirements.

All verified cases of low back injury were double checked to eliminate any duplicate claim records that might have been generated from multiple physician visits for treatment of the same injury. All injury cases were included for rate derivations, but for a small number, data on some factors were missing. No contact was made with the employee or corporate safety management to secure the missing information because of the historical nature of the study and pledges of confidentiality.

Analysis

Incidence density rates per 1 million work hours were calculated overall and according to age, sex, length of employment, and job-lifting intensity. Incidence density rate ratios and 95 percent confidence intervals were derived using standard methods (50).

For multivariate analyses, crude and adjusted rate ratios and 95 percent confidence intervals for factors associated with low back injuries were determined using Poisson regression. Models were run to estimate rates of all injury outcomes and rates of injuries leading to at least 1 day away from work. Categories for Poisson modeling were chosen to reflect the distribution of rates in the cohort and to minimize the number of cells. Age was categorized into those aged less than 25, 25–44, and over age 44. Length of employment was categorized into those working less than 1 year, 1–2 years, and more than 2 years. EGRET (51) software was used for the analyses.

The chi-square test of contingency was used to evaluate the distributions of activity at the time of injury, lost work days, work activity restrictions, and day and hour of injury occurrence.

RESULTS

Incidence

In the study period, 1,760 low back injuries meeting case criteria were identified: an incidence density rate of 20.2 per million work hours (table1). The lost time back injury rate was 12.3 per million work hours. The incidence density rate for men was significantly greater than for women overall for serious back injuries. Age-specific incidence density rates overall and for lost time injury show a significant downward trend with increased age overall and for those with a lost time injury.

TABLE 1. Number injured, work hours, and sex- and age-specific incidence density rates, rate ratios, and 95% confidence intervals (CIs) among employees of The Home Depot, Inc., California, 1990–1994

Factor	No. injured	No. with lost work days	Work hours (×1,000)	Injury rate/ million	Lost days injury rate/ million	Overall rate ratio	95% CI	Lost work days rate ratio	95% CI
Total	1,760	1,069	87,078	20.2	12.3				
Sex									
Men	1,346	798	58,698	22.9	13.6	1.57	1.41–1.75	1.43	1.24–1.63
Women	414	271	28,380	14.6	9.5	1.00		1.00	
Age (years)									
<25	555	307	25,594	21.7	12.0	1.45	1.12–1.86	1.22	0.89–1.67
25–34	683	425	33,869	20.2	12.5	1.34	1.05–1.73	1.27	0.93–1.74
35–44	330	215	15,588	21.2	13.8	1.41	1.08–1.83	1.40	1.01–1.94
45–54	125	78	7,562	16.5	10.3	1.10	0.82–1.48	1.05	0.72–1.51
≥55	67	44	4,465	15.0	9.9	1.00		1.00	

Incidence density rates by job material lifting intensity requirements and length of employment are given in table 2. The rate of low back injury increases with lifting intensity; that is, workers with moderate lifting requirements have 3.6 times the frequency, and those with high lifting intensity have 5.8 times the frequency of low back injury compared with those with low lifting intensity requirements. This pattern was similar for those having a lost time injury.

Injury rates decrease from a high of 27.9 per million working hours in those working less than 1 year to 10.5 per million for workers with more than 5 years' experience, with a significantly progressive decrease with increasing length of employment. Those with lost time injuries had a similar pattern in decrease in rates but with lower levels of occurrence.

We next examined the interrelations of two-factor and three-factor associations through stratified analyses of incidence density rates, rate ratios, and 95 percent confidence intervals. The number of low frequency cells, the absence of clear patterns in rate ratios, and the perceived complexity of factor covariation prompted the Poisson regression approach to the data.

Crude rate ratios from Poisson modeling of injury rates for all injuries show increased rates for males (rate ratio (RR) = 1.48, 95 percent confidence interval (CI) 1.27–1.72) (table 3). This rate ratio is different from that of hand calculation in table 1 (RR = 1.57) because of fitting of the Poisson regression model. Rate ratios are also elevated with increased lifting intensity (RR = 2.61, 95 percent CI 2.32–2.94). Rates are lower among those with longer employment periods (RR = 0.69, 95 percent CI 0.62–0.77). Age is not a significant predictor of changes in rates in the unadjusted model.

