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Received: 13 May 2021 | Revised: 29 October 2021 | Accepted: 1 November 2021

DOI: 10.1002/ajim.23312

RESEARCH ARTICLE

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE WILEY

Differential effectiveness of the Minnesota Safe Patient Handling Act by health care setting: An exploratory study

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Funding information

Midwest Center for Occupational Health and Safety, Grant/Award Number: T42OH008434

Abstract

Background: The Minnesota Safe Patient Handling (MN SPH) Act requires health care facilities to implement comprehensive programs to protect their workers from musculoskeletal injuries caused by lifting and transferring patients. Nursing homes, hospitals, and outpatient facilities each face unique challenges implementing and maintaining SPH programs. The objective of the study was to compare patient handling injuries in these three health care settings and determine whether change in injury rate over time differed by setting following enactment of the law.

Methods: Workers' compensation data from a Minnesota-based insurer were used to describe worker and claim characteristics in nursing homes, hospitals, and outpatient facilities. Negative binomial models were used to compare claims and estimate mean annual patient handling claim rates by health care setting and time period following enactment of the law.

Results: Consistent with national data, the patient handling claim rate was highest in Minnesota nursing homes (168 claims/$100 million payroll [95% confidence interval: 163–174]) followed by hospitals (35/$100 million payroll [34–37]) and outpatient facilities (2/$100 million payroll [1.8–2.2]). Patient handling claims declined by 38% over 10 years following enactment of the law (vs. 27% for all other claims). The change in claims over time did not differ by health care setting.

Conclusions: In this single-insurer sample, declines in workers' compensation claims for patient handling injuries were consistent across health care settings following enactment of a state SPH law. Though nursing homes experienced elevated claim rates overall, results suggest they are not lagging hospitals and outpatient facilities in reducing patient handling injuries.

KEYWORDS

health care workers, injury compensation, musculoskeletal, occupational injury

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1 | INTRODUCTION

The health care sector employs 12% of the US workforce, totaling 16.9 million workers in 2018.[1] While health care workers are exposed to a variety of hazards, those in direct patient care roles are particularly vulnerable to musculoskeletal injuries due to frequent lifting, transferring, and repositioning of patients. Manual patient handling techniques are also linked to adverse outcomes for patients, including falls and skin tears.[2] In response, several states have passed legislation aimed at reducing patient handling hazards and subsequent injuries to workers and patients.[3,4]

The 2007 Minnesota Safe Patient Handling (MN SPH) Act requires each health care facility to adopt an SPH program that establishes a plan to minimize manual lifting of patients by direct care workers. Programs must include assessment of hazards, acquisition of assistive equipment (e.g., overhead and sit-to-stand lifts), ongoing staff training, procedures to ensure that construction is consistent with safe patient handling, and an evaluation plan. Further, each facility must establish a safe patient handling committee comprised of at least 1/2 direct care staff. [5] To date, 12 states have enacted an SPH law or ordinance, most requiring SPH program implementation in hospitals.[6] Minnesota is one of only six states to require participation of nursing homes and one of only three to require participation of outpatient facilities.[3,6]

Historically, rates of recordable injuries and illnesses in Minnesota health care facilities have exceeded national averages. Between 2007 and 2019, injury and illness rates in privately-owned Minnesota hospitals declined from 9.0/100 full-time equivalent workers (FTE) (vs. 7.7/100 US average) to 5.9/100 (vs. 5.5/100 US average).[7] However, the 2019 injury and illness rate remained elevated in Minnesota nursing homes (7.6/100 vs. 6.0/100 US average). Injury and illness rates in outpatient facilities are notably lower (2.9/100 in Minnesota vs. 3.9/100 US average in 2019).

Differences in injury and illness rates may be due, in part, to differential exposures to patient handling hazards.[8] However, worker demographics also vary by health care setting. In nursing homes, 84% of workers are women, 36% are nursing/medical assistants or personal care aides, 28% are Black or African American, 11% are Hispanic or Latinx, and 5% are Asian. Only 8% of hospital workers and 7% of outpatient workers are nursing/medical assistants or aides. Further, Black or African American workers comprise only 16% of the hospital workforce and 14% of the outpatient workforce.[9,10] Nursing home workers receive low wages, few benefits, and experience low professional prestige.[11] Data describing worker and injury characteristics (e.g., patient handling relatedness) by health care setting are needed to explore potential disparities in injuries among vulnerable direct care workers.

Published evaluations of patient handling laws do not compare their effectiveness by health care setting. In 2006, the state of Washington passed a safe patient handling law that targeted hospitals. In 3 years following enactment of the law, hospitals experienced favorable declines in workers' compensation claims compared to nursing homes (nursing homes were not subject to the law).[12,13] In a pre-post California study, hospital RNs experienced declines in self-reported musculoskeletal symptoms but no change in injury incidence in 4 years following enactment of the 2012 Hospital Patient and Health Care Worker Injury Protection Act.[14,15] In Minnesota nursing homes, we found a 38% reduction in lost time workers' compensation claims for injuries related to patient handling (vs. a 20% reduction in claims for all other injuries and illnesses) following enactment of the 2007 MN SPH Act.[16]

To our knowledge, no study has compared worker and patient handling injury characteristics or evaluated time trends in patient handling injuries by health care setting among facilities required to comply with a state SPH law. Additionally, the duration of existing evaluations may be inadequate to capture the full impacts of the laws because facilities are often given several years to establish their SPH programs and come into compliance.[5,13] Health care setting determines occupational hazards and culture of safety, and, therefore, may be an important predictor of SPH program success. For example, nursing homes have frail resident populations requiring frequent lifts and transfers, high managerial and staff turnover, and challenging physical environments (e.g., small, cluttered spaces).[17] Well-designed, longitudinal studies describing worker injuries by health care setting are needed to target outreach and support in states with safe patient handling laws.

