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SPECIAL ISSUE: Epidemiological Studies of Workplace Musculoskeletal Disorders

Low-Back Pain Ratings for Lifetime, 1-Month Period, and Point Prevalences in a Large Occupational Population

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Objective: This manuscript systematically quantifies multiple measures of low-back pain (LBP) prevalence by pain rating in a large, multisite cohort of workers.

Background: Published LBP prevalence rates vary. Studies rely on one measure of LBP and none report prevalence stratified by pain rating.

Method: Cross-sectional analyses of baseline data from a multicenter prospective cohort study were performed to evaluate differences in lifetime prevalence, 1-month period prevalence, and point prevalence of LBP. Workers were from 28 different employment settings in 4 diverse U.S. states. All workers completed computerized questionnaires and structured interviews. LBP prevalence measures were stratified by pain ratings.

Results: A total of 828 subjects had complete health data at baseline. Lifetime prevalence, 1-month period prevalence, and point prevalence for any LBP (≥1/10) were 63.4%, 44.0%, and 20.8% respectively. Prevalence of LBP decreased with increasing pain ratings. As an example, using a threshold of LBP ≥ 3/10 pain, prevalence measures were 61.0%, 37.6%, and 16.7% respectively. A threshold of LBP ≥ 5/10 had prevalence measures of 51.2%, 22.9%, and 9.9% respectively. Age, systolic and diastolic blood pressure, high cholesterol, high blood pressure, and tobacco use were statistically significantly related to lifetime prevalence of LBP.

Conclusion: Lifetime LBP prevalence, 1-month period prevalence, and point prevalence stratified by pain ratings demonstrate a wide variation of prevalence measures of LBP and self-reported pain ratings. Higher pain rating thresholds yield lower prevalence measures and may impact assessments of risk factors. Differences in pain ratings may allow for focused surveillance within an occupational cohort.

Keywords: epidemiology, risk factors, cohort, ergonomics, cross-sectional study design

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INTRODUCTION

Low-back pain (LBP) is a common and costly disorder (Dagenais, Caro, & Haldeman, 2008; Goetzel, Hawkins, Ozminkowski, & Wang, 2003; Pai & Sundaram, 2004; Waddell, 1996). Direct costs of LBP annually in the United States are estimated between $20 billion and $98 billion (Dagenais et al., 2008; Juniper, Le, & Mladsi, 2009; Katz, 2006; Mehra, Hill, Nicholl, & Schadrack, 2011; Ritzwoller, Crounse, Shetterly, & Rublee, 2006). Annual direct and indirect costs, including lost productivity, have been estimated at $100 to $200 billion (Katz, 2006). The population-based relationship(s) among LBP severity, persistence, and costs are somewhat unclear.

LBP is commonly classified as a binary outcome (i.e., present or absent); however aggregating those with a pain rating indicating minimal pain, for example, a pain scale rating of 1/10, with those whose rating is of severe pain, for example, those with a pain rating of 9/10, may be problematic. These two pain ratings may suggest differences in severity or etiology, require different treatment, and have differing prognoses. Individuals with low pain ratings may not imminently incur medical costs or require workplace accommodations, though some may ultimately be at risk for more severe disorders. Conversely, those with higher pain ratings may incur a disproportionate burden of resources.

Estimates for lifetime prevalence, 1-month period prevalence, and point prevalence of LBP all vary and appear highly dependent on the definition of LBP (Dionne et al., 2008; Hoy et al., 2010; Loney & Stratford, 1999). Estimates of point prevalence of LBP of any pain level range from 8.4% to 37.1% (Andersson, Ejlertsson, Leden, & Rosenberg, 1993; Bredkjær, 1991;

Carmona, Ballina, Gabriel, & Laffon, 2001; Cassidy, Carroll, & Côté, 1998; Harkness, Macfarlane, Silman, & McBeth, 2005; Hillman, Wright, Rajaratnam, Tennant, & Chamberlain, 1996; Hoy, Toole, Morgan, & Morgan, 2003; Mahajan, Singh, Jasrotia, & Jamwal, 2003; Oksuz, 2006; Schmidt et al., 2007; Skovron, Szpalski, Nordin, Melot, & Cukier, 1994; Walker, Muller, & Grant, 2004). The point prevalence of 8.4% was reported in a study from India, which included ages 15 years or older and a wide array of socioprofessional groups and defined LBP as below the 12th rib but above the gluteal folds with or without pain radiating into the legs (Mahajan et al., 2003). The highest point prevalence of 37.1% was from Germany and included the entire back, not only LBP (Schmidt et al., 2007).

