Physical Workload, Work Intensification, and Prevalence of Pain in Low Wage Workers: Results From a Participatory Research Project With Hotel Room Cleaners in Las Vegas

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Background *Occupational injury rates among hotel workers exceed the national service sector average. This study assesses the prevalence of back and neck pain, and its associations with physical workload, ergonomic problems, and increasing work demands.*

Methods *Nine hundred forty-one unionized hotel room cleaners completed a survey about health and working conditions. Associations between job demands and pain were determined by logistic regression models adjusting for individual characteristics, cumulative work demands, care-taking responsibilities at home, and psychosocial job factors.*

Results *The 1-month prevalence of severe bodily pain was 47% in general, 43% for neck, 59% for upper back, and 63% for low back pain. Workers in the highest exposure quartiles for physical workload and ergonomic problems were between 3.24 and 5.42 times more likely to report severe pain than workers in the lowest quartile. Adjusted odds ratios for work intensification ranged from 1.74 (upper back) to 2.33 (neck).*

Conclusions *Most room cleaners experience severe back or neck pain. Severe pain showed strong associations with physical workload, work intensification, and ergonomic problems.* Am. J. Ind. Med. 00:1–12, 2005. © *2005 Wiley-Liss, Inc.*

KEY WORDS: musculoskeletal disorders; work-related low back pain; job stress; ergonomics

INTRODUCTION

The hospitality industry is a major employer of low-wage service workers. The second largest occupation is housekeeping, comprising 26% of all hotel employment [Bureau of Labor Statistics, 2003c], and characterized by a predominantly female workforce, repetitive physical tasks, low job control, low wages, increasing use of contingency employment, and few opportunities for career advancement [Krause et al., 1999b; Parker and Krause, 1999; AFL-CIO Working for America Institute, 2002; Bernhardt et al., 2003]. There is compelling evidence that such low-wage jobs result in a high burden of illness, injury, and disability [Krause et al., 1997b, 2001; Amick et al., 1998; Woods et al., 1999; Borg and Kristensen, 2000; Ala-Mursula et al., 2002; Pransky

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et al., 2002a; Murray, 2003]. This burden falls disproportionately on workers who are multiply disadvantaged in society, and who have been under-represented and under-served in occupational health research [Murray, 2003; National Institute for Occupational Safety and Health, n.d.]. The hospitality industry has, in recent years, both upgraded guest services and implemented lean staffing and greater performance demands [Parker and Krause, 1999; Bernhardt et al., 2003], which may be associated with occupational injury [Bernhardt et al., 2003].

Hotel workers have higher rates of occupational injury and illness compared to workers in the service sector at large. In 2002, hotel workers had 6.7 occupational injuries and illnesses per 100 full-time workers, compared to 4.6 in the service sector as a whole; hotel workers also had higher rates for occupational injuries and illness resulting in lost workdays (1.8 vs. 1.3 per 100 full-time workers) [Bureau of Labor Statistics, 2003a].

Few epidemiological studies have focused on hotel room cleaners [Krause et al., 1999b]. Recent research suggests that room cleaners are especially at elevated risk for musculoskeletal disorders [Intilli, 1999; Krause et al., 1999b; Milburn and Barrett, 1999; Bernhardt et al., 2003]. However, due to under-reporting of work-related injury and illness, the prevalence of work-related musculoskeletal pain in this population is probably underestimated [Dasinger et al., 1999; Krause et al., 1999a, 2001; Pransky et al., 1999, 2002b; Rosenman et al., 2000, Scherzer et al., 2005; Boden et al., 2001; Evanoff et al., 2002].

This article describes the prevalence of work-related pain, especially in the region of the spine, among 941 unionized hotel room cleaners in Las Vegas, Nevada, who participated in an epidemiological study of working conditions and health. The effects of several measures of physical workload, ergonomic problems, and of work intensification are investigated for their association with general bodily pain, neck pain, and back pain.

Heavy physical labor, biomechanical, and ergonomic factors have been identified as risk factors for musculoskeletal disorders in several reviews [Bernard, 1997; Panel on Musculoskeletal Disorders and the Workplace, 2001]. However, most studies did not control for potential psychosocial confounders at work [Bongers et al., 1993; Davis and Heaney, 2000]. Another limitation of many existing studies is that physical workload had been measured only at the group level [Bigos et al., 1991] or crudely by job title [Riihimaki et al., 1994], or by non-specific survey questions with low sensitivity if applied to single occupational groups. In this study of hotel room cleaners, job-specific measures of physical workload, intensification of work during the past 5 years, and ergonomic problems were developed with worker participation and then assessed at the individual level by a questionnaire. Their associations with various measures of bodily pain were analyzed with adjustment for psychosocial job factors measured by a standardized instrument, the Job Content Questionnaire (JCQ) [Karasek, 1985; Karasek et al., 1998]. In addition, analyses were adjusted for child and elder care provided by room cleaners at home.

