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Research funded by WorkSafeBC and WorkSafe Saskatchewan

Identifying Risk Factors of Falls among BC's Healthcare Workers

March 2010

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WorkSafeBC, Saskatchewan Workers' Compensation Board and Workplace Health, Safety and Compensation Commission of Newfoundland & Labrador for funding

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Main Research Findings and Policy/Prevention Implications

Main Research Findings

- Workers in BC's healthcare are at high risk of occupational falls.
- Fall injuries increased over the three year study period (2005-2007).
- Workers in long-term care sector are at higher risk of falls compared to the other two sub-sectors, acute care and community care.
- With respect to occupation, Facility Support Services workers, Community Health workers and Maintenance workers are at high risk.
- Females and older workers are more vulnerable to fall injuries compared to their male and younger colleagues.
- With respect to body parts affected, falls largely resulted in injury to the upper extremity.
- The major contributing factors identified are slipperiness and uneven floor surfaces, inadequate lighting and ice and heavy precipitation.
- With respect to workers' compensation statistics, for falls that result in time-loss from work, on average 14 days were lost (median) with a median compensation claims costs of $1703.

Policy/Prevention Implications

- Since the rate of falls is high and increasing over time, falls prevention initiatives should be a priority in healthcare.
- Occupation-specific interventions may be helpful to bring effective and immediate changes, keeping in mind the diversity of tasks they perform, dispersion of their workload over the day, week, month and season and the different work environments for a wide range of occupations working in the healthcare sector; a job task analysis may be helpful to obtain detailed information on how the tasks are currently performed to suggest alterations.
- Facility Support Services workers and Community Health workers are particularly vulnerable; therefore policy and prevention strategies should be targeted towards them.
    - The majority of falls for Facility Support Services workers occurred in the dish-room- the drainage functions and current floor conditions floors in the dish-room should be examined and improved and current compliance to general housekeeping procedures should be scrutinized as well.
    - The majority of falls for Community Health workers occurred outside the clients' homes; thus, hazard perception training and an appropriate footwear policy and ensuring compliance may be helpful.
- Lack of proper signage (caution signs/wet floor) and slow and inadequate cleanup were concerns identified across facilities; thus, compliance to current housekeeping procedures should be assessed and improved.
- Promotional campaigns to improve reporting of near miss and minor fall incidents will be helpful in order to pro-actively identify and reduce associated hazards before serious injuries occur.

Executive Summary

Occupational falls are the second leading cause of injury to workers in British Columbia's (BC's) healthcare. While there has been a substantial amount of ongoing and completed research on identifying and controlling needle stick, patient handling and chemical exposure incidents, there is a paucity of epidemiological and prevention research on occupational falls, especially in the healthcare setting. The monitoring of occupational falls in healthcare is critical to understand the size of the problem, characterize trends and estimate the associated economic burden, and thereby, improve the knowledge among health and safety professionals, policy makers and the workers so that appropriate preventative initiatives are designed and implemented. The aims of this study are to identify the risk factors that lead to fall related injuries and to estimate associated economic burden with respect to days lost from work and compensation costs for falls related claims.

This study is a detailed investigation of workplace falls among healthcare workers in a large BC health region. The data for this study were gathered from the Workplace Health Indicator Tracking and Evaluation (WHITE™) Database: a web-based surveillance system in place at the BC health regions. WHITE™ facilitates the analysis of workplace incidents and injuries to ascertain whether preventive measures are needed and where should they lie. These data were linked to the workers' compensation data and payroll data. Training on data entry and coding and standardization are provided as part of this 5-year old ongoing surveillance across the health authorities.

This analysis included incidents over a three year period of follow up (2005-2007). The rates, days lost and costs of falls were stratified and analyzed by worker demographics and workplace characteristics. The locations and the contributing workplace and environmental factors that led to the falls as well as time and seasonal patterns were also examined. This study examined both 1) all falls and 2) falls that resulted in workers' compensation claims. Falls from elevation and falls from same level were both captured and included.

Results show that the rate of fall incidents is increasing over the years. For time loss falls, rates increased from 0.5 falls per 100,000 productive hours (PH) in 2005 to 0.7 falls per 100,000 PH in 2007. Fall rates are high in the long-term care sector (0.9/100,000 PH), for Facility Support Services (2.5/100,000 PH) and Community Health workers (1.6/100,000 PH) and found to have an association with gender, age and experience of the worker. The falls incidence varies by quarter of the year, day of the week, and time of the day. Falls are most frequent in the winter months, middle of the working week and from 7 am to 11 am in the day. There is also variation found by location of work. Falls in acute care occur largely in the dishroom, hallway, parking lot and patients' rooms; falls in community care happen most frequently outside of patients' homes; whereas, falls in long term care occur principally in residents' rooms. The leading contributing factors are slippery and uneven floors and icy/snowy conditions, followed by workspace and layout/design of the location of work. Both compensation costs and associated days lost for falls with claims are increasing over the years, along with the number of falls.

Research examining how, when, where, and why fall injuries take place and who are at higher risk (the varying degrees of susceptibility by demographic and workplace characteristics) is helpful in developing, implementing and evaluating appropriate injury reduction programs.

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Research Problem/Context

British Columbia's healthcare sector employs approximately 217,000 workers, which accounts for approximately 10% of the provincial workforce (WorkSafeBC, 2007). Between 2001 and 2005, over 35,600 time-loss injury claims resulted in almost 1.7 million days lost from work and over $225 million paid in these claims in this sector (WorkSafeBC, 2006). Approximately 14% of these time-loss injury claims were due to falls, making falls the second leading cause of injury in the healthcare sector. Furthermore, the number of fall injuries is increasing each year.

Research has shown that change in working environment and adoption of new technologies can alter the risk factors of injuries, including slips and falls. A 1999 study conducted in nursing homes found that musculoskeletal injuries due to slips and falls increased after the implementation of a "zero lift program," where floor and ceiling lifts were used to reduce injuries among staff. Consequently, ergonomic specialists established interventions to reduce slip/fall injuries by investigating the key causes leading to the incidents (Garg, 1999). Therefore, research is necessary to update the knowledge and examine how and why certain injuries take place to determine the varying degrees of susceptibility of workers to help develop suitable injury interventions.

Although there is limited research on falls in healthcare specifically, occupational falls have been studied extensively in other industrial sectors such as construction (Chi et al. 2005; Lipscomb et al. 2003) and postal work (Haslam and Bentley, 1999; Bentley, 2008). As some risk factors for falls are similar across industries, it is useful to briefly review the epidemiology and trends in other industries as well.

For all occupational falls, Gauchard et al. (2001) describes that environmental hazards such as obstacles, inadequate lighting, uneven/slippery surfaces and clutter are major risk factors. In the construction industry falls were largely caused by surface conditions, terrain and weather (Lipscomb et al. 2006). Researchers have found that postal workers are prone to falls due to slippery surfaces, improper footwear, poor lighting (Haslam and Bentley, 1999), abrupt vertical transitions, steps, slopes (Bentley and Haslam, 2001) and climate (Bentley, 2008). As community health workers work outside of hospital settings; they may share similar dangers of slipping/falling as postal workers.

There are few studies that have addressed the risk factors for falls specifically in the healthcare setting. A study of injuries in the Food Services and Nutrition Department in an urban hospital showed that 68% of injuries over a three year period were due to slips and falls compared to other hospital departments (Eckerman et al. 2004). In addition, cleaners also bear risks for falling/slipping in almost any industry and a substantial portion of workers in healthcare are involved in cleaning activities that put them at risk for injuries (Di Pilla, 2003). Among medical personnel in Sweden, the following constitute the majority of falls risk factors: slipping on wet floors, falling from stairs, tripping on objects, trying to maneuver a patient, rushing to emergency incidents, assaults by patient and slipping on ice outdoors (Ohman, 2002). Similarly, a study on hospitals in the US showed that environmental risk factors for falls include obstacles, cords, uneven flooring, liquid contamination, stairs, and ice/snow (Bell et al. 2008). Furthermore, falls were principally (23.6%) resulting from liquid contamination (Bell et al. 2008).

To plan and institute effective fall prevention programs, it is useful to examine first the causes of falls and identify vulnerable worker populations. This study seeks to examine the risk factors for falls across all healthcare settings – acute, community and long term care. Risk factors are identified by sub-sector, occupation and other worker demographics, such as, age, gender, and experience.

Methods

The data for this study were gathered from the Workplace Health Indicator Tracking and Evaluation (WHITE™) Database. WHITE™ data include information on: descriptions of incidents, demographics of the injured worker, contributory factors related to the location and circumstances of injury, nature and cause of injury, and body part involved. Following an incident or noted hazard, the affected worker reports his/her concern to a manager/supervisor. Details of the incident are written onto a triplicate form through a Workplace Incident Reporting Call Centre through which staff ask questions that reflect the fields contained in the WHITE™ Database. The form is received by the occupational health and safety department of the relevant health region where the incident details are verified and followed up. If an incident requires medical care or time-loss, a portion of the form goes to the claims department of the Workers' Compensation Board (WorkSafeBC).

Payroll data were used to identify workers who were working at the health region from 2005 to 2007. Information on occupation, facility type, wage rate, duration of employment, hours worked per pay-period, gender, and years of age were also obtained. For this analysis, all records with the following standard WHITE™ nature of injury category "Slip, Trip and Fall" were retained and analyzed. A second set of analysis included only incidents that resulted in approved workers' compensation time-loss compensation payments (at least one day lost from work by definition). Analysis was made possible by using an individual level linking of incident, payroll and WorkSafeBC data.