In this study, we use data from a single large workers' compensation provider to describe claim and worker characteristics by health care setting (nursing homes vs. hospitals vs. outpatient facilities). As an initial exploration into differential effectiveness of the MN SPH Act, we compare trends in patient handling injury claims over time by health care setting before and after enactment of the MN SPH Act. We anticipate that, consistent with national data, patient handling claim rates will be highest in nursing homes and lowest in outpatient facilities and that the change in claim rate following enactment of the law will be smaller in nursing homes compared to other health care settings.

2 | METHODS

2.1 | Study population

We used workers' compensation claims data from a large private workers' compensation provider based in Minnesota. All claims from January 1, 2005 through December 31, 2017 were extracted for Minnesota Classification Index (MCI) codes 8833 and 9040 (hospitals), 8829 and 8830 (nursing homes), and 8832 (outpatient facilities). Class codes were grouped by facility type, and each unique combination of employer, facility type, and class code comprised a "facility" for analysis. Employers enrolled with the provider could contribute data for multiple facility types (e.g., hospitals and nursing homes) and multiple class codes for each facility type (e.g., 8833 and 9040 for hospitals).

Consistent with our previous research, time periods were categorized as follows: pre-law (2005–2007), implementation

(2008–2010), 4–6 years post-implementation (2011–2013), and 7–10 years post-implementation (2014–2017).[16] Time periods were selected to reflect the roll out of the MN SPH Act, which required facilities to establish a written program and SPH committee by July 2008 and meet program requirements (e.g., complete patient handling hazard assessment, acquire an adequate supply of equipment, track and analyze injuries) by January 2011.[5] Facilities were included in the sample for all years they were enrolled with the insurer. The study was determined to be exempt from review by the University of Minnesota Institutional Review Board as research involving the study of existing data recorded in a manner that subjects cannot be identified.

2.2 | Workers' compensation data

Each workers' compensation claim included occupation, injury date, claim type (lost time [>3 days away from work] or medical only), text description of injury, and Workers' Compensation Insurance Organization (WCIO) codes for body part injured, injury cause, and nature.[18] WCIO codes were assigned by the insurer based on the first report of injury submitted by the employer.

Patient handling injuries were identified using a list of activities developed by the Minnesota Department of Labor and Industry (Table S1). Two authors manually reviewed text descriptions to characterize patient handling relatedness. Common patient handling tasks included transferring patient to bed, wheelchair, or commode; repositioning or moving patient in bed; bathing, diapering, or dressing patient; fall prevention or recovery; and positioning patient for treatment (e.g., X-ray or catheter). Cumulative musculoskeletal injuries (e.g., injuries attributed to "lifting patients all day") were also included. Injuries resulting from general patient contact (e.g., patient walked worker into door); patient violence unrelated to lifting, transferring, or repositioning; and contact with patient handling equipment when no patient was present were excluded. For claims that were unclear, patient handling relatedness was determined by discussion and consensus between the two coders.

2.3 | Data analysis

We calculated claim counts and rates for patient handling claims and non-patient handling claims (i.e., all injuries and illnesses that were not identified as patient handling injuries in our manual review) separately by health care setting. Rates were calculated using claim count as the numerator and payroll as the denominator. Payroll was selected as the denominator because annual number of workers was not available in the data set. Caution is needed interpreting rates because payroll is dependent on both number of workers and wages.

To account for inflation, we adjusted payroll to 2017 dollars using an estimate of 2% growth per year. Claim counts and rates were then stratified by claim type. Claim rates of ≥10,000 claims per $100 million payroll were excluded from descriptive and multivariable analyses as they were determined to reflect likely reporting errors. This resulted in the exclusion of rates for 15 facility years. We described claimant and injury characteristics for patient handling and non-patient handling claims by health care setting. Claimant characteristics included age, gender, and occupation. Claim characteristics included body part injured, injury cause, and nature as specified in WCIO codes.

We regressed injury claim counts on predictors using mixed effects negative binomial regression with annual payroll as the offset and employer and facility as random effects. Facility was nested within employer. We created separate models for patient handling claims and non-patient handling claims. The predictors were time period and health care setting. We assessed the interaction between time period and health care setting to determine whether the impact of time on claim rate differed between hospitals, nursing homes, and clinics. Stata 15.1 was used for all analyses.

3 | RESULTS

3.1 | Descriptive results

Between 2005 and 2017, 1980 Minnesota facilities were enrolled with the insurer (Table 1). On average, facilities were enrolled for 7.3 years (SD: 3.8, range: 1–13). Thirty-five percent of facilities (n = 695) reported one or more claims to the insurer during the study period.