When these factors are mutually adjusted, male sex and older age appear to become protective factors for low back injury. High lifting intensity remains a very strong predictor of low back injury rates in the adjusted model (RR = 2.94, 95 percent CI 2.64–3.32). Longer length of employment remains a protective factor in the adjusted model.

Poisson models for injuries with lost work days show similar patterns as for all injuries. Rate ratios for high intensity are slightly higher among those with lost work days in both crude and adjusted models, and the effects of sex are slightly stronger. Age and length of employment are virtually unchanged when using only those injuries leading to lost work days.

Activity at time of injury, lost work days, and work restrictions

Over 60 percent of all low back injuries were reported to be associated with lifting activities. Pushing, pulling, bending, turning, reaching, twisting, and related body motion actions not involved with lifting were associated with 18.8 percent of all instances of low back injury. Struck by or striking objects and climbing or loss of footing while walking were reported in 13 percent and 7.7 percent of cases, respectively. The distribution of activities leading to injury was significantly different between men and women employees (table 4), with a higher proportion of women struck by or striking objects or injured while climbing or lost footing compared with men employees. The percentage of low back injuries from lifting was highest (61.4 percent) in high lifting intensity job titles compared with those in low lifting job titles (48.6 percent) (table 5).

Slightly over 36 percent of injured workers returned to work on the same day, and 16.9 percent lost 1 day

TABLE 2. Number injured, work hours, incidence density rates, rate ratios, and 95% confidence intervals (CIs) by job-lifting intensity and length of employment at The Home Depot, Inc., California, 1990–1994

Factor	No. injured	No. with lost work days	Work hours (×1,000)	Injury rate/ million	Lost days injury rate/ million	Overall rate ratio	95% CI	Lost work days rate ratio	95% CI
Job-lifting intensity									
Low	92	41	15,874	4.5	2.6	1.00		1.00	
Moderate	284	180	17,576	16.2	10.2	3.56	2.75–4.61	3.97	2.82–5.57
High	1,404	848	53,628	26.2	15.8	5.77	4.55–7.31	6.12	4.48–8.38
Length of employment (years)									
<1	901	565	32,345	27.9	17.5	2.66	2.11–3.36	2.55	1.92–3.40
1–<2	376	219	19,864	18.9	11.0	1.81	1.42–2.31	1.61	1.19–2.19
2–<3	188	102	12,951	14.5	7.9	1.39	1.07–1.81	1.15	0.82–1.61
3–<4	146	86	8,675	16.8	9.9	1.61	1.22–2.12	1.45	1.03–2.05
4–<5	71	46	5,784	12.3	7.9	1.17	0.85–1.62	1.16	0.78–1.73
≥5	78	51	7,459	10.5	6.8	1.00		1.00	

TABLE 3. Poisson model of risk ratios and confidence intervals for factors predicting low back injuries among material handlers, The Home Depot, Inc., California, 1990–1994

Model variable	All injuries		Injuries with lost work days*	
	Unadjusted rate ratio	Adjusted rate ratio	Unadjusted rate ratio	Adjusted rate ratio
Male sex	1.48 (1.27–1.72)†	0.80 (0.70–0.90)	1.58 (1.42–1.77)	0.72 (0.61–0.85)
Age	0.96 (0.87–1.08)	0.84 (0.78–0.90)	0.94 (0.88–1.02)	0.86 (0.77–0.95)
Length of employment	0.69 (0.62–0.77)	0.68 (0.63–0.74)	0.70 (0.65–0.75)	0.68 (0.61–0.76)
Lifting intensity	2.61 (2.32–2.94)	2.94 (2.64–3.32)	2.57 (2.36–2.80)	3.05 (2.66–3.50)

* Lost work days defined as injuries that led to 1 or more days away from work.
† Numbers in parentheses, 95% confidence interval.

TABLE 4. Number and percentage of activities associated with low back injury, by sex, among employees of The Home Depot, Inc., California, 1990–1994*

Activity	Men		Women		Total	
	No.	%	No.	%	No.	%
Lifting	832	61.8	233	56.3	1,065	60.5
General physical movements†	256	19.0	74	17.9	330	18.7
Struck by or striking object	179	13.3	74	17.9	253	14.4
Climbing or lost footing	79	5.9	33	8.0	112	6.4
Total	1,346	100.0	414	100.1	1,760	100.0

* χ^2 test of contingency = 8.65, 3 df, $p = 0.034$.
† Includes bending, twisting, pushing, and pulling.

of work. Two to three days were lost from work for 12.9 percent of injured workers, while 8.2 percent missed 4–7 days. Just under 9 percent lost 1 week or more of work, of which about half (4.5 percent) never returned to work. The distributions of lost work days were not significantly different between men and women employees ($\chi^2_{(6\ df)} = 4.39$, $p = 0.60$).

