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Medical Cost of Workers' Compensation Claims Related to Patient Handling and Mobility Tasks Within Skilled Nursing Facilities, Continuing Care Retirement Communities and Assisted Living Facilities

An Exploratory Analysis

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Objective: Evaluate the medical costs related to patient handling & mobility (PH&M) claims. **Methods:** Closed medical only and indemnity workers' compensation claims were utilized for this exploratory study. In addition to the PH&M tasks, the claimants' gender, age, tenure, and the claim lag time were also analyzed. **Results:** Generalized linear models indicated that variables related to tasks, claims' number of open days and age of the claimants had meaningful effects on the adjusted medical costs for medical only claims. For indemnity claims, the number of open days of claims, age and tenure had meaningful effects. Gender had meaningful effects only for indemnity claims when classifying the claims by patient handling tasks versus non-patient handling tasks. **Conclusions:** Results showed that factors, other than the type of injury; meaningfully influenced the adjusted medical costs of indemnity claims.

Keywords: long term care, medical costs, musculoskeletal injuries, patient handling, workers' compensation

It is well known that the healthcare industry in the United States is one of the industries with the highest rates of nonfatal occupational injuries; including the industry's subgroups nursing care facilities, continuing care retirement communities (CCRCs) and assisted living facilities.[1] Musculoskeletal injuries during patient handling & mobility (PH&M) tasks tend to be one of the biggest contributors of occupational injuries[2–6] and workers' compensation claims.[7–9] In addition, the healthcare industry is forecasting a shortage of nursing staff and an increase in the age of their nurses.[10,11] As the workforce ages, the likelihood of injuries increases as the capacity to perform physical work diminishes and long-term care facilities are not exempt of these issues.[12–14] Nursing assistants tend to have one of the highest rates of injuries for all occupations.[15] Rosebush et al[7] described the disparities of musculoskeletal injuries in workers' compensation indemnity claims among certified nursing assistants, licensed practical nurses and registered nurses in nursing homes. They found that nursing assistants have higher odds of musculoskeletal injuries related claims when compared to licensed practical and registered nurses. Kotejoshyer et al[3] determined that approximately 80% of workers' compensation claims related to musculoskeletal injury in 202 skilled nursing facilities and 20 assisted living facilities were from nursing aides and therapy staff. Effective safe patient handling & mobility programs (SPH&M) are well known to lower musculoskeletal injuries in the healthcare industry.[6,16] Lahiri et al[8] described the positive economic impact of having an effective SPH&M program in 110 skilled nursing facilities. They estimated that the average annualized net savings per bed was $143 and the annualized net savings per full time equivalent was $165. Kurowski et al[17] compared the effects of a SPH&M program for a healthcare corporation with 136 nursing homes by reviewing workers' compensation claim rates before and after its implementation. Over 80% of nursing homes experienced a decrease in patient handling claims. In a follow up study, Kurowski et al[18] found that SPH&M programs reduced the recurrence of patient handling related injuries. Ann Adamczyk[19] described how SPH&M initiatives reduced musculoskeletal injuries in a critical care unit and Olinski and Norton[20] described how a safe patient handling program in a multi-hospital system yielded a reduction of 82% of OSHA recordable cases related to patient handling injuries and over 80% reduction in workers' compensation costs.

Although the program's effectiveness for reduction of musculoskeletal injuries is well known, its implementation may be challenging due to a variety of factors. In 2018, Powell-Cope et al[21] performed a survey of 228 academic nursing programs which revealed that most programs included outdated patient handling techniques in their curriculums. Hurtado et al[22] described the possible association of high turnover of nurses with low safe patient handling peer support. Elnitsky et al[23] surveyed 51 U.S. Department of Veterans Affairs medical centers and found that programs with lack of organizational support may produce adverse patients events.

While many studies have outlined the benefits and challenges of SPH&M interventions, the same cannot be said regarding the medical costs associated with musculoskeletal injuries related specifically to PH&M tasks. This study reviews the medical costs among workers' compensation claims associated with musculoskeletal injuries incurred during patient handling and mobility tasks within skilled nursing facilities, CCRCs and assisted living facilities.

METHODS

Claims Data

The claims analyzed in this exploratory study were obtained from The MEMIC Group, a mono-line workers' compensation insurance carrier licensed in 46 states with a focus on those states located on the eastern coast of the United States. A search query was performed to gather closed or re-closed single claims from

From The MEMIC Group, Portland, Maine.

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The study was determined to be Exempt by the University of Southern Maine IRB and the Office of Research Integrity and Outreach (ORIO).

Clinical significance: This study provides healthcare and occupational safety professionals an overview of the factors that influence medical costs related to musculoskeletal injuries originating from patient handling and mobility tasks within long term healthcare. A better understanding of these factors can lead to the improvement of safe patient handling and mobility programs.

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policyholders with governing class codes (8824, 8825, 8826, 8829, 8841, 940, 960, 974 and 979) applicable to skilled nursing facilities, CCRCs, and assisted living facilities with accident dates between January 1, 2012 and December 31, 2018. This yielded a total of 10,342 single claims. After an initial review, 941 claims were removed because they were not related to long term healthcare facilities and/or they had inconsistent information (eg, claim stated hire date of injured worker was after the accident date), resulting in a total of 9401 claims. A second review was performed to remove claims with $0 dollars in medical expenses which resulted in an additional 1092 claims removed. Although some researchers may assume claims with $0 in medical costs is the result of claims with less severity; we partially disagree with that assumption. Employers may decide to pay the medical expenses related to a claim to avoid a negative impact to their experience modification rate. Some states like New Hampshire, US[24] allow employers to pay up to $2000 in workers' compensation medical treatments but other states do not have clear guidelines on whether employers can or cannot pay for such costs. Due to this inconsistency, it was decided to remove those claims with $0 in medical expenses because it was not possible to distinguish between claims with a true low severity and claims where the employers paid for medical treatment. At the end, a total of 8309 claims were analyzed. These claims were from all jobs within these healthcare settings and not specific to nursing staff.

