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Safe patient handling behaviors and lift use among hospital nurses: A cross-sectional study

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ABSTRACT

Purpose: Patient handling is well known for the risk of musculoskeletal injury. Safe work practices are important to reduce risk of injury while performing patient handling tasks. This study investigated factors associated with safe patient handling behaviors and lift use among hospital nurses in the United States.

Methods: This study analyzed cross-sectional survey data from a statewide random sample of 221 hospital nurses in California who had patient handling duties. Safe patient handling behaviors and lift use were examined for the relationships with demographic characteristics, organizational safety practices, physical and psychosocial job factors, musculoskeletal symptoms, and perceptions about lift use and risk of injury.

Results: In multivariable logistic regression, high safe patient handling behaviors were significantly associated with a positive organizational safety climate (Odds Ratio [OR] = 2.76, 95% Confidence Interval [CI] 1.51–5.03), people-oriented culture (OR = 2.59, 95% CI 1.45–4.62), and ergonomic practices (OR = 1.67, 95% CI 1.04–2.67). High lift use (> 50% of the time when needed) were significantly associated with high lift availability (OR = 3.1, 95% CI 1.06–9.01) and positive perceptions about lift use (OR = 3.48, 95% CI 1.63–7.44). In bivariate analysis, high safe patient handling behaviors were associated with shorter height, non-White race, lower physical workload, lower job strain, higher job satisfaction, and less musculoskeletal symptoms.

Conclusions: The study findings underscore the importance of organizational safety practices and culture to promote safe work practices for patient handling injury prevention. Also, making lift equipment readily available and improving positive perceptions and experiences about lifts can be crucial to ensure the use of lift equipment.

What is already known about the topic?

- Patient handling is well known for the risk of musculoskeletal injury among nurses.
- Safe work practices are important to reduce the risk of injury while performing patient handling tasks.
- Use of lifting equipment is an effective and necessary measure to reduce the risk of injury from patient handling tasks. However, lift use is not part of regular practices among many nurses.

What this paper adds

- Positive organizational safety climate, people-oriented culture, and ergonomic practices were significant factors for safe patient handling behaviors among hospital nurses.
- High lift use was significantly associated with a high level of lift availability on the unit and nurses' positive perceptions about lift use.

1. Introduction

Patient handling, such as lifting, repositioning, or transferring patients and helping patients' mobility, is an integral part of nursing care. Yet, the high risk of musculoskeletal disorders from patient handling has been a major concern among nursing workers worldwide. Recently, Davis and Kotowski (2015) reviewed 132 studies conducted over the past 30 years and provided a comprehensive report on prevalence of musculoskeletal disorders in nursing workers (e.g., the mean annual prevalence rates of 55% for low back pain, 44% for shoulder pain, 42% for neck pain, 26% for upper extremity pain, and 36% for lower extremity pain). The review showed wide variations in the prevalence data across countries. In the United States (U.S.), each year 10,000–12,000 registered nurses sustain work-related musculoskeletal disorders resulting in loss of work time, and these nurses are away from work for a median 8–9 days (Bureau of Labor Statistics, 2013, 2014, 2015). Studies that analyzed workers' compensation data showed that

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patient handling accounted for 31–72% of musculoskeletal disorder cases among hospital workers (Kim et al., 2012; Lipscomb et al., 2012; Pompeii et al., 2009). A study analyzing injury reports from 112 U.S. health care facilities reported a patient handling injury incidence rate of 11.3 per 10,000 worker-months (Gomaa et al., 2015). Unsafe patient handling can cause career-ending, devastating injuries and threatens the retention of a healthy nursing workforce (Dockrell et al., 2011).

To prevent patient handling injuries, organizations' policies and programs to ensure safe patient handing and individual workers' safe work practices are crucial. In particular, lifting equipment has been shown as an effective and necessary measure to reduce the risk of injury from patient handling (Burdorf et al., 2013; Nelson and Baptiste, 2004) and, therefore, use of lifting equipment is emphasized as a key component for safe patient handling practices. However, studies have shown that lift use is not part of regular practices among many nurses (Gomaa et al., 2015; LCWA Research Group, 2011; Lee et al., 2013a, 2015). Two U.S. studies using nationwide samples reported that only about one third of nurses with available lifting equipment used the lift frequently to perform patient handling (LCWA Research Group, 2011; Lee et al., 2013a). Similarly, a study in the Netherlands reported that only 27% of hospital nursing workers had sustained behaviors of using lift equipment (Koppelaar et al., 2013). In a study analyzing 4674 patient handling injury cases, Gomaa et al. (2015) reported that lifting equipment was not used in 82% of the injury cases where the lift use information was available. As such, studies show the large gap in safe patient handling practices. The lack of availability of usable equipment, time constraints, lack of workplace policy or specific protocol, lack of training, and lack of knowledge to use the lift have been identified as the main barriers to the use of lifting equipment (Koppelaar et al., 2009, 2013; Schoenfisch et al., 2011). In addition to using appropriate lift equipment, a range of work behaviors such as assessment of the patient and risk, assessment and correction of the physical environment (e.g., space or obstacles), getting necessary help from coworkers and cooperation of the patient, and use of good body mechanics are also important to perform the patient handling task safely (Lee et al., 2010; Nelson and Baptiste, 2004). However, in the literature on safe patient handling behavior, most studies focused on lift use behavior alone, and only a few studies investigated safe patient handling practices encompassing multiple behaviors (Lee et al., 2010).

