ORIGINAL RESEARCH

The Incidence of Hip Fractures in Long-Term Care Homes in Saskatchewan from 2008 to 2012: an Analysis of Provincial Administrative Databases

Lilian U. Thorpe, MD, PhD, FRCP[1], Susan J. Whiting, PhD[2], Wenbin Li, MSc[3], William Dust, MD[4], Thomas Hadjistavropoulos, PhD[5], Gary Teare, PhD[3]

[1]Community Health and Epidemiology, College of Medicine, University of Saskatchewan, Saskatoon, SK; [2]College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, SK; [3]Saskatchewan Health Quality Council, Saskatoon, SK; [4]Division of Orthopedic Surgery, Surgery, College of Medicine, University of Saskatchewan, Saskatoon, SK; [5]Department of Psychology and Centre on Aging and Health, University of Regina, Regina, SK, Canada

DOI:https://doi.org/10.5770/cgj.20.273

ABSTRACT

Background

Hip fractures (HFs) represent an important cause of morbidity and mortality among adults in long-term care (LTC), but lack of detailed epidemiological data poses challenges to intervention planning. We aimed to determine the incidence of HFs among permanent LTC residents in Saskatchewan between 2008 and 2012, using linked, provincial administrative health databases, exploring associations between outcomes and basic individual and institutional characteristics.

Methods

We utilized the Ministry of Health databases to select HF cases based on ICD 10 diagnoses fracture of head and neck of femur, pertrochanteric fracture and subtrochanteric fracture of femur. HF incidence rates in LTC were compared to older adults in the general population.

Results

LTC residents were more likely to be female overall (65.5%), although this varied by age, with only 46.6% female in those under 65, but 77% female among those 90 years and older. Mean age of residents was highest in rural centres (85.2 yrs) and lowest in medium–large centres (81.0 yrs). Of 6,230 cases of HFs in the province during the study period, 2,743 (44%) were in the LTC cohort. Incidence rates per 1,000 person years increased with age and were higher in the LTC group (F = 68.6, M = 49.8) than the overall population (F = 1.62, M = 0.73). Rates of HFs in the province and in LTC were higher in females than males in all age groups, except for the youngest (< 65 years), where males had higher rates, and the oldest category (90+) where rates were similar. Women 90+ years in larger LTC had significantly higher ($p = .035$) HF rates than those in smaller LTC, and also had significantly ($p = .001$) higher rates in medium-large compared to smaller population centres. However, after age standardization to the overall SK population, it was apparent that the larger LTC facilities and the medium-large population centres had overall lower HF rates than the small and medium LTC facilities and the small urban and rural PCs, respectively. One health region had particularly high rates, even when accounting for age and sex composition.

Conclusion

Both HF numbers and incidence rates were higher in LTC compared to the overall population, with higher rates in older women, small to medium size LTC, and particular health regions. Our data suggest the need for further exploration of potentially remediable factors for HFs in smaller LTCs, and for targeting specific facilities and regions with outlying HF rates.

Key words: hip fractures, long-term care, administrative databases

INTRODUCTION

Hip fractures (HFs) represent an important cause of morbidity and mortality in older adults, especially those who are frail and have multiple comorbidities.(1) The outcome for an older adult suffering a HF is often very poor and includes hospitalization, infection, decreased functioning, increased pain, new falls, and increased mortality.(2-6) HFs also result in considerable increase in health services utilization and cost.(7-11) Long-term care home (LTC) residents represent a particularly frail population, and it is therefore not surprising that they are likely to suffer HFs,[12] and that one-third of older adults suffering HFs reside in long-term care.[13]

Although general guidelines for the prevention of fractures in LTC have recently been released,[14] there is limited research information addressing differences between individual LTC facilities which would help target strategies for optimal use of resources. This is important, as in Canada, variations in fall rates among specific facilities range from 10–24%.[15] Factors associated with different rates include budgets,[16] facility size,[17] and long-term care staffing changes.[18] Facilities in larger population centres closer to tertiary resources such as Universities will likely have greater access to educational and other opportunities, which might reduce HF rates. On the other hand, because rural locations have fewer opportunities for formal, home-based care and fewer working age adults left to provide care,[16] these areas might have higher per capita institutional beds,[19] earlier and increased likelihood of admission to LTC,[20] and possibly therefore a less-frail LTC population, resulting in decreased rates of HFs. Higher rates of early life activity in currently older rural residents of LTC, who would have led more labour-intensive lives in their younger years than currently occurs on heavily mechanized farms, generally may also mitigate the rate of HFs in this group.