The scope of this study was to evaluate only the medical costs associated with the claims analyzed and; therefore, it should not be assumed the costs shown in this research article represent the total or net incurred costs of these claims. For claims classified as indemnity, only the costs associated with the medical treatment of the injury was analyzed. The logic behind this decision is that the total cost of indemnity claims includes medical costs plus indemnity payments as well as other expenses. Losses related to indemnity payments and/or other expenses may not be directly related to musculoskeletal injures incurred during PH&M tasks. For example, if a policyholder has an informal or poor return to work program, the payments related to indemnity and/or expenses may be higher than those claims where the policyholder has a solid return to work program or if the policyholder can direct the care of the injured worker.[25,26] Additionally, medical costs have been increasing over the years and it is estimated to account for 60% of all annual workers' compensation costs.[27]

The data was retrieved in July 2019, therefore; any claims with accident dates between January 1, 2012 and December 31, 2018 with close or re-closed dates after July 2019 were not included. Data gathered were from 357 distinct policies and a total of 943 policy years.

Claims Classification

A total of 8309 claims were analyzed based on the cause, nature, and description of the injury. From that total, 2627 claims were classifiable as musculoskeletal injuries during PH&M tasks. PH&M related claims were classified in different groups to explore if any differences in their adjusted medical costs' ranks were present. Initially, the claims were grouped by age group (16 to 24, 25 to 39, 40 to 54 and 55 or more), by work tenure (less than 1 y, 1 to 4 y, 5 to 9 y and 10 y or more) and by delayed report time. The report time or lag time represents the number of days between the date of the accident and the date that it was reported to the insurance carrier (0 to 3 d, 4 to 7 d, 8 to 14 d and 15 d or more). The purpose of including the report time was to evaluate if there were any effects on the medical costs due to a delayed reporting of the injury and therefore, its delayed medical treatment and/or management. Additionally, the claims were also grouped by PH&M task. The PH&M tasks classifications were:

1. Boosting, turning or repositioning in bed,
2. Boosting or repositioning in chair or wheelchair,
3. Catching a falling patient,
4. Recovering fallen patient from floor,
5. Showering or bathing,
6. Transfer from/to bed or stretcher,
7. Transfer to/from chair or wheelchair,
8. Transfer to/from toilet or commode.
9. All other PH&M tasks.

In addition to these PH&M tasks, musculoskeletal injury claims related to providing assistance during activities of daily living or ADLs were also included. Although assisting with activities of daily living may not always be considered PH&M tasks, these activities include manual handling of patients where the caregiver may absorb part of the patient's weight.[17,28] For this study, ADLs include ambulation (not including when a patient falls, whether caught or not) along with dressing/grooming and holding or lifting limbs. The claims related to transfers were classified based on the starting point of the PH&M task when the starting and end point of the transfer was mentioned. For example, if the description of the claim stated, "*the employee injured her back while performing a transfer from the bed to a chair*", it was classified as *transfer from/to bed or stretcher* rather than *transfer to/from chair or wheelchair*. In addition, using the claims' information; musculoskeletal injury claims were classified as "*Ergonomics—Patient Handling & Ergonomics—Non-Patient Handling*" based on the task being performed at the time of injury.

The medical costs for all claims were adjusted for inflation to June 1, 2020, using the Personal Health Care (PHC) index from the Centers for Medicare and Medicaid Services.[29,30] This study was determined to be Exempt by the University of Southern Maine IRB and the Office of Research Integrity and Outreach (ORIO) pursuant to 45 CFR 46.104.

Statistical Analysis

The adjusted medical costs for the analyzed claims (both medical only and indemnity) were found to be lognormally distributed using Shapiro-Francia test for normality ($P < 0.001$) and histogram plots. Nonparametric analyses were performed using Wilcoxon rank sum test and Kruskal-Wallis rank test along with Dunn's test, with Bonferroni correction instead of traditional parametric tests using log transformed data in order to avoid possible biased estimates.[31,32] Additionally, generalized linear model analysis (*glm, family (gamma), link (log)*)[33,34] was performed to evaluate the influence of the variables analyzed to the adjusted medical costs. The effects of type of injury (categorical), gender (categorical), number of claims' open days (continuous), age (continuous) & tenure (continuous) of injured workers as well as the lag time in which the claim was reported (continuous) on the adjusted medical costs were assessed. All statistical analyses, including the estimation of median costs and associated standard errors were performed using Stata software (v. 15.1; StataCorp, LLC., College Station, TX).

