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Risks and causes of musculoskeletal injuries among health care workers

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Background Musculoskeletal injuries (MSIs) persist as the leading category of occupational injury in health care. Limited evidence exists regarding MSIs for occupations other than direct patient care providers. An evaluation of the risks, causes and activities associated with MSIs that includes non-patient care health care occupations is warranted.

Aims To examine the risks and causes of time-loss MSIs for all occupations in health care.

Methods Workers employed by a health region in British Columbia were followed from April 2007 to March 2008 using payroll data; injuries were followed using an incidence surveillance database. Frequency and rates were calculated for all occupational injuries and MSIs and relative risks (RRs) were computed using Poisson regression. Causes and occupational activities leading to MSIs were tabulated for direct care occupations and non-patient care occupations.

Results A total of 944 injuries resulting in time-loss from work were reported by 23 742 workers. Overall, 83% injuries were musculoskeletal. The two occupations showing highest RR of MSIs relative to registered nurses were facility support service workers [RR = 3.16 (2.38–4.18), respectively] and care aides [RR=3.76 (3.09–4.59)]. For direct patient care occupations, the leading causes of MSIs were awkward posture (25%) and force (23%); for non-patient care occupations were force (25%) and slip/fall (24%). Patient handling activities accounted for 60% of all MSIs for direct care occupations. For non-patient care occupations, 55% of MSIs were due to material/equipment handling activities.

Conclusions Prevention efforts for MSIs should be directed to non-patient care occupations as well and consider their occupation-specific causes and activities.

Key words Health care worker; musculoskeletal injury; occupational health; occupational injury.

Introduction

Despite numerous engineering and administrative controls that have been put in place, musculoskeletal injuries (MSIs) persist as the leading category of occupational injury in health care. Health care workers are reported to sustain MSIs at a rate exceeding that of workers in other industries [1–4]. Data from the Bureau of Labor Statistics in 2001 report that rates of time-loss occupational injury were 8.8/100 full-time hospital workers and 13.5/100 long-term care workers [5]. These rates are indeed higher than those for other industries, including mining (4.0/100 full-time workers) and construction (7.9/100 full-time workers) [5]. In British Columbia (BC), Canada, the health care sector also has a higher injury rate than other industries (i.e. agriculture) and has a consistently higher injury rate than the provincial average for all industries [6]. Furthermore, within BC's health care sector, the long-term care sub-sector has experienced consistently higher injury rates than the other sub-sectors (community health and acute care) and has an injury rate that is 2.5 times the entire health care sector's average [6].

The disproportionate number of MSIs sustained by direct care providers has been attributable to patient handling and overexertion [7–9]. The cumulative effects of the daily activities involved with the provision of nursing care, such as lifting, transferring and repositioning patients,

throughout a working lifetime are conceived to result in the development and exacerbation of an MSI [10]. These activities place extremely high physiological stresses on the body, beyond the upper limits suggested by the National Institute for Occupational Safety and Health [11,12].

As much of the previous research exploring MSIs in health care has largely focused on direct patient care occupations, especially nurses, limited evidence exists regarding MSIs for other occupations [13,14]. The jobs within the health care sector are diverse; they range from administration and finance to housekeeping to maintenance. Approximately, 40% of occupations are actually non-patient care providers [15]. The job tasks of workers in health care are very different and consequently, so are their health and safety risks. An evaluation of the risks, causes and activities associated with MSIs that includes all workers in health care is warranted as the interventions need to be specifically designed to target each group.

This study uses surveillance data from one health region in the Canadian province of BC to examine the risks and causes of time-loss MSIs for all occupations in health care, with the exception of physicians and contracted workers. The specific objectives of this study were to:

1. report the risk of MSIs among workers in health care;
2. determine the risk of MSIs across demographic (gender and age) and occupational (health care sub-sector, employment status and occupation) variables and
3. examine whether the causes and occupational activities leading to MSIs were different for direct patient care and non-patient care occupations.

We sought to characterize the burden of MSIs among workers in health care for the purpose of identifying appropriate prevention strategies and alleviating this significant burden.

