



Exploring the impact of safe patient handling and mobility program compliance on patient handling injury rates[☆]

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ABSTRACT

Introduction: Patient handling injuries (PHIs) from activities of turning, repositioning, and transferring patients are one of the leading causes of work-related injuries and musculoskeletal disorders (MSD) among healthcare workers. Safe Patient Handling and Mobilization (SPHM) programs aim to reduce PHIs. Differences in program design and implementation can impact program effectiveness, underscoring the importance of evaluating compliance rather than merely assessing program existence. This study examined the relationship between SPHM program compliance and direct care staff's PHI rates in Veterans Health Administration (VHA) facilities. **Methods:** This cross-sectional study used data from the 2023 Annual SPHM Compliance Survey; 124 of 152 VHA facilities were included in the study. A SPHM program compliance index was created to measure each facility's compliance with the SPHM program's performance criteria. Data were analyzed using Kruskal-Wallis Test, Mann Whitney-U, and Negative binomial regression analysis. **Results:** Facilities with higher SPHM Compliance Index showed higher PHI rates when adjusted for the staff-to-patient ratio, but their significant relationship did not remain after adding other facility characteristics. Facilities with higher staff-to-patient ratio and lower ceiling lift coverage had lower PHI rates. PHI rates were lower in facilities with ambulatory care services only compared to long-term care. Medium-sized facilities and large-sized facilities reported significantly lower PHI rates compared to small-sized facilities. **Conclusion:** This study found mixed results in different models between the relationship of SPHM program and PHI rate. The unexpected finding of a positive correlation between higher SPHM Compliance Index and higher PHI rates requires further research to validate the findings. **Practical Applications:** This study can be used by healthcare organizations to evaluate their SPHM program compliance and strengthen the roles of the SPHM program managers in active surveillance. The findings provide guidance for identifying facility-level factors that influence injury risk and for implementing targeted strategies to improve staff safety.

1. Introduction

Musculoskeletal disorders (MSDs) are a leading cause of work-related disorders among health care workers (U.S. Department of Labor. Bureau of Labor Statistics, 2021; National Institute for Occupational Safety and Health [NIOSH], 2023). In 2018, MSD rates in health care workers were substantially higher than those of the construction industry and all industries (38.4 vs. 28.9 vs. 27.2 per 10,000 full-time equivalent (FTE), respectively). The MSDs resulted in a median of 8 lost days of work (U.S. Bureau of Labor Statistics, 2018). MSDs are

associated with diminished health care workers' job satisfaction, negative perceptions of work performance, increased psychological work demands, decreased quality of life outside of the workplace, and impaired quality of patient care (Koyuncu & Karcioglu, 2018; Lin et al., 2020; Mayeda-Letourneau, 2014; Ou et al., 2021).

The primary cause of MSDs in health care workers is patient handling activities that involve lifting, transferring, repositioning, or mobilizing patients (Kim et al., 2012; Krishnan et al., 2021; Lee et al., 2022). Efforts to reduce the risk of MSDs and patient handling injuries (PHI) require organizational-level programs such as safe patient handling and

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mobility (SPHM) programs (Kim et al., 2012; Krishnan et al., 2021; Lee et al., 2022). SPHM programs to prevent and reduce PHI have been introduced to health care organizations through endorsement by professional agencies (e.g., American Nurses Association, the Joint Commission) and governmental agencies (e.g., NIOSH) and legislation by state governments. SPHM programs included organization-level interventions to increase the availability and use of patient handling equipment (e.g., ceiling lifts, friction reducing sheets, floor-based lifts, and sit-to-stand lifts), proper patient handling education, patient mobility assessment tools, and culture of safety development (Powell-Cope & Rugs, 2015; Powell-Cope et al., 2014; Wählin et al., 2022). Different organizations have variations in their SPHM program's components, such as the use of patient mobility assessments that necessitate differences in the selection of safe patient handling equipment, the number of available lift equipment for each patient care area, and the organizations' post-injury protocols (Powell-Cope & Rugs, 2015). Additionally, health care organizations implement SPHM programs selectively, which may only apply them in certain patient care settings, including hospitals, nursing care facilities, and outpatient clinics (Powell-Cope & Rugs, 2015).

Research has shown that SPHM programs can effectively reduce PHI rates among workers. Teeple et al. (2017) reviewed 27 studies on the effect of SPHM programs on PHI rates in long-term care facilities, inpatient hospitals, intensive care units, and other care areas. Their meta-analysis of 24 studies showed that SPHM program implementation significantly reduced PHI by 56%. On the other hand, in a systematic review of 29 studies by Wählin et al. (2022), 18 studies reported that SPHM programs reduced PHI rates and MSD symptoms, but 11 studies showed no effect. Wählin et al. concluded that the evidence for SPHM programs reducing PHI rates was inconclusive and emphasized the necessity of incorporating programs that adopt a systems perspective focusing on safety, human factors (e.g., the propensity for mistakes), and organizational aspects, including workplace culture. One reason contributing to the discrepancies in the review results is that the SPHM programs reviewed by Teeple et al. primarily focused on the introduction of patient handling equipment and lift teams, whereas the SPHM programs reviewed by Wählin et al. included a broader range of components—such as patient handling equipment, staff training, and participatory ergonomics—resulting in greater variability and less consistent outcomes.