3.1.1 | Claim characteristics by health care setting

Over the study period, Minnesota workers filed 19,501 claims, including 5547 claims related to patient handling injuries and 13,954 related to other injuries and illnesses (i.e., non-patient handling injuries) (Table 1). Patient handling injuries comprised 45% of claims in nursing homes, 27% in hospitals, and 5% in outpatient facilities. The overall claim rates for 2005–2017 were 26/$100 million payroll (95% CI: 26–27) for patient handling injuries and 66/$100 million payroll (95% CI: 65–67) for non-patient handling injuries. Nursing homes had the highest claim rates for patient handling injuries (168/$100 million payroll) and non-patient handling injuries (209/$100 million payroll). However, median claim cost was highest in hospitals for both patient handling injuries ($724, interquartile range [IQR]: $272–2215) and non-patient handling injuries ($451, IQR: $125–1179). Claim cost reflects both injury duration and worker wage.

3.1.2 | Worker characteristics by health care setting

Across settings, workers with patient handling injuries were younger (26% of claimants <25 years of age) than those with non-patient handling injuries (11% <25 years of age) (Table 2). Nursing homes had the highest proportion of claims filed by workers in the youngest age group for patient handling injuries (31%) and non-patient handling

TABLE 1 Workers' compensation claims for patient handling and non-patient handling injuries by health care setting, Minnesota, 2005–2017

	Outpatient (*N* = 1299 facilities)	Hospital (*N* = 425 facilities)	Nursing home (*N* = 256 facilities)	Total (*N* = 1980 facilities)
Payroll, million $[a]	13,128	6133	1867	21,128
Patient handling claims				
Claim count, total	261	2142	3144	5547
Claim rate, total (95% CI)[b]	2.0 (1.8–2.2)	35 (34–37)	168 (163–174)	26 (26–27)
Annual claim count per facility, mean (SD)	0.04 (0.30)	1.4 (6.9)	2.8 (8.2)	0.60 (4.1)
Annual claim rate per facility, mean (SD)[b]	2.0 (42)	44 (235)	120 (298)	23 (151)
Cost total ($)	1,530,362	14,036,281	15,480,650	31,047,393
Claim cost ($), median (IQR)	489 (129–1837)	724 (272–2215)	594 (212–1608)	639 (227–1828)
Claim cost ($), 95th pct	16,217	29,965	21,500	23,394
Non-patient handling claims				
Claim count, total	4397	5653	3904	13,954
Claim rate, total (95% CI)[b]	33 (33–34)	92 (90–94)	209 (202–216)	66 (65–67)
Annual claim count per facility, mean (SD)	0.67 (3.3)	3.7 (12.4)	3.4 (8.9)	0.72 (2.9)
Annual claim rate per facility, mean (SD)[b]	30 (158)	145 (390)	223 (543)	73 (289)
Cost total ($)	14,563,926	27,033,076	14,857,973	56,454,975
Claim cost ($), median (IQR)	312 (79–958)	451 (125–1179)	344 (117–1000)	368 (107–1039)
Claim cost ($), 95th pct	11,129	17,314	14,908	14,702

Abbreviations: CI, confidence interval; IQR, interquartile range; pct, percentile.

[a]Adjusted for 2% annual inflation.

[b]Claim rate per $100 million payroll.

injuries (18%). Ninety-one percent of claims for patient handling injuries and 84% of claims for non-patient handling injuries were filed by women.

Focusing on patient handling injuries, 84% of nursing home claims were filed by nursing, medical, or care aides compared to 49% of hospital claims and 15% of outpatient claims. Many patient handling injury claims in hospitals and outpatient facilities were filed by registered or licensed practical nurses (36% and 28%, respectively). Additionally, a high proportion of claims in outpatient settings were filed by other care workers (23%), including clinic assistants, surgical technicians, and sonographers.

For non-patient handling injuries, the distribution of claims was strikingly different with greater representation across occupations. While most nursing home claims were filed by nursing, medical or care aides (38%), nurses (17%), food services workers (15%), and housekeeping (12%) were also represented. In hospitals, claims were filed by workers in nursing (24%), aide (13%), other care (15%), and housekeeping (14%) roles. Outpatient claims included administrative workers (21%), professional providers (18%), nurses (13%), aides (9%), and other care workers (16%).

3.1.3 | Injury characteristics by health care setting

Twenty-three percent of patient handling claims compensated lost time and 77% compensated only medical costs. Hospitals had the highest proportion of lost time claims for patient handling injuries (24%) and outpatient facilities had the lowest (16%). Across settings, the most common patient handling injury causes were lifting, handling, or carrying (48%); patient or coworker (18%); strain or injury by a source not otherwise classifiable (17%); and push, pull, twist, or reach (14%) (Table 3). The most common nature of injury was sprain or strain (90%) followed by contusion or inflammation (7%). Injuries to the back (48%) were the most common, followed by injuries to the upper extremity (14%) and shoulder (11%). Little variation was seen by health care setting for injury cause, nature, or body part injured.