One-month period prevalence estimates of LBP of any pain range from 31.7% to 49.5% (Croft et al., 1995; Heistaro, Vartiainen, Heliövaara, & Puska, 1998; Nyland & Grimmer, 2003; Stranjalis, Tsamandouraki, Sakas, & Alamanos, 2004). Stranjalis et al. (2004) reported a 1-month prevalence of 31.7% from a population of individuals 15 years or older in Greece. One-month prevalence of 49.5% was reported from Heistaro et al. (1998). This population consisted of middle-aged individuals from two areas in Finland. LBP was defined as back ache or pain in the past month. Croft et al. (1995) reported a 1-month prevalence of 39.0% in a population of adults from the United Kingdom aged 18 to 75 years old. Nyland and Grimmer (2003) reported a 1-month prevalence of 44% in a population of students enrolled in the 4-year bachelor's of physiotherapy program in Australia.

Lifetime prevalence estimates of LBP vary from 57.7% to 85% (Bejia et al., 2005; Cassidy et al., 1998; Jin, Sorock, & Courtney, 2004; Nyland & Grimmer, 2003; Oksuz, 2006; Von Korff, Dworkin, Le Resche, & Kruger, 1988; Walsh, Cruddas, & Coggon, 1991, 1992). Bejia et al. (2005) reported the lifetime prevalence was 57.7% in a population composed of individuals from a teaching hospital in Tunisia. LBP was defined as mechanical pain in the lower back that did not radiate below the knees. Chronic LBP was defined as pain lasting for more than 3 months. Schmidt et al. (2007) reported a lifetime prevalence of 85.5% in a German population. Nyland and Grimmer (2003) reported the lifetime prevalence was 84.1% among students enrolled in a 4-year program for a bachelor's of physiotherapy at an Australian university. Nyland and Grimmer defined LBP as pain between the 12th rib and the gluteal folds. The wide distribution of pain prevalence measures may also suggest a lack of precision in assessing LBP in populations.

The purpose of this article is to quantify prevalence and demonstrate the variation in pain using many different definitions of LBP prevalence and pain ratings. Although there are many articles reporting prevalence of LBP, there are few publications reporting prevalence rates simultaneously measured on a large, well-defined occupational population using multiple case definitions that include pain ratings. There are no publications reporting any prevalence measure stratified by pain ratings. By including pain ratings in analyses of LBP prevalence, these data allow for direct comparisons of prevalence based on different case definitions of LBP.

METHOD

This study was approved by the Institutional Review Boards of the University of Utah, University of Wisconsin, and Texas A&M University. A methods protocol paper has been published (Garg et al., 2013). A brief summary of the methods follows.

Study participants were recruited from 27 employers with 34 diverse facilities located in four U.S. states (Illinois, Texas, Utah, and Wisconsin). The job tasks were primarily manual material handling. Employers paid workers regular wages, and respondents were not given additional incentives for participation. Workers were invited to enroll and signed informed consent documents to participate. Enrollment goals were approximately one third of respondents in low, medium, and high low-back job physical demands groups, as assessed by expert opinion in large job categories within each facility (Garg et al., 2013). Participants in different job categories were typically enrolled at each facility. For example, workers enrolled from jobs at one facility may range from lifting required for packaging to heavy manual material handlers

and palletizers. Therefore, facilities were not categorized as high, medium, or low job physical demands. Eligible participants were (a) at least 18 years of age, (b) able to give informed consent, (c) without plans to retire or leave their employer within 4 years, (d) able to speak either English or Spanish, and (e) free of major limb deformities and/or substantial amputations. Supervisors, maintenance/mechanics, and forklift truck drivers were not eligible due to probable frequent and unpredictable changes in job physical exposures as well as difficulty in videotaping sufficient cycles of work for these workers.