Each injury related claim statistic was censored at 4 months, except the claims submitted in December of 2007, which were observed for only three months. The analysis was conducted using the statistical package for the social sciences (SPSS Version 14.0, 2006) and is outlined by the following themes:

1. **Falls Statistics provide the total counts and rates (per 100,000 Productive Hours) of**
   - **a.** All falls
   - **b.** Time-loss falls: falls resulting in WorkSafeBC approved time-loss compensation payments by March 2008.

   Incidents are stratified by a range of variables (gender, occupation, age, experience, year of injury and sub-sector). Time-loss falls are considered to be more severe as they require absence from work for recovery.

2. **Multivariate Results** provide the relative risk of experiencing a fall injury for different worker populations (e.g. by occupations, sub-sector, experience, etc.) while controlling for confounding variables. This analysis was done for only time-loss falls.

3. **Environmental factors, location and other factors related to falls** examine the seasonal variation of falls, time of the incident, affected body parts, nature of the sustained injury, and the activity at the time of incident as well as the locations in which the majority of incidents occurred and the contributing factors. This analysis was done for all falls.

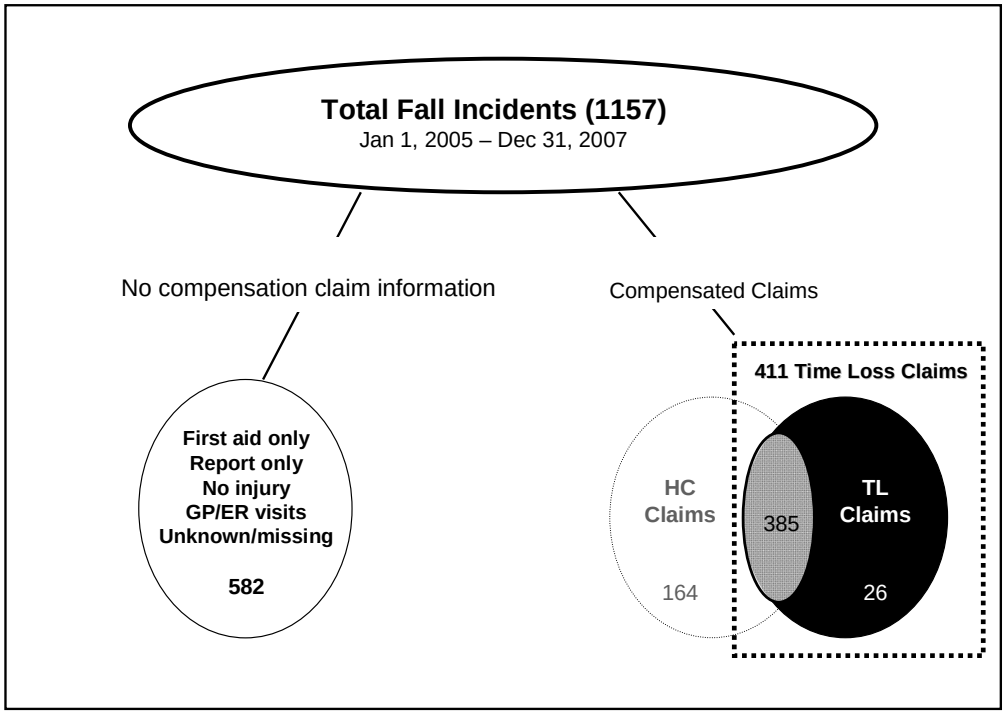
4. **WorkSafeBC compensated days and payments** provide the total and median (per accepted claim) of WorkSafeBC compensated days and the corresponding payments stratified by similar variables.

Research Findings

A total of 1157 fall incidents were recorded from January 1, 2005 to December 31, 2007. 411 of those incidents were 'time-loss.'

Overview of the incidents of falls at one BC health Region

A summary of injury counts based on WorkSafeBC claims status is below.



HC: Healthcare GP: General Practitioner
TL: Time-loss ER: Emergency Room

Figure 1 - Summary of fall incident statistics

Occupational Health & Safety Agency for Healthcare in BC
#301-1195 West Broadway, Vancouver, BC V6H 3X5 www.ohsah.bc.ca

The table below outlines the population of all workers and who had experienced a fall by year, sub-sector, gender, age, occupation and experience (N=1157 for all falls and N=411 for time-loss falls).

Table 1 – Demographic and workplace **c**haracteristics of falls

	Total Productive Hours	% of Productive Hours	Number of Falls (N=1157) (% of 1157)	No of Time-Loss Falls (N= 411) (% of 411))	Time-loss falls as % of all falls
Year					
2005	20,960,597	30.78%	306 (26)	108 (26)	35.29%
2006	22,253,486	32.68%	397 (34)	135 (33)	34.01%
2007	24,878,729	36.54%	454 (39)	168 (41)	37.00%
Sub-sector					
Acute Care	47,177,880	69.28%	725 (63)	242 (59)	33.38%
Long-term Care	7,933,607	11.65%	247 (22)	75 (18)	30.36%
Community Care	11,973,699	17.58%	175 (15)	91 (22)	52.00%
Gender of workers					
Female	59,146,129	86.86%	1,062 (92)	377 (92)	35.50%
Male	8,814,763	12.95%	95 (8)	34 (8)	35.79%
Occupation					
Registered Nurses (RN)	23,589,973	34.64%	350 (33)	97(26)	27.71%
Licensed Practical Nurses	3,353,057	4.92%	54 (5)	14 (4)	25.93%
Care Aide (CA)	7,322,491	10.75%	190 (18)	78 (21)	41.05%
Facility Support Services	2,706,048	3.97%	149 (14)	67 (18)	44.97%
Health Sciences Professionals	7,564,156	11.11%	58 (5)	18 (5)	31.03%
Admin/HR	9,290,201	13.64%	88 (8)	23 (6)	26.14%
Maintenance worker	1,096,325	1.61%	25 (2)	10 (3)	40.00%
Laboratory and imaging	1,631,334	2.40%	20 (2)	6 (2)	30.00%
Health Services worker	3,344,412	4.91%	43 (4)	13 (4)	30.23%
Community Health worker	2,415,900	3.55%	69 (7)	38 (2)	55.07%
Excluded/Other/Unclassified	3,073,995	4.51%	20 (2)	4 (1)	20.00%
Age of workers					
Less than 30	8,114,949	11.92%	74 (6)	30 (7)	40.54%
30-39	14,120,873	20.74%	166 (14)	65 (16)	39.16%
40-49	21,804,170	32.02%	375 (32)	132 (32)	35.20%
50-59	20,181,293	29.64%	459 (40)	146 (36)	31.81%
60+	3,737,729	5.49%	83 (7)	38 (9)	45.78%
Experience in Years					
Less than 1	8,529,501	12.53%	108 (9)	34 (8)	31.48%
1-5	22,351,956	32.83%	306 (26)	104 (25)	33.99%
6-10	11,646,342	17.10%	194 (17)	73 (18)	37.63%
10+	25,089,011	36.85%	541 (47)	198 (48)	36.60%

Risk of Falls (N=1157)

The rates of fall incidents are increasing over time. The rate of falls is shown below by year and health service delivery area (HSDA) in Figure 2, the demographic characteristics of the injured workers (gender, age, and experience) in Figure 3 and by occupation and sub-sector (Figure 4). Fall rates are highest at HSDA 1, in the long term care sector, for facility support services, community health workers, for females, and increase with age and experience of the worker.