MATERIALS AND METHODS

Study Design and Population

A community-based epidemiological study of health and working conditions was conducted in 2002 in Las Vegas, as a collaborative effort of the Culinary Workers Union Local 226 (Hotel Employees and Restaurant Employees Union) in Las Vegas, the Labor Occupational Health Program (LOHP) at the University of California, Berkeley, and the Department of Medicine at the University of California, San Francisco. The study was initiated by the union, which was concerned that increasing injury rates and health plan costs reflected changes in the work environment of hotel workers. The union asked university researchers to find out if there could be a link between working conditions, work intensification, and work-related pain and injury.

Details of the methodology of the participatory research process are described elsewhere [Lee and Krause, 2002; Lee et al., 2003]. Briefly, hotel room cleaners were involved in all aspects of the project, including the formulation of the research questions, survey development, implementation of the study, and interpretation of results; 26 room cleaners participated in an advisory group throughout the project. Through focus groups, room cleaners described in detail their physical and psychosocial work environment—including job tasks, daily schedules, changes in the last 5 years, relationships with supervisors and co-workers, ergonomic problems, and work-related pain and injury. Union leaders selected five unionized hotels to study, with a final eligible sample of 1,276 day-shift room cleaners.

Instrument Development

The survey questionnaire was a combination of items developed from focus group discussions and standardized instruments used by the authors in an earlier study of San Francisco hotel room cleaners [Krause et al., 1999b]. A draft questionnaire was pilot tested with 30 room cleaners. The final 29 page instrument included 334 items and covered physical workload, psychosocial working conditions, ergonomic problems, interactions with medical professionals, health status and behavior, care for dependents at home, and work pain, injury, and reporting. A room cleaner advisory council evaluated questions for content validity and reading level. The questionnaire was translated into Spanish and Serbo-Croatian in order to reach both the largest ethnic group and a relatively new group the union wished to reach out to.

Data Collection

Surveys were administered by university researchers at the union hall in March and April 2002. This meeting room had separate entrances out of sight of union offices, and only university researchers, participants, and survey administrators were allowed to enter, to ensure anonymity.

The survey administrators were local college students and room cleaners from non-participating hotels. They received a half-day training from university researchers. Most administrators spoke Spanish, Serbo-Croatian, or one or more Asian languages; they served as translators and read the questions to illiterate participants. Completion of the survey took 1–2 hr. Completed surveys were collected by university researchers. The procedure was approved by Institutional Review Boards of the University of California at Berkeley and San Francisco.

Assessment of Pain

Several different pain outcome measures were used from both standardized instruments and survey questions specifically developed for this project:

- One-month prevalence of overall **bodily pain** was assessed by the Short-Form 36 questionnaire [Ware, 1993], a standardized instrument that has been validated across numerous populations. Respondents were asked, ''How much bodily pain have you had during the past 4 weeks?'' and given six response categories: ''None,'' ''Very Mild,'' ''Mild,'' ''Moderate,'' ''Severe,'' and ''Very Severe.''
- One-month prevalence of **musculoskeletal pain** was assessed for 12 body regions using a similar survey question (''How much pain have you experienced in the following parts of your body during the past 4 weeks?'') and the same response categories as above. In this paper, the analyses are restricted to spinal disorders, which include three body regions: neck, upper back, and low back.
- One-month prevalence of **utilization of pain medication** was assessed by a single question: ''During the past 4 weeks did you take any medication for pain you had at work (for example aspirin, Motrin, Ibuprofen, Advil, Tylenol)? (yes/no).''
- Twelve-month prevalence of **pain perceived as work-related** was measured by the question ''Have you had any pain or discomfort during the past 12 months that you feel might have been caused or made worse by your work as a hotel room cleaner?'' This question mirrors the medical–legal criteria used by physicians to determine whether reported pain is work-related, that is, (i) whether it was caused by work and (ii) whether it occurred in the course of conducting work duties; (iii) or whether these work duties aggravated a non-industrial pre-existing condition so that (iv) the aggravation resulted in disability or need for medical care [Industrial Medical Council, 2001]. The latter two conditions were reflected in three follow-up questions: ''If yes, have you visited a doctor about this pain or discomfort? (yes/no)''; ''If yes, have you called in sick in the last 12 months because of this pain or discomfort you feel was caused by or made worse by your work as a hotel room cleaner? (yes/no)''; and ''Have you taken any sick or vacation days off work in the last 12 months because of this pain or discomfort you feel was caused or made worse by your work as a hotel room cleaner? (yes/no).''