RESULTS

A summary of the medical costs for all the claims gathered within assisted living facilities, CCRCs and skilled nursing facilities are shown in Table 1. Ergonomic related claims accounted for 36.7% of all medical only claims and 47.1% of all the indemnity claims. Patient handling related claims had the highest proportion of all claims. The medical costs from medical only claims was approximately 93% of the total cost of the claims where the remaining 7% can be attributed to claims-related expenses. For indemnity claims, the proportion of medical costs accounted for over 50% of the total costs of the claims except for claims related to slips, trips and falls. These percentages were lower than what was previously reported by the National Council on Compensation Insurance (NCCI). The medical costs related to patient handling claims accounted for 34.4% of the total medical costs ($29,123,800)

TABLE 1. Summary of Workers' Compensation Claims' Medical Costs Within Assisted Living Facilities, Continuing Care Retirement Communities and Skilled Nursing Facilities

Major Types of Injury	Proportion of All Claims (%)	Proportion of Medical Only Claims (%)	Proportion of Indemnity Claims (%)	Median Proportion of Medical Cost to the Total Cost of Medical Only Claims* (%) (Std. Err.)	Median Proportion of Medical Cost to the Total Cost of Indemnity Claims* (%) (Std. Err.)	Medical Costs (USD)		
						Sum of All Adjusted Medical Costs	Medical Only Claims Median Cost (Std. Err.) (*n*)	Indemnity Claims Median Cost (Std. Err.) (*n*)
Ergonomics—patient handling	31.6%	29.0%	36.6%	92.9% (0.2%)	52.9% (1.4%)	$10,030,500	$598 ($25) (1,586)	$2,062 ($87) (1,041)
Ergonomics—non-patient handling	8.6%	7.7%	10.5%	93.4% (0.4%)	57.8% (2.6%)	$3,494,100	$785 ($50) (419)	$2,873 ($436) (298)
Slips, trips and falls	20.1%	18.3%	23.5%	93.1% (0.2%)	46.5% (1.6%)	$7,363,000	$605 ($37) (1,000)	$2,800 ($184) (668)
Struck by/against/aggression	19.8%	22.6%	14.4%	93.4% (0.2%)	50.3% (2.4%)	$4,244,800	$449 ($19) (1,236)	$1,863 ($203) (409)
Other	19.9%	22.4%	15.1%	93.3% (0.2%)	55% (2.6%)	$3,991,400	$452 ($13) (1,224)	$1,979 ($172) (428)

Medical costs shown were adjusted for inflation to June 1, 2020 using the PHC index. All medical cost shown were rounded.
Data shown is from 357 distinct policies and 943 policy years.
Std. Err., standard error; *n*, number of claims.
*Proportion is based on unadjusted medical costs and total cost of the claim.

of the analyzed claims. Although patient handling claims had the highest frequency, the same could not be said about its median cost. The ranks of the medical costs for the different types of injury were compared and a summary of these comparisons are shown Table 2. For medical only claims, most of the medical costs' ranks for the different types of injury meaningfully differed from each other. For indemnity claims, the ranks were found not to be meaningfully different from each other, except for slip, trips and falls.

Table 3 shows a summary of the PH&M claims' adjusted median medical costs by gender, age group, tenure and report time. The proportions of the claims of female and male claimants for PH&M related injuries were 94.4% and 5.6%, respectively. For all types of injuries, the proportions were 84.2% for female claimants and 15.8% for male claimants. In most cases, no meaningful differences (where comparisons could be made) were observed between the medical costs' ranks of female and male claimants when grouping the claims by age group, tenure and lag report time of the claim. The average absolute percentage of difference between the median cost for medical only and indemnity claims of female claimants and the combined median cost (females and males claimants) were 3.3% and 3.0%, respectively.

As shown in Table 3, no meaningful differences were observed between the medical costs' ranks for medical only claims arranged by age group. For all indemnity claims, the medical costs' ranks where found to be meaningfully different except for age groups 40 and above. The median costs for both medical only and indemnity claims generally increased as the age group increased. The same pattern was not observed when looking at the claims by tenure group where the highest median cost for indemnity claims were observed in the 5 years to 9 years tenure group. This discrepancy can be attributed to the healthy worker survivor effect.[35]

The medical costs were also grouped by the time (number of days) in which the claim was reported. Most of the claims were filed within three days from the date of the injury. Generally, the median cost of the injuries did not increase with increased lag time, and therefore, delayed medical treatment.

Table 4 shows a summary of the medical costs for the different PH&M tasks. Overall, no meaningful differences were observed between the ranks of the medical costs associated within the specific PH&M tasks (where comparisons could be made). For medical only claims, the overall median claims' cost of male claimants was found to be lower than their female counterparts. The opposite was observed for the indemnity claims, where the overall median cost for male claimants was higher than the female claimants.

Table 5 shows a summary of the general linear analysis for claims when grouped by the different types of injury. When compared to *Other* types of injuries, claims related to *Ergonomics* (patient and non-patient handling) and *Slips, Trips and Falls* had meaningful effects on the adjusted medical costs for medical only claims. This was not observed for indemnity claims. Claims from male claimants, when compared to female claimants; did not have a meaningful effect on the adjusted medical costs for medical only nor indemnity claims. The number of days in which the claim was open had meaningful effects for both medical only and indemnity of claims with the multiplicative factor being higher for medical only claims in contrast to the indemnity claims (1.0061 vs 1.0033). The age of the injured worker also had meaningful effects on the adjusted medical costs for both types of claims. In this case, the multiplicative factor for indemnity claims was higher than the medical only claims (1.0165 vs 1.0043). Regarding the tenure of the employee, a ''reductive'' meaningful effect was observed for indemnity claims but not for medical only claims. This can be attributed to the healthy worker survivor effect. No meaningful effects were observed for the delayed reporting of claims as well as the interactions effects between the variables gender and the types of injury.