We planned this study to enrich research information in this area, focusing initially on a descriptive analysis and exploration of basic associations between variations in the incidence of HFs and basic individual and institutional characteristics. We hypothesized that the LTC population will have higher crude and age-adjusted HF incidence rates than the province as a whole; that age-adjusted HF incidence rates will vary by size of the population centre and size of the facility; and, due to the demographics of Saskatchewan, that LTC cohorts in the north will reflect underlying population demographics with a greater proportion of younger residents than in the south of the province.

METHODS

Setting

In Saskatchewan (SK), LTC (or nursing homes) are officially called Special-Care homes, and are defined as facilities designated to provide “long-term care, on a temporary or permanent basis, to meet the needs of individuals, usually with heavy care needs, that cannot be met through home-based/community services”.[21] Across Canada LTC facilities are referred to by various terms, but the basic definition is very similar, based on the Federal-Provincial Working Party on Patient Care Classification: availability of supervision, assistance with activities of daily living, and personal care on a continuing 24-hour basis, with medical and professional nursing supervision, and provision for meeting psychosocial needs.[22] Saskatchewan LTC facilities are predominantly located in the southern and central health regions of the province, with very few located in the north, where the population density is low. Facilities comprise a combination of public (health region administered) and private (for profit or non-profit) institutions which differ in many ways including size, vision, basic philosophy of care, admission criteria affecting resident mix and complexity, staffing, educational opportunities for staff, and proximity to tertiary care resources.

Date Sources

After appropriate ethics approvals to access the administrative databases were obtained from the University of Saskatchewan Biomedical Research Ethics Board, we accessed Ministry of Health databases at the Saskatchewan Health Quality Council (HQC), linking information from individual patients using a unique, anonymous identifier to maintain privacy requirements. Databases from which information was accessed included:

1. Discharge Abstracts Database (DAD): administrative, clinical, and demographic information on hospital discharges including up to 25 ICD-10-CA diagnosis codes, and date and time of admission and discharge;
2. Person Health Registration System (PHRS): demographic information including year and month of birth, sex, and Registered Indian status;
3. Institutional Supportive Care Home Database (ISCH): a database of individuals in provincial institutional supportive care facilities, including type of admission, data of admission and discharge, and regional health authority of the facility;
4. Resident Assessment Instrument–Minimum Data Set (RAI-MDS):[23] this is a standardized, automated common assessment instrument for individuals in LTC which is conducted at admission and then at three-month intervals.

Data Selection

Both the LTC cohort and the comparison, SK cohort, were selected from Ministry of Health databases, including permanent residents of Saskatchewan with public medical services coverage any time between January 1, 2008 and December 31, 2012. Records were excluded from residents without medical services coverage at any time in this study period, residents lacking a coding of sex as male or female, and those with unclear date of birth. HF events were identified from the CIHI-DAD database by searching for ICD-10-CA codes S72.0 to S72.2 in any of the 25 available diagnosis columns for residents who were admitted to an acute care institution within the study period. The first event of HF was defined as the earliest dated record of HF occurring within the study period, which was not a record related to the same HF case initially occurring within 28 days prior to the study. If the admission date of a subsequent record was equal to the previous record's discharge date, it was considered to be the same event (likely a transfer between sites). Similarly, if a subsequent record was dated within 28 days of the previous event then it was considered as part of the same event. Subsequent records of HFs occurring more than 28 days after the previous admission date for HFs were considered to be new events.

The LTC study cohort was composed of a subset of the above-described SK cohort, with residents selected if their information was found in both the ISCH and the RAI_MDS. Additional information about individual LTC facilities was obtained from the Ministry of Health directly. Records were selected from ISCH relating to all residents who resided in a LTC at any time between January 1, 2008 and December 31, 2012. Records from residents which were not matched in the RAI-MDS dataset were removed. Records were cross-checked with Ministry of Health files listing valid LTC in each of the years, and events from residents not in a permanent LTC bed at the time of the event were excluded. This frequently occurred because the resident had been in a non-permanent placement, such as a day program.