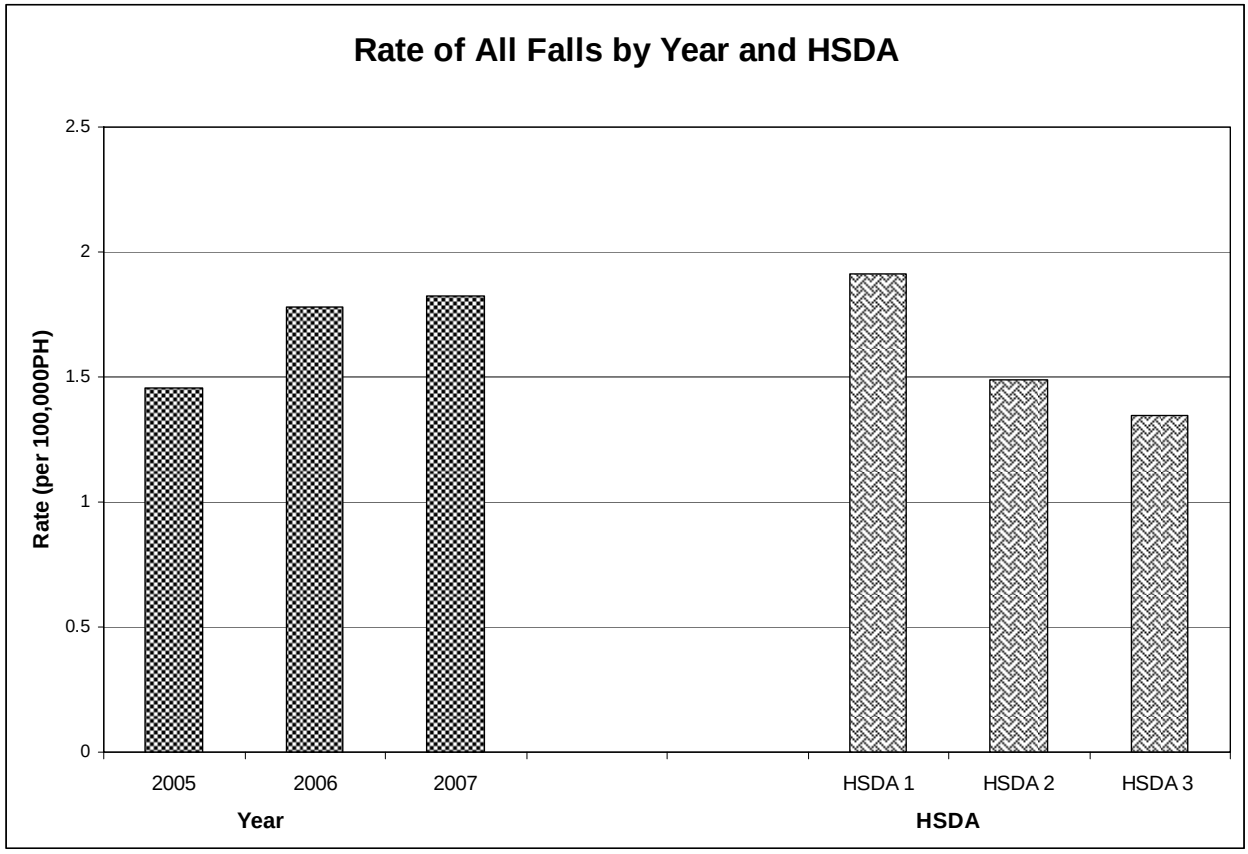


Figure 2 –Rates of all falls by year and HSDA

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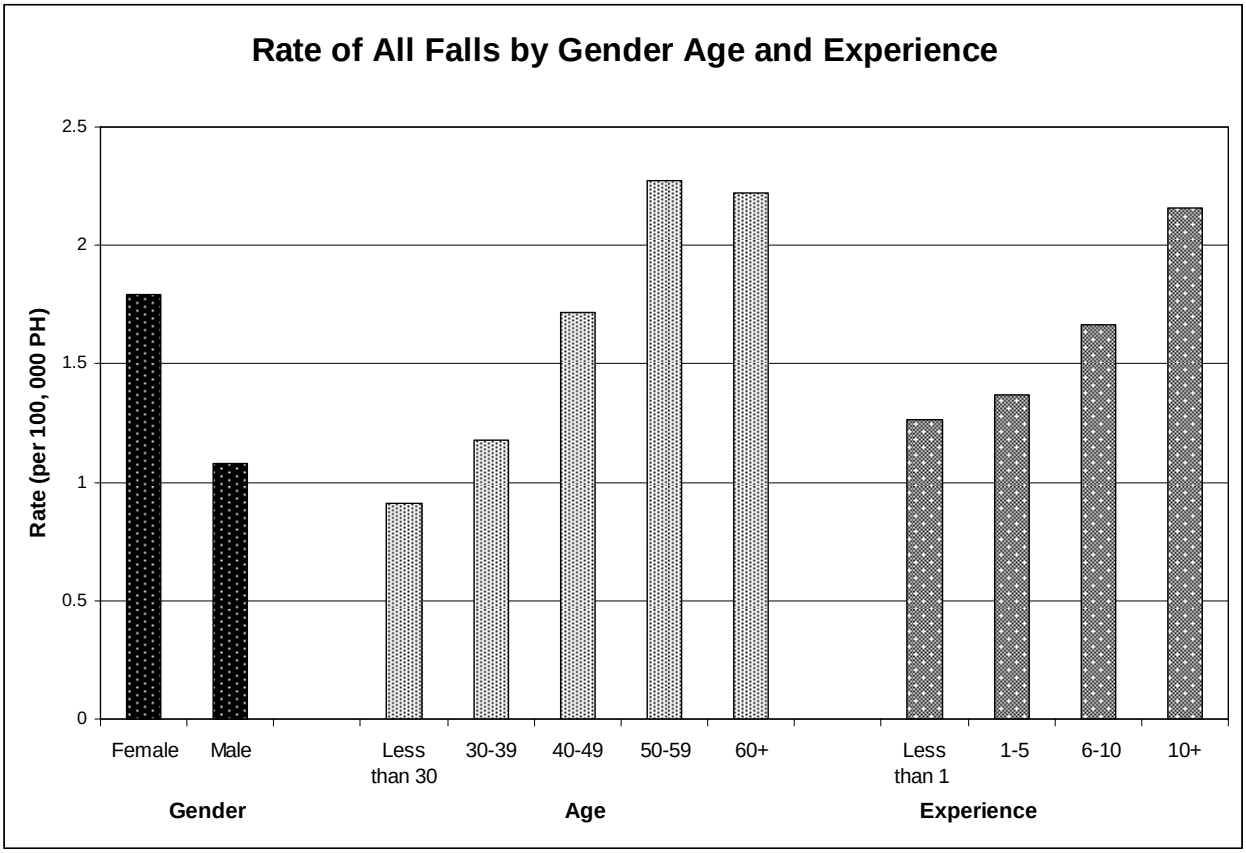

Figure 3 - Rates of all falls by gender, age and experience

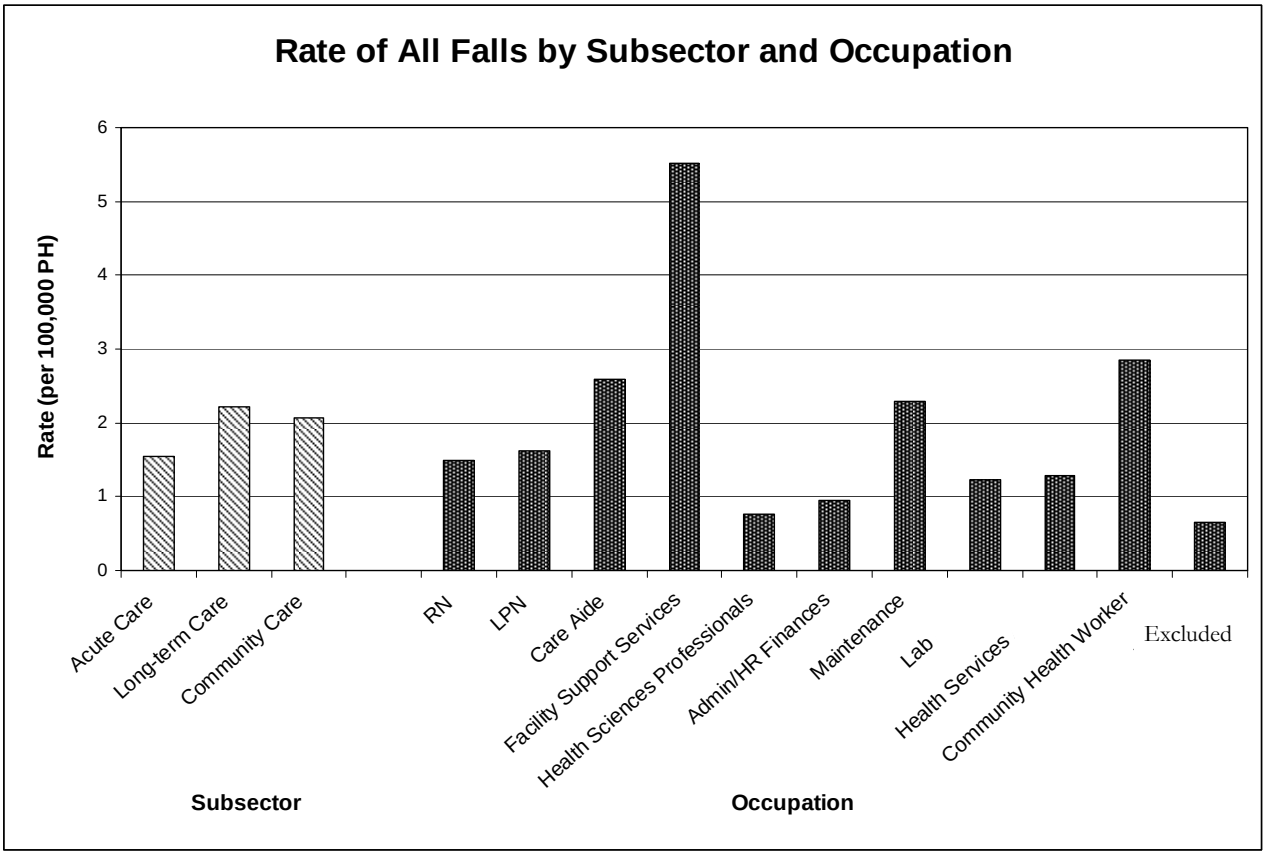

Figure 4 - Rates of all falls by sub-sector and occupation

Risk of Time-loss Falls (N=411)

The rate of time-loss falls is shown below by year and HSDA in Figure 5, the demographic characteristics of the injured workers (gender, age, and experience) in Figure 6 and by occupation and sub-sector in Figure 7. Fall rates are highest in HSDA 1, in the long term care sector, for facility support services, community health workers, for females, and increase with age and experience of the worker.