Current research evidence indicates the need to further investigate the effects of SPHM programs on PHI rate. Few studies have investigated the compliance of incorporating SPHM programs into workplace culture. Previous research has examined the program effectiveness on PHI, mostly based on the presence or absence of the SPHM program. However, the program effect by the level of SPHM program compliance with established standards, such as state legislative mandates or the ANA's SPHM guidelines, has not been investigated. Therefore, this study examined the relationship between SPHM program compliance with direct care staff's PHI rates in Veterans Health Administration (VHA) facilities.

2. Methods

2.1. Study design and setting

The study is a cross-sectional correlational investigation in the VHA health system facilities. The VHA is segmented into 18 Veteran Integrated Service Networks (VISNs) that operate in all 50 states, the US territories of Guam and Puerto Rico, and a facility in Manila, Philippines. The VHA health care systems comprise a network of outpatient clinics, residential nursing facilities, veterans' centers, and acute care medical centers (U.S. Department of Veterans Affairs, n.d.). Of the 152 facilities nationwide, 124 (82%) had complete data for this study.

The VHA health care system adopted the SPHM program agency-

wide from 2008 to 2011; the SPHM program implementation was guided by VHA Directive 1611. VHA Directive 1611 included SPHM program components, such as policy development, hiring a program manager, presence of an oversight committee, collaboration with safety offices, ergonomic assessments, SPHM equipment coverage, unit peer leader recruitment and training, and staff education and training of all staff including on-call, part-time, and full-time staff (Elnitsky et al., 2015; Hodgson et al., 2013). Directive 1611 mandates that all of the VHA's 152 SPHM programs must satisfy the required performance criteria standards. Furthermore, Directive 1611 does not mandate dedicated lift teams as part of the SPHM program.

2.2. Ethical consideration

The present study was approved by the San Francisco VA Research and Development Committee. The study also received consent exemption certification from the University of California, San Francisco, Institutional Review Board; exemption was granted because (a) the database used in the study did not contain any identifiable patient information, and (b) the data were used for program evaluation purposes.

2.3. Data source

This study obtained 2023 Annual SPHM Survey data from the VHA SPHM Central Office. To determine the status of the SPHM program and the facilities' compliance with VHA Directive 1611, the VHA SPHM Central Office conducts an annual survey of the VHA's 152 facilities. The SPHM survey is completed by the SPHM facility program manager and submitted in October to coincide with the start of the new fiscal year; this completion period ensures the inclusion of complete data from the previous fiscal cycle, which runs from October to September. The SPHM Survey collects data on the facility's characteristics, the SPHM facilities' strategic plans, ergonomic assessments, ceiling lifts and technology, patient injuries and handling incidents, the program's oversight committee, SPHM program managers, the SPHM program manager's experience, and patient handling training. The survey includes instructions on sources for collecting necessary information (e.g., number of ceiling lift technologies, number of unique veterans seen, number of direct care staff, and PHI incidence rates). The SPHM Survey's data are analyzed and reported by the VA SPHM Central Office located in Washington, DC.

2.4. Study variables

2.4.1. PHI rate

The dependent variable was the PHI, which was defined as an injury caused by patient lifting, handling, repositioning, or assistance with mobility, and the definition did not include patient actions that injure staff, such as an assault (U.S. Department of Veterans Affairs, n.d.).

Direct care staff are all personnel (licensed and non-licensed) who perform patient handling activities. Both full-time and part-time staff are counted equally, with each individual counted as one direct care staff member. These personnel include physicians, nurses, imaging staff, social workers, rehabilitation therapy staff, personnel assisting people in and out of vehicles and transporting patients, and certified nursing assistants. SPHM program managers ascertain the number of direct care staff through the HR portal. The PHI rate was calculated as the number of annual PHI counts relative to the number of direct care staff in each VA facility (injuries per 1000 direct care staff).

2.4.2. Safe patient handling and mobility compliance index

A Safe Patient Handling and Mobility Compliance Index (SPHMCi) was created to measure the adherence of VHA facilities' SPHM programs with the performance criteria prescribed by the VHA Directive 1611. VHA facilities' program managers were asked to answer the 17-performance criteria achievement with three response options: *yes* (2), *in progress* (1), and *no* (0). One question about the facility's SPHM program

manager's FTE status uses different response categories and scoring. A program manager with 1.0 FTE was considered fully dedicated to the SPHM program and was scored as 1. A SPHM program manager with less than 1.0 FTE was considered to have shared responsibilities with non-SPHM programs and was scored as 0. SPHM program managers are not required to have clinical background but are expected to complete SPHM specific training, participate in national SPHM learning activities, receive mentorship from experienced coordinators, and develop competency through ongoing education. All item scores were added to calculate the SPHMCi score. The SPHMCi ranges from 0 to 34; higher scores indicate greater compliance. The SPHMCi had a Cronbach's alpha of 0.79 in this study sample, which demonstrated acceptable reliability.