TABLE 2. Pairwise Comparison of Medical Costs' Ranks by Injury and Type of Claim

	Medical Only Claims				
Major Types of Injury	**Ergonomics—Patient Handling**	**Ergonomics—Non-Patient Handling**	**Slips, Trips and Falls**	**Struck by/Against/Aggression**	**Other**
Ergonomics—patient handling	–				
Ergonomics—non-patient handling	**	–			
Slips, trips and falls	NMD	*	–		
Struck by/against/aggression	***	***	***	–	
Other	***	***	***	NMD	–
	Indemnity Claims				
Ergonomics—patient handling	–				
Ergonomics—non-patient handling	NMD	–			
Slips, trips and falls	***	***	–		
Struck by/against/aggression	NMD	NMD	***	–	
Other	NMD	NMD	***	NMD	–

Medical cost's ranks comparison was performed using Kruskal-Wallis rank test. Post hoc test was performed using Dunn' s test with Bonferroni correction.
Meaningful differences: differences between medical costs' ranks; NMD, no meaningful difference with P value >0.05; $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

Table 6 shows the main and interactions effects when grouping the claims by specific PH&M tasks. For medical only claims, none of the specific PH&M tasks had meaningful effects on the adjusted medical costs when compared to *All Other Patient Handling & Mobility Tasks.* The group for *All Other Patient Handling & Mobility Tasks* represents the claims related to PH&M tasks that could not be included into a specific PH&M task due limited information as explained in the *Methods* section. For indemnity claims, only claims related to *Boosting or repositioning in chair or wheelchair* had a meaningful reductive effect. This group had the lowest median values for both type of claims among all PH&M tasks as shown in Table 4. As in Table 5, the claims from male claimants were found not to have meaningful effects on the adjusted medical costs when grouping the claims by specific PH&M tasks. The

TABLE 3. Summary of Patient Handling & Mobility Claims' Median Adjusted Medical Costs by Gender, Age Group, Tenure and Report Time

	Medical Costs (USD)							
	Medical Only Claims Median Cost (Std. Err.) (*n*)	**Medical Only Claims Median Cost for Female Claimants (Std. Err.) (*n*)**	**Medical Only Claims Median Cost for Male Claimants (Std. Err.) (*n*)**	**Meaningful Differences between Medical Only Claims by Gender**	**Indemnity Claims Median Cost (Std. Err.) (*n*)**	**Indemnity Claims Median Cost for Females Claimants (Std. Err.) (*n*)**	**Indemnity Claims Median Cost for Male Claimants (Std. Err.) (*n*)**	**Meaningful Differences Between Indemnity Claims by Gender**
Claim type by age group								
16 to 24	$580 ($36) (326)	$597 ($37) (306)	$443 ($181) (20)	NMD	$1,432 ($192) (163)	$1,341 ($215) (157)	$3,036 ($2,959) (6)	NMD
25 to 39	$583 ($48) (588)	$602 ($55) (549)	$366 ($79) (39)	NMD	$1,954 ($150) (402)	$1,907 ($142) (386)	$2,570 ($1,251) (16)	NMD
40 to 54	$598 ($53) (495)	$602 ($55) (465)	$458 ($169) (30)	NMD	$2,410 ($224) (354)	$2,278 ($258) (334)	$4,742 ($3,900) (20)	NMD
55 or more	$758 ($113) (177)	$739 ($130) (166)	$839 ($246) (11)	NMD	$3,592 ($500) (122)	$3,471 ($511) (117)	$5,640 ($8,441) (5)	NMD
Meaningful differences between the Groups	NMD	NMD	NDM		***	***	NMD	
Claim type by tenure								
Less than 1 year	$563 ($35) (579)	$563 ($35) (539)	$565 ($158) (40)	NMD	$1,599 ($33) (375)	$1,598 ($146) (361)	$3,047 ($1,544) (14)	NMD
1 year to 4 years	$528 ($46) (561)	$605 ($48) (525)	$351 ($80) (36)	**	$2,009 ($161) (352)	$1,997 ($168) (336)	$2,442 ($4,119) (16)	NMD
5 years to 9 years	$780 ($95) (190)	$723 ($107) (180)	$618 ($236) (10)	NMD	$3,664 ($402) (138)	$3,440 ($441) (128)	$11,930 ($4,783) (10)	NMD
10 years or more	$786 ($84) (256)	$790 ($88) (242)	$593 ($363) (14)	NMD	$2,355 ($296) (176)	$2,339 ($307) (169)	$2,645 ($1,358) (7)	NMD
Meaningful Differences between the groups	NMD	*	NMD		***	***	NMD	
Claim type by report time								
0 to 3 days	$734 ($45) (760)	$731 ($50) (719)	$650 ($134) (41)	NMD	$2,253 ($154) (463)	$2,196 ($130) (438)	$2,703 ($1,109) (25)	NMD
4 to 7 days	$496 ($32) (457)	$490 ($34) (430)	$549 ($124) (27)	NMD	$1,990 ($145) (323)	$1,968 ($180) (311)	$2,556 ($3,148) (12)	NMD
8 to 14 days	$537 ($61) (192)	$549 ($77) (177)	$268 ($440) (15)	NMD	$1,788 ($308) (136)	$1,737 ($311) (131)	$6,781 ($4,670) (5)	*
15 days or more	$523 ($75) (177)	$556 ($94) (160)	$302 ($87) (17)	*	$1,911 ($375) (119)	$1,860 ($355) (114)	$3,159 ($4,398) (5)	NMD
Meaningful differences between the groups	***	***	NMD		NMD	NMD	NMD	

Medical cost's ranks comparison was performed using Kruskal-Wallis rank test. Post hoc test was performed using Dunn' s test with Bonferroni correction. Comparison of medical costs' ranks by gender was performed using Wilcoxon rank sum test.
Medical costs shown were adjusted for inflation to June 1, 2020 using the PHC index.
Data shown is from 357 distinct policies and 943 policy-years.
n, number of claims; Std. Err., standard error.
Meaningful differences: differences between medical costs' ranks; NMD, no meaningful difference with P value >0.05; $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