For non-patient handling claims, 12% compensated lost time and 88% were medical-only claims. Lost time claims comprised 14% of hospital claims, 13% of nursing home claims, and 9% of outpatient claims. Across settings, the leading injury causes were slip, trip, or fall (21%); lifting, handling, or carrying (13%); and exposure (e.g., ingestion or inhalation, chemicals, heat) (11%). The leading injury nature

TABLE 2 Worker characteristics by health care setting for patient handling and non-patient handling workers' compensation claims, Minnesota, 2005–2017

	Outpatient	Hospital	Nursing homes	Total
Patient handling claims				
Claims	*N* = 261	*N* = 2142	*N* = 3144	*N* = 5547
Age (years)				
<25	23 (9%)	430 (21%)	971 (31%)	1424 (26%)
25–<35	71 (27%)	607 (28%)	852 (27%)	1530 (28%)
35–<45	69 (26%)	424 (20%)	571 (18%)	1064 (19%)
45–<55	57 (22%)	441 (21%)	485 (15%)	983 (18%)
≥55	41 (16%)	236 (11%)	253 (8%)	530 (10%)
Missing	0	4 (<1%)	12 (<1%)	16 (<1%)
Gender				
Female	223 (85%)	1930 (90%)	2870 (91%)	5023 (91%)
Male	38 (15%)	210 (10%)	270 (9%)	518 (9%)
Missing	0	2 (<1%)	4 (<1%)	6 (<1%)
Occupation				
Nursing/medical/care aide	39 (15%)	1040 (49%)	2641 (84%)	3720 (67%)
Nurse (RN, LPN)	74 (28%)	765 (36%)	275 (9%)	1114 (20%)
Professional provider	51 (20%)	45 (2%)	12 (<1%)	108 (2%)
Dental	0	0	0	0
Housekeeping	1 (<1%)	5 (<1%)	8 (<1%)	14 (<1%)
Food services	0	4 (<1%)	4 (<1%)	8 (<1%)
Administrative	3 (1%)	16 (<1%)	4 (<1%)	23 (<1%)
Other care	60 (23%)	166 (8%)	63 (2%)	289 (5%)
Other non-care	6 (2%)	50 (2%)	5 (<1%)	61 (1%)
Missing or unknown	27 (10%)	51 (2%)	132 (4%)	210 (4%)
Non-patient handling claims				
Claims	*N* = 4397	*N* = 5653	*N* = 3904	*N* = 13,954
Age (years)				
<25	358 (8%)	517 (9%)	713 (18%)	1588 (11%)
25–<35	1158 (26%)	1267 (22%)	812 (21%)	3237 (23%)
35–<45	1018 (23%)	1171 (21%)	710 (18%)	2899 (21%)
45–<55	1034 (24%)	1490 (26%)	918 (24%)	3442 (25%)
≥55	805 (18%)	1199 (21%)	730 (19%)	2734 (20%)
Missing	24 (<1%)	9 (<1%)	21 (<1%)	54 (<1%)
Gender				
Female	3756 (85%)	4626 (82%)	3310 (85%)	11,692 (84%)
Male	637 (14%)	1019 (18%)	588 (15%)	2244 (16%)
Missing	4 (<1%)	8 (<1%)	6 (<1%)	18 (<1%)
Occupation				
Nursing/medical/care aide	394 (9%)	707 (13%)	1501 (38%)	2602 (19%)
Nurse (RN, LPN)	588 (13%)	1334 (24%)	675 (17%)	2597 (19%)

(Continues)

TABLE 2 (Continued)

	Outpatient	Hospital	Nursing homes	Total
Professional provider	779 (18%)	244 (4%)	24 (1%)	1047 (8%)
Dental	340 (8%)	0	0	340 (2%)
Housekeeping	51 (1%)	767 (14%)	479 (12%)	1297 (9%)
Food services	9 (<1%)	512 (9%)	585 (15%)	1106 (8%)
Administrative	933 (21%)	326 (6%)	79 (2%)	1338 (10%)
Other care	686 (16%)	860 (15%)	145 (4%)	1691 (12%)
Other non-care	290 (7%)	677 (12%)	248 (6%)	1215 (9%)
Missing or unknown	327 (7%)	226 (4%)	168 (4%)	721 (5%)

was again sprain or strain (38%), though contusion or inflammation (19%) and punctures (14%) were also common. Due largely to needlesticks, punctures were frequently reported among outpatient claimants (24%) as were injuries to the upper extremities (e.g., fingers). Across settings, injuries to the upper extremities (41%), lower extremities (15%), and multiple body parts (15%) were most common.

3.1.4 | Multivariable models

Claim rate by time period of SPH Act implementation did not differ by health care setting for patient handling (Wald $\chi^2 = 3.4$, $p = 0.758$) or non-patient handling injuries (Wald $\chi^2 = 4.8$, $p = 0.568$). Interactions were therefore dropped to allow interpretation of main effects. Patient handling injuries were 23 times more common (95% confidence interval [CI]: 16–33) among hospital claims and 72 times more common (95% CI: 54–97) among nursing home claims compared to outpatient claims (Table 4). Non-patient handling injuries were 4.3 times more common (95% CI: 3.5–5.2) among hospital claims and 6.7 times more common (95% CI: 5.7–7.9) among nursing home claims (vs. outpatient claims).

All claims declined from pre-law (2005–2007) to second post-implementation (2014–2017), patient handling claims by 38% and non-patient handling claims by 27%. The greatest decline in patient handling claims was observed between pre-law and first post-implementation (2011–2013). There was little additional decline thereafter (from 2011–2013 to 2014–2017), suggesting a potential leveling out of the law's effects.