After consent was obtained, the Health Outcomes Assessment Team administered computerized questionnaires and structured interviews (Garg et al., 2013). The questionnaire included medical health items and psychosocial factors including (a) demographics, (b) medical history, (c) psychosocial questions, and (d) other questions (e.g., sleeping patterns, smoking, alcohol consumption; Garg et al., 2013).

Structured interviews were administered by either physical therapists or occupational medicine residents who were trained and standardized on interview questioning and physical exam maneuvers annually. It included a survey of symptoms required for LBP case definitions and diagnostic impressions and utilized a body diagram to help localize symptoms (Garg et al., 2013). Lifetime history of LBP, including lifetime worst ever pain, longest duration of LBP, most recent episode of LBP, and lifetime treatments for LBP were recorded. Besides lifetime LBP measures, respondents' recalled LBP ratings and anatomic pain location(s) were recorded for the month prior to enrollment (1-month period prevalence) as well as on the day of enrollment ("current" or point prevalence). Pain ratings were recorded for each period or point prevalence on a 0 to 10 scale with 0 being *no pain* and 10 being *the worst pain imaginable*. Duration of LBP was entered in days (e.g., if a respondent recalled 2 years of duration, this was entered as 730 days). All outcome data for this report were collected in the structured interview, which has not been validated in other studies but is freely available in the previously published methods paper (Garg et al., 2013). Participants were also asked about changing jobs, time off of work, modified duty, and workers compensation claims for LBP. Height and weight were measured to calculate body mass index (BMI).

Case Definitions

Case definitions for this report, each with 0 to 10 pain ratings assessed in the structured interview, include (a) lifetime history of LBP, (b) LBP in the past month, and (c) current LBP. Verbal anchors for the 11-point scale were *no pain*, for a pain rating of 0, and *the worst pain imaginable*, for a rating of 10. Participants were asked if they had ever experienced LBP lasting more than 24 hours in their life. Lifetime maximum LBP (0–10 scale) was recorded for those who reported having experienced pain for more than 1 day (lifetime history of LBP). Participants were also asked about LBP in the past month (1-month period prevalence) and current LBP (point prevalence). Pain ratings (0–10 scale) were recorded separately for both those who reported having had pain in the past month and current pain.

Statistical Analysis

Variables selected for analysis comparing lifetime prevalence of LBP were chosen based on biological plausibility and potential risk factors reported in the literature. Mean values, standard deviations, and frequencies were calculated. Tests comparing mean values of continuous variables were conducted using the Wilcoxon test because data were not normally distributed. Categorical data were analyzed using chi-squared tests. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated using logistic regression. Reference categories for all OR calculations were selected based on the one with the lowest risk from prior literature (e.g., no diabetes) or the category with the highest number of respondents if no category was regarded as low risk (e.g., company type of book distribution and warehousing). All analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC).

RESULTS

There were 828 study respondents with complete baseline health data who were included

in these analyses. Most of the respondents were male (n = 529, 63.9%), with a mean age of 38.8 ± 12.0 years and BMI of 29.3 ± 6.5 kg/m^2. Slightly more than half were never smokers (458, 55.3%) and 192 (23.2%) were past smokers. Few had a diagnosis of diabetes mellitus (37, 4.5%), and relatively few had a history of high cholesterol (155, 18.7%) or high blood pressure (119, 14.4%). In all, 526 participants (63.9%) reported having at least 1 day of LBP within their lifetime; 302 (36.4%) reported either never having had LBP or having had LBP lasting less than 1 day in their life.