Methods

Workers employed by a health region in BC were followed from April 2007 to March 2008 using payroll data. Injuries were reported through the Workplace Health Indicator Tracking and Evaluation (WHITE™) Database, which was developed by the Occupational Health and Safety Agency for Healthcare in BC in collaboration with BC's health care employers and unions. The WHITE™ Database is an active surveillance system used in five of six health regions in BC to keep track on all occupational incidents—near-miss, non-compensable medical aid (first aid, emergency and general practitioner visits) and compensable time-loss and health care payments by the workers' compensation board (WorkSafeBC). After an incident, workers fill out a triplicate form, which has identical fields to the WHITE™ Database with their supervisors. One portion of the form is sent to the occupational health and safety department and the other portion is sent to WorkSafeBC, if an incident requires lost time or health care. Details of incidents, such as nature of injury, causes and activities, are tracked within the database. Information regarding the development and usage of the WHITE™ Database has been previously published [16].

The selected health region serves an urban population of 1.5 million people, with >23 000 workers. For each worker, data on occupation, age, gender, sub-sector (acute care, community care and long-term care), employment status (full time, part time, casual and multiple) and productive hours were extracted without personal identifying information.

Occupations were grouped into direct patient care and non-patient care. We defined direct patient care occupations as those involving the provision of patient care services, such as registered nurses (RNs), licensed practical

Table 1. Frequency of all injury and MSI, by selected demographic and occupational variables

Demographic and occupational variables	p-y (% of p-y)	All injury, *n*	MSI, *n* (% of all injury)
Gender			
Female	11558 (87)	852	709 (83)
Male	1792 (13)	92	69 (75
Age group			
<30	1910 (14)	103	88 (85)
30–39	2908 (22)	192	166 (86)
40–49	4250 (32)	318	256 (81)
50–59	3684 (28)	278	224 (81)
≥60	598 (4)	53	44 (83)
Sub-sector			
Acute care	9297 (70)	562	465 (83)
Community care	2313 (17)	129	113 (88)
Long-term care	1572 (12)	244	195 (80)
Others	168 (1)	9	5 (56)
Employment status			
Full time	5560 (42)	351	296 (84)
Part time	1721 (13)	105	89 (85)
Casual	1901 (14)	124	99 (80)
Multiple	4168 (31)	360	290 (81)
Missing	0	4	4 (100)
Occupation			
Registered nurses	4601 (34)	235	210 (89)
Licensed practical nurses	697 (5)	72	64 (89)
Care aides	1849 (14)	360	304 (84)
Facility support service workers	539 (4)	113	70 (62)
Health sciences professionals	1470 (11)	30	27 (90)
Management/admin and clerk	1835 (14)	20	15 (75)
Resident/student/unknown	655 (5)	6	5 (83)
Maintenance workers	211 (2)	21	13 (62)
Lab and imaging workers	340 (3)	15	11 (73)
Health services workers	663 (5)	38	33 (87)
Missing	490 (4)	34	26 (76)

p-y, person-years.

In addition to MSIs, all injury includes cuts, burns, bruise/contusions, puncture wounds, allergic responses and irritations.

nurses (LPNs), care aides (CAs) and health sciences professionals. All other occupations were defined as non-patient care in this study.

Time-loss injuries of all types and MSIs were reported in our study. MSIs were defined as a type of injury involving muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue through sprains, strains and inflammation. MSIs also included injuries relating to overuse or overexertion, such as cases of tendonitis or muscle strain.

Frequencies of 'all injury' and 'MSIs only' were tabulated by age, gender, employment status, occupation and sub-sector. Person-years were summed and used as denominator data to denote person-time at risk. Rates and adjusted relative risks (ARRs) for all injury and MSIs only were calculated for the variables sub-sector and occupation using injury as the dependent variable. The adjusted model used Poisson regression to control for the variables gender, age group, sub-sector and employment status (full-time, part-time, casual and multiple) to examine the difference by occupation. We did not include experience in the model with age as it was found to be highly correlated with age.

Causes of MSIs and occupational activities leading to MSIs were tabulated for direct patient care occupations and non-patient care occupations. Both causes and activities were not mutually exclusive so that each MSI could have more than one associated cause and/or activity.

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS Version 17.0, 2008) with two-sided significance levels of $P \leq 0.05$.