Assessment of Physical Workload

Hotel room cleaners are generally paid on an hourly basis assuming an 8-hr work day. However, management assigns room cleaners each day a specific number of rooms of various types to be cleaned. Maximum daily assignments are determined by labor contracts, which vary between hotels. Assignments are generally determined by the number of rooms to be cleaned per shift. However, as described in previous studies [Krause et al., 1999b; Bernhardt et al., 2003], the actual physical workload of cleaning a room varies by type of hotel, type of room, number of beds or guests, amenities provided, specific job tasks, and ergonomic problems encountered. Focus groups reported that some hotels had remodeled rooms in the previous years as to accommodate more beds and that workers experienced work-task changes in each room that could result in intensification of work (e.g., irons and ironing boards became standard amenities in many hotels; extra garbage became a more frequent problem). Based on these focus group results and previous investigations of physical workload among San Francisco hotel room cleaners [Krause et al., 1999b], five different workload measures were adapted for this study:

- **Number of rooms** cleaned per worker during the last workday
- **Number of beds** made per worker during the last workday
- **Workload index**, a sum score of the frequency of 26 different job tasks or problems. Specifically, workers were asked for each item to ''Check how often these problems usually occur.'' Answer options ranged from ''never'' to ''16 or more rooms per day''(See Table II for a list of items).
- **Workload change index (work intensification)**, a sum score of 5-year changes in the frequency of those 26 job tasks/problems, was developed to study the effect of work intensification over the past 5 years. Workers were asked to ''Check how these problems have changed over the past 5 years. Or, if you have worked less than 5 years, how have these things changed since you started working?'' Answer

options for each item were "I do it less," "I do it about the same," and "I do it more."

- **Ergonomic index**, a sum score of 12 different specific ergonomic problems observed by room cleaners that would tend to increase their work effort during each task because of faulty equipment or other reasons. Respondents were asked "How much of a problem are the following for you in your work?"(See Table III for a list of items developed in focus groups). Answer options were "No problem," "Very little problem," "Somewhat of a problem," and "Big problem." (Cronbach's alpha was 0.86, indicating good internal reliability).

Control Variables

Other job characteristics ascertained by questionnaire included hours worked per week, and years worked as hotel room cleaner, which reflect duration of exposure to the physical job demands described above.

Psychosocial job factors (psychological demands, decision latitude, supervisor support and co-worker support) were measured by a 21-item version of the JCQ [Karasek, 1985, 1998] (five items for psychological demands, nine items for decision latitude, and seven items for social support). An additional question developed in focus groups assessed time pressure: "During your last work week did you skip lunch or breaks, take shorter lunch or breaks, or work longer hours to complete your assigned rooms?" (yes/no).

Individual worker characteristics included anthropometric variables (height and weight, measured by researchers during the baseline survey administration using a portable scale), age, health behaviors (currently smoking; number of days during past 30 days consuming at least one alcoholic beverage), and the number of children or elderly family members needing care.

Data Analysis

Frequency tables and summary statistics were created for pain outcomes, job and worker characteristics. The prevalence of pain outcomes was compared across age groups using chi square test statistics.

Associations between job characteristics and pain outcomes were analyzed by two sets of logistic regression models. The first set of models adjusted for all control variables noted above, except the psychosocial job factors. The second set additionally adjusted for the psychosocial job factors (psychological demands, decision latitude, support at work).

Outcome measures were dichotomized (0 = no pain, very mild, mild, or moderate pain; 1 = severe or very severe pain). Two physical workload measures (number of rooms and beds, respectively) were dichotomized at the median (14 or fewer vs. 15 or more rooms cleaned daily; 18 or fewer vs. 19 or more beds made daily) to reduce the influence of potential outliers and potential misclassifications due to inconsistent characterization of multiple-room suites as "room" or "suite" by respondents. Indices of physical workload, work intensification, and ergonomic problems were recoded into quartiles, with the lowest exposure quartile as the reference group.

To allow for direct comparisons of effect measures based on partly adjusted (without controlling for psychosocial job factors) and fully adjusted (additionally controlling for psychosocial job factors) logistic regression models, cases with missing values for any variable in the fully adjusted model were excluded from all regression analyses. Because there were only 10 men in the study sample, they were excluded from regression analyses. All analyses were conducted using Stata Statistical Software version 7.0.

RESULTS

Participation Rate and Characteristics of the Study Population

Out of the eligible study population of 1,276 room cleaners, 941 completed the survey (response rate 74%). All but 10 respondents were women, and most were middle-aged (mean age 41.7 years, SD 9.59), racial-ethnic minorities (76% Latina, 6% African American, 5% Filipino, 5% Asian/Pacific Islander), and immigrants (85%), with less than a high school education (65%). The vast majority had at least one child (95%), and 59% had at least one child or elder who needed care. Years of working as a room cleaner ranged from 6 months to 46 years (average 7.7 years, SD 5.6, median 6.6 years). Most respondents worked full-time (92%), averaging 40.2 hours per week (SD 11.2).

Prevalence of Pain

Table I shows the 1-month period prevalence of pain, by body region and severity. Overall, 47% of hotel room cleaners report severe or very severe bodily pain during the past 4 weeks. The highest prevalence was reported for severe or very severe pain in the lower (63%) and upper back (59%). Chi square analyses showed that pain prevalence differed by age in most body regions, including upper and lower back. Older workers (50 years or older) experienced pain consistently less frequently than younger and middle-aged workers (up to 49 years old) (data not shown).