Descriptive values comparing those with 1 or more days of LBP in their life and those without 1 day of LBP in their life are in Tables 1 and 2. The mean age of those experiencing LBP was 39.4 ± 12.2 years, compared to 37.7 ± 11.5 years for those who have not experienced LBP (OR per year = 1.01, 95% CI = 1.00–1.02, p = .058). Body mass index was not significantly different between the two groups, with those having had LBP with a BMI of 29.3 ± 6.7 kg/m^2 and those without a LBP history with a mean BMI of 29.5 ± 6.1 kg/m^2 (p = .669). The mean systolic blood pressures statistically differed, although the magnitudes of differences were not large, with those having had LBP having a mean 130.0 ± 17.3 mm Hg compared to 126.7 ± 17.0 mm Hg for those without LBP (OR per mm Hg increase = 1.01, 95% CI = 1.00–1.02, p = .008). Diastolic blood pressures similarly differed with a mean diastolic blood pressure of 79.0 ± 10.4 mm Hg for those with a history of LBP compared to 77.2 ± 11.6 mm Hg for those without a LBP history (OR per mm Hg increase = 1.01, 95% CI = 1.00–1.03, p = .025).

The mean maximum lifetime LBP rating for those experiencing at least 1 day of LBP was 6.8 out of 10 (*Mdn* = 7, range of 1 to 10; see Table 1). Among those who had at least 1 day of LBP, the longest duration of LBP was a mean of 173.1 ± 844.0 days (*Mdn* = 6 days, range = 1 to 9,125 days). The total number of days of light duty from LBP averaged 9.3 ± 72.7 days (*Mdn* = 0 days, range = 0 to 1,460 days). The mean number of days participants missed work because of LBP averaged 7.9 ± 52.8 days (*Mdn* = 0 days, range 0 to 750 days).

There was no significant difference (p = .135) in the proportion of males to females between those who experienced LBP lasting at least 1 day and those who have not experienced LBP. The diagnosis of diabetes mellitus was not significantly different (p = .602). Among those with LBP there were 116 (22.1%) who were diagnosed with high cholesterol, as compared to only 39 (12.9%) in the control group (OR = 1.91, 95% CI = 1.29–2.83, p = .013). Among those with LBP, 87 (16.5%) had a diagnosis of high blood pressure as compared to the controls with only 32 (10.6%) having had a diagnosis of high blood pressure (OR = 1.67, 95% CI = 1.09–2.58, p = .020). Current smoking and past smoking as compared to never smoking were both significantly different, with OR = 1.87 (95% CI = 1.28–2.72, p = .001) and OR = 1.45 (95% CI = 1.28–2.72, p = .039), respectively. Multivariate modeling, adjusting for age, gender, and BMI did not meaningfully change the relationships between these factors and prevalence of LBP.

In all, 111 (13.4%) participants reported having a maximum lifetime pain rating of 10 out of 10 on a pain scale (see Table 3). Relatively few, 36 (4.4%), reported a maximum lifetime pain rating of 9, whereas 85 (10.3%) reported a maximum lifetime pain rating of 8. Pain ratings of 7 through 4 had 60 (7.3%), 67 (8.1%), 65 (7.9%), and 54 (6.5%) respondents, respectively.

Relatively few reported maximum lifetime pain ratings of 3, 2, or 1, with 3.3%, 2.3%, and 0.2%, respectively. A total of 302 (36.4%) study participants reported never having pain lasting more than a day. Of respondents, 28.0% reported a maximum lifetime pain rating of 8 or greater on a 10-point scale, and 57.7% had a maximum pain rating of 5 or greater on a 10-point scale. Lifetime cumulative prevalence of any pain (1–10/10) was 525 study respondents (63.4%); thus the vast majority of those recalling pain rated it at least 5 out of 10.

The maximum pain rating for 1-month period prevalence is lower and more normally distributed as compared to lifetime maximum pain ratings. For pain ratings of 10, 9, or 8 the 1-month period prevalences were 1.5%, 1.2%, and 3.5%, respectively. Frequencies of pain ratings of 7 through 4 were comparatively higher than those of 8, 9, or 10 pain ratings. Frequencies for ratings of 7 through 4 were 3.3%, 5.9%, 7.5%, and 7.1%, respectively. One-month period prevalence pain ratings of 3, 2, or 1 were 7.6%, 4.7%,

TABLE 1: Continuous Demographic Data Comparing Those With and Without a Lifetime History of Any LBP Lasting at Least 1 Day.