Studies suggest that individual workers' safety practices are affected by organizational and psychosocial job factors. In particular, the workplace safety climate—workers' shared perceptions about the safety of the workplace and organizational safety practices, including management commitment and support and safety communication—has been associated with higher safe work practices in various worker populations in health care, construction, and other industries (Arcury et al., 2012; Dutra et al., 2014; Felknor et al., 2000; Lee et al., 2010; Morrow et al., 2010; Seo, 2005; Zohar, 2010). In a study by Lee et al. (2010), safety climate was found to be the strongest factor associated with safe patient handling behaviors among critical care nurses. The study also found that job stress measured by effort-reward imbalance was significantly associated with safe patient handling behaviors, suggesting perceptions about job play a role in safety practices. However, empirical evidence for an independent relationship between job stress and safety practices is mixed or limited in the literature (Bronkhorst, 2015; Gershon et al., 1995; Masia and Pienaar, 2011; Seo, 2005). Meanwhile, recent studies suggest the role of job satisfaction in safety practices (Masia and Pienaar, 2011; Wei et al., 2016) and higher job satisfaction may improve engagement in safety practices, but the relationship has never been examined with safe patient handling behaviors. On the other hand, the role of risk perception has been suggested by theories (Rogers, 1975; Rosenstock et al., 1988), but most studies failed to find a significant relationship with safe work practices (Lee et al., 2010; Seo, 2005; Rickett et al., 2006).

To improve and ensure safe work practices, better understanding is needed in regard to factors affecting safe patient handling practices of hospital nurses. The purpose of this study was to examine safe patient handling behaviors and lift use among hospital nurses and identify associated factors. Lift use behavior is included in safe patient handling behaviors, but we investigated lift use as a separate outcome as well, considering its importance as a key indicator. We conducted a comprehensive examination by including individual, job, and organizational factors, perceptions about work and risk, and musculoskeletal symptom and injury experiences. Fig. 1 presents the conceptual framework of this investigation (Lee et al., 2013b).

2. Methods

2.1. Study design and sample

This study was a statewide, cross-sectional survey in a random sample of 2000 registered nurses in California, United States. The sample was selected from the 2012 California Board of Registered Nursing list of registered nurses with an active license. The sampling was stratified by nine regions of California to ensure regional representation, by referring to the method used by Spetz et al. (2011). The sample size in each stratum was selected to be proportional to the size of the registered nurse population by region.

The study collected data using both postal and online surveys from January 2013 to July 2013. The online survey was developed using Qualtrics survey software (Qualtrics, Provo, UT). We initially mailed the survey packets, enclosing the study information letter, study questionnaire, and return envelope. The information letter included instructions on the response option of online survey format; unique username and password were provided to each respondent. Reminders were sent at 2-week intervals up to four times and the 3rd reminder enclosed another copy of the study questionnaire. As an incentive, a $50 gift certificate was given to 20 respondents by random drawing. All study procedures had the prior approval of the Committee on Human Research at the University of California San Francisco.

Among the 2000 nurses, a total of 526 nurses responded, a response rate of 26.3%: 416 (79.1%) returned the paper survey, 93 (17.7%) completed the online survey and 17 (3.2%) contacted the researcher by phone or email. Of the respondents, 424 were currently employed and 284 (67.0% of current nurses) were working in hospital settings. Of the hospital nurses, 230 (81.0%) had patient handling duties. In the data analysis, we excluded eight nurses working in neonatal intensive care units based on the different nature of patient handling and one case where the outcome variable of safe patient handling behavior was missing. Consequently, 221 hospital nurses who performed patient handling tasks served as the final sample for the data analysis.

2.2. Study variables and measures

The outcome variables of the study were safe patient handling behaviors and the use of lifting equipment. Independent variables included demographics, employment characteristics, physical workload, psychosocial work factors, organizational safety practices, and perceptions about lift use and injury risk, and work-related injury or symptoms.

2.2.1. Outcome variables

Safe patient handling behaviors were measured by the 15-item Safe Patient Handling Behavior (SPHB) measure developed by Lee et al. (2010). The SPHB measure asked how often the nurse engaged in safer practices when performing patient handling tasks (e.g., patient and environment assessment, corrective actions, use of a lift or transfer aid, ask for assistance from coworkers, and use of good body mechanics). The SPHB measure used a 6-point Likert-type scale (1 = never to 6 = always); the SPHB score was computed as a mean score of the items. Higher SPHB scores indicated safer behaviors. The Cronbach's alpha was 0.86 in the survey sample. As the safe patient handling behavior variable