Eighty-four percent of workers reported that they took pain medication during the past 4 weeks for pain they had at work. More than three-quarters (78%) have had pain during the past 12 months, which they felt might have been caused or made worse by work as a room cleaner. Of these workers, 96% stated that this pain began after they started their current

TABLE I. Four-Week Prevalence of Pain by Body Region and Severity

	N[a]	None		Very mild		Mild		Moderate		Severe		Very severe	
		%	n	%	n	%	n	%	n	%	n	%	n
Bodily pain[b]	915	5%	46	6%	56	10%	89	33%	300	24%	217	23%	207
Neck[c]	894	15%	133	10%	91	12%	103	21%	184	19%	167	24%	216
Upper back[d]	889	8%	71	6%	52	7%	64	20%	176	21%	191	38%	335
Lower back[e]	901	5%	47	5%	47	8%	73	19%	175	23%	203	40%	356

Las Vegas Hotel Worker Study 2002 (N = 941).
[a]Total number of responses to each question.
[b]Percent and number of room cleaners responding to the question "How much bodily pain have you experienced during the past 4 weeks?"
[c]Percent and number of room cleaners responding to the question "How much neck pain have you experienced during the past 4 weeks?"
[d]Percent and number of room cleaners responding to the question "How much upper back pain have you experienced during the past 4 weeks?"
[e]Percent and number of room cleaners responding to the question "How much lower back pain have you experienced during the past 4 weeks?"

job; 62% visited a doctor for this pain; and 60% used at least one day of sick or vacation leave because of this pain. Only 21% of all workers reported a workers' compensation injury. The reasons given by workers for not reporting work-related pain to workers' compensation have been published elsewhere [Scherzer et al., 2005].

Physical Workload, Work Intensification, and Ergonomic Problems

Room cleaners cleaned an average of 15.3 (median 14, SD 4.5) rooms and made an average of 19.4 (median 18, SD 6.9) beds per day. Time pressure was experienced by the majority of respondents: 75% agreed with the statement "My job requires working very fast," and 66% reported that they skipped or shortened their breaks, or worked longer hours, in order to complete their assigned rooms during their last work week.

Table II shows the average daily frequency of 26 job-specific tasks or problems and the percentage of workers who said they "did it more" often compared to 5 years ago. Job-tasks with the highest frequency included "lots of garbage left in room" (8.1 times per day), "problems dusting high or low areas in room" (9.1 times), "clean large glass or mirror doors" (10.7 times), "clean marble sinks" (9.0), and "call in from each room" (9.4 times). Regarding increased frequency during the last 5 years, 11 items were cited by 40% or more of respondents (e.g., "problems with replacement linens" and "put away iron and ironing board"). Compared to 5 years ago, room cleaners on average performed 9.4 tasks more often, 12.4 tasks at about the same frequency, and 4.2 tasks less often (data not shown).

Table III lists the prevalence of ergonomic problems that respondents perceived as a "big problem" or "somewhat of a problem." The most frequent ergonomic problems were: "linen cart too heavy" (84%), "heavy bedspreads, or comforters on beds" (74%), "cleaning supplies irritate skin or eyes" (72%), "cleaning supplies do not clean well" (62%), "vacuum cleaner too heavy" (62%), and "vacuum cleaner needs repair" (62%).

Associations Between Job Factors and Pain Outcomes

Results from the fully adjusted logistic regression models are shown in Table IV. All models controlled for individual worker characteristics, health behaviors, and child or elder care at home; and for psychosocial workplace factors including psychological demands, decision latitude, and supervisor and co-worker support.

- **Bodily pain** was positively, albeit not significantly, associated with number of rooms cleaned per day (OR = 1.34, 95% CI 90–1.98) and was not associated with the number of beds made per day (OR = 0.86, 95% CI 59–1.24). Positive and strong dose–response relationships were found with quartiles of the physical workload index (highest quartile OR = 4.60, 95% CI 2.57–8.23) and with the ergonomic problems index (highest quartile OR = 4.46, 95% CI 2.44–8.15). A positive dose–response relationship was also found with the work intensification index (highest quartile OR = 2.16, 95% CI 1.24–3.75).
- **Neck pain** had similar patterns of association to workload variables as bodily pain. There was a moderate but not significant association with rooms cleaned per day (OR = 1.46), no relationship with beds made per day, and strong positive dose–response relationships with physical workload and work intensification indices. Workers with exposure to any of the upper three quartiles of ergonomic problems were also significantly more likely to have severe or very severe neck pain (highest quartile OR = 5.42, 95% CI 2.95–9.97).
- **Upper back pain** had no statistically significant relationship to rooms cleaned per day or to beds made per day. The associations with the three indices were slightly weaker

TABLE II. Daily Frequency of Specific Job Tasks or Problems and Percent of Room Cleaners Reporting an Increase in Frequency of These Job Tasks During the Past 5 Years