Activity restrictions were not recorded on 33.5 percent of injury reports but, among those with restriction notations, 78.5 percent had limited duty on return to work, about 14 percent had no work restrictions, and 6.8 percent were not permitted to return to the same job. (The Cal/OSHA injury reporting form is the employer's first report and, in some cases, the final disposition of the injured worker with regard to restricted activities has not yet been determined.) This restriction pattern was not different between injured men and women employees ($\chi^2_{(2\ df)} = 0.937$, $p = 0.60$).

Time of occurrence

Frequency of injury by day of week shows a significant difference ($\chi^2_{(6\ df)} = 62.14$, $p < 0.001$) from that recorded and that expected based on work hour distribution data supplied by The Home Depot (figure 1). Far fewer injuries were reported on Saturdays or Sundays than expected, based on day of week work hours in the study period. This pattern was similar for men and women ($\chi^2_{(6\ df)} = 7.306$, $p = 0.30$).

Figure 2 shows the number of low back injuries and rate per million work hours by hour of the day. About

TABLE 5. Number and percentage of activities associated with low back injury, by lifting intensity, among employees of The Home Depot, Inc., California, 1990–1994

Activity	Lifting intensity							
	Low		Moderate		High		Total	
	No.	%	No.	%	No.	%	No.	%
Lifting	35	48.6	168	59.2	862	61.4	1,065	60.5
General physical movements*	13	18.1	40	14.1	277	19.7	330	18.7
Struck by or striking object	4	5.6	24	8.5	84	6.0	112	6.4
Climbing or lost footing	20	27.8	52	18.3	181	12.9	253	14.4
Total	72	100.1	284	100.1	1,404	100.0	1,760	100.0

* Includes bending, twisting, pushing, and pulling.

9 percent of reported injuries did not specify hour of occurrence. Stores are routinely open between 7 a.m. and 9 p.m. depending on the season of the year. Although the count of injuries is highest between the hours of 10 a.m. and 4 p.m., the rates by work hour show high occurrence from 2 a.m. until 6 a.m. The distributions of hour of injury occurrence were similar for men and women ($\chi^2_{(3\ df)} = 6.755$, $p = 0.08$).

DISCUSSION

Although the published literature on low back pain or injury is extensive, findings from the relatively few epidemiologic studies are virtually impossible to compare because of fundamental differences among reports on definitions or terms, study populations, data sources, study designs, and measures of outcome events. For example, some investigators refer to the low back event as pain (1, 17, 52–56), while others refer to the event as a disorder (57), disability or injury (25, 26), trouble (22), or a mixture of terms in the same research paper (23).

In most research reports, the definition of the outcome is influenced by the source of the information such as questionnaire (11, 21, 22, 56, 58), interview

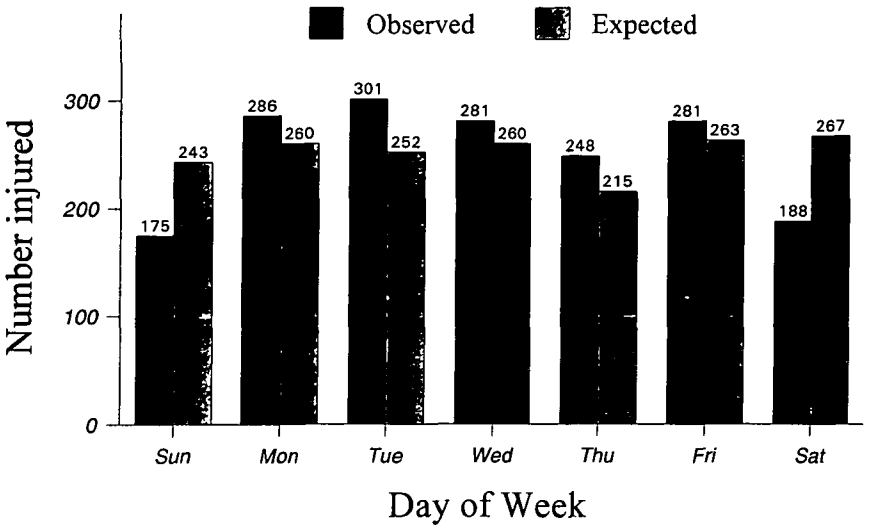

FIGURE 1. Number of observed and expected low back injuries by day of week, The Home Depot, Inc., California, 1990–1994.