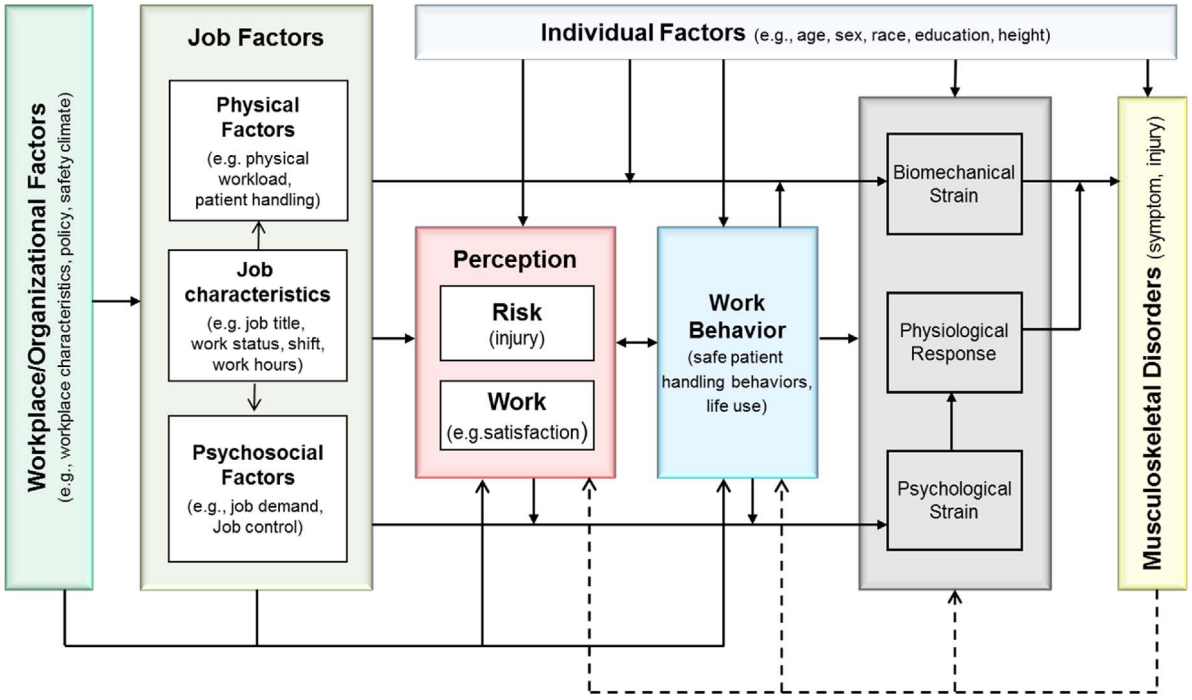

Fig. 1. Conceptual framework of the study.

presented a left skewed distribution, it was dichotomized at the median and scores above the median were defined as "High".

The use of lifting equipment was assessed by the question "When you lift or transfer a physically dependent patient, how often do you use a lifting device?" with four response categories (≤25% of the time, 26–50%, 51–75%, 76–100%). The categories were collapsed into low lift use (≤50% of the time) and high lift use (> 50% of the time) in the analysis.

2.2.2. Independent variables

Demographic and employment characteristics included age, gender, height, body mass index (BMI), race/ethnicity, education, country of initial nursing education, job tenure in nursing, type of hospital, size of hospital, type of unit, job title, work status, work schedule, and hours worked per shift.

Physical workload was measured by the number of patient handling tasks (lifting, transferring, and repositioning) performed per shift and the 19-item Physical Workload Index Questionnaire (PWIQ). The PWIQ (Hollmann et al., 1999) measures cumulative physical load with the frequency of work postures and handling weights using five response categories (0 = never to 4 = very often). This study used a modified PWIQ, which added pushing and pulling to the wording (Janowitz et al., 2006). The higher the PWIQ score, the higher the physical workload. The Cronbach's alpha was 0.88 in the survey sample.

Psychosocial work factors included job demands, job control, job strain, and job satisfaction measured by the Job Content Questionnaire (Karasek et al., 1998). Using a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), the job demands scale (5 items, Cronbach's alpha = 0.77) measures psychological demands of job tasks, and the job control scale (9 items, Cronbach's alpha = 0.75) measures perception of control over job requirements in terms of skill discretion and decision authority. Job strain was derived by dividing job demands by job control. Job satisfaction was measured by one question—"How satisfied are you with your job"—using four response options (from not at all satisfied to very satisfied).

Organizational safety practice factors included the presence of a patient handling policy (no-lifting policy: yes/no), time receiving training on safe patient handling (within the last year, 1–3 years ago, 3+ years ago, never), provision of patient lifting equipment (yes/no), the level of availability of patient lifting equipment (readily available when needed: ≤25%, 26–50%, 51–75%, 76–100% of the time), and safety climate (7 items), people-oriented culture (4 items), and ergonomic practices (6 items) measured by a modified Organizational Policies and Practices (OPP) questionnaire (Dennerlein et al., 2012). The safety climate scale measures workers' perceptions about management commitment and support for employee safety and working conditions. The people-oriented culture scale measures working relationships and communications in the organization. The ergonomic practices scale measures workers' perceptions about the organization's consideration of ergonomic factors in work design and equipment purchase. For ergonomic practices, Dennerlein et al. (2012) adapted the original OPP subscale (Amick et al., 2000) to use among patient care workers. In this study, we further modified one item of the ergonomic practices subscale by adding "manual" as follow: "Work is designed to reduce manual patient handling." The OPP questionnaire used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) and an average score was computed for each subscale. Higher scores indicated safer climate and practices or more positive culture. The Cronbach's alpha was 0.93 for safety climate, 0.89 for people-oriented culture, and 0.94 for ergonomic practices in the survey sample. The three variables were dichotomized at the median in the analysis.