Resident Follow-Up

For individuals in the SK group, the last follow-up date was the earliest of one of the following: December 31, 2012, date of death, or the date the resident permanently left the province. For each individual in the LTC study cohort, the last follow-up date was the earliest of one of the following: December 31, 2012, date of death, or discharge from the LTC.

Data Analysis

The yearly age-stratified HF incidence per 1,000 person-years in both the SK and the LTC cohort was calculated as the total number of HF events in each age group during that year divided by the total midyear population in that age group × 1,000. The data were stratified by age into four groups (< 65, 65–79, 80–89, and > 90), separately for males and females. Stratification by health region used the new entity, "North SK", to represent the sparsely populated Northern regions consisting of Mamawetan Churchill River, Keewatin Yatthe, and Athabasca. In exploring potential rural–urban differences, we used the more recent Statistics Canada term Population Centre (PC) using definitions: rural (< 1,000), small population centre (1,001–29,999, medium population centre (30,000–99,999), and large population centre (100,000 and over).[24] Medium and large PCs were collapsed into one new Med–Large category. The effect of facility size (in terms of bed number) on HFs was explored by stratification into three sizes (1–35, 36–100, and > 100 beds). ANOVA was used to determine significance for comparisons between HFs in various groups. Lastly, as the age composition of PCs and LTC facilities varied and might have affected overall outcomes, we also used direct standardization to the mean age distribution of the overall SK population during the study period to calculate summative, adjusted HFs incidence results.

RESULTS

Characteristics of the Overall Saskatchewan Population and the LTC Cohort

Table 1 illustrates differences in sex distribution in the LTC cohort compared to the overall Saskatchewan population. Numbers in the SK and the LTC population totals column represent the sum of each midyear populations of all five years, which is approximately five times the mean population over that entire period. Note that the people in the cohort each year were not necessarily the same, as some would have entered and some left the cohorts each year. Whereas there were equal numbers of males and females in the Saskatchewan cohort, there were more females (65.5%) than males (34.5%) in LTC. Age distribution was even more noticeably different in the LTC cohort. The greatest proportion (85.8%) of people in Saskatchewan were under 65, but in the LTC cohort only 8% were under 65, and the greatest number (41.1%) were in the 80–89 age group.

The size of the population centre may have affected (through various mechanisms) the age and sex mix in the LTC, and consequently HF rates. Table 2, therefore, presents the LTC study population by size of the population centre and sex. In all groups, females were significantly older than males. Mean age decreased from rural-to-small and med–large population centres.

Hip Fracture Incidence Rates in Saskatchewan Overall Compared to the LTC Cohort

Individuals in Saskatchewan (including those in LTC) had from none to four separate HFs recorded during the five-year study period. Repeated fractures recorded for the same hip could have included completely unrelated fractures of the same hip, but also fractures around the stem of a previous replacement occurring after 28 days. The percentage of people suffering one or two and more hip fractures, with duplicate entries removed as described in the Methods section, are presented in Figure 1 for the province and for the LTC cohort, stratifying by sex. A greater percentage of residents in the LTC cohort had repeated fractures during the study period, and three or more HFs in the same individual were only reported in the LTC cohort.

There was a total of 6,230 HFs in SK during the study period, of which 2,743 occurred in residents of LTC. The incidence rates per 1,000 person-years of follow-up are shown in Figures 2 and 3. Incidence rates for HFs were higher in females than males in all but the youngest age groups in both the Saskatchewan and the LTC cohort.