Table 2. Rates and ARR for all injury and MSI by demographic and occupational variables

Demographic and occupational variables	All injury		MSI	
	Rates per 100 p-y	ARR[a] (95% CIs)	Rates per 100 p-y	ARR (95% CIs)
Gender				
Female	7.4	1.00 (ref.)	6.1	1.00 (ref.)
Male	5.1	0.72 (0.57, 0.91); $P < 0.01$	3.8	0.69 (0.52, 0.90); $P < 0.01$
Age				
<30	5.4	1.00 (ref.)	4.6	1.00 (ref.)
30–39	6.6	0.94 (0.75, 1.19); NS	5.7	1.02 (0.78, 1.32); NS
40–49	7.5	0.94 (0.76, 1.18); NS	6.0	0.95 (0.74, 1.22); NS
50–59	7.5	0.99 (0.79, 1.24); NS	6.1	0.98 (0.76, 1.27); NS
≥60	8.9	1.25 (0.90, 1.75); NS	7.4	1.36 (0.94, 1.97); NS
Sub-sector				
Acute care	6.0	1.00 (ref.)	5.0	1.00 (ref.)
Community	5.6	0.73 (0.60, 0.89); $P < 0.01$	4.9	0.75 (0.61, 0.94); $P < 0.05$
Long-term care	15.5	1.30 (1.10, 1.54); $P < 0.01$	12.4	1.14 (0.94, 1.38); NS
Employment status				
Full time	6.3	1.00 (ref.)	5.3	1.00 (ref.)
Part time	6.1	0.89 (0.72, 1.10); NS	5.2	0.89 (0.70, 1.13); NS
Casual	6.5	0.63 (0.52, 0.78); $P < 0.001$	5.2	0.60 (0.48, 0.77); $P < 0.001$
Multiple	8.6	1.09 (0.94, 1.26); NS	7.0	1.03 (0.87, 1.21); NS
Occupation				
Registered nurses	5.1	1.00 (ref.)	4.6	1.00 (ref.)
Licensed practical nurses	10.3	1.98 (1.54, 2.55); $P < 0.001$	9.2	1.98 (1.49, 2.63); $P < 0.001$
Care aides	19.5	3.62 (3.03, 4.33); $P < 0.001$	16.4	3.76 (3.09, 4.59); $P < 0.001$
Health sciences professionals	2.0	0.43 (0.30, 0.61); $P < 0.001$	1.8	0.42 (0.28, 0.63); $P < 0.001$
Facility support service workers	21.0	4.06 (3.23, 5.12); $P < 0.001$	13.0	3.16 (2.38, 4.18); $P < 0.001$
Management and clerk	1.1	0.23 (0.15, 0.35); $P < 0.001$	0.8	0.18 (0.10, 0.31); $P < 0.001$
Resident/student/ unknown	0.9	0.16 (0.07, 0.38); $P < 0.001$	0.8	0.16 (0.06, 0.42); $P < 0.001$
Maintenance workers	10.0	2.27 (1.39, 3.70); $P < 0.01$	6.2	1.77 (0.97, 3.25); NS
Lab and imaging workers	4.4	0.88 (0.53, 1.45); NS	3.2	0.74 (0.40, 1.36); NS
Health services workers	5.7	1.11 (0.79, 1.56); NS	5.0	1.18 (0.81, 1.70); NS

p-y, person-years.

[a]Adjusted variables: gender, age group, sub-sector, employment status and occupation.

Results

The workers studied were predominantly female (87%), between 40 and 59 years of age (60%) working in acute care (70%), working full-time (42%) and RNs (34%).

During the 1 year study period, a total of 944 injuries resulting in time-loss from work were reported by 23 742 workers working 13 350 person-years. Of these injuries, 83% were of musculoskeletal nature. Other injuries included cuts, burns, bruises/contusions, punctures, allergic responses and irritations.

Table 1 presents the frequency of all injury and MSIs only by demographic and workplace variables. For all demographic and workplace variables, MSIs represented the highest proportion of all injury types.

Table 2 presents the rates and ARRs for all injury types and 'MSIs only', by demographic and occupational variables. For gender, we observed that males sustained a lower relative risk (RR) for all injury [RR (95% CI) = 0.72 (0.57–0.91)] and MSIs only [RR = 0.69 (0.52–0.90)] compared with females [RR (95% CI) = 1]. Relative to the acute care sub-sector, the community care sub-sector sustained a lower risk for all injury [RR = 0.73 (0.60–0.89)] and MSIs only [RR = 0.75 (0.61–0.94)]. In contrast, long-term care showed an increased RR to acute care for all injury [RR = 1.30 (1.10–1.54)]. A lower risk was observed