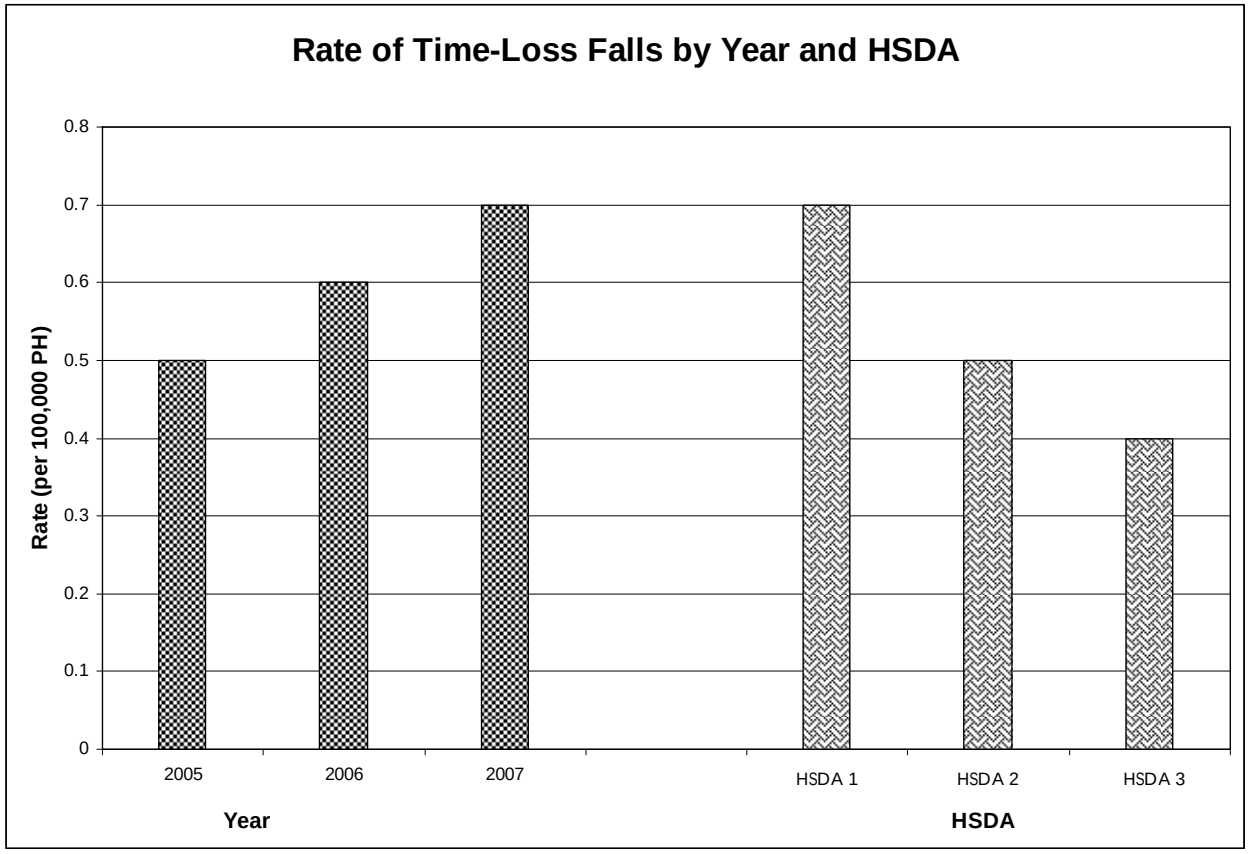

Figure 5 - Rates of time-loss falls by year and HSDA

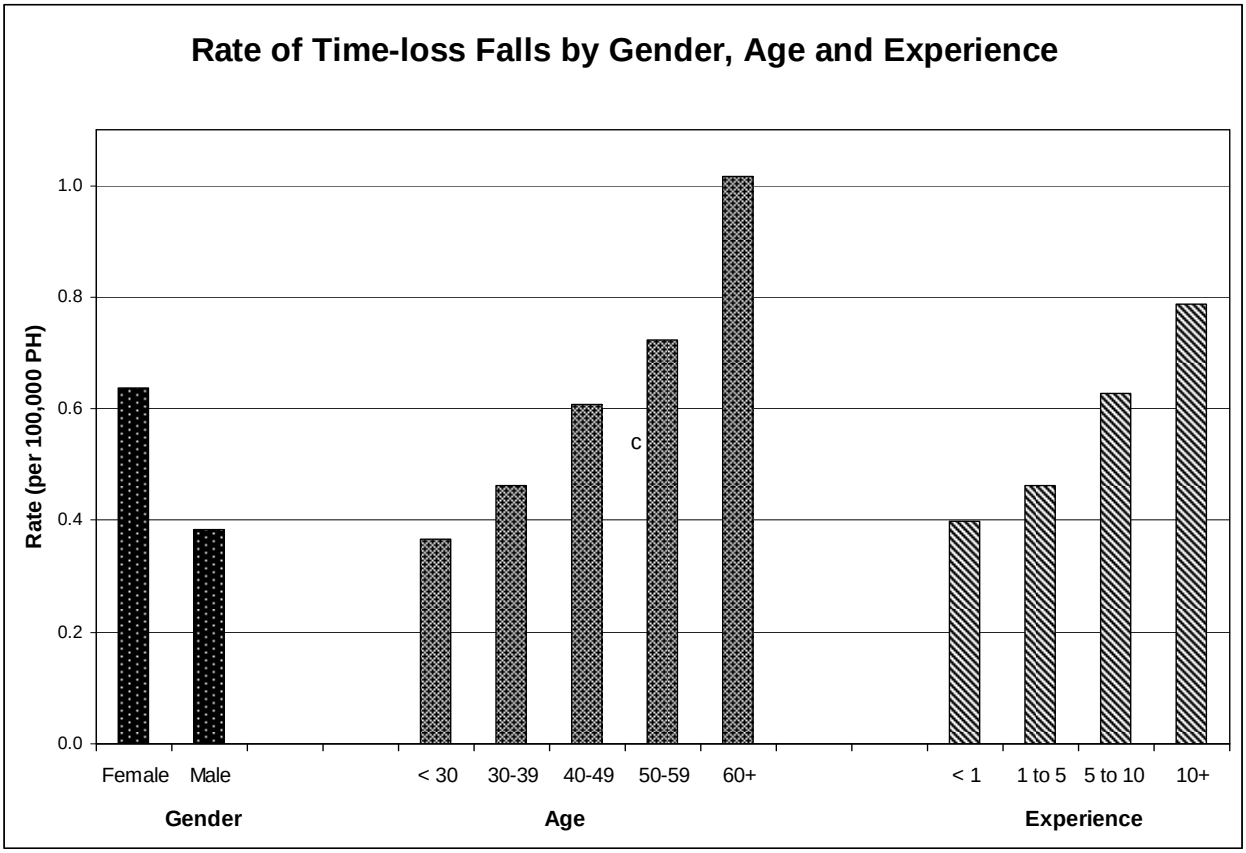

Figure 6 - Rates of time-loss falls by gender, age and experience

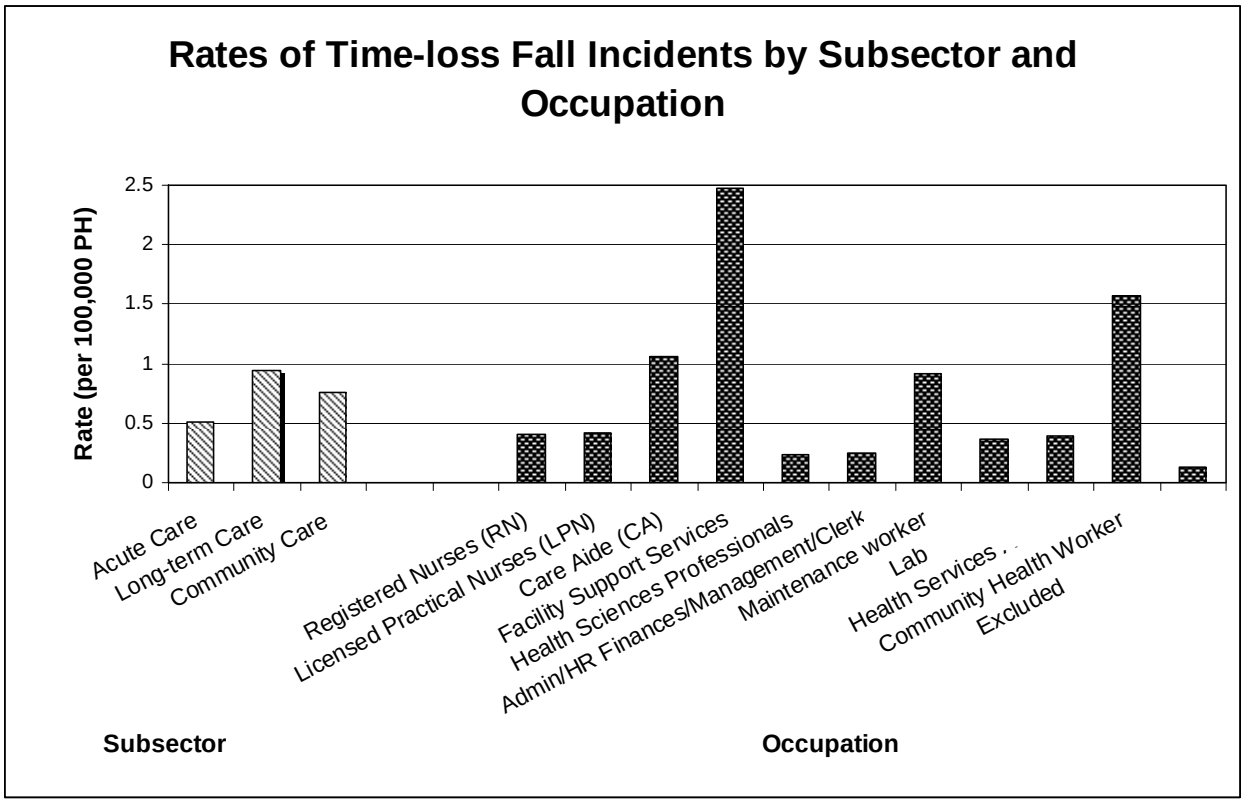

Figure 7 - Rates of time-loss falls by sub-sector and occupation

Multivariate Analyses for Time-loss Falls (N=411)

Table 2 presents the results of multivariate analysis for time-loss falls adjusted for occupation, sub-sector, gender and age. Experience was found to be highly correlated with age and was thus excluded from the model. The findings show an increasing risk for falls with age; workers over 60 years of age were found to have a statistically significant higher risk for falls [2.53 (1.53, 4.19)] compared to individuals under 30. Furthermore, females were at 1.81 times greater at risk for falls than their male counterparts (significant). Additionally, workers in the long-term care sector were at higher risk for falls than both community care and acute care workers (not significant). When compared to Registered Nurses, Facility Support Services workers, Community Health workers, Maintenance workers and Care Aides were at the highest risk: 6.29, 6.58, 3.45 and 2.22 times higher, respectively; these findings were significant.