2.4.3. Facility characteristics

Facility characteristics included facility type, facility size by the number of direct care staff, acute care and long-term care bed capacities, facility complexity in terms of patient acuity, staff-to-patient ratio, and ceiling lift coverage. *Facility type* was derived from the bed capacity (acute or long-term care) and categorized as providing both acute and long-term care, mainly acute care, mainly long-term care, or ambulatory care only. *Facility size* was derived from the number of direct care staff and categorized based on tertiles, with large-sized facilities having 2000 or more, medium-sized facilities having 1000 to 1999, and small-sized facilities having fewer than 1000 staff. *Bed capacity* was the number of beds licensed to operate in an acute or long-term care hospital. *Acute care beds* were categorized into large bed capacity (200 or more beds), medium bed capacity (101–200 bed), small bed capacity (1–100 bed), and none. *Long-term care beds* were categorized into large bed capacity having 100 or more, medium bed capacity having 26 to 100, small bed capacity having 1 to 25, and none. *Facility level of complexity* referred to the VHA facility's classification based on the types of care and surgeries provided, the presence of teaching and research capabilities, and the volume of patients seen. A facility's complexity was categorized as 1A (the most complex), 1B, 1C, 2, and 3 (least complex). Staffing is an important factor affecting risk for patient handling injuries. Using the available data in the surveys, the *staff-to-patient ratio* was created by calculating the number of direct care staff divided by the number of veterans treated at the designated VHA facility per year. A categorical variable was created based on quartile distribution: ≤ 2.0 , > 2.0 to 2.7, > 2.7 to 3.8, and > 3.8 direct care staff per 100 patients. *Ceiling lift coverage* referred to the ratio of overhead lift coverage currently available relative to the total identified coverage needed, as reported by facility representatives in the SPHM program survey. The VHA SPHM guidebook acknowledges that achieving a 100% ceiling-lift coverage is ideal, but it is not feasible (VHA Center for Engineering and Occupational Safety and Health, 2016). The determination of ceiling lift needs within the VHA SPHM program is guided by the patient's dependency and mobility, frequency of high-risk tasks, and other clinical unit factors such as room design (VHA Center for Engineering and Occupational Safety and Health, 2016). *Ceiling lift coverage* was further categorized into four groups (None: 0%, Low: 1–79%, Medium: 80–94%, High: $> 94\%$) based on response patterns observed across facilities.

2.5. Data analysis

The study variables were summarized by descriptive statistics, including frequency, percentages, mean, standard deviation (SD), median, interquartile range (IQR), minimum and maximum values. The data analysis was executed using Stata version 7. A power analysis is based on the sample 124 VHA facilities, assuming a significance level (α) of 0.05 and a desired power of 0.8 determined that the study could detect an incidence rate ratio (IRR) of 1.03 or greater.

A bivariate analysis was conducted to describe and compare PHI rate and SPHMCi by facility characteristics. For staff-to-patient ratio and ceiling lift coverage, categorical variables were used in the bivariate analysis. The central limit theorem was used to determine the

distribution of the PHI and SPHMCi. Since the data were not normally distributed, the Kruskal-Wallis test was used to examine differences in the medians of PHI and SPHMCi by facility characteristics. A Mann-Whitney *U* test was used to examine the relationship between each individual component of the SPHMCi and the PHI rate.

A negative binomial model was used to examine the relationship between the SPHMCi and the PHI. The outcome variable was modeled as the count of PHI events, with the number of direct care staff included as an offset to account for differences in the population at risk across facilities. Using the direct care staff as an offset normalizes the PHI rate, permitting comparisons between facilities while controlling for variations in staffing levels. For the multivariable analysis, four models were constructed by adding facility characteristics step by step. Model 1 included the SPHMCi as the sole predictor. Model 2 adjusted for staffing ratio. Model 3 further adjusted for ceiling lift coverage in addition to staffing ratio. Model 4 further added hospital setting, facility size, and facility complexity. Bed capacity (acute bed and long-term care bed) was excluded in the multivariable analysis to avoid redundancy with the facility size by direct care staff. To identify the best-fitting model with the optimal balance of simplicity and accuracy, the Bayesian Information Criterion was used. Lower BIC values indicate a better balance between model fit and complexity (Vrieze, 2012).

3. Results

3.1. Characteristics of facility samples

The characteristics of the 124 facilities are described in Table 1. The majority of VHA facilities (70.9%) provided both acute and long-term care, followed by 16.1% offering acute care only. Facilities providing mainly long-term care and ambulatory care only represented 6.5% each. Small-sized facilities comprised 40.3% of the total sample, followed by medium-sized facilities at 32.3%, and large-sized facilities at 27.4%. The majority of VA facilities (55.6%) had small bed capacity (1–100 beds) for acute care; 41.1% of VA facilities had medium bed capacity (26–100 beds) for long-term care. For facility complexity, 28.2% of VA facilities were designated as Level 1a, representing the highest level, followed by Level 3 (21.8%), Level 1b (18.6%), Level 1c (17.7%), and Level 2 (13.7%). Overall, the median number of direct care staff at VA facilities was 1,261, and the median number of unique veterans served by these facilities was 44,682. The median staff-to-patient ratio was 2.73 direct care staff per 100 patients.