Room cleaning task or problem	Frequency per day mean (SD)	Percent of workers with increase in last 5 years
Problems with replacement linens	3.7 (4.8)	40
Room needs extra linens like robes, etc.	2.7 (4.1)	26
Coffee pot in room needs cleaning	1.3 (3.6)	14
Put away iron and ironing board	6.1 (5.5)	46
Room service trays left in room	4.9 (4.4)	44
Lots of garbage left in room	8.1 (5.7)	56
Ashtrays in room need cleaning	7.1 (6.5)	37
Food left in room on tables or carpet	6.9 (5.6)	43
Extra scrubbing required in the bathroom	6.6 (6.1)	46
Bathroom very wet or dirty	7.7 (5.8)	47
Restock missing supplies on cart	7.7 (6.0)	46
Problems dusting high or low areas in room	9.1 (6.4)	45
Do not disturb sign on door	5.3 (4.6)	27
Deep cleaning of room required	5.9 (5.9)	45
Need to report a problem to someone else	2.5 (4.1)	25
Make extra beds	2.1 (3.5)	30
Clean Jacuzzi	2.6 (4.4)	24
Travel to another floor or building	2.7 (4.2)	38
Clean VIP or rush rooms	1.6 (2.7)	28
Clean large glass or mirror doors	10.7 (5.9)	45
Clean marble sinks	9.0 (6.8)	33
Clean chrome or brass fixtures	7.2 (6.9)	26
Elevator not working	1.6 (3.9)	21
Count linens	3.1 (5.6)	21
Call in from each room	9.4 (6.9)	38
Put three sheets on bed	5.7 (5.8)	34

Las Vegas Hotel Worker Study (N = 941).

TABLE III. Percent of Room Cleaners Reporting Ergonomic Problems

	Percent[a]
Linencart too heavy	84
Linencart broken	49
Linencart difficult to stock	44
Heavy bedspreads or comforters on beds	74
Cleaning supplies do not clean well	62
Cleaning supplies irritate skin or eyes	72
Vacuum cleaner too heavy	62
Vacuum cleaner needs repair	62
Vacuum cleaner cord too short	30
Don't have a squeegee for bathroom	39
Don't have a mop	32
Have to move furniture	43

Las Vegas Hotel Worker Study 2002 (N = 941).
[a]Percent of those responding "Somewhat of a problem" or "Big problem" to each item.

than the other two pain measures. The strongest effects were found for physical workload index (highest quartile OR = 3.54, 95% CI 1.94–6.47) and ergonomic problems, where workers with exposure to any of the upper three quartiles were at least twice as likely than those in the reference group to have severe or very severe upper back pain (highest quartile OR = 4.17, 95% CI 2.25–7.74).

- **Low back pain** had no association to rooms cleaned per day and a moderate but not significant association with beds made per day. The odds to experience LBP were 44% higher among workers who made 19 or more beds per day than among those those who made 18 or fewer. The odds of experiencing moderate to severe low back pain was 3.74 as high among workers exposed to the upper quartile of physical workload compared to the lower quartile (OR = 3.74, 95% CI 2.00–7.00), and the odds of having such severe LBP was 4.65 times higher in workers

TABLE IV. Associations Between Physical Workload, Ergonomic Problems, Work Intensification, and Severe or Very Severe Pain Among Hotel Room Cleaners

	N = 506[a]	Bodily pain n = 242[b]	Neck pain n = 225[b]	Upper back pain n = 310[b]	Lower back pain n = 324[b]
	n	Adjusted OR[c] (95% CI)	Adjusted OR[c] (95% CI)	Adjusted OR[c] (95% CI)	Adjusted OR[c] (95% CI)
Rooms per day (median split)					
14 or fewer	166	Ref.	Ref.	Ref.	Ref.
15 or more	340	1.34 (0.90–1.98)	1.46 (0.99–2.16)	1.23 (0.82–1.83)	1.21 (0.81–1.81)
Beds per day (median split)					
18 or fewer	255	Ref.	Ref.	Ref.	Ref.
19 or more	251	0.86 (0.59–1.24)	1.01 (0.70–1.45)	1.25 (0.85–1.83)	1.44 (0.98–2.12)
Physical workload (quartiles)					
Lowest	111	Ref.	Ref.	Ref.	Ref.
Second	133	1.50 (0.86–2.64)	1.16 (0.66–2.03)	1.01 (0.59–1.73)	0.94 (0.55–1.61)
Third	135	2.54 (1.45–4.46)**	2.44 (1.41–4.24)**	1.59 (0.92–2.73)	1.30 (0.76–2.24)
Highest	127	4.60 (2.57–8.23)***	3.24 (1.84–5.69)***	3.54 (1.94–6.47)***	3.74 (2.00–7.00)***
Work intensification (quartiles)					
Lowest	122	Ref.	Ref.	Ref.	Ref.
Second	123	1.02 (0.59–1.75)	1.34 (0.78–2.30)	1.11 (0.65–1.89)	0.92 (0.54–1.56)
Third	127	1.89 (1.10–3.26)*	1.67 (0.97–2.87)	1.75 (1.01–3.05)*	1.80 (1.03–3.13)*
Highest	134	2.16 (1.24–3.75)**	2.33 (1.34–4.04)**	1.74 (.99–3.05)	2.04 (1.15–3.61)*
Ergonomic problems (quartiles)					
Lowest	120	Ref.	Ref.	Ref.	Ref.
Second	140	1.90 (1.09–3.29)*	1.78 (1.01–3.12)*	2.58 (1.50–4.43)**	2.17 (1.27–3.72)**
Third	130	2.25 (1.28–3.95)**	2.71 (1.53–4.81)**	2.00 (1.15–3.46)*	1.91 (1.10–3.31)*
Highest	116	4.46 (2.44–8.15)***	5.42 (2.95–9.97)***	4.17 (2.25–7.74)***	4.65 (2.47–8.76)***