	No Lifetime History of LBP (n = 302)			Lifetime History of LBP (n = 526)			
Continuous Data	*M* ± *SD*	*Mdn*	Range	*M* ± *SD*	*Mdn*	Range	OR and 95% CI
Age (years)	37.7 ± 11.5	36.3	18.3–61.9	39.4 ± 12.2	38.8	19.2–69	1.01 (1.00, 1.02)
Body mass index (kg/m^2)	29.5 ± 6.1	28.4	15.87–52.3	29.3 ± 6.7	28.2	17.5–85.4	1.00 (0.97, 1.02)
Systolic blood pressure (mm Hg)	126.7 ± 17.0	125	74–235	130.0 ± 17.3	128	92–205	1.01 (1.00, 1.02)*
Diastolic blood pressure (mm Hg)	77.2 ± 11.6	76	47–147	79.0 ± 10.4	79	43–124	1.01 (1.00, 1.03)*
LBP worst pain (0–10)[a]	N/A	N/A	N/A	6.8 ± 2.4	7	1–10	N/A
Longest duration of LBP (Days)[a]	N/A	N/A	N/A	173.1 ± 844.0	6	1–9125	N/A
Days light duty due to LBP[a]	N/A	N/A	N/A	9.3 ± 72.7	0	0–1460	N/A
Days missed work due to LBP[a]	N/A	N/A	N/A	7.9 ± 52.8	0	0–750	N/A

Note. CI = confidence interval; LBP = low-back pain; OR = odds ratio.
[a]Within participant's lifetime.
*$p < .05$.

and 1.7%, respectively. Most participants (n = 464, 56.0%) reported no LBP in the month prior to enrollment. In the month prior to enrollment, 51 (6.2%) recalled pain with ratings of 8 or greater and 189 (22.9%) recalled pain with ratings of 5 or greater. One-month period prevalence for any pain was 44.0% (n = 364 respondents).

The point prevalences on the day of enrollment for ratings of 10, 9, or 8 were 0.4%, 0.6%, and 2.1%, respectively. Point prevalences for pain ratings of 7 through 4 were 1.7%, 2.1%, 3.1%, and 3.9%, respectively. Point prevalences for pain ratings of 3, 2, or 1 were 2.9%, 3.0%, and 1.0%, respectively. Of the participants, 656 (79.2%) reported no pain on the day of enrollment. The point prevalence for pain ratings of 8 or higher was 3.0% (n = 25). The point prevalence for a rating of 5 or higher was 9.9% (n = 82). In all, 172 (20.8%) had any LBP at the time of enrollment.

DISCUSSION

There is a high proportion of this large occupational cohort who recall prior episodes of LBP in their life, as well LBP in the month prior to enrollment. A total of 63.4% report having had LBP of at least 1 day's duration. In addition, LBP ratings demonstrate large variability between reports, with twofold to fivefold differences in prevalence measures (e.g., point prevalence of 8.7% vs. 45.0%). These data illustrate that a large proportion of workers in this population have relatively high current pain ratings while still at work. Shockingly, almost 10% (9.9%, n = 82) have pain ratings of at least 5 out of 10 on the day of enrollment in the workplace.

TABLE 2: Categorical Demographic Data Comparing Those With and Without a Lifetime History of LBP Lasting at Least 1 Day.