3.2. PHI and SPHMCi by facility characteristics

Table 2 presents PHI rates (per 1000 direct care staff) and the SPHMCi by the facility characteristics. Across all facilities in 2023, the median PHI rate was 3.9 per 1000 direct care staff (IQR: 2, 6.6), and the median SPHMCi was 31 out of 34 (IQR: 28, 32).

The bivariate analysis showed no significant differences in PHI rates across facility characteristics, including staff-to-patient ratio, ceiling lift coverage, facility type, bed capacity, number of direct care staff, and facility complexity. However, significant differences in SPHM Compliance Index (SPHMCi) emerged based on ceiling lift coverage ($p < 0.01$). Facilities with high ($> 94\%$) and medium (80–94%) ceiling lift coverage exhibited the highest median SPHMCi of 31. Furthermore, SPHMCi significantly differed according to facility type ($p = 0.03$), with facilities offering both acute care and long-term services or exclusively long-term services achieving the highest median SPHMCi of 31.

3.3. Relationship between SPHM compliance and PHI

Table 3 shows PHI rates by each SPHM performance criteria between facilities that met the SPHM program criteria and those that did not. Among the 17 SPHM program criteria, PHI rates were significantly different depending on the compliance with only two criteria. Facilities

Table 1

Characteristics of sample veterans health care administration facilities (n = 124).

Variable	N (%)
Facility Type	
Both Acute and Long-Term Care	88 (70.9)
Mainly Acute Care	20 (16.1)
Mainly Long-Term Care	8 (6.5)
Ambulatory Care Only	8 (6.5)
Acute Care Beds	
Large (>200)	9 (7.3)
Medium (101–200)	30 (24.2)
Small (1–100)	69 (55.6)
None	16 (12.9)
Long-Term Care Beds	
Large (>100)	33 (26.6)
Medium (26–100)	51 (41.1)
Small (1–25)	12 (9.7)
None	28 (22.6)
Number of Unique Veterans Seen Annually (Median, IQR)	44,682 (28,633–69,171)
Number of Direct Care Staff (Median, IQR)	1,261 (719–2,127)
Staff to Patient Ratio (per 100 patients, Median, IQR)	2.7 (2.0–3.8)
≤2.0 (per 100 patients)	30 (24.2)
>2.0–2.7	31 (25)
>2.7–3.8	31 (25)
>3.8	32 (25.8)
Facility Size by the number of direct care staff	
Large (≥2,000)	34 (27.4)
Medium (1,000–1,999)	40 (32.3)
Small (<1000)	50 (40.3)
Facility Complexity ^a	
Level 1a (most complex)	35 (28.2)
1b	23 (18.6)
1c	22 (17.7)
2	17 (13.7)
3 (least complex)	27 (21.8)
Ceiling Lift Coverage (Median, IQR) ^b	90 (80–99)
High (>94%)	52 (41.9)
Medium (80–94%)	44 (35.5)
Low (1–79%)	22 (17.7)
None	6 (4.8)

^a The facility level of complexity determines the VHA facility's classification based on the types of care and surgeries provided, teaching and research capabilities, and the volume of patients seen.

^b Ceiling lift coverage was reported by facility representatives as the proportion of identified patient care areas equipped with ceiling lifts.

where program managers collaborated with the Safety Office showed a higher median PHI rate of 4.08 per 1000 direct care staff compared to facilities that did not (median PHI rate 2.92). Similarly, facilities where program managers collaborated with the Patient Safety Office showed a higher median PHI rate of 3.95 per 1000 direct care staff compared to facilities that did not (median PHI rate was 2.19).

Table 4 shows negative binomial analysis models that examined the association between SPHMCI and PHI rates, by adding facility characteristics hierarchically. In Model 1, without covariate adjustment, SPHMCI was not significantly associated with PHI rate ($\beta = 0.029$, 95% CI: -0.007 , 0.067). However, in Model 2 adding the staff-to-patient ratio, SPHMCI had a significant positive association with the PHI rate ($\beta = 0.037$, 95% CI: 0.001 , 0.074). In Models 3 adding ceiling lift coverage and Model 4 further adding facility type, facility size, acute care beds, long-term care beds, and facility complexity, the significant association between SPHMCI and PHI rate did not remain.

Among facility characteristics, the staff-to-patient ratio consistently showed a significant negative association with PHI rates across all models (Model 2: $\beta = -0.003$, 95% CI: -0.004 , -0.002 ; Model 3: $\beta = -0.003$, 95% CI: -0.004 , -0.001 ; Model 4: $\beta = -0.002$, 95% CI: -0.003 , -0.001). In Model 3, the ceiling lift coverage showed a significant positive association with the PHI rate ($\beta = 0.006$, 95% CI: 0.001 , 0.012), but the significance did not remain in Model 4 adding other facility characteristics. In Model 4, facility type and size showed significant

Table 2

Patient Handling Injury (PHI) Incidence and Safe Patient Handling and Mobility Compliance Index (SPHMCI) by Facility Characteristics.