Results from Logistic Regression Adjusted for 12 Factors. Las Vegas Hotel Worker Study 2002 (N = 941).

[a]Workers with missing values for any independent variables, co-variates, or outcome variables were excluded from these analyses.

[b]Number of respondents with severe or very severe pain, excluding those respondents with missing values for any independent variables, co-variates, or outcome variables.

[c]Odds ratio adjusted for age, height, weight, smoking, alcohol use, self-reported years of working as hotel room cleaner, self-reported hours worked per week, family member with special needs, psychological demands, decision latitude, supervisor support, and co-worker support.

*$P < 0.05$.

**$P < 0.01$.

***$P < 0.001$.

exposed to the upper quartile of ergonomic problems compared to the reference group (OR = 4.65, 95% CI 2.47–8.76).

- **Pain perceived as work-related** showed similar patterns of associations with physical workload measures albeit of a lesser magnitude than bodily pain or low back pain. It was statistically significant associated with work intensification during the past 5 years. Workers reporting the greatest number of increased tasks (highest quartile of 5-year change) were at 123% greater odds to perceive work-related pain than the reference group (OR = 2.23, 95% CI 1.08–4.61) (results not shown).

All associations reported here were adjusted for psychosocial job factors. Models not adjusted for psychosocial job factors showed about 5–25% stronger effects (results not shown) indicating a moderate confounding effect by psychosocial job factors in unadjusted models. Independent effects of psychosocial job factors will be reported elsewhere.

DISCUSSION

Summary of Main Results

Bodily pain and back pain are widespread problems among hotel room cleaners in this study. The majority of respondents also reported several ergonomic problems involving equipment and supplies that are indispensable parts of room cleaners' work (e.g., vacuum cleaners, linen carts, cleaning supplies). Logistic regression analyses of physical workload and pain outcomes indicated that potential confounders included in the first model (i.e., age, height, weight, smoking, alcohol use, years working as room cleaner,

hours worked per week, and care-taking of children or elderly family members) did not reduce the effect of the physical workload on pain. Additional adjustment for psychosocial job factors reduced the magnitude of the effect size by 5–25%, indicating a confounding effect. However, even after additional adjustment for psychosocial factors, strong independent and statistically significant effects on all pain outcomes were found for physical workload, work intensification, and ergonomic problems.

Prevalence of Pain

Only 5% of room cleaners reported no bodily pain during the past 4 weeks and about 60% of room cleaners experienced severe or very severe back pain during the past 4 weeks. This is much higher than the 4-week prevalence of any type of back pain in representative adult general population samples, which range from 29% to 31% [Walker, 2000].

Our data also indicate that room cleaners may be at elevated risk for occupational injuries compared to hospitality workers at large and service sector employees in general. In our study, the self-reported rate of injuries filed with workers' compensation in the last 12 months is 26.9 per 100 full-time employees (FTE). This rate is four times higher than the national incidence rate of 6.6 per 100 FTE [Bureau of Labor Statistics, 2003a] and 6.3 per 100 FTE in Nevada [Bureau of Labor Statistics, 2003b], for the Hotel and Lodging industry. It is nearly six times higher than the national incidence rate of 4.6 per 100 FTE for all jobs in the service sector [Bureau of Labor Statistics, 2003a]. The significantly higher incidence rate of self-reported injuries in our study suggests substantial under-reporting by either workers to employers or employers to OSHA.

Under-reporting shifts the cost away from the employers' liability insurance. As discussed earlier, the study was initiated in part to address the union's concern that the employee health insurance plan was overly stressed because of treatment costs (including high usage of pain medication) for conditions that were possibly work-related. In fact, previously published analyses of injury reporting and barriers to reporting indicated that as much as 69% of treatment costs could have been shifted from employer liability insurance (workers' compensation) to the union's health plan (health insurance) in this population [Scherzer et al., 2005]. In general, such cost-shifting is bound to increase the overall cost of the employee health insurance, which in turn may lead to employers' pressure to increase employees' share of this cost. This is a frequent point of contention in contract negotiations for unionized workers, and is a major barrier for low-wage workers to participate in employer's health plans, especially in non-unionized workplaces.