Perceptions about lift use were assessed by seven items asking about the degree of agreement (1 = strong disagree to 5 = strongly agree) in the following aspects: Using a mechanical lift is (a) easy, (b) comfortable for patient, (c) safe for workers, (d) safe for patients, (e) time-consuming, (f) It is easy to access equipment, and (g) It is easy to store equipment. The Cronbach's alpha was 0.83 in the survey sample.

Risk perception was measured by the Risk Perception of Musculoskeletal Injury to Self (RPMI-S) measure (Lee et al., 2013b). The 4-item RPMI-S measure asked about the likelihood of having a musculoskeletal injury within a year from (a) nursing work in general, (b) patient handling tasks performed manually, (c) patient handling performed using a mechanical lift, and (d) work tasks not related to patient handling. The RPMI-S score was computed as a mean score of

the items. A higher RPMI-S score indicated greater risk perception. The Cronbach's alpha was 0.77 in the survey sample.

Work-related musculoskeletal symptoms were assessed by questions used in a study by Lee et al. (2013a). Symptom questions asked whether the respondent had pain, aching, stiffness, burning, numbness, or tingling in the lower back, neck, shoulders, or hands/wrists in the past 12 months. Work-relatedness was assessed by asking whether the symptoms were caused or made worse by work. *Work-related injury* was measured by the question "In the past 12 months, have you had any injury or health problem at work?"

2.3. Data analysis

Data management and analyses were performed with SPSS 22.0 (SPSS, Chicago, IL) and SAS 9.4 (SAS Institute, Cary, NC) software programs. For paper surveys, data were double-entered into the SPSS-based data entry form; discrepancies between the two data sets were resolved by manual reviews of raw data. The data file from the paper surveys was combined with the online survey data extracted from the Qualtrics survey program. The final data set for the data analysis (n = 221) was created by applying the inclusion and exclusion criteria described earlier. For multi-item scales, if approximately 70% of items were answered, the scale scores were created by substituting the mean score of answered items to the missing items. The case mean substitution method is regarded as a robust method in handling missing data in multi-item measures (Roth et al., 1999).

Descriptive statistics were used to summarize the study variables. Chi-square tests were used for categorical variables and Student's *t*-tests were used for continuous variables to compare independent variables by the two outcome variables of safe patient handling behaviors (high/low) and lift use (high/low). For the outcome of lift use, the data analysis was restricted to those who had lifting equipment (n = 142). For multivariable analyses, logistic regressions were conducted using two-tailed tests, and odds ratios (OR) and 95% confidence intervals (CI) were obtained. Variables that presented p-value < 0.15 in the bivariate analysis were entered into the multivariable model; for the lift use outcome, we additionally included no-lifting policy (p = 0.154). For the job strain variable, considering the score size and distribution, we transformed the variable by dividing by standard deviation (SD). For the level of lift availability variable, considering the distribution, we dichotomized it into ≤75% vs. > 75% of the time. For the variables of perception about lift use, we used an aggregate variable by calculating the mean score of the seven items if at least 70% of the items were answered; one item (time-consuming) was reverse coded in this calculation. In the examination of multicollinearity, high correlations were found between age and job tenure (r = 0.84) and among three organizational safety practices variables (r = 0.72–0.81). We selected job tenure rather than age based on the strength of correlation with the outcome variable. For organizational safety practices variables, we examined each variable by entering into the multivariable model separately. To evaluate the overall model fit, we obtained Akaike information criterion (AIC) and p-value of a Wald test.

3. Results

3.1. Sample characteristics

The demographic and employment characteristics of the study sample (n = 221) are presented in Table 1. The majority of the sample were female (87.3%), 30–49 years old (50.7%, mean age 44.0), and received bachelor or higher education (64.4%). Most participants were non-Hispanic White (55.7%) or Asian (24.9%), and 82.7% received their initial nursing education in the United States. Mean years in nursing job was 15.8 years. About half of the nurses (51.2%) worked in teaching hospitals and the proportion of nurses working in medium-sized hospitals (200–399 beds, 45.9%) was higher than those in small or large hospitals. Most participants were staff (74.2%), full time (72.9%) nurses, and worked on day shifts (57.9%) and more than 8 h per shift (80.2%).

Table 1
Sample characteristics (N = 221).