Adjusted claim rates by health care setting and time period are presented in Table 5. From pre-law to second post-implementation, the mean annual patient handling claim rate per nursing home declined from 230 claims/$100 million payroll (95% CI: 174–286) to 142 claims/$100 million payroll (95% CI: 110–175). The mean annual non-patient handling claim rate declined from 297 (95% CI: 253–342) to 217 (95% CI: 186–249). In hospitals, the rate declined from 72 (95% CI: 50–95) to 45 (95% CI: 31–58) for patient handling claims and from 190 (95% CI: 156–224) to 139 (95% CI: 114–163) for non-patient handling claims. Much lower claim rates were observed in outpatient facilities for all time periods, though patient handling and non-patient handling injuries still declined over time.

4 | DISCUSSION

In this longitudinal study of workers' compensation claims from a single insurer, claim rates declined in Minnesota nursing homes, hospitals, and outpatient facilities following enactment of the Minnesota SPH Act. From pre-law (2005–2007) to post-implementation (2014–2017), declines were greater for patient handling injuries (37% reduction by first post-implementation and 38% reduction by second post-implementation time periods) than for other injuries and illnesses (18% reduction by first post-implementation and 27% reduction by second post-implementation time periods). The larger decline in patient handling injuries seen in our study suggests that the MN SPH Act and other efforts to enhance safe patient handling may have been effective. However, caution is required interpreting our results because the rates of all health care worker injuries are trending down over time in the United States,[7] and it is unknown how patient handling injuries and non-patient handling injuries compare in states that have not enacted SPH legislation.

Across settings, 91% of patient handling claims were filed by women. Women account for 84% of nursing home workers, 75% of hospital workers, and 77% of outpatient workers, suggesting they are overrepresented in the patient handling claims data. Further, claims filed by nursing, medical, or care aides comprised 84% of patient handling claims in nursing homes and 49% of patient handling claims in both hospitals and outpatient facilities. These occupations comprise 36% of the workforce in nursing homes, 8% in hospitals, and 7% in outpatient facilities.[9,10] Patient handling claims were almost all sprains and strains due to lifting, handling, or carrying, and almost 50% were back injuries. The nursing, medical, and care aide workforce is vulnerable due to organizational and structural factors such as low pay, limited benefits, and personal circumstances (e.g., nursing assistants are frequently the primary breadwinner for their family).[11,19] Aides are disproportionately Black, Asian, or Hispanic, are often immigrants, and have low levels of formal education on average.[20] The ramifications of patient handling injuries, including impacts on physical health, income (e.g., lost work days following injury), and career longevity (e.g., permanent disability due to serious injury), may be particularly detrimental to the well-being of these workers.

Consistent with national data on musculoskeletal injuries,[7] crude and adjusted patient handling claim rates differed by health care

TABLE 3 Claim characteristics by health care setting for patient handling and non-patient handling workers' compensation claims, Minnesota, 2005–2017

	Outpatient	Hospital	Nursing homes	Total
Patient handling claims				
Claims	*N* = 261	*N* = 2142	*N* = 3144	*N* = 5547
Type				
Lost time	42 (16%)	506 (24%)	549 (17%)	1274 (23%)
Medical only	219 (84%)	1636 (76%)	2595 (83%)	4273 (77%)
Cause				
Lifting/handling/carrying	110 (42%)	1077 (50%)	1490 (47%)	2677 (48%)
Patient/coworker	68 (26%)	389 (18%)	528 (17%)	985 (18%)
Strain or injury by, NOC	35 (13%)	335 (16%)	550 (17%)	920 (17%)
Push/pull/reach/twist	34 (13%)	263 (12%)	456 (15%)	753 (14%)
Repetitive/cumulative	13 (5%)	23 (1%)	29 (<1%)	65 (1%)
Contact with object	0	11 (<1%)	34 (1%)	45 (<1%)
Slip/trip/fall	0	12 (<1%)	15 (<1%)	27 (<1%)
Machine/tool	0	6 (<1%)	10 (<1%)	16 (<1%)
Exposure	0	3 (<1%)	4 (<1%)	7 (<1%)
Cut/puncture/scrape	0	2 (<1%)	5 (<1%)	7 (<1%)
Other	1 (<1%)	21 (<1%)	23 (<1%)	45 (<1%)
Nature				
Sprain/strain	217 (83%)	1928 (90%)	2837 (90%)	4982 (90%)
Contusion/inflammation	26 (10%)	139 (6%)	218 (7%)	383 (7%)
Puncture	7 (3%)	8 (<1%)	26 (<1%)	41 (<1%)
Laceration	3 (1%)	15 (<1%)	20 (<1%)	38 (<1%)
Contagious disease	1 (<1%)	7 (<1%)	4 (<1%)	12 (<1%)
Foreign body	0	1 (<1%)	0	1 (<1%)
Fracture/dislocation	0	15 (<1%)	9 (<1%)	24 (<1%)
Burn	0	0	1 (<1%)	1 (<1%)
No physical injury	0	2 (<1%)	5 (<1%)	7 (<1%)
Other	7 (3%)	27 (1%)	24 (<1%)	58 (1%)
Body part				
Back	108 (41%)	1022 (48%)	1505 (48%)	2635 (48%)
Upper extremity	54 (21%)	269 (13%)	444 (14%)	767 (14%)
Shoulder	19 (7%)	235 (11%)	359 (11%)	613 (11%)
Trunk	19 (7%)	161 (8%)	223 (7%)	403 (7%)
Lower extremity	17 (7%)	146 (7%)	209 (7%)	372 (7%)
Neck	5 (2%)	53 (2%)	57 (2%)	115 (2%)
Head	8 (3%)	45 (2%)	50 (2%)	103 (2%)
Multiple	31 (12%)	211 (10%)	297 (9%)	539 (10%)
Non-patient handling claims				
Claims	*N* = 4397	*N* = 5653	*N* = 3904	*N* = 13,954