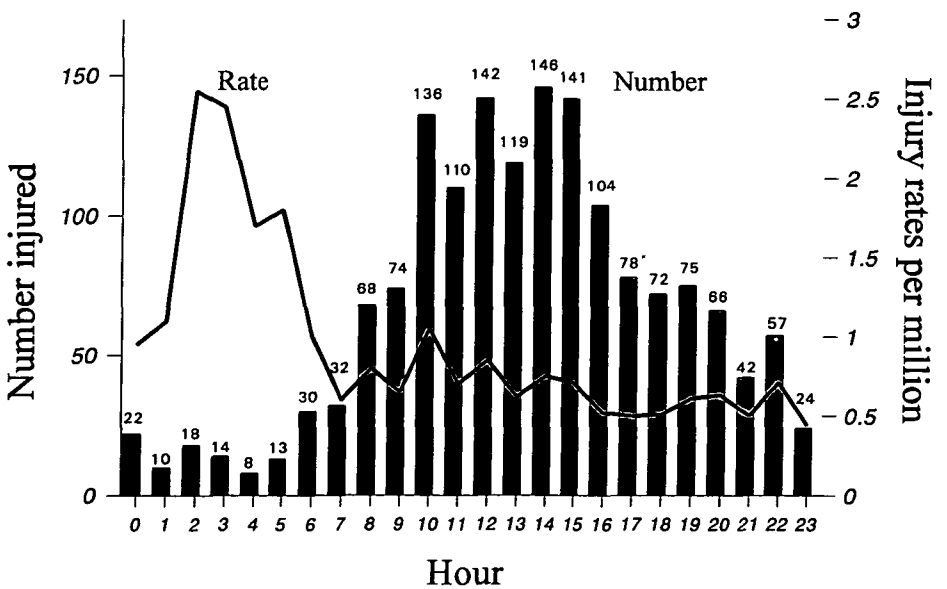

FIGURE 2. Number of low back injuries and rate of injuries per million work hours, by hour of day, The Home Depot, Inc., California, 1990–1994.

(17, 18), business injury records (25, 26, 59), group medical practice records (2), or workers' compensation files (37, 53). The study groups have varied as well, including surveys of the general population (1, 17, 18, 22, 56), working populations (17, 25, 54, 55, 60), and specific occupational groups such as coal workers (17), members of a trade union (58), aircraft workers (25), hospital workers (11, 14), or mixtures of working groups (52). The study type most commonly used is the prevalence survey (1, 11, 22, 23, 54–56, 58), but one case-control study has been used to derive estimates of effect (21). Prevalence data have been analyzed to obtain estimates of relative risk (23, 52) and, in a few reports, cumulative incidence (37, 53) or incidence density rates (26) have been reported.

The only report giving data for incidence density rate calculations among a specified working group was authored by Clemmer et al. (26). The incidence density rate during 1979–1989 of all low back injuries based on standard company injury report forms was about 35 per 1 million work hours of offshore drilling employees who are described by the authors as engaged in the heaviest physical labor. This rate is considerably higher than that found for high lifting intensity employees in Home Depot stores of 26.2 per million work hours. However, the study years and the nature of the working exposure are different between the two study populations. In addition, the lower rate of low back injury in Home Depot high lifting intensity workers may be due to the mandatory use of back supports that reduced back injuries by about 31 percent from 1989 through 1994 (61).

Studies of low back injuries in working men and women are rare, and reports in those with identical work tasks are virtually nonexistent. Our finding unadjusted for other factors that risk of low back injury is much higher in men than women employees is consistent with that reported by Abenhaim and Suissa (53) in the province of Quebec, Canada. However, among employees in this current study, the overall difference in injury experience between the sexes appears to be influenced by lifting intensity that, when controlled in the regression model, resulted in a reversal of risk for women compared with men.