Variable	N	PHI rate (per 1000 direct care staff) Median (IQR)	P	SPHMCI ^c Median (IQR)	P
	124	3.9 (2, 6.6)		31 (28, 32)	
Facility Type			0.07		0.03
Both Acute and Long-Term Care	88	4.11 (2.67, 6.94)		31.0 (28.5, 33)	
Mainly Acute Care	20	3.86 (1.75, 6.05)		29.5 (27.0, 32)	
Mainly Long-Term Care	8	3.27 (1.85, 13.15)		31.0 (28.5, 32)	
Ambulatory Care Only	8	0.65 (0.0, 3.63)		28.0 (21.5, 30)	
Acute Care Beds			0.37		0.19
Large (>200)	9	4.7 (4, 5.7)		29 (26, 33)	
Medium (101–200)	30	3.8 (3, 6.9)		31 (28, 32)	
Small (1–100)	69	4.1 (2.1, 7)		31 (28, 33)	
None	16	2.5 (0, 4.4)		29.5 (24.5, 31)	
Long-Term Care Beds			0.19		0.06
Large (>100)	33	4.3 (2.7, 6.9)		32 (30, 33)	
Medium (26–100)	51	4.4 (2.7, 7.3)		31 (28, 33)	
Small (1–25)	12	3 (1.8, 5.2)		31 (29, 32)	
None	28	3 (0.5, 4.8)		29 (25.5, 31)	
Staff to Patient Ratio ^a			0.49		0.12
≤2.0	30	3.2 (1.3, 7.7)		29.5 (27, 31)	
>2.0–2.7	31	4.1 (1.9, 7.3)		31 (27, 32)	
>2.7–3.8	31	4.7 (2.7, 6.7)		32 (28, 33)	
>3.8	32	3.5 (1.8, 5.4)		31 (28, 32.5)	
Facility Size by the number of direct care staff			0.65		0.34
Large (≥2,000)	34	4.0 (2.7, 6.0)		31 (27, 32)	
Medium (1,000–1,999)	40	3.6 (2.1, 5.7)		31 (28, 33)	
Small (<1000)	50	4.2 (1.3, 10.4)		31 (27, 32)	
Facility Complexity			0.06		0.65
Level 1a (most complex)	35	4.7 (3.2, 7.4)		31 (28, 33)	
1b	23	2.9 (1.3, 4.1)		30 (28, 32)	
1c	22	4.2 (2.9, 6.6)		31 (28, 33)	
2	17	4.3 (2.7, 7)		31 (29, 32)	
3 (least complex)	27	2.9 (0, 10.7)		31 (27, 32)	
Ceiling Lift Coverage ^b			0.21		<.01
High (>94%)	52	4.3 (3.1, 6.8)		31 (29, 33)	
Medium (80–94%)	44	3.4 (2.2, 5.9)		31 (28, 32)	
Low (1–79%)	22	4.1 (1.2, 7.8)		30 (24, 32)	
None	6	2.1 (0.6, 3.7)		27 (21, 29)	

Differences among groups for PHI rate, and SPHMCI were analyzed using the Kruskal-Wallis test.

^a Staff to Patient Ratio is calculated as the number of direct care personnel by 1000 unique veterans.

^b Percentage of available ceiling lift refers to the proportion of available ceiling lifts in patient care areas.

^c SPHM Compliance Index ranges from 0 to 34.

associations with PHI rates. Facilities with ambulatory care services only had lower PHI rates compared to facilities with mainly long-term care services ($\beta = -1.114$, 95% CI: $-2.037, -0.190$). The medium-sized facilities ($\beta = -0.517$, 95% CI: $-0.889, -0.146$) and large-sized facilities ($\beta = -0.543$, 95% CI: $-0.908, -0.177$) had lower PHI rates compared to small-sized facilities.

4. Discussion

The study examined the association between SPHM program compliance and the PHI rates among direct care staff in VHA facilities. This study found a significant association between SPHMC and PHI rates in the model accounting for staffing ratios, but their significant association did not remain in other models adding other facility characteristics. On the other hand, staffing ratio appeared to play a consistent role, with better staffing (i.e., a higher number of staff-per patient) associated with reduced PHI rates. Moreover, facility type, facility size, and ceiling lift coverage showed significant associations with PHI rates.

4.1. Mixed relationship between SPHM programs and PHI rates

Previous studies on the relationship between SPHM programs and PHI rates among health care staff suggested either a reduction in PHI rates or no significant effect (Lee et al., 2022; Powell-Cope & Rugs, 2015; Teeple et al., 2017; Wåhlin et al., 2022). A potential reason for the inconsistent findings in previous research may, in part, due to differences in study approach across studies. Unlike prior studies, which focused on assessing the existence of SPHM programs in an organization, this study focused on examining the organizations program compliance which emphasizes the quality and extent of program implementation. Additionally, examining the effect of the program compliance by incorporating specific components offers a more nuanced understanding of the SPHM program's potential impact. By utilizing a compliance index, this study quantitatively assessed compliance with VHA SPHM program performance criteria. To our knowledge, indices have only been previously employed by Restrepo et al. (2013) in the evaluation of SPHM programs in nursing home settings. In contrast to the index developed by Restrepo et al. (2013), this study's SPHMC incorporated a broader range of facility types beyond long-term care, included additional interdisciplinary components such as collaboration with the Safety and Patient Safety Offices, and provided greater authority to program managers in investigating injuries, a mandate not present in Restrepo et al.'s framework. Although the SPHMC was developed based on the VHA's internal performance criteria, several components remain applicable in non-VHA settings. For example, components such as the appointment of a program manager, the establishment of oversight committees, regular ergonomic assessments, and ongoing staff training can be adapted and implemented across various healthcare environments.