Table 2 - Poisson regression results for time-loss fall incidents adjusted for subsector, gender, age and occupation

	Adjusted RR	95% Confidence Interval	P Value
Subsector			
Acute Care	Ref.		
Long term Care	1.26	(0.93, 1.70)	0.1361
Community Care	0.53	(0.33, 0.85)	0.0083
Gender			
Male	Ref.		
Female	1.81	(1.19, 2.76)	0.0058
Age			
Less than 30	Ref.		
30-39	1.11	(0.71, 1.73)	0.6423
40-49	1.22	(0.81, 1.83)	0.3507
50-59	1.49	(0.99, 2.25)	0.0526
60+	2.53	(1.53, 4.19)	0.0003
Occupation			
Registered Nurses (RN)	Ref.		
Licensed Practical Nurses (LPN)	0.99	(0.57, 1.74)	0.9778
Care Aide (CA)	2.22	(1.58, 3.11)	<0.0001
Facility Support Services	6.29	(4.56, 8.69)	<0.0001
Health Sciences Professionals	0.66	(0.39, 1.09)	0.1058
Admin/HR/Finance	0.67	(0.43, 1.06)	0.0847
Excluded/Other/Unclassified	0.39	(0.15, 1.03)	0.0575
Maintenance worker	3.45	(1.63, 7.28)	0.0012
Lab/imaging	0.99	(0.44, 2.26)	0.9960
Health Services	1.07	(0.60, 1.90)	0.8110
Community Health Worker	6.58	(3.76, 11.50)	<0.001

* RRs, 95% CIs and p-values were derived from Poisson regression model using GEE (Generalized Estimating Equations); adjusted variables age group, gender, occupation and sub-sector. Facility was treated as the clustering variables in the model.

Environmental Factors, Location and other Factors

Fall incidents by time (N=1157)

This shows an analysis of the number and percentage of falls by quarter of the year, day of the week and time of the day. Most of falls occurred:

- October through December
- In the middle of the week (highest frequency on Wednesdays)
- Between 7AM to 3PM

Table 3 - The total number and rates by quarter, and day of the week

Time Period *(N=1157)*	# falls	Proportion of all falls
Quarter		
1: January - March	319	27.6
2: April – June	252	21.8
3: July – September	231	20.0
4: October – December	355	30.7
Day of the Week		
Sunday	97	8.4
Monday	183	15.8
Tuesday	206	17.8
Wednesday	219	18.9
Thursday	179	15.5
Friday	172	14.9
Saturday	101	8.7

Table 4 - The association of the time of the day with all fall related incidents

Time *(N=1157)*	# falls	Proportion of all falls
3 AM – 6:59 AM	65	5.7
7 AM - 10:59 AM	429	37.6
11 AM - 2:59 PM	331	29.0
3 PM - 6:59 PM	194	17.0
7 PM - 10:59 PM	91	8.0
11 PM - 2:59 AM	32	2.8

The frequency of time-loss falls by location by sub-sector is shown here. (Note: patient's room refers to the actual room where the patient stays; resident's home refers to any general public area within the long term care home. Hallway in community care may refer to the client's home hallway or a hallway within the community care office.) The following table shows frequency and proportion of time-loss falls by location by high risk occupations.

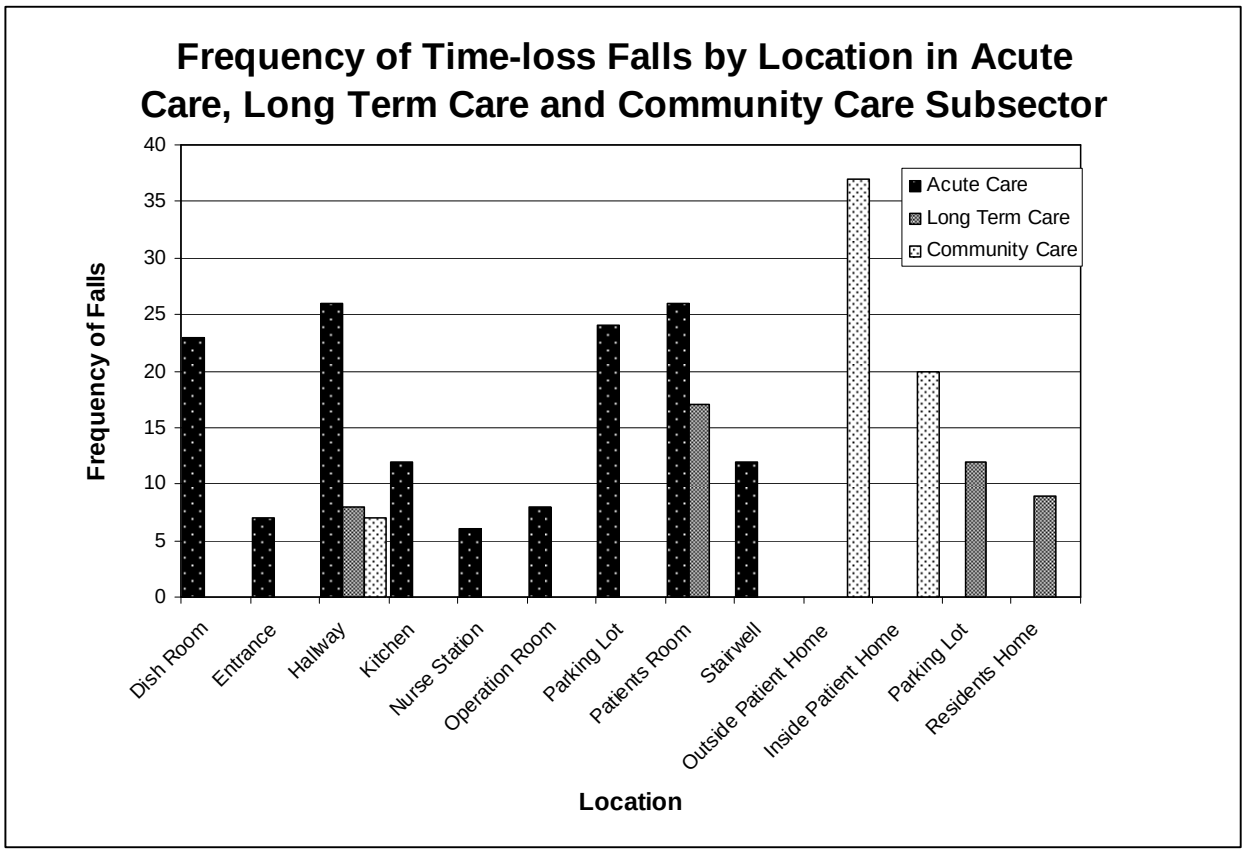

Figure 8 - Frequency of time-loss falls by location (N=411)

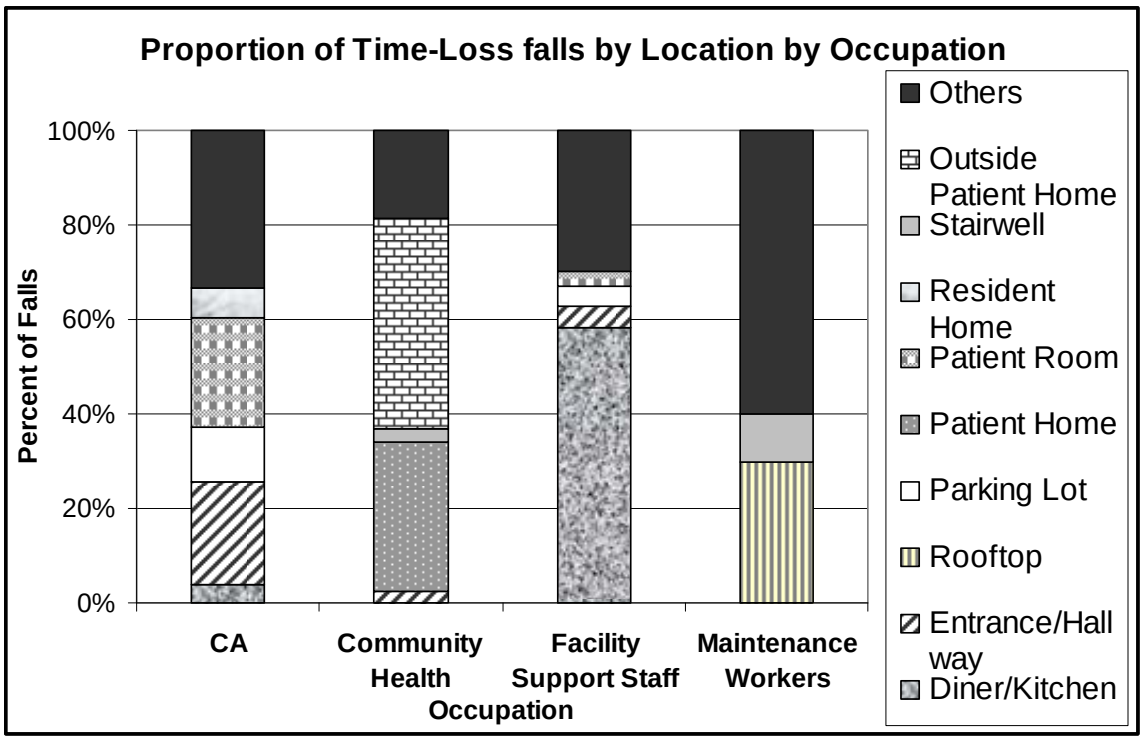

Figure 9 – Proportion of time-loss falls by location by high risk occupation (N=411)