		No Lifetime History of LBP (n = 302)	Lifetime History of LBP (n = 526)	
Categorical Data	Category	Frequency (%)	Frequency (%)	OR and 95% CI
Gender	Male	183 (60.6)	346 (65.8)	Reference[a]
	Female	119 (39.4)	180 (34.2)	0.80 (0.60, 1.07)
Diabetes mellitus diagnosis	No	290 (96.0)	501 (95.3)	Reference[a]
	Yes	12 (4.0)	25 (4.8)	1.21 (0.60, 2.44)
High cholesterol diagnosis (>200 mg/dl)	No	263 (87.1)	410 (78.0)	Reference[a]
	Yes	39 (12.9)	116 (22.1)	1.91 (1.29, 2.83)*
High blood pressure diagnosis	No	270 (89.4)	439 (83.5)	Reference[a]
	Yes	32 (10.6)	87 (16.5)	1.67 (1.09, 2.58)*
Tobacco use	Never	190 (62.9)	268 (51.0)	Reference[a]
	Past	63 (20.9)	129 (24.5)	1.45 (1.02, 2.07)*
	Current	49 (16.2)	129 (24.5)	1.87 (1.28, 2.72)*
Saw a physician for LBP		0	198	N/A
On light duty for LBP		92	92	N/A
Missed work due to LBP		0	98	N/A
Workers compensation claim for a back injury		0	57	N/A
Changed jobs because of LBP		0	31	N/A
Company type				
Office workers		8 (2.7)	25 (4.8)	0.48 (0.20, 1.12)
Airbag manufacturing		12 (4.0)	33 (6.3)	0.54 (0.26, 1.12)
Bathroom products manufacturing		11 (3.6)	25 (4.8)	0.66 (0.31, 1.42)
Beverage warehousing		4 (1.3)	1 (0.2)	5.97 (0.65, 54.5)
Book distribution and warehousing		10 (3.3)	24 (4.6)	Reference[a]
Book printing		73 (24.2)	109 (20.7)	0.62 (0.28, 1.38)
Chemical manufacturing and warehousing		2 (0.7)	4 (0.8)	0.75 (0.13, 4.18)
Commercial lighting manufacturing		9 (3.0)	30 (5.7)	0.45 (0.20, 1.00)*
Cosmetic manufacturing and warehousing		8 (2.7)	5 (1.0)	2.39 (0.75, 7.59)
Electric welding and cutting tools manufacturing		1 (0.3)	7 (1.3)	0.21 (0.03, 1.77)
Engineered roof manufacturing		1 (0.3)	9 (1.7)	0.17 (0.02, 1.34)
Food retailer warehouse (6 facilities)		53 (17.6)	68 (12.9)	1.16 (0.73, 1.85)
Frozen and canned food manufacturing		5 (1.7)	4 (0.8)	1.87 (0.49, 7.18)
Garage door manufacturing		11 (3.6)	5 (1.0)	3.29 (1.10, 9.85)
Medical equipment manufacturing		23 (7.6)	34 (6.5)	1.01 (0.55, 1.85)
Metal automotive engine parts manufacturing		5 (1.7)	13 (2.5)	0.57 (0.20, 1.68)

(continued)

TABLE 2: (continued)

Categorical Data	Category	No Lifetime History of LBP (*n* = 302) Frequency (%)	Lifetime History of LBP (*n* = 526) Frequency (%)	OR and 95% CI
Modular furniture manufacturing and warehousing		6 (2.0)	12 (2.3)	0.75 (0.27, 2.08)
Office chair manufacturing and warehousing		9 (3.0)	11 (2.1)	1.22 (0.48, 3.10)
Outdoor yard equipment manufacturing		3 (1.0)	16 (3.0)	0.28 (0.08, 1.00)*
Plastic molding and assembly		6 (2.0)	23 (4.4)	0.39 (0.15, 1.00)
Poultry processing		5 (1.7)	17 (3.2)	0.44 (0.16, 1.24)
Salt products manufacturing company 1		8 (2.7)	5 (1.0)	2.39 (0.75, 7.59)
Salt products manufacturing company 2		5 (1.6)	8 (1.5)	0.93 (0.29, 2.97)
Small engine manufacturing		2 (0.7)	15 (2.9)	0.20 (0.04, 0.90)*
Small metal parts manufacturing		15 (5.0)	10 (1.9)	2.24 (0.95, 5.26)
Soft drink manufacturing and warehousing		1 (0.3)	3 (0.6)	0.50 (0.05, 4.88)
Textile manufacturing and warehousing		3 (1.0)	5 (1.0)	0.90 (0.21, 3.86)
Wholesale medical distribution		3 (1.0)	2 (0.4)	2.24 (0.37, 13.74)
Wood cabinet manufacturing		0 (0.0)	3 (0.6)	N/A

Note. CI = confidence interval; LBP = low-back pain; OR = odds ratio.
[a]Reference value for statistical analysis.
*$p < .05$.