Elsewhere we have discussed room cleaners' perception of pain as work-related, their attribution of this pain to their current job, widespread use of sick and vacation leave for this pain, and a high level of pain medication for ''pain at work'' [Scherzer et al., 2005]. We acknowledge the limitations of self-reported data, and that some of the ''pain at work'' may be unrelated to work. However, it is unlikely that the entire 84% of respondents who reported taking pain medications during the last 4 weeks for pain at work took them because of non-work causes. We previously concluded that many workers are working while in pain, and managing their pain with self-medication and personal days off [Scherzer et al., 2005]. The strong statistical associations between physical workload and musculoskeletal pain in the current analyses confirm workers' perceptions that much of their pain is work-related.

Clearly, hotel room cleaners comprise a high-risk group for MSDs. The high amount of work-related pain and disability adds to the disease burden experienced by low-wage female immigrant workers in the hospitality industry, and emphasizes the need for worksite prevention programs addressing this multiply-disadvantaged group of workers.

Sociodemographic Factors

We could not compare prevalence rates between men and women because the study population was nearly exclusively comprised of women. However, among women, the presence or absence of dependents needing care did not influence the associations between occupational physical activity and musculoskeletal pain. Therefore, care-taking demands at home cannot explain the high rates of MSDs in this population.

Increasing reports of work-related pain and injury are often attributed to aging of the workforce. However, our data do not support this view. Multivariate analyses controlling for age did not show any confounding effects of age. Bivariate analyses of age and pain indicated few statistically significant differences between age groups. Only knee pain increased with age; low back pain in fact decreased with age. There were no statistically significant differences between age groups in terms of perceived work-related pain.

Age has been found to be related to musculoskeletal pain in some epidemiologic studies [e.g., Biering-Sorensen, 1982; Hedberg, 1988] but not in others [Pietri et al., 1992]. It is likely that age functions as an indicator for cumulative lifetime workload, especially in studies of occupations in which most workers enter at a young age. In occupations where entry in the workforce occurs across ages, the age effect can be separated from the effects of past cumulative workload. For example, studies of transit operators, who like room cleaners enter the profession at all life stages, also showed no effect of age on prevalence or incidence of low back pain [Hedberg, 1988; Krause et al., 1997a,c, 1998, 2004; Pietri et al., 1992].

Physical Workload, Work Intensification, and Ergonomic Problems

The traditional measure of physical workload in the hospitality industry (number of rooms cleaned per day) consistently increased the odds of pain between 21% (low back pain) and 46% (neck pain), but these associations were not statistically significant. This finding should be interpreted with caution because dichotomization of the number of rooms at the median reduced the power for detection of statistically significant effects. The dichotomization, though, was performed to minimize the influence of respondents possibly reporting the number of suites instead of the actual (higher) number of rooms due to common parlance.

Making more than 18 beds per day was associated with a (statistically non-significant) 44% increase in low back pain, but was not associated with neck or other bodily pain. This pattern is consistent with the high lumbosacral loads caused by trunk bending and lifting during bed making [Milburn and Barrett, 1999].

Interestingly, all three index measures of physical workload based on job-specific task-level questionnaire items developed in focus groups, showed strong and statistically significant associations with general bodily pain, neck, upper back, and lower back pain. Nearly all the relationships followed a gradient suggesting a dose–response relationship between exposures and pain outcomes. For physical workload and ergonomic problem indices, workers in the highest exposure quartiles experienced 3.24 and 5.42 times higher odds of having pain than workers in the reference group. Work intensification over the past 5 years increased the odds of pain between 74% (upper back) and 133% (neck pain).

Work intensification, defined as workload change over the past 5 years is difficult to assess in a cross-sectional study. Instead of using a subjective rating of work intensification in general, we asked workers to consider whether the frequency of specific job-tasks and problems had changed over the past 5 years. The fact that workers identified certain tasks that increased in frequency (e.g., cleaning coffee pots) as well as those that decreased in frequency (e.g., cleaning ash trays) contributes to the face validity of the work intensification index. The significant associations found with pain (noted above) demonstrate the good predictive validity of the index. However, observational and prospective studies are needed to further determine the degree of work intensification for hotel room cleaners.

Room cleaners reported several ergonomic problems that involved equipment and chemicals used throughout the workday. Linen carts and vacuum cleaners were judged as too heavy by 84% and 62% of the sample, respectively. Pushing and pulling of such heavy equipment constitutes an established risk factor for low back pain [Bernard, 1997]. Similarly, forceful movements are established risk factors for upper extremity disorders [Bernard, 1997; Panel on Musculoskeletal Disorders and the Workplace, 2001]. Inadequate cleaning supplies (62%) and lack of squeegees (39%) or mops (32%) are likely to increase the rate and force of upper extremity movements during cleaning of bathrooms and floors, thereby increasing the risk for back, neck, shoulder, and upper extremity disorders. The strong associations between ergonomic problems and neck pain (OR = 5.42 for the highest quartile) demonstrate the enormous impact of these problems on the well-being of room cleaners.