Variable	N	Mean ± SD or N (%)
Age (years)	217	44.0 ± 12.0
Gender	220	
Female		192 (87.3)
Male		28 (12.7)
Race/Ethnicity	221	
White, non-Hispanic		123 (55.7)
Asian		55 (24.9)
Hispanic		21 (9.5)
Other		22 (9.9)
Highest education	219	
Diploma or Associate		78 (35.6)
Bachelor		113 (51.6)
Master or Doctoral		28 (12.8)
Country of nursing education	220	
US		182 (82.7)
Foreign		38 (17.3)
Height (cm)	216	165.1 ± 8.07
Body Mass Index	216	25.6 ± 4.98
Job tenure in nursing (years)	218	15.8 ± 11.9
Type of hospital	207	
Teaching		106 (51.2)
Non-teaching		101 (48.8)
Size of hospital	185	
Less than 200 beds		51 (27.6)
200–399 beds		85 (45.9)
400 beds or more		49 (26.5)
Type of work unit	220	
Medical/Surgical		63 (28.6)
Intensive care		34 (15.5)
Emergency department		25 (11.4)
Operation room		24 (10.9)
Maternal/nursery		23 (10.5)
Pediatrics		14 (6.4)
Orthopedics/Rehabilitation		10 (4.5)
Other		27 (12.3)
Job title	221	
Staff nurse		164 (74.2)
Charge nurse		34 (15.4)
Other (e.g., manager, nurse practitioner, case manager)		23 (10.4)
Work status	221	
Full-time		161 (72.9)
Part-time or per-diem		60 (27.1)
Work schedule	221	
Days		128 (57.9)
Evenings		18 (8.1)
Nights		63 (28.5)
Rotating		12 (5.4)
Work hours per shift	217	10.9 ± 1.92
≤8 h		43 (19.8)
9–11 h		33 (15.2)
≥12 h		141 (65.0)

Note: Sample sizes for each variable vary due to missing.

3.2. Safe patient handling behaviors and lift use: bivariate analysis

The mean safe patient handling behavior score was 4.94 (SD 0.66) out of 6. Among the sample, 144 (65.2%) nurses had lift devices on their unit; of these, 72 (50.7%) reported using it ≤25% of the time when lifting or transferring a physically dependent patient, 26 (18.3%) used 26–50% of the time, 15 (10.6%) used 51–75% of the time, and 29 (20.4%) used 76–100% of the time (two missing answers excluded; data not shown in a table). Table 2 presents bivariate analysis results on factors associated with high safe patient handling behaviors and high lift use.

Table 2
Safe patient handling behavior and lift use by demographic, employment factors, organizational safety practices, physical and psychosocial work factors, risk perception and work-related injury and musculoskeletal (MS) symptoms.

Variable	Safe patient handling behavior[a]			Lift use[b]		
	High (N = 103) Mean (SD) or%	Low (N = 118) Mean (SD) or%	p	High (N = 44) Mean (SD) or%	Low (N = 98) Mean (SD) or%	p
Demographic factors						
Age (years)	45.3 (11.7)	42.9 (12.2)	0.156	47.3 (11.9)	42.7 (11.8)	**0.039**
Gender (Female)	88.2	86.4	0.690	90.9	85.7	0.586
Height (cm)	163.5 (7.3)	166.7 (8.4)	**0.004**	164.0 (8.4)	165.8 (7.7)	0.218
Body mass index	26.1 (5.3)	25.2 (4.7)	0.171	26.0 (5.5)	25.9 (4.8)	0.885
Race/Ethnicity			**0.018**			0.230
White, non-Hispanic	46.6	63.6		50.0	53.1	
Asian	33.0	17.8		38.6	26.5	
Other	20.4	18.6		11.4	20.4	
Education (Bachler or higher)	61.8	66.7	0.450	70.5	59.2	0.199
Country of nursing education (U.S.)	81.4	83.9	0.621	75.0	86.7	0.084
Employment factors						
Job tenure in nursing (years)	16.9 (11.9)	15.0 (11.8)	0.247	20.0 (13.3)	13.6 (10.8)	**0.004**
Type of hospital (Teaching)	55.7	47.3	0.228	56.1	45.2	0.243
Size of hospital						
Less than 400 beds	67.5	78.4	0.093	76.5	75.9	0.944
400 beds or more	32.5	21.6		23.5	24.1	
Job title (Staff nurse)	75.7	72.9	0.629	75.0	79.6	0.540
Work status (Full time)	71.8	73.7	0.753	65.9	71.4	0.508
Work schedule (Day)	64.1	52.5	0.083	61.4	55.1	0.486
Work hours per shift (≥12 h)	58.8	69.8	0.090	61.9	67.0	0.561
Physical work factors						
Number of patient handling task per shift	7.92 (7.47)	9.70 (7.47)	0.082	7.85 (6.17)	10.2 (8.30)	0.105
Physical workload index (range 0–56.2)	39.2 (13.3)	43.0 (10.3)	**0.021**	36.8 (12.1)	41.9 (11.5)	**0.025**
Psychosocial work factors						
Job demand (range 12–48)	35.0 (5.86)	36.9 (5.87)	**0.015**	35.6 (6.47)	36.9 (5.78)	0.248
Job control (range 24–96)	72.4 (9.50)	68.0 (8.83)	< **0.001**	73.0 (8.94)	69.7 (8.45)	**0.036**
Job strain (range 0.125–5.0)	0.49 (0.12)	0.55 (0.12)	< **0.001**	0.50 (0.11)	0.54 (0.12)	**0.048**
Job satisfaction			**0.038**			0.767
Not at all or not too satisfied	7.8	16.2		13.6	12.2	
Somewhat satisfied	43.1	49.6		50.0	44.9	
Very satisfied	49.0	34.2		36.4	42.9	
Organizational safety practices						
No-lifting policy (Yes)	29.1	14.5	**0.008**	34.1	22.7	0.154
Safe patient handling training			0.219			0.219
Within the last year	73.8	62.1		68.2	74.2	
1–3 years ago	13.6	21.6		18.2	20.6	
More than 3 years ago	8.7	8.6		13.6[c]	5.2[c]	
Never	3.9	7.8				
Safety climate (range 1–5)	3.97 (0.83)	3.16 (0.80)	< **0.001**	3.98 (0.77)	3.57 (0.84)	**0.006**
People-oriented culture (range 1–5)	3.74 (0.88)	3.09 (0.85)	< **0.001**	3.65 (0.78)	3.39 (0.92)	0.095
Ergonomic practice (range 1–5)	3.43 (1.00)	2.67 (0.91)	< **0.001**	3.59 (0.87)	3.09 (0.96)	**0.003**
Injury, symptom, risk perception						
Injury/illness at work in the past year (Yes)	23.3	34.7	0.063	31.8	28.6	0.695
Work related MS symptom (Yes)	59.8	79.5	**0.001**	65.1	69.1	0.644
Risk perception of MS injury (range 1–6)	3.73 (1.14)	3.92 (0.90)	0.182	3.89 (1.20)	3.81 (0.87)	0.693