Contributing Factors Resulting in Time-loss Falls (N=411)

Figure 10 and 11 list the frequency and proportion of contributing factors by sub-sector and occupation. *(Please refer to appendix table 2 for a key of the contributing factor categories)*

- The main contributing factor, in acute care and long-term care, was slippery or uneven floor followed by the environment (layout design of the workplace, limited workspace, inadequate lighting).
- The main contributing factor in the community care was the environment followed by floors and weather conditions (cool temperature resulting in ice, heavy precipitation).
- With regards to fall incidents by occupation, floor was cited as the primary contributing factor for Care Aides and Facility Support staff, while the work environment was cited as the main contributing factor for Community Health and Maintenance workers.

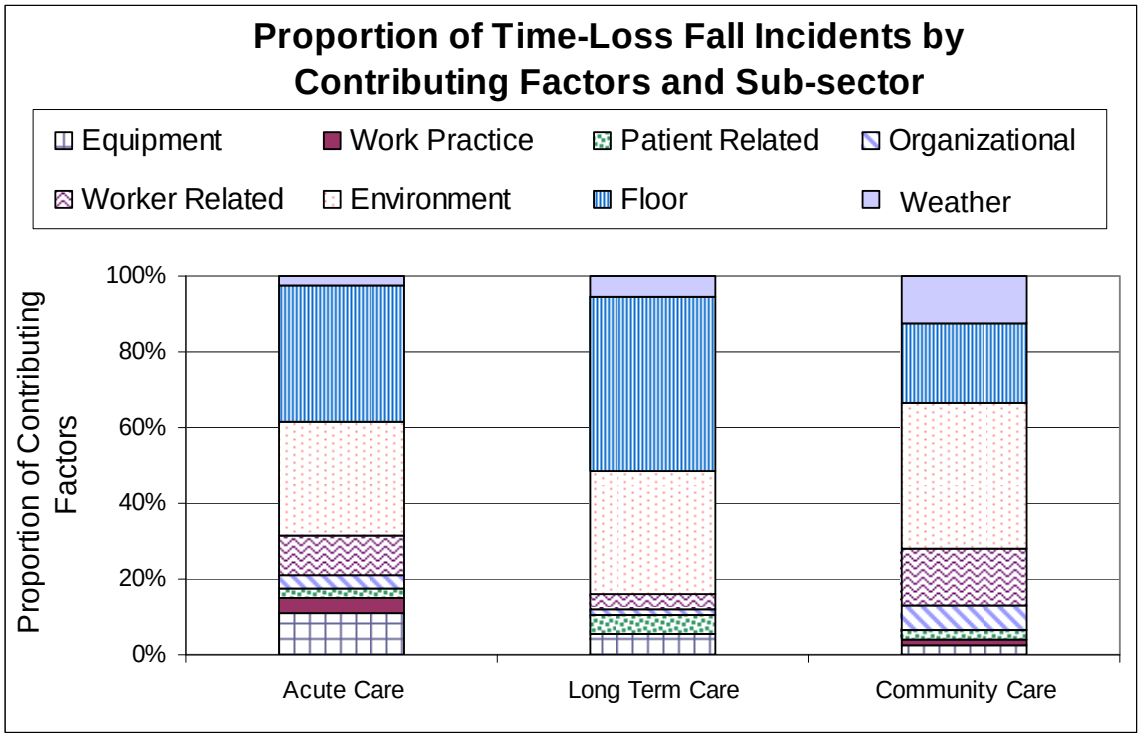

Figure 10 - Contributing factors resulting in time-loss falls by sub-sector (N=411)

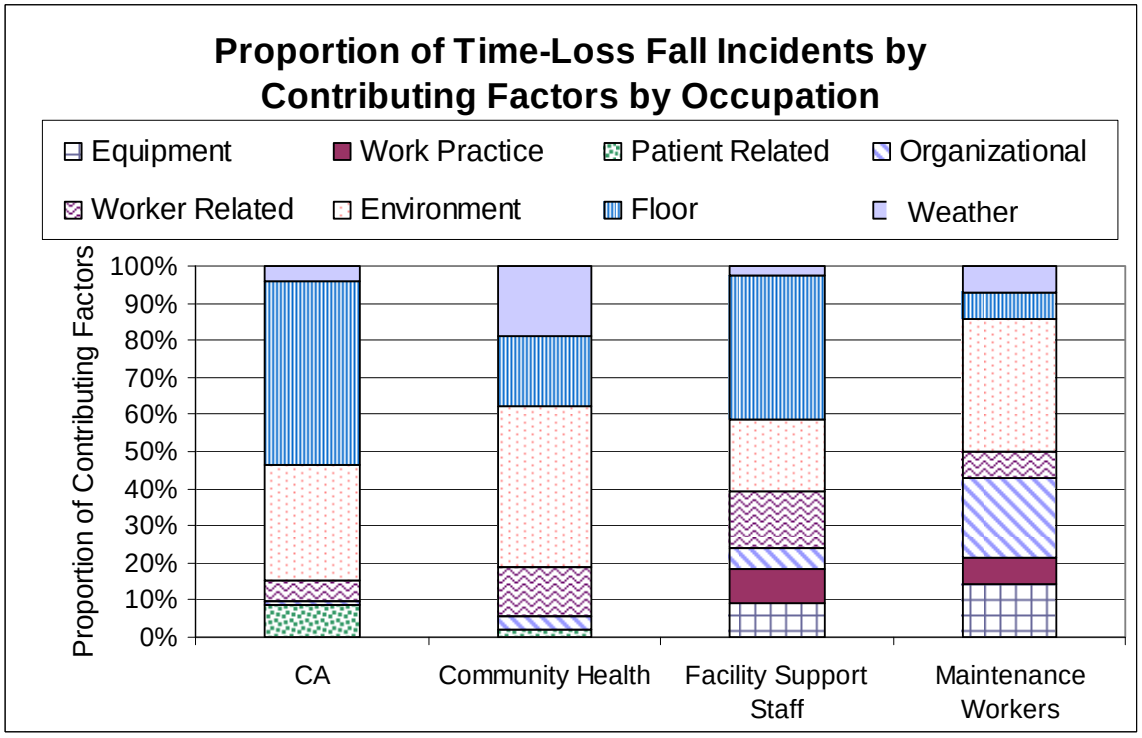

Figure 11 - Contributing factors resulting in time-loss falls by the high-risk occupations (N=411)

Incident descriptions (N=411)

- From an examination of the incident descriptions (Fig.12), a large portion of falls (for all sub-sectors combined) were caused by liquid contamination on the floor; furthermore, 22 out of the 411 falls were from liquid contamination with no proper signage (i.e. wet floor/caution signs).
- Other contributing factors to indoor falls were interference with patients' cords and medical equipment.
- In addition, several accounts reported falling outside, traveling from vehicle and on stairs due to ice and slippery weather conditions.