(Continues)

TABLE 3 (Continued)

	Outpatient	Hospital	Nursing homes	Total
Type				
Lost time	411 (9%)	819 (14%)	509 (13%)	1739 (12%)
Medical only	3986 (91%)	4834 (86%)	3395 (87%)	12,215 (88%)
Nature				
Sprain/strain	1337 (30%)	2351 (42%)	1571 (40%)	5259 (38%)
Contusion/inflammation	659 (15%)	1114 (20%)	847 (22%)	2620 (19%)
Puncture	1060 (24%)	465 (8%)	457 (12%)	1982 (14%)
Laceration	281 (6%)	458 (8%)	316 (8%)	1055 (8%)
Contagious disease	345 (8%)	285 (5%)	144 (4%)	774 (6%)
Foreign body	122 (3%)	147 (3%)	77 (2%)	346 (2%)
Burn	40 (<1%)	163 (3%)	117 (3%)	320 (2%)
Fracture/dislocation	92 (2%)	147 (3%)	79 (2%)	318 (2%)
No physical injury	75 (2%)	78 (1%)	33 (<1%)	186 (1%)
Other	386 (9%)	445 (8%)	363 (7%)	1094 (8%)
Body part				
Upper extremity	2304 (52%)	2004 (35%)	1422 (36%)	5730 (41%)
Lower extremity	443 (10%)	967 (17%)	673 (17%)	2083 (15%)
Back	242 (6%)	604 (11%)	572 (15%)	1418 (10%)
Head	404 (9%)	590 (10%)	312 (8%)	1306 (9%)
Shoulder	136 (3%)	278 (5%)	162 (4%)	576 (4%)
Trunk	127 (3%)	253 (4%)	151 (4%)	531 (4%)
Neck	46 (1%)	87 (2%)	40 (1%)	173 (1%)
Multiple	695 (16%)	870 (15%)	572 (15%)	2137 (15%)

Abbreviation: NOC, Not Otherwise Classifiable as defined by Workers' Compensation Insurance Organizations (WCIO) codes.

setting, with the lowest rate observed in outpatient facilities (crude rate 2.0/$100 million payroll [95% CI: 1.8–2.2]) and highest rate in nursing homes (crude rate 168/$100 million payroll [95% CI: 163–174]). Despite the high overall rate of patient handling injuries in nursing homes, results from our multivariable analysis show that the decline in claims over time did not differ by health care setting. There are several plausible explanations for these findings.

Minnesota health care facilities may have successfully addressed their unique patient handling challenges while complying with the requirements of the MN SPH Act. For example, Minnesota nursing homes may have developed SPH programs that include training protocols appropriate for their high acuity residents and acquired equipment that works well in small spaces. These efforts may have been bolstered by state resources provided by the Minnesota Occupational Safety and Health Administration (MN OSHA), including no-cost ergonomic consultation, nursing home and hospital safe patient handling workgroups, and matching grants for equipment purchases.[21]

In addition to Minnesota's efforts, many national organizations have launched SPH initiatives that make research, toolkits, and web-based trainings widely available to all health care facilities. Leaders include the American Nurses Association (ANA), Tampa VA Research and Education Foundation, National Institute for Occupational Safety and Health and US OSHA.[22–26] Regardless of health care setting, Minnesota facilities may have successfully leveraged these resources to effectively reduce injuries. Finally, all facilities may share common motivations for enacting and maintaining safe patient handling programs, including protecting workers from injuries, reducing direct and indirect costs, improving patient care outcomes, and complying with the MN SPH Act.

Our previous study found that lost time workers' compensation claims for patient handling injuries declined in Medicaid-certified nursing homes following enactment of the MN SPH Act. Compared to 2005–2007 (pre-law), claims declined by 25% in 2011–2013 and by 38% in 2014–2016.[16] Claims for all other injuries and illnesses declined by 20% in 2014–2016 only. However, the study was limited to nursing homes and excluded medical-only claims, which comprise approximately 77% of total claims in Minnesota.[27] In the present study, patient handling claims also declined by 38% from pre-law to post-implementation (2014–2017) across health care settings.