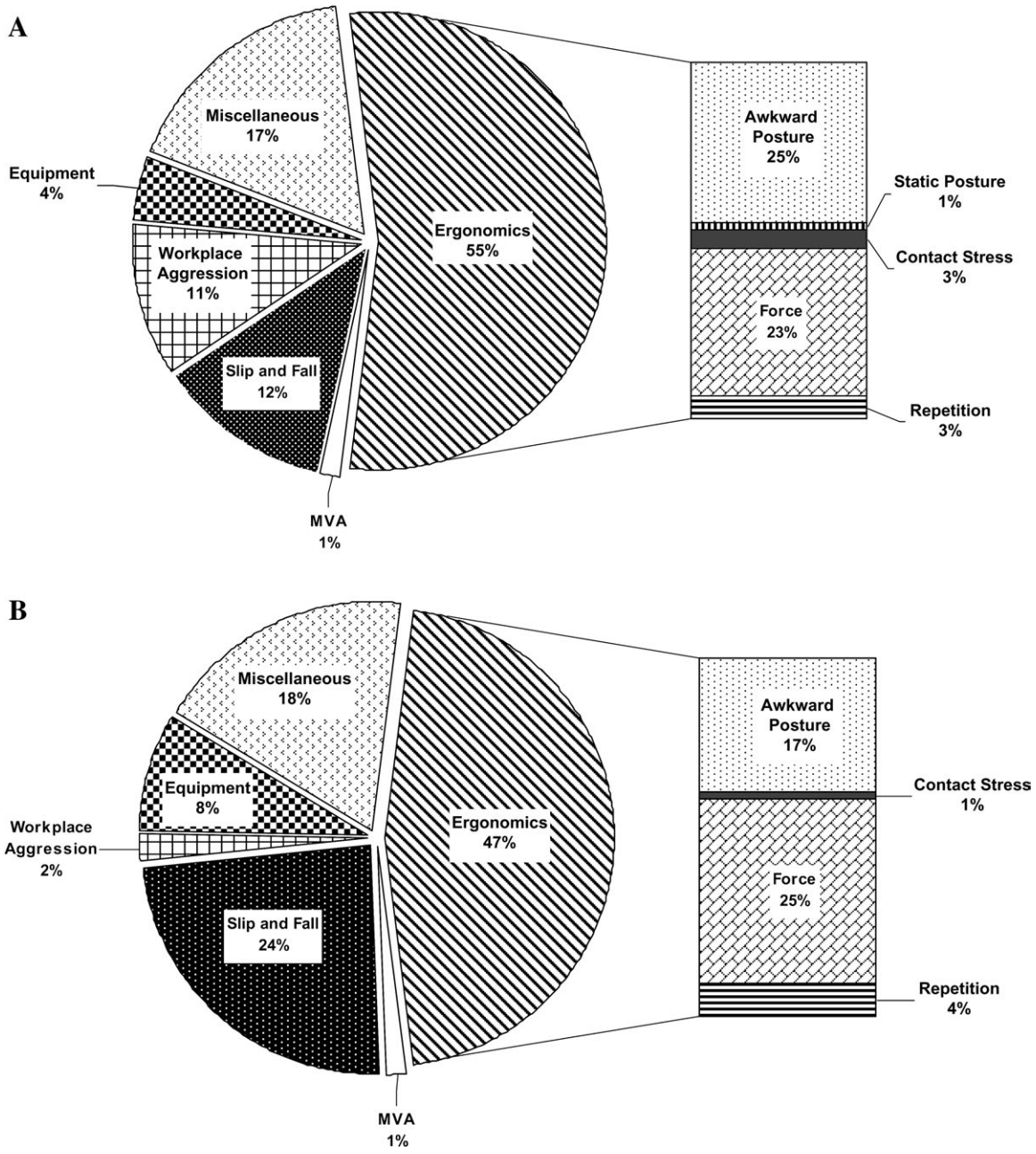

Figure 1. (A) Causes of MSI for direct patient care occupations. (B) Causes of MSI for non-patient care occupations. MVA, motor vehicle accident.

for casual workers relative to their full-time workers for all injury [RR = 0.63 (0.52–0.78)] and MSIs only [RR = 0.60 (0.48–0.77)]. The two occupations showing greatest RR of all injury and MSIs only relative to RNs were facility support service workers [RR = 4.06 (3.23–5.12) and 3.16 (2.38–4.18), respectively] and CAs [RR = 3.62 (3.03–4.33) and 3.76 (3.09–4.59), respectively].

Figure 1 illustrates causes of MSIs for direct patient care occupations (Figure 1A) and non-patient care occupations (Figure 1B). For direct patient care occupations, the leading cause of MSIs was ergonomics (55%), which was dominated by awkward posture (25%) and force (23%), whereas the leading cause for non-patient care occupations was ergonomics (57%)—of which force constituted 25%—and slips and falls 24%.