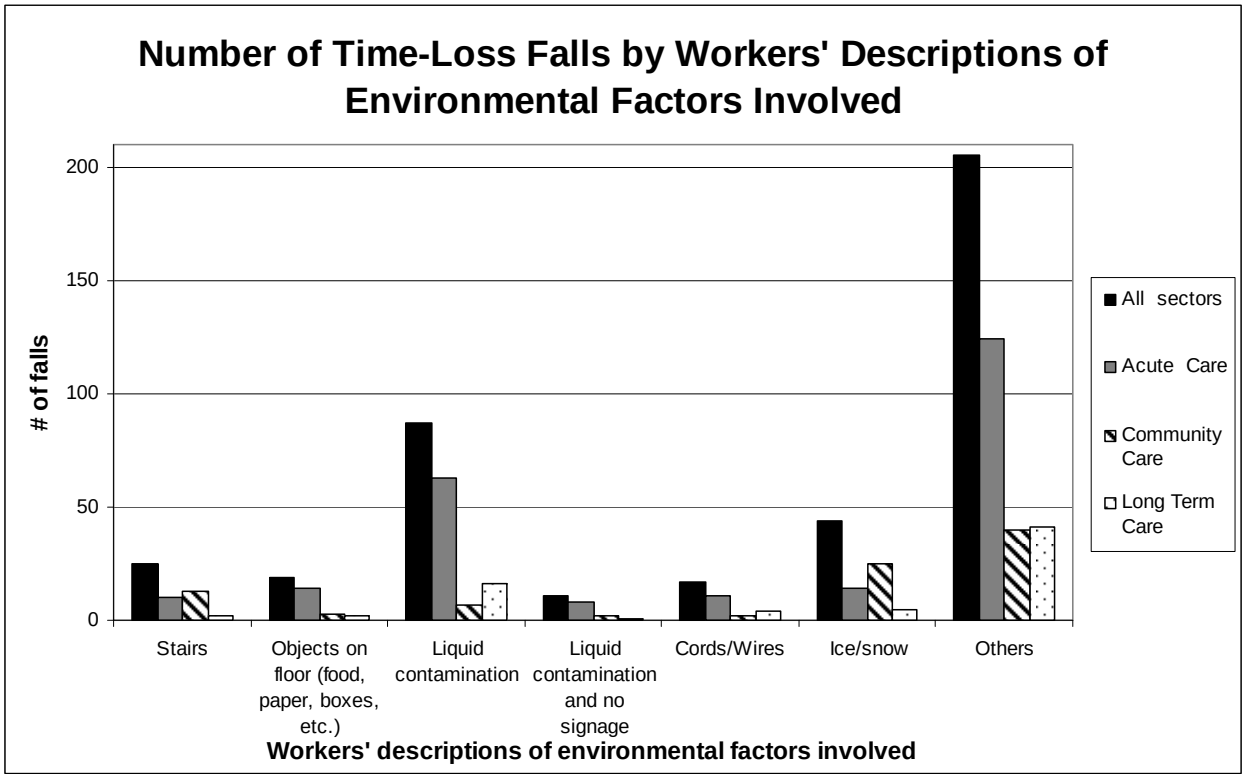

Figure 12 – Number of time-loss falls by workers' descriptions of environmental factors involved (N=411)

Activity and Body Parts Injured (N=1157)

The majority of fall incidents occurred during walking or running followed by reaching for things and pushing/pulling handling of medical equipment (Table 5). When separated by occupation, the activity mainly associated with falls for Care Aides, Facility Support Service workers and Maintenance workers was patient washing, cleaning and reaching for things, respectively. (Note: activities are not mutually exclusive; more than one activity could be involved for one injury).

Table 5 – Frequency of falls by activity

Activity at the Time of the Incident:	Frequency (1157)
Patient handling/transfer	22
Preventing a patient from falling	24
Washing patients	22
Medical Equipment Handling (MEH) - Push and Pull	35
MEH - Carry	26
Reaching for things	35
Cleaning	21
Walking or Running	1025
Total	1421

Table 6 – Activity associated with fall related incident by occupation (frequencies 4 and above included)

Activity by Occupation:	Frequency (1157)
Care Aide	
Patient transfer	8
Patient washing	10
MEH - Push and pull	4
Facility support services	
MEH push and pull	10
Cleaning	11
MEH - Carry	9
Maintenance Workers	
Reaching for things	5

* MEH: Medical Equipment Handling

The majority of the fall incidents resulted in injury to the upper body, which includes: chest, shoulders, arms and hands. The next major body part affected in many fall incidents were the lower extremity, which includes the buttocks and lower limbs followed by the head and neck. Please note that more than one body part can be affected from one injury.

Table 7 – The counts of body parts most affected by falls

Body Part	Back	Trunk	Lower Extremity	Upper body	Neck and Head
Counts (Total = 1157)	256	286	375	400	349
Percentages	22.1	24.7	32.4	34.6	30.2

WorkSafeBC Compensated Days and Payments for time-loss falls (N=411)

The total WorkSafeBC costs (time-loss compensation, healthcare payments) and compensated days lost due to falls are steadily increasing; results show that (Table 8):

- The total costs are highest in acute care and for Registered Nurses.
- The total costs increases with age with the exception of workers 60+.

The median (per accepted claim of) WorkSafeBC compensated days lost and corresponding payments related to a fall (time-loss and healthcare payments) show:

- The median costs are increasing over time.
- The median days lost and costs are higher for the long-term care facilities.
- Licensed Practical Nurses, Care Aides and Maintenance have high median number of *compensated days*.
- Registered Nurses have the highest median of costs for *compensation payments* followed by Care Aides and Facility Support Service workers.

Table 8 - The number of time-loss falls and the total, and median number of days lost and associated compensation costs (wage loss +healthcare payments)

	Number of falls	Total Days Lost	Median days lost	Compensation Costs ($)	Median ($)
Year of Incident					
Jan 1,2005 - Dec 31, 2005	108	4,745	14.0	573,394	1,555
Jan 1, 2006 – Dec 31, 2006	135	6,118	17.5	726,714	1,711
Jan 1, 2007- Dec 31, 2007	168	9,024	13.0	1,178,774	1,731
Sub-sector					
Acute Care	242	12,169	13.0	1,586,537	1,616
Community Care	75	3,311	16.0	402,548	1,571
Long Term Care	91	4,233	27.0	473,394	3,222
Sex					
Female	377	19,087	15.0	2,336,706	1,827.5
Male	34	800	5.5	142,176	896
Occupation					
Registered Nurse (RN)	97	5,544	12.0	868,226	4,438
Licensed Practical Nurse (LPN)	14	789	48.5	74,911	4,355
Care Aide (CA)	78	4,867	27.0	560,134	2,599
Facility Support Services	67	2,720	14.0	240,095	980.5
Health Sciences Professionals	18	530	7.5	126,408	940
Admin/HR/Finance	23	1,003	5.0	124,763	837.5
Maintenance	10	638	21.5	106,929	7,166
Lab/Imaging	6	48	6.5	5,286	797.5
Health Services	13	570	14.0	59,055	1,639
Community Health Worker	38	1,418	13.5	127,400	1,348
Age					
Less than 30	30	1,434	10.5	166,625	1,560
30-39	65	2,673	11.0	298,408	1,358
40-49	132	5,465	14.0	663,066	1,697
50-59	146	8,932	16.5	1,210,502	2,369
60+	38	1,383	12.0	140,281	1,651
Experience					
Less than 1	34	2,169	9.0	253,367	1,071
1-5	104	4,820	15.0	599,420	1,711
6-10	73	2,445	14.0	312,223	2,012
10+	198	10,453	15.0	1,313,872	1,818
Total					
	411	19,887	14.0	2,478,882	1,703

Discussion of Findings

The results of our study show that falls are a growing concern for workers in British Columbia healthcare sector. Certain types of works are putting workers at greater risk of falls and certain workplace environments are proving to be more hazardous than others. This emphasizes the importance of conducting analysis like this to pin-point the exact risk factors for falls in a worker population prior to development and implementation of an intervention program. In this study, Care Aides, Facility Support Services workers, Maintenance workers, Community healthcare workers, and workers in long term care sub-sector were found to be most susceptible to falls, suggesting that prevention programs should be prioritized in these areas. In addition, high-risk areas such as hallways, patients' rooms, dish-room and parking lots should be closely attended to during pitting a falls prevention program in place.

Sub-sector and Occupation

Although not surprising that the acute care subsector had the highest number of fall injuries (as it is the largest), the long term care sector had the highest rate of falls compared to the other subsectors. With respect to all injuries, long term care workers in BC have had twice the injury rate as the other subsectors for the last five years (WorkSafeBC, 2008). Falls contribute to12% of their injuries (WorkSafeBC, 2009). In our study, time-loss falls mainly occurred in the patients' rooms in long term care followed by parking lot. In community care, the majority of falls occurred outside patients' homes. Kemmlert and Lundholm (2001) also reports falls for home helpers mainly occurred between the homes of different patients, mainly due to snow or ice (56%).

By occupation, Facility Support Service workers had the highest rate of falls for *all falls* (5.5/100,000PH) and *time-loss falls* (2.4/100,000OH). Facility Support Service workers are made up of cleaners, housekeeping, cooks, dishwashers, transport, security etc. In a large study on hospital workers in the US, Bell et al (2008) also found that workers in food services, transport/emergency medical service and housekeeping staff were at the highest risk of slip, trip and fall claims; nursing and office administrative staff contributed the highest *number* of falls. Similarly in our findings, Registered Nurses had the highest number of all falls (33%) and time-loss falls (26%) out of all the occupations.

Gender and Age

The difference in the risk of falls by gender is one frequently cited in the literature. In concurrence with our study, the incidence of falls is higher for females than males (Talbot et al., 2005; Layne and Landen, 1997; Islam et al. 2001). In a large study of work-related injuries, presented for treatment in US hospital departments, it was found that females were more likely to experience falls on the same level (67.9%) compared to males (45.1%) (Layne and Landen, 1997). However, falls from height most frequently involved males. Furthermore, a study by Islam and Colleagues (2001) examined an entire state's workforce and showed females having a greater proportion of falls than males.

A high incidence of falls with age is often attributed to muscle weakness. Females tend to have a rapid decrease in muscle and bone mass for three years post menopause, due to hormonal changes (Greeves et al. 1999; Rutherford and Jones, 1992). In our study population made up of 92% females, there was a statistically significant higher risk of falls for workers between the ages of 50 and 60.

Older workers having an increased risk for falls has been extensively studied in the literature (Talbot et al. 2005; Kemmlert and Lunholm, 2001; Layne and Landen, 1997). This is distinct from research examining all injuries, where an increase in age typically corresponds to a decrease in non-

fatal injury; furthermore, age and occupational injury have a relationship for reasons such as the healthy worker effect, progressive job selection and seniority, and work experience (Layne and Landen, 1997). However, when looking at all work-related fall injuries, the falls are primarily occurring in the oldest population (65+) (Layne and Landen, 1997).