Note: Sample sizes for each variable vary due to missing data. Significant results with p value less than 0.05 are bolded.
[a] High and low by median cut.
[b] High use: ≥50% of the time.
[c] "More than 3 years ago" and "never" categories were combined.

Among demographic factors, safe patient handling behaviors were significantly associated with shorter height (p = 0.004) and race/ethnicity (p = 0.041). For race/ethnicity, high safe patient handing behaviors were the most common among Asian nurses (34 out of 55, 61.8%) and the least common among non-Hispanic White nurses (48 out of 123, 39.0%). High lift use also tended to be more common among Asian nurses and foreign-educated nurses, but the findings were not significant. Among employment factors, high safe patient handing behaviors tended to be more common among nurses employed in large hospitals (≥400 beds) and nurses working on day shifts and less than 12 h per shift; however, none of employment factors were significant (p > 0.05). High lift use was significantly associated only with older age (p = 0.039) and longer job tenure in nursing (p = 0.004).

For physical work factors, physical workload index was significantly lower among nurses reporting high safe patient handling behaviors (p = 0.021) and high lift use (p = 0.025). For psychosocial factors, high safe patient handling behaviors were associated with lower job demand (p = 0.015), higher job control (p < 0.001), lower job strain (p < 0.001), and higher job satisfaction (p = 0.038). Job control and job strain were also significant for high lift use (p < 0.05). Among organizational safety practice variables, high safe patient handling behaviors were more common among nurses who worked in hospitals having a no-lifting policy in place (p = 0.008). Also, high safe patient handling behaviors were significantly associated with better safety climate, people-oriented culture, and ergonomic practices (p < 0.001). For lift use, significant associations were found with

Table 3
Lift use by lift availability, type, and perceptions about lifts among nurses (N = 142).

Variables	All N (%)	High lift use[a] (N = 44) %	Low lift use (N = 98) %	*p*
Readily availability of lifting device				< **0.001**
≤25% of the time	23 (16.4)	0	24.0	
26–50% of the time	25 (17.9)	13.6	19.8	
51–75% of the time	13 (9.3)	4.5	11.5	
76–100% of the time	79 (56.4)	81.8	44.8	
Availability of ceiling lift (Yes)	27 (19.0)	25.0	16.3	0.223
Perceptions about lift use (Agree or Strongly Agree)				
Easy to use	75 (54.8)	79.5	43.0	< **0.001**
Comfortable for patients	69 (50.0)	72.7	39.4	< **0.001**
Safe for workers	115 (83.3)	93.2	78.7	**0.034**
Safe for patients	106 (76.8)	88.6	71.3	**0.024**
Time consuming	109 (78.4)	59.1	87.4	< **0.001**
Easy to access lifts	59 (43.4)	74.4	29.0	< **0.001**
Easy to store lifts	51 (37.8)	61.9	26.9	< **0.001**

Note: Sample sizes for each variable vary due to missing data. Significant results with p value less than 0.05 are bolded.
[a] > 50% of the time when needed.

safety climate (p = 0.006) and ergonomic practices (p = 0.003). Work-related musculoskeletal symptom experience was significantly less among nurses reporting high safe patient handling behaviors (p = 0.001). For such nurses, injury or illness experience at work also tended to be less frequent but the finding was not significant (p = 0.063). Risk perception of musculoskeletal injury was not associated with safe patient handling behaviors or lift use.

Table 3 shows significant associations of lift use with the level of lift availability and perceptions about lift use. Among nurses who had lifts, 56.4% reported having a lift readily available more than 75% of the time when needed, and nurses with high lift availability were more likely to use lifts (p < 0.001). The relationship with lift use was significant for all perception variables. The vast majority of nurses positively perceived about the safety of lift use but also reported that its use was time-consuming. Only less than half of the nurses reported that accessing and storing lifts were easy.