Comparing the two subpopulations of those with versus without a history of having had LBP lasting at least 1 day, there were significant differences for several variables, including high cholesterol, high blood pressure, current tobacco use, and former tobacco use. Additional analyses to adjust for confounding of these variables may shed light on these potential relationships. Those analyses will also include job physical factors and are the subject of subsequent analyses and reports.

This study's results for lifetime cumulative prevalence are reasonably comparable to prior reports. A population-based study in the United Kingdom (Walsh et al., 1992) reported lifetime prevalence increasing by age up to 70.5% among those 50 to 59 years old. Jin et al. (2004) found varying lifetime LBP prevalence among Chinese workers based on occupational group, with teachers having the lowest lifetime prevalence at 50% and garment workers having the highest prevalence at 79%. A recent study from Turkey reported lifetime LBP prevalence of 44.1%, with large differences between genders (Oksuz, 2006). Little is known regarding potential reasons for differences in reported prevalence. These differences may also be confounded by other factors, including job physical factors and differences in age. A similar article by Bejia et al. (2005) reported lifetime prevalence of 57.1%.

Reports of occupational or population-based 1-month period prevalence rates of LBP are relatively uncommon. Heistaro et al. (1998) reported 1-month LBP period prevalence in a Finnish cohort was similar for both males and females at approximately 50%. Similarly, Stranjalis et al. (2004) reported a 1-month period prevalence of 31.7% and found differences by

TABLE 3: Lifetime, 1-Month Period, and Point Prevalence Low-Back Pain (LBP) Rating (n = 828).

Pain Rating	Lifetime History of LBP Frequency Frequency (%)	Lifetime History of LBP Cumulative Frequency Frequency (%)	1-Month Period Prevalence LBP Frequency Frequency (%)	1-Month Period Prevalence LBP Cumulative Frequency Frequency (%)	Point Prevalence LBP Frequency Frequency (%)	Point Prevalence LBP Cumulative Frequency Frequency (%)
10	111 (13.4)	111 (13.4)	12 (1.5)	12 (1.5)	3 (0.4)	3 (0.4)
9	36 (4.4)	147 (17.8)	10 (1.2)	22 (2.7)	5 (0.6)	8 (1.0)
8	85 (10.3)	232 (28.0)	29 (3.5)	51 (6.2)	17 (2.1)	25 (3.0)
7	60 (7.3)	292 (35.3)	27 (3.3)	78 (9.5)	14 (1.7)	39 (4.6)
6	67 (8.1)	359 (43.4)	49 (5.9)	127 (15.4)	17 (2.1)	56 (6.8)
5	65 (7.9)	424 (51.2)	62 (7.5)	189 (22.9)	26 (3.1)	82 (9.9)
4	54 (6.5)	478 (57.7)	59 (7.1)	248 (30.0)	32 (3.9)	114 (13.8)
3	27 (3.3)	505 (61.0)	63 (7.6)	311 (37.6)	24 (2.9)	138 (16.7)
2	19 (2.3)	524 (63.3)	39 (4.7)	350 (42.3)	25 (3.0)	163 (19.7)
1	2 (0.2)	526 (63.4)	14 (1.7)	364 (44.0)	9 (1.0)	172 (20.8)
0[a]	302 (36.4)	828 (100.0)	464 (56.0)	828 (100.0)	656 (79.2)	828 (100.0)

[a]Individuals who report never having had any LBP lasting at least 1 day of any intensity.

gender, age, education, type of job, marital status, family income, and residence. The 44.0% 1-month period prevalence of LBP in this study is higher than the 31.7% reported by Stranjalis et al.; however, Stranjalis et al. included a high proportion of elderly and did not include many workers in high job physical demands that are included in our study. A population survey by Croft et al. (1995) reported a 1-month period prevalence of 39.0%, with strong relationships with psychological distress. This body of articles suggests that the prevalence for 1-month period prevalence may be relatively stable. The gradations of pain intensity in the current study further illustrate the wide range of pain within this working population.