TABLE 4. Summary of Claims' Medical Costs Data by Type, Gender and Patient Handling & Mobility Tasks

	Medical Costs (USD)							
Patient Handling & Mobility Task	**Medical Only Claims Median Cost (Std. Err.) (*n*)**	**Medical Only Claims Median Cost for Female Claimants (Std. Err.) (*n*)**	**Medical Only Claims Median Cost for Male Claimants (Std. Err.) (*n*)**	**Meaningful Differences Between Medical Only Claims by Gender**	**Indemnity Claims Median Cost (Std. Err.) (*n*)**	**Indemnity Claims Median Cost for Females Claimants (Std. Err.) (*n*)**	**Indemnity Claims Median Cost for Male Claimants (Std. Err.) (*n*)**	**Meaningful Differences Between Indemnity Claims by Gender**
ADLs	$805 ($191) (88)	$869 ($211) (79)	$409 ($253) (9)	NMD	$2,411 ($455) (65)	$2,411 ($455) (63)	$5,426 (NV) (2)	NC
Boosting or repositioning in chair or wheelchair	$449 (184) (24)	$449 ($175) (22)	$401 (NV) (2)	NC	$1,516 ($1,561) (18)	$1,435 ($774) (17)	$19,739 (NV) (1)	NC
Boosting, turning or repositioning in bed	$758 ($71) (250)	$758 ($87) (241)	$220 ($100) (9)	**	$2,019 ($232) (168)	$1,991 ($213) (162)	$2,931 ($18,774) (6)	NMD
Catching a falling patient	$606 ($70) (145)	$608 ($70) (133)	$449 ($187) (12)	NMD	$2,149 ($333) (105)	$2,130 ($320) (101)	$6,365 (NV) (4)	NMD
Recovering fallen patient from floor	$522 ($264) (44)	$518 ($252) (37)	$2,079 ($501) (7)	NMD	$2,258 ($513) (24)	$2,223 ($431) (22)	$7,956 (NV) (2)	NC
Showering or bathing	$801 ($832) (16)	$629 ($305) (15)	$4,456 (NV) (1)	NC	$2,666 ($11,146) (7)	$2,666 ($11,146) (7)	$0 (NV) (0)	NC
Transferring from/to bed or stretcher	$666 ($108) (114)	$666 ($114) (110)	$489 (NV) (4)	NMD	$2,562 ($875) (58)	$2,274 ($766) (54)	$11,987 (NV) (4)	NMD
Transferring from/to chair or wheelchair	$525 ($134) (91)	$543 ($170) (84)	$524 ($2,666) (7)	NMD	$1,925 ($376 (60)	$1,959 9$338) (55)	$913 ($8,455) (5)	NMD
Transferring from/to toilet or commode	$565 ($128) (63)	$673 ($154) (55)	$419 ($971) (8)	NMD	$1980 ($580) (50)	$1,887 ($545) (49)	$5,182 (NV) (1)	NC
All other PH&M tasks	$564 ($28) (751)	$567 ($30) (710)	$472 ($112) (41)	NMD	$2,009 ($158) (486)	$1,993 ($154) (464)	$2,589 ($987) (22)	NMD
Median cost for all claims	$598 ($25) (1,586)	$607 ($26) (1,486)	$459 ($84) (100)	*	$2,062 ($87) (1,041)	$2,024 ($92) (994)	$3,159 ($1,104) (47)	*
Meaningful differences between all PH&M tasks	NMD	NMD	NMD		NMD	NMD	NMD	

Medical cost's ranks comparison was performed using Kruskal-Wallis rank test. Post hoc test was performed using Dunn' s test with Bonferroni correction. Comparison of medical costs' ranks by gender was performed using Wilcoxon rank sum test.

Comparisons of costs' ranks in each column were made with the corresponding median cost for all claims (medical only or indemnity claims) excluding the claims related to the subgroup being compared.

Medical costs shown were adjusted for inflation to June 1, 2020 using the PHC index.

n, number of claims; NC, no comparison; NV, no value; Std. Err., standard error.

Meaningful differences: differences between medical costs' ranks; NC, no comparison due to low number of claims in one of the subgroups; NMD, no meaningful difference with P value >0.05; $^{*}P < 0.05$; $^{**}P < 0.01$.

TABLE 5. Main and Interaction Effects of Major Types of Injury, Number of Claims' Open Days, Number of Days of Delayed Reporting, Gender, Age and Tenure of Injured Workers to the Adjusted Medical Costs of All Injuries

	Multiplicative Factor for Medical Only Claims (e^{β})	Multiplicative Factor for Indemnity Claims (e^{β})
Major types of injury		
Ergonomics—patient handling	1.3372***	1.0502
Ergonomics—non-patient handling	1.6113***	1.2576
Slips, trips and falls	1.2234***	1.1803
Struck by/against/aggression	1.0631	0.9868
Other	Base	Base
Gender of injured worker		
Males	0.9531	1.283
Females	Base	Base
Number of claims' open days	1.0061***	1.0033***
Age of injured worker	1.0043***	1.0165***
Tenure of injured worker	1.0010	0.9883***
Number of days of delayed reporting	0.9998	0.9998
Interaction effects between gender and type of injury		
Male & ergonomics—patient handling	0.8833	1.1517
Male & ergonomics—non-patient handling	0.7843	1.0739
Male & slips, trips and falls	1.0390	0.9683
Male & struck by/against/aggression	0.8870	0.7914