3.3. Factors associated with safe patient handling behaviors and lift use: multivariable analysis

Multivariable analysis results are presented in Tables 4 and 5. For safe patient handling behaviors, only organizational safety practices variables remained significant in the multivariable model: safety climate (OR = 2.76, 95% CI 1.51–5.03), people-oriented culture (OR = 2.59, 95% CI 1.45–4.62), and ergonomic practices (OR = 1.67, 95% CI 1.04–2.67). For lift use, significant factors associated with high use were only high lift availability (OR = 3.1, 95% CI 1.06–9.01) and perceptions about lift use (OR = 3.48, 95% CI 1.63–7.44).

4. Discussion

This study conducted a comprehensive investigation on factors associated with safe patient handling behaviors among nurses and demonstrated the importance of organizational safety culture and practices. Positive safety climate, people-oriented culture, and ergonomic practices were found to be significant factors for safe patient handling behaviors, after controlling for a comprehensive set of variables. We also investigated the specific safety behavior of lift use separately and found that high lift availability and positive perceptions about lift use were significant factors for high lift use.

There is increasing evidence supporting the significant role of safety climate in workers' safety practices (Arcury et al., 2012; Dutra et al., 2014; Felknor et al., 2000; Lee et al., 2010; Morrow et al., 2010; Seo, 2005) and our study adds additional evidence. In particular, this study reinforces the finding of a previous study that showed safety climate as a key factor for safe patient handling behaviors among nurses (Lee et al., 2010). For people-oriented culture and ergonomic practices, to our knowledge no studies have examined these variables with safe work practices, and our study showed their significant associations. Dennerlein et al. (2012) reported that better people-oriented culture and ergonomic practices as well as safety climate were significantly associated with reduced musculoskeletal pain experiences in patient care workers. As such, our findings suggest that the three organizational safety practice variables can significantly affect overall safe patient handing behaviors; however, we did not find the same evidence for the specific behavior of lift use. Similarly, in a study by Koppelaar et al.

Table 4
Factors associated with high[a] safe patient handling behaviors among nurses: multivariable analysis[b] (N = 161).

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Height	0.97 (0.93–1.02)	0.97 (0.93–1.02)	0.96 (0.92–1.01)
Race/ethnicity (non-Hispanic White)	0.73 (0.34–1.57)	0.63 (0.29–1.34)	0.80 (0.38–1.68)
Size of hospital (≥400 beds)	1.54 (0.66–3.61)	1.78 (0.75–4.21)	1.56 (0.68–3.59)
Work schedule (Day)	1.85 (0.86–3.97)	2.14 (1.00–4.60)	2.02 (0.96–4.23)
Work hours per shift (< 12 h)	1.29 (0.58–2.87)	1.23 (0.56–2.73)	1.40 (0.64–3.09)
Frequency of patient handling tasks/shift	0.99 (0.94–1.05)	0.99 (0.95–1.05)	0.99 (0.95–1.05)
Physical workload index	0.98 (0.94–1.01)	0.97 (0.94–1.00)	0.98 (0.95–1.02)
Job strain[c]	1.08 (0.68–1.72)	1.04 (0.64–1.68)	0.91 (0.59–1.41)
Job satisfaction (very satisfied)	0.96 (0.41–2.21)	0.79 (0.33–1.88)	1.04 (0.46–2.34)
Work-related injury/illness (Yes)	1.06 (0.40–2.76)	1.12 (0.43–2.91)	0.94 (0.37–2.38)
Work-related musculoskeletal symptom (Yes)	0.58 (0.25–1.36)	0.53 (0.23–1.24)	0.57 (0.25–1.32)
Presence of a no-lifting policy (Yes)	1.29 (0.51–3.22)	1.36 (0.55–3.41)	1.43 (0.58–3.56)
Safety climate	**2.76 (1.51–5.03)**		
People-oriented culture		**2.59 (1.45–4.62)**	
Ergonomic practice			**1.67 (1.04–2.67)**
Model fit: AIC[d]	206.684	207.744	214.624
Wald test (P value)	0.0038	0.0045	0.0120

Note: Significant results with p value less than 0.05 are bolded.
[a] High scores by median cut.
[b] All variables included in the model. Due to multicollinearity, three models were constructed by including organizational safety practices variables separately.
[c] Considering the small score size and distribution (range 0.26–1.14), a transformed variable dividing by its standard deviation was used in this analysis.
[d] Akaike information criterion.

Table 5
Factors associated with high lift use (≥50% of the time) among nurses: Multivariable analysis[a] (N = 121).