Point prevalences vary widely in the published literature. Mahajan et al. (2003) found the point prevalence of those with low-back aching was 8.4%. The point prevalence of LBP in the Oksuz (2006) study was 19.7%. Harkness et al. (2005) reported results from two cross sectional studies and found increasing point prevalence from 1956 to 1994 from 8.7% to 18.0%, suggesting an increasing trend. This study's point prevalence of 20.8% is higher than the point prevalence in most other reports. These articles suggest point prevalence may not have been stable over time and may be related to other factors. This apparently increasing prevalence across these studies could be from differences in the populations studied, changing risk factors, better capture of cases, or variability in the definitions of LBP used and/or could be influences of the job physical factors in this population.

This study's strengths include a large sample size and enrollments from four diverse U.S. states that include 34 different plants. Strengths also include standardization of trained interviewers, computerization of structured interviews, as well as detailed data collection of LBP symptoms, duration, and location. Last, blinding of the health outcomes team to participants' occupational exposures provided an additional study strength.

Although weaknesses exist, they are likely minimized by the study methods and data collection. This study's inclusion of primarily man-

ual material handling workers may limit its generalizability and application to workers in other economic sectors, although other studies have suggested high prevalence rates in other employment settings as well as in the general population. Enrollment of workers was on a volunteer basis, and the precise participation rate is not known. Estimates of the participation rate are greater than 60% of all eligible participants, with participation among those invited to participate near 90%. It is likely that there are some potential participants who were not at work due to LBP, and therefore these measures may be slightly underestimated; however, we enrolled at most sites on more than 1 day and thus captured most people absent on the initial enrollment day by follow-up of those specific potential respondents. There is a possibility of recall bias; however, future analyses of the longitudinal data from this study will allow for comparison with 1-month period prevalence and point prevalence. There is also a possibility that other factors, including workplace physical and psychosocial factors, have a relationship with pain intensity.

This study's analysis of the potential relationship between BMI and LBP does not coincide with some other published reports. This relationship may also have been confounded as BMI may be a relatively ineffective measure of obesity for this population that includes some workers with extremely heavy job tasks that would necessitate high muscle mass and thus high BMIs to perform the job. It is also possible that the healthy worker effect may confound the relationship between BMI and LBP. Additional analyses investigating relationships between LBP and both waist circumference and waist-to-hip ratio yielded similar, nonsignificant results.

CONCLUSION

This study reports three measures of LBP prevalence: lifetime LBP prevalence, 1-month period prevalence, and point prevalence. These prevalence measures stratified by pain ratings demonstrate wide variations in prevalence measures of LBP and large variability in self-reported pain ratings. Higher pain rating thresholds yield lower prevalence measures and may affect assessments of risk factors. In addition, there are factors that are statistically significantly related to lifetime LBP prevalence. Whether there are additional differences in risk factors based on variations in LBP case definitions needs to be systematically evaluated.

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KEY POINTS

- Multiple measures of low-back pain have been simultaneously measured in few studies.
- Lifetime prevalence, 1-month period prevalence, and point prevalence for any LBP (1/10 or more) were 63.4%, 44.0%, and 20.8%, respectively.
- Prevalence of LBP decreased with increasing pain ratings, thus when using a threshold of 3/10 pain, prevalence measures were 61.0%, 37.6%, and 16.7%, respectively.
- Age, systolic and diastolic blood pressure, high cholesterol, high blood pressure, and tobacco use were significantly related to lifetime prevalence of LBP.
- Higher pain rating thresholds yield lower prevalence measures and may affect assessments of risk factors, which remain to be determined.

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