Generalized linear model (GLM) using gamma family with log link.
For medical only claims: Log likelihood = −43614.04, AIC = 115.97, BIC = −40404.29.
For indemnity claims: Log likelihood = −26760.60, AIC = 18.82, BIC = −18640.80.
Claims from female claimants were used as the base for interaction effects by gender.
No meaningful interaction effects were observed between the variables task, age, tenure and claims' open days.
Values of multiplicative factors were rounded.
Patient handling tasks and gender variables are categorical, the other variables are continuous.
Medical costs used were adjusted for inflation to June 1, 2020 using the PHC index.
Data shown is from 357 distinct policies and 943 policy-years.
Meaningful differences: only meaningful effects are denoted, $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

TABLE 6. Main and Interaction Effects by Gender of Type of Patient Handling Task, Number of Claims' Open Days, Number of Days of Delayed Reporting, Age and Tenure of Injured Workers to the Adjusted Medical Costs of Patient Handling Injuries

	Multiplicative Factor for Medical Only Claims (e^{β})	Multiplicative Factor for Indemnity Claims (e^{β})
Patient handling task		
ADLs	1.1084	0.9001
Boosting or repositioning in chair or wheelchair	0.9365	0.4933*
Boosting, turning or repositioning in bed	1.1216	0.9473
Catching a falling patient	1.1127	1.2354
Recovering fallen patient from floor	1.2227	0.7046
Showering or bathing	1.2715	0.8569
Transferring from/to bed or stretcher	1.0336	0.9326
Transferring from/to chair or wheelchair	0.9535	0.9032
Transferring from/to toilet or commode	1.3556	0.0832
All other patient handling & mobility tasks	Base	Base
Gender of injured worker		
Males	0.8624	1.4360
Females	Base	Base
Number of claims' open days	1.0060***	1.0036***
Age of injured worker	1.0031	1.0191***
Tenure of injured worker	1.0057	0.9847*
Number of days of delayed reporting	1.0010	0.9968
Interaction effects between gender and patient handling task		
Male & ADLs	0.7736	1.1180
Male & boosting or repositioning in chair or wheelchair	0.5684	0.1285
Male & boosting, turning or repositioning in bed	0.3363*	0.6352
Male & catching a falling patient	0.7151	0.2985
Male & recovering fallen patient from floor	0.8724	0.9953
Male & Showering or bathing	4.332	No claims
Male & transferring from/to bed or stretcher	1.444	3.5607
Male & transferring from/to chair or wheelchair	2.3483	0.5874
Male &transferring from/to toilet or commode	0.5807	2.3556

Generalized linear model (GLM) using gamma family with log link.
For medical only claims: Log likelihood = −12860.22, AIC = 16.25, BIC = −9546.
For indemnity claims: Log likelihood = −9622.33, AIC = 18.53, BIC = −5822.85.
Claims from female workers were used as the base for interaction effects by gender.
No meaningful interaction effects were observed between the variables task, age, tenure and claims' open days.
Patient handling tasks and gender variables are categorical, the other variables are continuous.
Medical costs used were adjusted for inflation to June 1, 2020 using the PHC index.
Data shown is from 357 distinct policies and 943 policy-years.
Meaningful differences: only meaningful effects are denoted, $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

TABLE 7. Main and Interaction Effects by Gender of Patient Handling vs Non-Patient Handling Task Related Claims, Number of Claims' Open Days, Number of Days of Delayed Reporting, Age and Tenure of Injured Workers to the Adjusted Medical Costs

	Multiplicative Factor for Medical Only Claims (e^{β})	Multiplicative Factor for Indemnity Claims (e^{β})
Patient handling tasks	1.1795*	0.9590
Non-patient handling tasks	Base	Base
Gender of injured worker		
Males	0.8982	1.2789**
Females	Base	Base
Number of claims' open days	1.0062***	1.0033***
Age of injured worker	1.0052***	1.0177***
Tenure of injured worker	1.0025	0.9884***
Number of days of delayed reporting	0.9984	0.9999
Interaction effects between task & gender		
Patient handling & males	0.9375	1.1626

Generalized linear model (GLM) using gamma family with log link.
For medical only claims: Log likelihood = −43654.05, AIC = 15.98, BIC = −40376.02.
For indemnity claims: Log likelihood = −26772.57, AIC = 18.83, BIC = −18664.57.
Claims from female workers were used as the base for interaction effects by gender.
No meaningful interaction effects were observed between the variables task, age, tenure and claims' open days.
Values of multiplicative factors were rounded.
Patient handling tasks and gender variables were categorical, the rest were continuous.
Medical costs used were adjusted for inflation to June 1, 2020 using the PHC index.
Data shown is from 357 distinct policies and 943 policy-years.
Meaningful differences: only meaningful effects are denoted. $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

number of days the claim was open had meaningful effects for both types of claims with the multiplicative factor being higher for medical only claims in contrast to the indemnity claims (1.0060 vs 1.0036). The age of the injured worker had a meaningful effect for indemnity claims but not for medical only claims. The same can be said for the tenure of the injured worker which also reflects the healthy worker survivor effect. The interactions between gender and specific PH&M tasks were evaluated and only the interaction between *Male & Boosting, turning or repositioning in bed* had a meaningful effect with a multiplicative factor less than 1 for medical only claims. The median cost of the medical only claims for male claimants in this group was lower than the median cost for female claimants as shown in Table 4.