Although musculoskeletal and physiologic differences between men and women are well documented, it would appear that the biomechanical stresses from material handling are differential by sex in its effect, and increased job lifting requirements are directly related to increased rates of reported low back injury for both sexes but more so for women. It is conceivable also that a healthy worker effect (62) is operating in which stronger, healthier women pursue occupations that include lifting or that the occupation itself strengthens the lower back.

Unadjusted and adjusted risk of injury declined progressively with increased years of length of employment for both men and women. The first Home Depot store opened in California in 1985 and, by 1994, few employees had accumulated more than 5 years of experience prior to the study period because of substantial personnel turnover in the home improvement retail industry. If mortality, morbidity, or economic biases are operating to select differentially employees for longer versus shorter employment tenure, it is not readily apparent from the data available in this study.

Age has been reported to be associated with low back disorders (8, 18, 34, 35, 36, 58, 60). However, the direction of the purported association is not consistent across these reports. In one study using injury records and worker compensation files, the risk of low back injury was higher with older age (26) but, in other studies (37, 54, 58), rates were higher in younger workers.

Sex, age, length of employment, and job-lifting intensity are all intercorrelated, but the interrelation of these factors has not been evaluated in working populations. The difference in crude and adjusted estimates for male sex can be explained by the relation between sex and lifting intensity. Females have very few work hours in the high lifting category, which has the highest rates of back injury, and when lifting intensity is not controlled the rates for females are lower than those for males. However, among those persons who work in high lifting intensity jobs, males have a lower rate of injury than females. Thus, when lifting intensity is controlled, male sex is protective for incidence of back injury. After mutually controlling for all factors, lifting intensity is most strongly associated with low back injuries overall and low back injuries resulting in lost days from work. The extent and frequency of job tasks that require manual lifting appear to be crucial in predicting low back injury, and other factors do not appear to modify this observation.

Lifting, carrying, pushing, and pulling materials were associated with almost two thirds of all reported injury episodes in this report not unlike the findings observed among offshore drilling workers (26). Careful ergonomic assessments coupled with changes in material handling practices are suggested by our data.

The risk of low back injury was less than expected on weekend work days. The retail stores are open 7 days a week except for major holidays. An engineering study in the fall of 1994 (Laura Ferguson, The Home Depot, Inc., personal communications, 1995) showed that, while work hours and sales volume were

considerably higher on weekends, the type of work was almost exclusively retail sales with much less material handling activities.

Low back injuries occur most frequently from 10 a.m. to 4 p.m. daily, but injury rates per million work hours are highest from 1 a.m. to 6 a.m. There are no sales activities during peak injury rate hours since these hours are for material handling activities, such as stocking and setting up new merchandise displays.

Although findings from this current study add to the epidemiologic knowledge on low back injury, the study design had limitations. The outcome event was a self-reported injury using standard company procedures and Cal/OSHA forms. Medical diagnoses were recorded on each report, but the elusive nature of the event cannot be overlooked. Nonclinical notations such as low back "tear," "pull," "twist," or "wrench" appeared frequently in the injury records. To the extent that reported events reflect true occurrence, this study then reflects also the true incidence and attendant risk factors. Under- or overreporting of low back injury cannot be totally eliminated.

The complete recording of compensated work time by name, date, age, sex, hire date (and termination date if appropriate), and job title allowed for cross-factor aggregation of work hours by these factors. "Dose" of exposure is essential in understanding the amount of biomechanical insult but is difficult to quantify and, hence, rarely undertaken. The availability of a company ergonomic assessment of all job titles allowed us to classify them unambiguously into three levels of expected job lifting requirements. This qualitative measure, while not precise in moment-to-moment individual worker activities, did provide an advantage in evaluating the exposure to lifting in the work performed.

Information on other factors possibly related to the occurrence of low back injury was not recorded in employee personnel files. Nested case-control studies are needed to determine the role of such factors as height, weight, smoking, prior back injury, current lifestyle, or exercise practices in low back injury among material handlers.

Findings from this study reflect one employer in one industry. A full understanding of risk of low back injury in other industries and a variety of different occupations is essential. The enormous size of the occurrence and impact of low back injury in industry and the need to use the skills of ergonometrists, clinicians, engineers, and epidemiologists strongly suggest the need for a well-focused national effort to study the problem further.

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