TABLE 4 Adjusted rate ratios for patient handling and non-patient handling workers' compensation claims, Minnesota, 2005–2017

	All patient handling claims		Lost time patient handling claims		All non-patient handling claims		Lost time non-patient handling claims	
	Rate ratio (95% CI)	χ^2 (p value)	Rate ratio (95% CI)	χ^2 (p value)	Rate ratio (95% CI)	χ^2 (p value)	Rate ratio (95% CI)	χ^2 (p value)
Health care setting								
Outpatient	1.0	809.5	1.0	467.6	1.0	597.4	1.0	315.5
Hospital	22.8 (15.9–32.7)	$p < 0.0001$	27.7 (17.0–45.0)	$p < 0.0001$	4.3 (3.5–5.2)	$p < 0.0001$	5.0 (3.9–6.3)	$p < 0.0001$
Nursing home	72.4 (53.9–97.3)		88.1 (58.1–133.5)		6.7 (5.7–7.9)		7.1 (5.6–8.9)	
Time period								
Pre-law (2005–2007)	1.0	22.5	1.0	37.5	1.0	21.4	1.0	61.4
Implementation (2008–2010)	0.76 (0.67–0.87)	$p = 0.0001$	0.94 (0.75–1.2)	$p < 0.0001$	0.87 (0.79–0.95)	$p = 0.0001$	0.94 (0.81–1.1)	$p < 0.0001$
First post (2011–2013)	0.63 (0.51–0.78)		0.59 (0.44–0.79)		0.82 (0.74–0.92)		0.77 (0.64–0.92)	
Second post (2014–2017)	0.62 (0.47–0.81)		0.59 (0.48–0.73)		0.73 (0.64–0.84)		0.56 (0.46–0.67)	

Note: Test statistics and p values are presented for Wald χ^2 tests for difference in rate ratios by health care setting and time period.

Abbreviation: CI, confidence interval.

Claims for non-patient handling injuries declined by 27% in the same period. These consistent findings suggest that declines in patient handling injuries are not unique to nursing homes and are not limited to the most severe claims (i.e., lost time claims).

Washington and California have both published evaluations of state SPH laws.[12–15] A 2006 Washington law requires each hospital to implement an SPH program and acquire adequate assistive equipment. Between 2001 and 2009, a 10.1% (95% CI: 8.0–12.3) decrease was observed in compensable claims for work-related MSDs in hospitals.[12] Nursing homes, used as a comparator, experienced a 5.8% (95% CI: 1.7–9.7) decline in MSDs. The rate of MSD claims in nursing homes was 1.6 times higher than hospitals. In our 2005–2017 study, the crude rate of patient handling injury claims was 4.9 times higher in Minnesota nursing homes compared to hospitals, though both were subject to the MN SPH Act. The longitudinal Washington study was comprised largely of pre-law years while our study focused on post-law years. Further, Washington cases were categorized as MSDs based on American National Standards Institute (ANSI) Occupational Injury and Illness Classification System (OIICS) codes, and International Classification of Diseases (ICD-9) codes,[13] while our study reviewed text descriptions of injuries to determine patient handling relatedness.

A second Washington study used 2007 and 2009 cross-sectional surveys of direct care hospital workers in Washington and Idaho, a state without safe patient handling legislation, to assess changes in perceptions and behaviors related to SPH program implementation.[13] Compared to Idaho workers, Washington workers reported beneficial changes in knowledge of workplace SPH policies, availability and use of assistive equipment, and equipment quality and training. In both states, declines were observed in belief that taking risks was part of the job and belief that a member of the team would be injured within a year. Washington workers reported more back pain than Idaho workers. No differences were seen between states in perceived physical exertion, satisfaction with staff input on assistive equipment, or whether a committee existed to identify equipment needs.

Finally, a study of the 2012 California Hospital and Health Care Worker Injury Protection Act used pre-post cross-sectional surveys to elicit changes in hospital nurses' perspectives of safe patient handling policies, practices, and injury outcomes over 4 years following enactment of the law.[14,15] While improvements were observed between 2013 and 2016 in knowledge of the law, SPH training, presence of assistive equipment, and prevalence of musculoskeletal symptoms, prevalence of work-related injury in the last 12 months did not significantly decline. Our previous research on the MN SPH Act in nursing homes suggests that more than 3 years of follow-up may be necessary to detect changes in injuries following enactment of a law.[16] Though objective injury measures were not studied in California, results show that an SPH law may effectively improve worker awareness of safe patient handling, training opportunities, and equipment access.

Comparing success of state SPH laws is complicated by differences in each law's requirements and implementation strategies. The MN SPH Act requires each health care facility to establish a written

TABLE 5 Adjusted injury rates by health care setting and time period for workers' compensation claims, 2005–2017

	Facility-years, *n*	Patient handling claims, *n*	Non-patient handling claims, *n*	Payroll[a] (million $)	Mean adjusted annual claim rate[b] (95% CI)	
					Patient handling claims	Non-patient handling claims
Outpatient						
Pre-law	433	63	835	2021	3.2 (2.2–4.1)	44 (38–50)
Implementation	593	56	1011	2655	2.4 (1.7–3.1)	38 (34–43)
First post	747	69	1141	3394	2.0 (1.4–2.6)	37 (32–41)
Second post	874	73	1410	5058	2.0 (1.4–2.5)	32 (29–36)
Hospital						
Pre-law	88	606	1285	1245	72 (50–95)	190 (156–224)
Implementation	114	488	1371	1349	55 (39–71)	164 (136–193)
First post	155	449	1613	1475	46 (33–59)	157 (130–184)
Second post	329	599	1067	2065	45 (31–58)	139 (114–163)
Nursing Home						
Pre-law	84	840	1067	461	230 (174–286)	297 (253–342)
Implementation	101	861	1062	478	176 (136–215)	257 (220–294)
First post	120	663	891	396	145 (110–180)	245 (209–281)
Second post	166	780	884	532	142 (110–175)	217 (186–249)

[a]Adjusted for 2% annual inflation.