Table 7 shows a third analysis where the claims were grouped in two categories: *Patient Handling Tasks and Non-Patient Handling Tasks*. The claims included in the Non-Patient Handling Tasks group included claims related to: *Ergonomics—Non-Patient Handling*, *Slips, Trips and Falls*, *Struck by/Against/Aggression* and *Others*. For medical only claims, patient handling claims had a meaningful effect on the adjusted medical costs when compared to non-patient handling claims. This was not observed for the indemnity claims. The gender variable (male vs female claimants) had a meaningful effect only for indemnity claims and its predictive margins are depicted in Fig. 1. This meaningful effect by gender was not observed when grouping the claims in different arrangements. A possible explanation is that male claimants were exposed

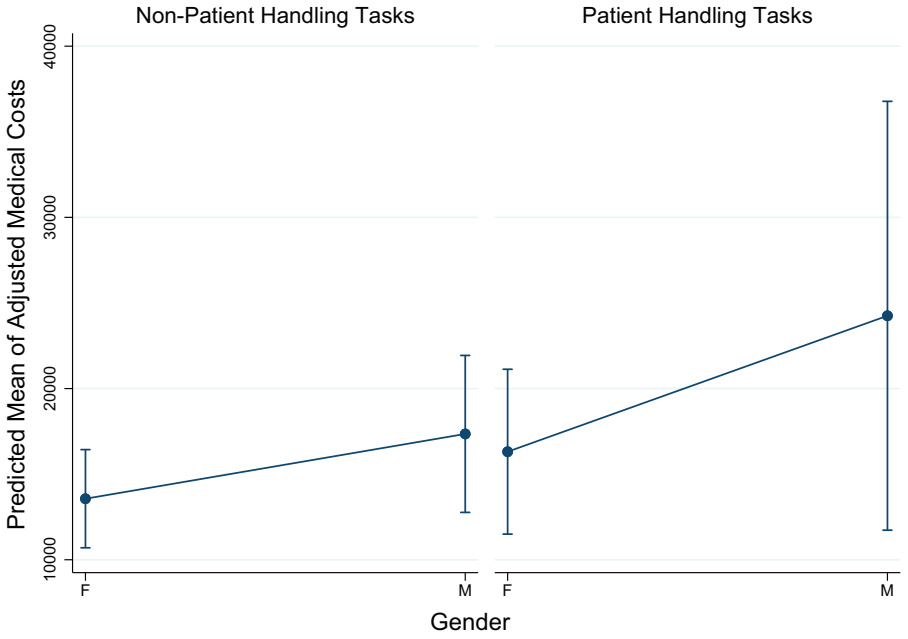

FIGURE 1. Predictive margins of gender variable with 95% confidence intervals for indemnity claims. Predictive margins were adjusted for claims' number of days open, age and tenure of the claimants.

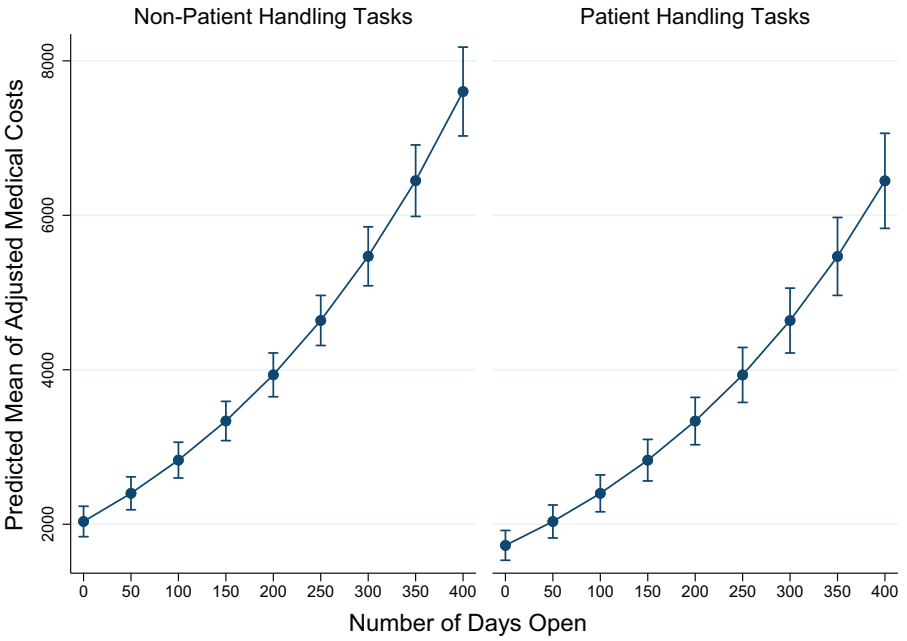

FIGURE 2. Predictive margins of claims' open days variable with 95% confidence intervals for indemnity claims. Predictive margins were adjusted for gender, age and tenure of the claimants.

to higher risk and/or more forceful exertion during PH&M tasks than their female counterparts.

Like the prior regressions, the number of days the claim was open and age of the claimants had meaningful effects for medical only and indemnity claims with similar multiplicative factors. The predictive margins for the number of open days and age of the indemnity claims are depicted in Figs. 2 and 3. For indemnity claims, the tenure of the claimants also reflected the healthy worker survivor effect.

Regardless of how the claims were grouped for analysis, the regressions showed a similar pattern. The adjusted medical costs for medical only claims were meaningfully affected by the type of injury (with the exception of the regression when grouping the claims by specific PH&M tasks), the number of days in which the claims were open and the age of the claimants. In these cases, the variable related to the type of injury had the highest multiplicative factor and the age of the claimants had the lowest. For indemnity claims, the number of open days, age and tenure of the claimants had meaningful effects on the adjusted medical costs where the age had the highest multiplicative factor. Additional research may be needed to understand the influence of the injured workers' age on the medical treatment costs of indemnity claims and if this influence is universal for all types of injuries or limited to musculoskeletal injuries.