This study found a positive association between SPHM program compliance and PHI when staffing ratio was adjusted for. The relationship indicating that higher SPHM program compliance is associated with higher PHI rates was the opposite of the expected direction. This finding may not necessarily imply that higher SPHM program compliance contributes to more injuries, but other explanations may exist. One possible explanation for the positive relationship may be due to the increase in PHI identification associated with collaboration with the staff safety and patient safety offices. The VHA SPHM program mandates program managers to work closely with the Safety Office, responsible for monitoring overall staff safety, ensuring a collaborative active

Table 3

Patient Handling Injury Rate by Safe Patient Handling Program and Mobility (SPHM) Compliance Performance Criteria in Veterans Health Care Administration Facilities (n = 124).

SPHM Performance Criteria	Patient Handling Injury Rate (per 1000 direct care staff)				
	Met Performance Criteria		In progress or did not meet Performance Criteria		P
	N (%)	Median (IQR)	N (%)	Median (IQR)	
The Medical Center has a written policy for Safe Patient Handling and Mobility (SPHM) based on Directive 1611.	113 (91.1)	3.9 (2.1, 6.7)	11 (8.9)	3.7 (0, 6.3)	0.47
The Medical Center Director has appointed a VHA SPHM program manager.	118 (95.2)	3.9 (2.1, 6.9)	6 (4.8)	2.4 (0, 4.1)	0.17
The appointed VHA SPHM program manager is (or will be) equivalent to one full-time assignment.	108 (87.1)	4.0 (2.1, 7.0)	16 (12.9)	3.6 (0.4, 4.8)	0.16
Does the SPHM PM have enough training and experience to manage the program effectively? ^a	86 (79.6)	4.0 (2.7, 6.6)	22 (20.4)	3.8 (1.6, 7.8)	0.65
A Medical Center Committee oversees SPHM activities, reviews injuries, and evaluates equipment and supplies.	119 (96.0)	4.1 (2.1, 6.9)	5 (4.03)	1.6 (1.3, 3.1)	0.06
The Safety Officer/Manager ensures safety investigations of employee injuries are conducted with the SPHM PM.	111 (89.5)	4.1 (2.1, 7.1)	13 (10.5)	2.9 (1.5, 3.7)	0.04
Patient Safety and Quality work with the SPHM PM to report outcomes and investigate incidents related to patient handling. ^a	78 (78.8)	3.9 (1.9, 6.6)	21 (21.2)	2.2 (0.8, 3.7)	0.02
Ergonomic assessments are conducted in all areas where patient handling and mobilization occur to identify and address hazards.	79 (63.7)	3.7 (1.5, 6.3)	45 (36.3)	4.3 (2.4, 7.4)	0.29
Ergonomic assessments are updated periodically using various methods, including CEOC rounds and discussions with staff.	119 (96.0)	4.0 (2.1, 6.9)	5 (4.0)	2.7 (1.3, 3.9)	0.24
High-risk tasks are addressed by ergonomic assessments, including lifting, repositioning, and handling patients.	110 (88.7)	4.0 (2.1, 6.9)	14 (11.3)	3.4 (1.5, 4.4)	0.36
SPHM technology is available in sufficient quantity and convenient locations.	83 (66.9)	3.87 (1.3, 6.9)	41 (33.1)	4.1 (2.4, 5.9)	0.58
Engineers collaborate with the PM on construction projects.	85 (68.6)	4.1 (2.2, 6.7)	39 (31.5)	3.5 (1.5, 5.9)	0.33
Patients are screened for SPHM technology needs across all care settings.	75 (60.5)	4.1 (2.1, 7)	49 (39.5)	3.7 (1.9, 5.8)	0.35
The SPHM Program includes Peer Leaders on all shifts to train and assist staff.	67 (54.0)	3.7 (2.1, 6.9)	57 (45.9)	3.9 (1.9, 6.3)	0.92

(continued on next page)

Table 3 (continued)

SPHM Performance Criteria	Patient Handling Injury Rate (per 1000 direct care staff)				P
	Met Performance Criteria		In progress or did not meet Performance Criteria		
	N (%)	Median (IQR)	N (%)	Median (IQR)	
SPHM UPL training is offered at least yearly.	102 (82.3)	4.2 (2.2, 7.0)	22 (17.7)	2.7 (1.6, 4.1)	0.07
New Employee Orientation includes training on SPHM technology and reporting injuries.	109 (87.9)	3.9 (1.9, 6.7)	15 (12.1)	4.3 (2.4, 5.9)	0.95
Employees have ongoing training and competency evaluations.	97 (78.2)	4.1 (2.1, 7.0)	27 (21.8)	3.7 (1.6, 5.6)	0.41

Differences among groups that “met performance criteria” and “did not fully meet performance criteria” were analyzed using the Mann-Whitney *U* test.