[b]Adjusted claim rate per $100 million payroll.

program and SPH committee comprised of at least 1/2 direct care workers.[5] In addition to an SPH program and committee, the Washington law defines minimum equipment requirements, establishes workers' right-to-refuse unsafe lifts, offers a tax credit for equipment purchase, and establishes a special workers' compensation risk class for participating hospitals.[12,28] California requires acute care hospitals to develop an SPH plan that includes worker training, use of assistive equipment, and availability of lift teams of trained assistive staff.[29] California does not offer funding or incentives for SPH program development. Despite these differences, research from the 3 states provides practical evaluation strategies that can help inform future research and policymaking.

4.1 | Strengths and limitations

Our sample was limited to health care facilities enrolled with a single large workers' compensation insurer. We conducted a claims-based analysis and were unable to identify repeat claimants. The insurer covers approximately 10% of the health care market in Minnesota. Facilities enrolled with the insurer are not necessarily representative of facilities across the state. Many enrollees are small employers that reported low annual injury counts. Our data do not capture self-insured employers, as is common among large hospitals and nursing homes. Self-insured facilities are likely systematically different than smaller facilities enrolled in workers' compensation in the voluntary market (e.g., self- insured facilities may have more resources and greater safety oversight). Availability of employer-sponsored benefits, including paid leave and health insurance, may also impact injury recovery and reporting behaviors.

The study did not include external comparator data (i.e., claims from a state without an SPH law). Instead, we compared trends in claims for patient handling injuries to claims for all other injuries and illnesses to explore differential effectiveness of the law. Further, we did not have access to important predictors of injury rate such as level of safe patient handling program implementation, location of facility (e.g., metro vs. rural), staffing measures (e.g., staff to patient ratio), and patient population measures (e.g., average acuity).

Comparing rates between health care settings requires caution because payroll reflects both number of workers and wages. In 2017 in Minnesota, average weekly wages were $545 for nursing homes, $1273 for hospitals, and $1396 for ambulatory health care services (including outpatient facilities).[30] The same annual payroll estimate generally represents more workers in a nursing home than in a hospital or outpatient facility. Therefore, the elevated injury and illness rates we report for nursing homes may be inflated. Despite this limitation, using payroll data allowed us to leverage a secondary data source to address an important gap in safe patient handling research.

The study has several important strengths. Workers' compensation studies often exclude medical-only claims because many states only collect data on lost time claims.[8,12,16] In our study, medical-only claims comprised 85% of total claims. The inclusion of medical-only claims provides a more complete picture of the injury experience in

Minnesota health care facilities. Importantly, we reviewed text from detailed injury descriptions to identify patient handling injuries. Many studies have used a subset of injuries (e.g., back injuries) or pre-coded fields for injury nature, source, and event, such as those provided by the OIICS, to define patient handling injuries.[8,12,16] Our review of individual injury circumstances likely resulted in more accurate identification of patient handling injuries. This summary of injury trends in hospitals, nursing homes, and outpatient facilities enrolled with a single Minnesota insurer may be used to generate hypotheses for larger-scale safe patient handling studies.

5 | CONCLUSIONS AND RECOMMENDATIONS

Our study provides a template for states wishing to assess the effectiveness of their safe patient handling legislation using secondary data. Deidentified statewide or insurer-based workers' compensation claims data are often accessible to researchers and provide an objective measure of worker injury trends. In the absence of external comparator data, comparing patient handling injury claims to claims for all other injuries and illnesses can help explain whether declines in patient handling injuries over time are potentially attributable to legislation or simply reflect industry-wide trends in injuries and reporting. Additional research using population-based samples (e.g., all health care facilities in the state) with external comparators (e.g., all health care facilities in a state without SPH legislation) is needed to confirm the external validity of these findings. Nonetheless, our study provides promising evidence that many nursing homes, hospitals, and outpatient facilities have successfully reduced patient handling injuries under the MN SPH Act.

ACKNOWLEDGMENTS

This study was supported by a Pilot Projects Research Grant, Midwest Center for Occupational Health and Safety, Education and Research Center (T42 OH008434) funded through the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC), Department of Health and Human Services.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Christina E. Rosebush and Katherine E. Schofield designed the study, led data analysis, and drafted the manuscript. Darin J. Erickson supported data analysis and interpretation. Marizen Ramirez, Breca Tschida, Brian Zaidman, and Patricia M. McGovern supported data interpretation and manuscript revisions.

ETHICS APPROVAL AND INFORMED CONSENT

Study determined to be exempt from review by University of Minnesota Institutional Review Board as research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens when the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

DISCLOSURE BY AJIM EDITOR OF RECORD

Paul A. Landsbergis declares that he has no conflict of interest in the review and publication decision regarding this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study were provided by a private third party and are not publicly available.

DISCLAIMER

The contents of this study are solely the responsibility of the authors and do not necessarily represent the official view of NIOSH, the University of Minnesota, the Minnesota Department of Labor and Industry, or other associated entities.

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How to cite this article: Rosebush CE, Schofield KE, Ramirez M, et al. Differential effectiveness of the Minnesota Safe Patient Handling Act by health care setting: An exploratory study. *Am J Ind Med*. 2022;65:105-116. doi:10.1002/ajim.23312