Late reporting and therefore, late medical treatment, did not yield an increase in the claims' medical costs. More studies may be

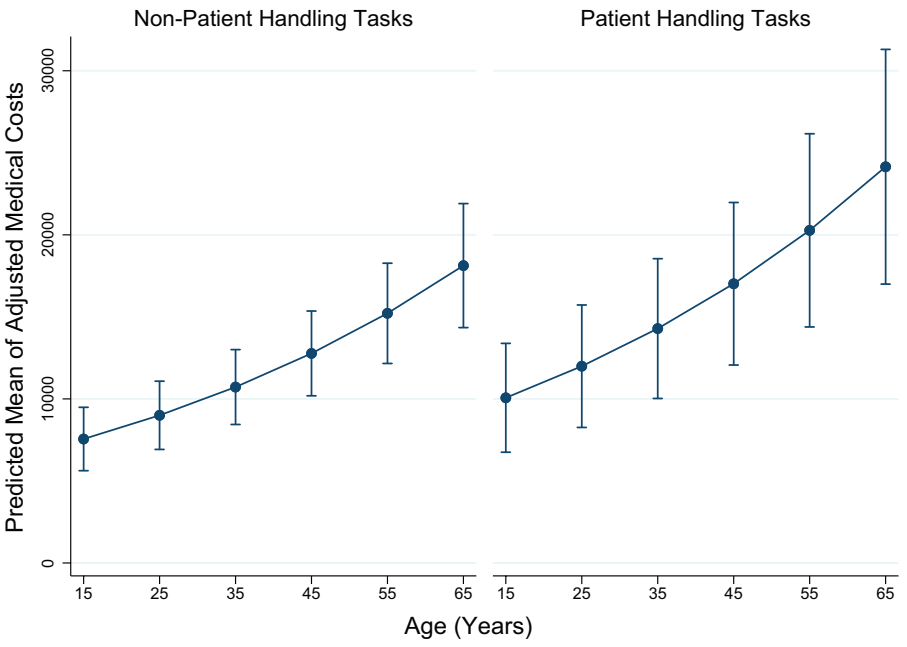

FIGURE 3. Predictive margins of age variable with 95% confidence intervals for indemnity claims. Predictive margins were adjusted for claims' number of days open, gender and tenure of the claimants.

needed to understand all the factors outside the scope of this analysis which may drive the total cost of claims when the injuries are not reported promptly.[36,37]

Unless required by the scope of their research, researchers analyzing the medical costs related to PH&M claims may benefit from grouping the claims by PH&M group (eg, boosting and transfer) rather than categorizing for each task (eg, transferring from/to bed or stretcher or transferring from/to chair or wheelchair, etc.). This most likely will increase the accuracy of claims classification and therefore increase the number of claims to be analyzed.

CONCLUSION

The results of this exploratory analysis showed the adjusted medical costs of the analyzed medical only and indemnity claims were generally influenced by different factors. For medical only claims, the costs were affected by the type of injury and to a lesser degree; the number of days in which the claim was open and the age of the claimant. For indemnity claims, it was the age of the claimant which mainly affected the medical costs except when looking at injuries related to patient handling and non-patient handling tasks. For this comparison, the gender of the claimant had the higher multiplicative factor affecting the costs. In an industry where most employees are female, male workers are often asked to perform higher risk and/or more difficult patient handling and mobility tasks. This can be seen as an indicator that there is room for improvement for some of the policyholders' safe patient handling and mobility programs from where the analyzed claims were gathered. In addition to the age, the number of open days and the tenure of the claimants also meaningfully affected the medical costs of indemnity claims but at a lesser degree than the age of the claimant.

The researchers recommend that healthcare administrators, directors of nursing and safe patient handling committee members focus their efforts to minimize the potential hazard of workers having to absorb partial weight of the patients for any PH&M task and not only on those they may deem as dangerous. This analysis revealed neither the type of injury nor the specific PH&M task being performed were found to meaningfully affect the medical costs analyzed for the most serious (indemnity) claims.

An effective safe patient handling and mobility program will not only decrease musculoskeletal injury rates but also increase the retention of experienced workers in an industry that is showing signs of an aging workforce.[14,38,39] Studies have shown that high retention of experienced workers in long-term healthcare facilities is associated with a lower number of deficiencies associated with Quality of Care.[40,41]

Limitations of the Data

Claims were classified based on the description provided by the policyholder at time of filing. Any errors or omissions by the policyholder could potentially produce a misclassification of the claim. The number of days a claim was open may include days that are not directly related to the treatment of the injury (eg, billing issues). The MEMIC Group provides PH&M interventions to its healthcare policyholders as part of its loss control services. These services include SPH&M programs include but not limited to; patient handling observations, fall recovery drills, and a full-day workshop along with ongoing program and committee support. Furthermore, The MEMIC Group asks its new and current healthcare policyholders' commitment to implement or enhance its patient handling and mobility program including avoiding manually recovering patients from the floor. It is possible that these interventions had an influence on the number of claims submitted and medical costs of the claims reviewed in this study. Although the selected claims had a status of closed or re-closed, it is possible that some of the most recent claims had not yet reached their maturity and therefore, underestimating their final medical costs. The adjusted medical costs are based on the PHC index and it is possible that a different index would yield different adjusted medical costs. As stated previously, it is also possible that the medical costs for some claims analyzed were partially paid by the policyholders and therefore, their true medical costs may be underestimated.

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