Table 3 depicts occupational activities leading to MSIs for direct patient care and non-patient care occupations. Patient handling activities accounted for ∼60% of all MSIs for direct patient care occupations. For non-patient care occupations, 55% of MSIs were explained by material/equipment handling activities.

Table 3. Occupational activities leading to MSI

Activity	Direct patient care occupation *n* (%)	Non-patient care occupation *n* (%)
Patient handling	369 (59)	12 (9)
Repositioning	137	0
Transferring	149	8
Preventing a fall	55	3
Holding/assisting during procedure	70	2
Assisted walking	12	0
Toileting	13	0
Patient care	84 (14)	1 (1)
Personal care	79	1
Washing	45	0
Dressing	22	0
Changing	34	1
Feeding	1	0
Procedure	5	0
Material/equipment handling	55 (9)	76 (55)
Lift/lower	22	39
Push/pull	31	40
Carry	6	6
Equipment operation	11 (2)	3 (2)
Driving	8	1
Other	3	2
Office work	2 (<1)	1 (1)
Natural activity	94 (15)	39 (28)
Walking/running	73	29
Bending	14	8
Reaching	14	7
Other	6 (1)	6 (4)
Spill clean-up	0	1
Cleaning	6	5

Individual activities are not mutually exclusive of one another and therefore do not equal the subgroup total.

Discussion

Our findings confirm that MSIs account for the greatest burden of all injury types in health care with respect to annual incidence. Overall, 83% of all injuries sustained were musculoskeletal. This high proportion of MSIs was held across gender, age groups, health care sub-sector, employment status and occupations, supporting the needs of mitigating risks of this type of injury for all occupations. It appeared that risks for all injury and MSIs were generally of comparable magnitude and direction.

Compared with RNs, occupations associated with an increased risk for all injury and MSIs include facility support service workers, LPNs and CAs. These results suggest that prevention efforts for direct patient care occupations should consider other occupations as well as RNs, as LPNs and CAs deal with many of the patient handling activities leading to MSIs. As patient handling activities have been associated with increased MSIs for direct care providers [17–19] and effective ergonomic interventions to improve patient handling techniques have been demonstrated [3,20,21], continued and heightened attention should endeavour to apply these prevention initiatives to all high-risk patient care occupations.

We offer new insight for non-patient care occupations, demonstrating that facility support service workers also sustain an increased risk for MSIs. Similar to direct patient care occupations, we observed force as a leading cause of MSIs; however, we also identified that slips and falls were the other leading cause of MSIs for non-patient care occupations. In a study on maintenance workers, 40% of daily activities were performed in strenuous postures; awkward postures are mainly explained by accessibility issues to machinery [22]. As such, prevention efforts for MSIs directed to non-patient care occupations should consider specific occupational causes and activities that differ from those of direct patient care occupations.

We acknowledge several limitations for this study. Firstly, our study only examined data from one health region over a 1 year period. Although this limits the ability to generalize results temporally and geographically, our undertakings are still helpful in providing new insight for non-patient care occupations. Secondly, our analysis included only time-loss injuries and thus, it could be possible that the true burden of injury might be underestimated by our results due to inherent under-reporting of injury among health care workers [13]. Thirdly, we were unable to control for confounders such as underlying MSI-related issues like muscle weakness and a lack of exercise and previous injuries prior to the 1 year study period, as this information is not available in the database. Finally, previous studies have suggested that work

organization [17,23] and work stress [19,24] influence the risk of MSIs; these are variables that we did not have access to in our current study. Further research should investigate organizational and psychosocial issues to develop a multifactorial understanding of MSIs for all occupations.

Yet, despite these limitations, our study increases the current understanding of MSI epidemiology by examining risks for all occupations in health care. Our approach comprehensively determined risks for several important demographic and workplace variables using person-time at risk data. We hope that findings from this study will help guide formulating policy and put appropriate effective and timely interventions in place to alleviate the burden caused by the injury for the workers and employers.

Key points

- Musculoskeletal injuries account for the greatest burden of all injury types in health care for all occupations.
- In addition to registered nurses, other direct patient care occupations such as licensed practical nurses and care aides should be targeted with patient-handling interventions.
- Prevention programs specific to the causes and occupational activities of non-patient care occupations in health care, especially facility support service workers, should be developed and implemented.

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