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Job tenure in nursing	1.04 (0.99–1.08)	1.03 (0.99–1.08)	1.04 (0.99–1.08)
Country of nursing education (Non-US)	1.46 (0.42–5.12)	1.48 (0.42–5.23)	1.48 (0.43–5.17)
Frequency of patient handling tasks/shift	1.01 (0.94–1.09)	1.01 (0.94–1.08)	1.01 (0.94–1.09)
Physical workload index	0.98 (0.94–1.02)	0.98 (0.94–1.02)	0.98 (0.94–1.02)
Job strain[b]	0.95 (0.53–1.69)	0.87 (0.50–1.51)	0.91 (0.52–1.61)
Presence of a no-lifting policy (Yes)	1.12 (0.37–3.38)	1.19 (0.41–3.51)	1.13 (0.37–3.47)
Availability of lift (> 75% of the time)	**3.10 (1.06–9.01)**	**3.19 (1.10–9.24)**	**3.17 (1.09–9.19)**
Perceptions about lift use	**3.48 (1.63–7.44)**	**3.59 (1.66–7.75)**	**3.43 (1.54–7.64)**
Safety climate	1.23 (0.58–2.58)		
People-oriented culture		1.02 (0.53–1.94)	
Ergonomic practice			1.13 (0.56–2.28)
Model fit: AIC[c]	132.431	132.718	132.609
Wald test (P value)	0.0033	0.0034	0.0033

Note: Significant results with p value less than 0.05 are bolded.
[a] All variables included in the model. Due to multicollinearity, three models were constructed by including organizational safety practices variables separately.
[b] Considering the small score size and distribution (range 0.26–1.14), a transformed variable dividing by its standard deviation was used in this analysis.
[c] Akaike information criterion.

(2011), the association between supportive management climate and lift use was not significant.

Instead, we found that lift use was associated with the level of lift availability and perceptions about lift use. Along with these results, more than one third of nurses did not have lift equipment on their unit, and even for nurses with lifts, more than one third reported that the lift was not readily available half of the time when needed. These results show substantial gaps in organizational support for safe patient handing programs. Only having a no-lifting policy (policy to prohibit manual patient handling) in place without providing an adequate level of equipment would not be effective. Our finding reinforces evidence from previous studies that showed significant relationships between high lift availability and lift use (Lee et al., 2013a; Rickett et al., 2006). Our study also examined perceptions about lift use in depth and demonstrated the importance. We found that most nurses did not feel easy about accessing and storing lifts and perceived that using a lift for patient handling was a time-consuming task. Making lift equipment readily available, removing barriers and obstacles in lift use, and making its use easy, convenient, and comfortable would be keys to ensure high usage. Time pressure is a well-known barrier that reduces lift use (Koppelaar et al., 2009; Schoenfisch et al., 2011). As ceiling lifts are equipped in the room and can be immediately available, we hypothesized that lift use would be higher among nurses with ceiling lifts; we found an increased tendency of lift use among these nurses, but the finding was not significant. This might be due to the lack of statistical power of this study and requires further investigation.

For psychosocial factors, we did not find their independently significant roles for safe patient handling behaviors among nurses. Job strain showed only a bivariate association and this pattern was observed in previous studies (Gershon et al., 1995; Lee et al., 2010). Job satisfaction also showed only a bivariate association and our study failed to strengthen evidence supporting the role of job satisfaction in safety practices reported in previous studies (Masia and Pienaar, 2011; Wei et al., 2016). As consistent with previous studies (Lee et al., 2010; Rickett et al., 2006), personal risk perception did not show a significant role in increasing safe patient handling behaviors. Our bivariate analysis results show some additional interesting findings although the significance did not remain in the multivariable models. We observed an association of safe patient handling behaviors with height, not BMI; the finding suggests that taller nurses are less likely to engage in safe patient handling behaviors than shorter nurses. Rickett et al. (2006) also found an inverse relationship between height and lift use. As research also suggests that tall height is associated with increased risk of low back pain (Adams et al., 1999; Hershkovich et al., 2013; Heuch et al., 2015; Smedley et al., 1997), the finding can be concerning with potential synergistic effects. In regard to race/ethnicity, non-Hispanic White nurses were less likely to engage in safe patient handling behaviors. This finding is consistent with the finding of Lee et al.'s study (2010) and shows a need for further investigation to understand the role of race and to identify specific behavioral barriers or motivators among White nurses. Our observation of higher safe patient handling behaviors among nurses reporting lower physical workload and among nurses without work-related musculoskeletal symptoms was also in line with the previous study (Lee et al., 2010). Overall, our findings indicate the need for improving physical and psychosocial working conditions to ensure safe work practices and to prevent musculoskeletal injuries.

This study has several limitations that require cautious interpretation of the findings. First, we could not determine either causal relationships or directions between variables with the cross-sectional study design. Second, this study is subject to selection bias from the low response rate. Third, by relying all measurements on self-reports, the study findings may have been affected by information bias from recall errors or common method bias. Measurement errors from social desirability, positive/negative affectivity, or item structure might have resulted in common method bias, and the observed relationships might be attributable to the measurement method (common method variance) rather than the true relationships between variables (Podsakoff et al., 2003). Finally, the relatively small sample size limited the statistical power. Our study findings may not be generalizable to all American nurses.

In conclusion, the study findings underscore the importance of organizational safety culture and practices to ensure safe patient handling behaviors and the need for improving working conditions to facilitate lift use among nurses. Enhancing management support to create a strong safety climate and good working relationships, making necessary equipment readily available, and removing barriers to improve positive perceptions and experiences about lift use are crucial to ensure safe patient handling behaviors. Large, prospective research is needed to confirm the findings of this study. Additionally, the impact of safe patient handling legislation on organizational safety practices and injury prevention needs to be investigated in future research.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

The study was approved by the Committee on Human Research of the University of California San Francisco.

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