Prevention of these commonly reported ergonomic problems is rather straightforward. For example, retro-fitting linen carts with bigger wheels to reduce pushing forces have been reported to reduce work-related MSDs in hotel room cleaners [Intilli, 1999]. Other hotels are using electrical carts, practically eliminating this problem. Provision of adequate cleaning utensils and supplies is a self-evident measure.

From the results of this study one can conclude that the observed high prevalence of musculoskeletal pain among room cleaners is strongly associated with the physical job demands and ergonomic problems. The results also suggest that the conventional way of measuring and assigning workloads (i.e., number of rooms cleaned per day) is inadequate because it does not take into account the different degrees of physical labor required by different room types, type of bedding and amenities, specific job tasks, and ergonomic problems that also determine room cleaners' total daily workloads.

Strengths and Limitations

This participatory research project developed innovative measures of physical workload based on qualitative data collected in a series of focus groups with room cleaners. These measures provide better guidance for prevention of occupational injury by indicating that labor–management contracts need to go beyond stating a fixed number of rooms to clean per day. Instead, contract language on workload should specifically consider and account for the type of rooms and amenities to be cleaned (e.g., a check-out room requires more work than a room where a guest is staying another night).

In fact, the earlier San Francisco study made an impact on prevention efforts by providing data that led to a reduced workload in new contracts in San Francisco, where union and management representatives changed contract language to allow for modification of room quota [Lee and Krause, 2002]. Similarly, this study in Las Vegas was instrumental in improving labor contracts. As expressed by D. Taylor, Secretary Treasurer of the Culinary Union Local 226: ''The contract negotiated after the Las Vegas housekeeping study contained language setting a quota of rooms to be cleaned and a formula for a reduction in rooms to be cleaned if there are a certain number of check-outs, roll-away beds, VIP rooms, or rooms that are especially dirty. There is also language requiring a

hazardous-materials team and the option of wearing pants for GRAs [''Guest Room Attendants'' or room cleaners]. These changes were all a result of the information gathered in the Las Vegas study. The organizing of the housekeepers to conduct the study was also a large part of winning the new language. The impact of the study in getting the housekeeping language was tremendous.'' (personal communication, December 9, 2004)

An important strength of this study was that analyses controlled for psychosocial job factors that may confound the relationship between physical workload and outcomes [Bongers et al., 1993; Davis and Heaney, 2000]. In fact, our results showed that psychosocial job factors reduced the effect sizes of physical job factors by 5–25%. However, independent associations between physical job factors and pain outcomes persisted and remained statistically significant even after controlling for psychosocial factors. The combined effects between physical workload and psychosocial factors deserve attention in future analyses.

Several general limitations of this study need to be acknowledged. First, because of the cross-sectional nature of the study, causal inference is limited, and final conclusions depend on confirmation in future prospective studies. However, the strength of the associations warrants further investigations with observational, prospective, and intervention studies.

There is a possibility of common method variance bias, since both exposures and outcomes were ascertained by self-report, which might produce spurious associations. Responses may have been influenced by such factors as negative affectivity [Watson and Clark, 1984]. Future studies should include objective measures of physical workload, ergonomic problems, or health outcomes [Woods et al., 1999]. Examples of these measures include direct observation of working conditions, ergonomic on-site evaluations, and data from administrative and medical records.

In this study, we used several different measures of physical workload to partially address the problem of self-report, especially by asking respondents to recall from their last workday specific tasks or items that are more objective indicators of physical workload (e.g., number of beds made, frequency of certain tasks) than overall subjective ratings of the heaviness of work. These questions were less vulnerable to distortion by worker perception, and there was no obvious reporting bias. In fact, workers did differentiate between problems or tasks that decreased, stayed the same, or increased in frequency. The use of multiple measures of physical workload and multiple outcome measures strengthens the confidence in the observed associations.

The findings cannot be generalized to the larger population of hotel room cleaners because the results are based on unionized hotels only and circumstances may also differ by employer and region. Physical workload and psychosocial working conditions could be less favorable in non-union hotels where workers lack protection by their union and negotiated labor contracts, or in geographic regions with less union presence or strength. However, within the selected hotels, the participation rate of 74% suggests that study participants were representative of the eligible workforce, making selection bias unlikely.

CONCLUSIONS

This study indicates that hotel room cleaners are a high-risk group for painful and disabling work-related MSDs. Rates of occupational injury may far exceed national rates for hospitality workers and service workers in general, and there is a pressing need for worksite prevention.

The participatory research approach was an essential element in the development of sensitive job-specific measures of physical workload, workload change over time, and identification of adaptable ergonomic problems. Our analyses demonstrate that these measures have high face and predictive validity, and they also point to specific worksite changes that can be proposed, implemented, and monitored by labor and management.

The strong cross-sectional associations of physical workload, work intensification, and ergonomic problems with severe neck and back pain, independent of individual worker characteristics, home responsibilities, and psychosocial job factors, warrant further investigations with observational, prospective, and intervention studies.

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