^a The sample size does not add up to 124 due to missing answers.

surveillance process through collecting and investigating injury data. The Patient Safety Office investigates patient safety issues, such as falls and pressure ulcers. Collaboration between the Patient Safety Office and the program manager in monitoring reported patient safety incidents can increase the likelihood of identifying unreported staff injuries and prompting further investigation. Additionally, the SPHM program manager determines whether an injury qualifies as a PHI, ensuring uniform classification. The connection between patient safety and staff safety stems from previous studies wherein staff assisting with patient falls and pressure ulcers increases the risk of staff injury, including PHI (Chavez et al., 2023; Taylor et al., 2012). While some SPHM programs may lack clear guidelines for PHI reporting and investigation, the VHA SPHM program mandates that program managers investigate and collect data about PHI, ensuring active surveillance. Macaluso et al. (2018) and Mullins-Jaime and Smith (2023) showed that safety professional engagement through active data collection improved injury identification.

A second possible explanation for the positive relationship could be reverse causation in this cross-sectional study (Besser et al., 2021). VHA facilities may have addressed high PHI rates by improving SPHM program compliance rather than the SPHM program compliance influencing the PHI rate. The findings of this study may align with the theoretical relationship highlighted in Beus et al.'s (2010) meta-analysis of 53 studies, which found that the effect of occupational injuries on organizational safety was stronger than the influence of organizational safety on injuries. These findings suggest that organizations may actively reshape their safety climate in response to injury occurrences. Future research is needed to validate our study findings that indicate the possible function of high injury rates among staff in improving SPHM program compliance.

4.2. Several facility characteristics were significant factors on PHI rate

In this study, several facility characteristics emerged as significant factors for PHI rate while SPHMCI became insignificant in the models adding those facility characteristics. Most importantly and consistently in all models, the staff-to-patient ratio showed a negative association with the PHI rate, indicating that better staffing is associated with lower PHI rates. This finding is consistent with other studies that attributed a decrease in worker injuries to adequate staffing (Rosebush et al., 2021; Leigh et al., 2015; Trinkoff et al., 2005). Adequate staffing is imperative to prevent injuries by distributing the workload more effectively, minimizing individual strain, and promoting faster recovery (Leigh et al., 2015; Trinkoff et al., 2005). Improving the staffing ratio among health care personnel would be important in reducing patient handling

Table 4

Relationship between Safe Patient Handling and Mobility Compliance Index (SPHMCI) and Patient Handling Injury Rate in Veterans Health Care Administration Facilities (N = 124): Negative Binomial Analysis Models.

Variable	Model 1 β (95% CI)	Model 2 β (95% CI)	Model 3 β (95% CI)	Model 4 β (95% CI)
SPHM Compliance Index	0.029 (−0.007, 0.067)	0.037 (0.001 , 0.074)	0.017 (−0.025, 0.059)	0.014 (−0.241, 0.053)
Staff to Patient Ratio (per 100 patients)		−0.003 (−0.005, −0.001)	−0.003 (−0.004, −0.001)	−0.002 (−0.003, −0.001)
Ceiling Lift Coverage			0.006 (0.001 , 0.012)	0.005 (−0.001, 0.011)
Facility Type (Ref: Mainly Long-Term Care)				
Both Acute and Long-Term				0.027 (−0.703, 0.756)
Acute Care Only				−0.151 (−0.961, 0.659)
Ambulatory Care Only				−1.114 (−2.037, −0.190)
Facility Size by the number of direct care staff (Ref. Small < 1000)				
Large (≥2000)				−0.517 (−1.031, −0.003)
Medium (1000–1999)				−0.543 (−0.908, −0.177)
Facility Complexity (ref. 3- least complex)				
1a (most complex)				0.260 (−0.389, 0.910)
1b				−0.204 (−0.790, 0.383)
1c				−0.188 (−0.807, 0.430)
2				0.039 (−0.534, 0.612)
Bayesian Information Criterion (BIC)	774.7	733.6	755.8	779.4

injuries.

Use of mechanical lift equipment is a key component of an SPHM program and, particularly, ceiling lifts have shown greater effectiveness than floor lifts (Lee & Rempel, 2020; Teeple et al., 2017; Wåhlin et al., 2022). Unexpectedly, this study found that higher ceiling lift coverage in patient care areas was associated with higher PHI rates. The first possible explanation is that despite having an adequate ceiling lift coverage, it does not constitute actual usage by staff and, therefore, may not have been linked to a reduction of PHI rates. Indeed, previous studies highlighted that the mere availability of ceiling lifts does not lead to a reduction of injuries but requires organizational integration through improvements in perceptions toward lifts, daily work operations, and leadership support (Khairallah et al., 2024; Lee & Lee, 2017; Schoenfisch et al., 2011). Future research should not only examine the availability of ceiling lifts but also investigate utilization and other institutional factors, such as staff perceptions toward the lifts and their integration with daily practices. The second possible explanation for the relationship is the possibility of reverse causation, wherein facilities with higher PHI

rates have installed more ceiling lifts. Future research is needed to validate the relationship between injury rates and ceiling lift coverage across patient care areas.