Our findings show an increasing risk of falling with age; however the explanation may be two-fold. Kemmlert and Lundholm (2001) report a higher proportion of falls among both men and women above the age of 45 compared to those under 45. Individual physiological factors such as postural control, visual cues and vestibular functions commonly decrease with age; these factors decrease balance control making an individual more prone to a fall (Gauchard et al. 2001; Talbot et al. 2005). On the other hand, falls in older workers may have a greater impact and cause a serious injury requiring time off work, whereas, younger individuals likely recuperate more quickly. Workers over 65 were twice as likely to have a principal diagnosis of fracture compared to those less than 65 years (Layne and Landen, 1997). Additionally, older workers may be more likely to report an injury (Talbot et al. 2005).

Body part involved

In our findings, injury to the upper body (chest, shoulders, arms, and hands), lower extremity, and neck and head were most frequently reported. Yoon et al (2006) found that the trunk (including shoulder and back) were the most affected body parts followed by lower extremity (knee, foot and toe).

Seasonality

The frequencies of falls incidents were greater in the winter months which also come with increased precipitation, which is verified with our findings of ice being one of the main factors mentioned, especially among community health workers who frequently travel outdoors for their work. Haslam and Bentley also report in their study on postal workers that 70% of slips, trips and falls were attributed to snow or ice (Haslam and Bentley, 1999).

Location and Contributing Factors

Uneven and slippery floors/surfaces were the main contributing factors to falls in our study-principally due to liquid contaminants as noted from the workers' descriptions of the incidents. Floor related factors are commonly mentioned as the leading factor causing falls in previous research (Yoon et al. 2006; Gauchard et al. 2001). In addition, a study on hospital employees in the US found that liquid contamination contributed to the majority of falls (26%); reports of water, slippery, fluid, greasy, slick spots were all noted. In our study, ice and water were reported as leading contributors to outdoor falls, especially in the community care sub-sector. Similar risk factors were found in home helpers reports (Kemmlert and Lundholm, 2001) and community postal workers' fall reports (Haslam and Bentley, 1999).

Costs

Over the three year period, the overall median of number of days lost was 14, 17 and 13, respectively. Yoon et al (2006) examined fall injuries across US industries and found the median number of days lost to be 8. They also reported that the National Safety Council estimates that one fall injury costs on average $12,000 for time loss and healthcare payments combined. In our study, the median cost for a fall was approximately $1700; however, the compensation and healthcare systems in US and Canada are substantially different and our estimate is based on healthcare sector only, rather than all industries. In addition, in our findings, the median days away from work from a fall varied by occupation and subsector, with the long term care sub-sector experiencing the highest median number of falls days lost (27 days) compared to acute care (13) and community care (16),

suggesting the long term care is sector is experiencing more severe fall injuries that require longer time off work.

Implications for Future Research on Falls

Injuries due to falls in the workplace are an important concern as the incident rate of falls is steadily increasing, along with the corresponding costs. Injuries due to falls are a multifaceted issue with several contributing extrinsic and intrinsic factors identified in this study. This project illuminates many areas for future research:

- The location of the fall incidents is addressed here but the causes are not described in broad detail. It may be useful to study the individual causes of slips and falls using a survey or focus group of injured workers to help develop a more accurate and effective intervention program.

- This research identified occupational groups who are experiencing a higher rate of falls than others. Facility Support Services workers and Community Health Workers are at higher risk. Intervention in these groups is a priority.

- This research was mainly a quantitative study of the epidemiology of falls; thus, a further qualitative study may be useful to gain valuable insights. The research team plans to have focus groups with workers from various occupations to determine the most important risk factors for falls based on frequency of occurrence and likelihood of injury.

- As this project identified the risk of falls, a follow-up project is being planned to assess the risk of falls by the development of a risk assessment tool for occupational falls in healthcare. The tool, in the form of a checklist will be used by supervisors and joint occupational health and safety committees to assess the risk factors for falls at the department and occupational level.

Policy and Prevention

Fall injury rates vary substantially by occupation and location, and have diverse contributing factors. Finding that certain occupational groups, such as Facility Support Services workers and Community Health workers are at high risk of falls and have high costs, indicate that policy and prevention strategies should be targeted towards improving the work environment for specific occupations. Focus group sessions with these workers and then developing and piloting prevention programs may help determine the most suitable interventions.

It is imperative that injury incidents are tracked effectively to ensure appropriate documentation of the occupation of worker, time of injury, location of injury, activities involved and environmental factors contributing to the fall injury. It will make it easier to effectively identify the modifiable risk factors. This research is the first to shed light on the epidemiology of falls in an entire health region – acute, community and long term care. The results suggest location as well as factors such as the indoor/outdoor environment, layout and design of the workplace and workplace organization contribute to elevate the risk of falls.

The findings shown here have been discussed with the health region from which the injury data for this study were obtained; and revision needed of the existing footwear policy for Community Health Workers was brought to attention. A second project is being planned to develop a tool in the form of a checklist that assesses and manages the risk of falls at the department level. Reports regarding the results from this study will be distributed to all the health authorities, unions, other stakeholders with the intention that the findings may be utilized in order to update their policy issues related to falls.

Dissemination/Knowledge Transfer

A final report has been made available to WorkSafeBC and the Health Authority studied. The results will also be made available to healthcare workers and the general public through fact sheets and putting information on OHSAH's website.

The knowledge transfer and exchange products for this project has been written for intended audiences – e.g. healthcare workers, healthcare supervisors, policy makers etc. – and focus on key users of the information. All knowledge transfer and exchange products developed for the project include the following components:

- The results from the research;
- What the results mean;
- Why the results are important;
- Recommendations from the research;
- Actions that should be taken based on the results of the research

The present knowledge transfer activities for this project include:

OHSAH Website

The OHSAH website makes available its research results on its website, with all relevant information available to people in the healthcare sector and beyond.

Conference Presentations

The results of this study were presented at the Northwest Occupational Health Conference as an oral presentation and were presented in a poster format at the BC Health Authorities Health & Wellness Conference.

Knowledge Transfer to Policy Makers

The study team has met the health authority staff to present and discuss the findings of this project and to plan for a fall intervention study. The Health Authority has also relayed the summary report on falls to their staff.

Results from this study are in an article that is in press in the journal of *Ergonomics*. A second manuscript is planned to present the costs of falls.

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Appendix

Table 1 – Occupation Categories

Occupation	Occupation description
Registered nurses	
	general duty nurse, charge nurse, clinical nurse leader, head nurse, clinical nurse specialist, nurse manager, clinical nurse educator, liaison nurse, mental health nurse, nurse supervisor registered psychiatric nurse, nurse clinician
Licensed practical nurses	
	licensed practical nurse and practical nursing care worker
Care aides	
	assist living worker, care aide, day health worker, direct patient care - profile classification, nursing assistant
Facility support services	
	Cleaner, cook, food service worker, food service supervisor, housekeeping worker, housekeeping supervisor, laundry, pot washer, store attendant, driver, transportation attendant
Health Sciences professionals	
	anesthetic technician, audiologist, dental hygienist, dietician, health science Officer, medical technician, medical technologist, nutritionist, occupational hygienist, occupational therapist, perfusionist, pharmacist, physiotherapist, psychologist, respiratory therapist, speech/language pathologist, rehabilitation therapist, cardiac exercise specialist, infection control practitioner
Admin/ HR Finance/ Management/	
	Administrator, administrative assistant, assistant nurse administrator, manager, assistant manager, clerk, health record administrator, leader, secretary, officer, accountant, auditor, buyer, cashier, librarian, medical secretary, data entry, multimedia specialist, planner, programmer, scheduler, timekeeper, communication specialist
Maintenance	
	AC mechanic, boiler operator, carpenter, electrician, groundskeeper, installer, machinist, maintenance worker, painter, plumber, sterile supply technician, gas fitter, power engineer
Laboratory and imaging	
	laboratory assistant, pathology assistant, pharmacy assistant, SPD tech pharmacy technician, research assistant, X-Ray assistant, electronystagmography tech
Health service	
	activity coordinator, activity worker, adult day program worker, advocate, associate, art therapist program worker, certified dental assistant, child care worker, clinician, client representative detox worker, facilitator, family resource worker, infant development worker, interpreter, liaison worker, material attendant, music therapist, porter, program and services program coordinator, program support worker, public health inspector, recreation therapist, rehabilitation assistant, security officer, social service assistant, supported child care worker, social worker, residence coordinator, group facilitator, aide
Community Health Worker	
	Community health worker
Other/Unclassified/Unknown	Student, resident, IT, consultant, counselor, researcher, evaluation specialist, epidemiologist, addictions counselor

Table 2 – Definitions of Contributing Factors

Contributing Factors	
Equipment	Malfunctioning of equipment, poor design, improper signage of on a device, improper use of a device
Work Practice	Worker did not follow procedure, worker did not use appropriate equipment
Patient Related	Patient was aggressive, patient did not follow directions, patient was resistant, patient's weight, patient made unexpected movement
Organizational	Inappropriate schedule (time constrains, working alone, etc), lack of safe work practice
Worker Related	Worker was fatigued, distracted, or had a previous injury
Environmental	Layout design of the workplace, limited workspace, inadequate lighting
Weather	Cool temperature resulting in ice, heavy precipitation
Floor	Floor slippery or uneven

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