This study found that PHI rates significantly differed by facility type. VHA facilities with only ambulatory services had lower PHI rates compared to facilities with mainly long-term care services. Additionally, facilities with ambulatory care services only had the lowest SPHMC I compared to other facility settings, such as acute and/or long-term care facilities. Ambulatory services facility type requires less frequent patient handling, as most patients are mobile and less dependent on staff assistance, and therefore, ambulatory settings may have reduced exposure to injury risks compared to inpatient settings. The findings are consistent with Rosebush et al. (2022), who found that outpatient services had the lowest PHI rate compared to acute care and long-term facilities following the implementation of statewide SPHM legislation. Therefore, ambulatory care service facilities may have focused less on ensuring SPHM compliance than inpatient service facilities.

Last, our findings suggest that small facilities (less than 1000 direct care staff) have increased risks of PHIs compared to larger facilities. Small facilities are often constrained by limited equipment, training, and a smaller workforce, and may expose their employees to greater injury risks. In contrast, larger facilities may have more consistent oversight and more injury prevention measures. Organizational leaders should prioritize small-sized facility in their efforts to reduce PHI.

4.3. Strengths and limitations

Strengths were identified in the present study. One strength was the mandatory nature of the SPHM program survey in VHA facilities, which allowed more available data for analysis and flexibility for the removal of unusable data during cleaning while still retaining enough VHA facilities for analysis. Another strength was the sample, which included facilities across the United States with varying levels of complexity and facility characteristics, providing a broad perspective on the VHA health care system. VHA facilities operate under a unified directive, using the same SPHM program performance criteria. This standardization resulted in a consistent method to measure PHI injuries across facilities, minimizing variations.

There are several limitations of the present study. First, this study using cross-sectional design allowed for identifying associations between SPHM program compliance and PHI rates but does not establish the causal relationship. As a result, some of the observed relationships may be explained by reverse causation, as discussed above. Future research should address this limitation by employing longitudinal studies that can establish the causal relationship between SPHM program compliance and PHI rates.

Second, facility program managers completed the survey as the representative of each VHA facility, which may have introduced response bias. Since the survey assesses SPHM program performance, program managers may have provided biased responses to present a higher level of compliance of their facility. To reduce the risk of response bias, future studies should measure program compliance using objective indicators such as training attendance records, lift equipment usage logs, unit champion meeting documentation, SPHM policy audit checklists, injury investigation reports, records of staff competency evaluations related to safe patient handling, and standardized methods of determining a unit's ceiling lift need. Additionally, relying on a single representative for the survey data collection may not accurately capture individual direct care staff's compliance with the SPHM program as facility-level data do not reflect SPHM behaviors of direct-care staff. Future studies should include compliance surveys designed for front-line staff to capture their compliance with the SPHM program requirements for individual staff.

Third, this study had the lack of specificity in the PHI variable, ceiling lift coverage, direct staff department data, and SPHM training modality. The available survey data provided only PHI incidence and

did not capture injury characteristics such as severity or identify clinical areas where injuries occurred (e.g., medical-surgical floor, intensive care units, operating room). The ceiling lift coverage indicates availability rather than actual usage. The direct care staff data lacks specificity regarding departmental assignment, job roles, full-time versus part-time status, and the nature of their patient handling responsibilities. Additionally, the lack of specificity in direct care staff data further limited the accuracy of the staff-to-patient ratio, as staffing was aggregated across all direct care professions rather than analyzed by specific occupational groups. Moreover, staff-to-patient ratios requirements vary across facilities, the current data do not indicate whether applicable ratios were met. The VHA SPHM guidebook outlines various SPHM training (e.g., simulation, group discussion, online modules, and return demonstration). Hence, this study only assessed whether SPHM training occurred and did not analyze the specific training modality each facility utilized. Future studies should consider collecting more granular data on injury information, equipment use, staffing composition (e.g. staff to patient ratio, direct care staff characteristics), and training modalities to better evaluate their influence on PHI outcomes.

5. Conclusions

The study found a positive association between SPHM program compliance and the PHI rates among direct care staff after adjusting for staffing. However, mixed results in different models indicate the complexity of the relationship and the need for further investigation. The observed positive association between SPHM program compliance and PHI rate may indicate that experiencing higher PHI rates prompts the facilities to enhance their compliance with SPHM program criteria. The SPHM program managers, who actively conduct investigations and collaborate with various interdisciplinary organizational teams, contribute to increased identification of PHI cases. Organizations should continue to support and strengthen the role of SPHM program managers in the active surveillance of PHI cases.

The study finding highlights the importance of adequate staffing levels in reducing PHI rates and improving workplace safety. This study also highlights elevated PHI risks in certain facility types, particularly inpatient facilities where patient handling demands are higher. Facility size must be balanced with adequate staffing and resources to ensure the integrity of SPHM program implementation. Leadership should focus on PHI reduction in smaller facilities due to their limited staffing and resources. Moreover, health care organizations should be aware that providing ceiling lifts is not enough to prevent PHI, and SPHM programs must also promote their consistent and proper use among direct care staff. Lastly, this study identified facility characteristics that may influence PHIs, providing valuable evidence for policymakers, researchers, and program managers to consider when addressing factors that impact PHI rates. This study addresses broader organizational challenges in SPHM program implementation. Future studies should investigate other unexplored variables that may play a role in the nuanced relationship between SPHM compliance and PHI rates.

CRedit authorship contribution statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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