TABLE 1.
Description (person-years followed) of the Saskatchewan and long-term care (LTC) cohort 2008–2012 by age and sex

	Saskatchewan Cohort				*LTC Cohort*			
Age	*Total person-years*	*F*	*M*	*% F*	*Total person-years*	*F*	*M*	*% F*
0–64	4,740,822	2,324,560	2,416,262	49.0	4,845	2,259	2,586	46.6
65–79	524,635	273,369	251,266	52.1	10,992	5,962	5,030	54.2
80–89	204,740	122,811	81,929	60.0	24,817	16,092	8,725	64.8
90+	53,421	38,702	14,719	72.4	19,782	15,282	4,500	77.3
All ages	5,523,618	2,759,442	2,764,176	50.0	60,436	39,595	20,841	65.5
Mean age	37.7±23.3[a]	38.6±23.9	36.8±22.7	N/A	83.2±12.4[a]	85.0±11.3	79.8±13.7	N/A

Mean age presented as mean ± SD. Approximation of person-years for the SK described above.
[a]Age significantly different ($p < .001$ based on one-way ANOVA) between males and females.

TABLE 2.
Description of the LTC cohort 2008–2012 according to population center

PC	*Person-years*			*% F*	*Mean Age ± SD*			
	All	*F*	*M*		*All*	*F*	*M*	*p value*
Rural	13,277	8,592	4,685	64.7	85.2±9.9	86.6±9.3	82.8±10.5	<.001
Small PC	22,709	14,992	7,717	66.0	84.4±11.1	85.8±10.2	81.5±12.2	<.001
Med–Large PC	24,450	16,011	8,439	65.5	81.0±14.4	83.4±12.9	76.5±15.8	<.001
All	60,436	39,595	20,841	65.5	83.2±12.4	85.0±11.3	79.8±13.7	<.001
p value	-	-	-	-	<.001	<.001	<.001	

Rural = < 1,000); small population centre = 1,001–29,999; medium–large population centre = 30,000 and over.
P values based on one-way ANOVA.

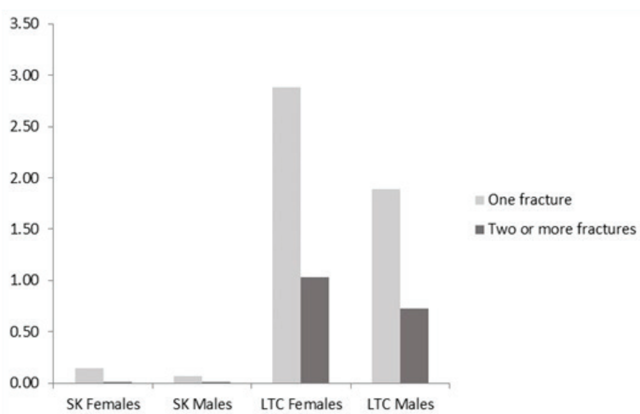

FIGURE 1. Percentage of males and females sustaining one or two hip fractures (HFs) in the province of Saskatchewan (SK) and in long-term care (LTC) residents, 2008–2012

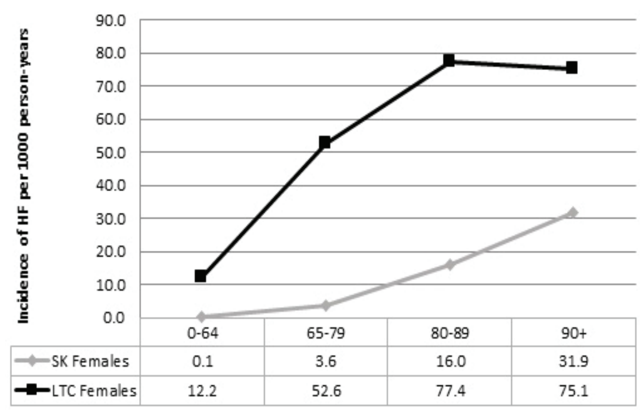

FIGURE 2. Hip fracture (HF) incidence in females in the province of Saskatchewan (SK), and in long-term care (LTC) residents, 2008–2012

HF Incidence Rates Within the LTC Cohort, Stratified by Additional Descriptors

HF incidence rates varied within the LTC cohort by individual, facility, and regional and temporal characteristics. HF rates per 1,000 person-years are shown in Table 3, stratified by size of the LTC, age, and sex. Age-adjusted standardized (to the overall SK population) HF rates are shown in the last row of the table. These standardized HF rates in both men and women were lowest in the large LTCs, and the stratified findings suggested potential interactions between HFs and age, sex, and size of the facility. For example, the oldest females seemed to have particularly high HF rates in larger, compared to smaller, LTCs (p = .035), whereas the youngest males had higher rates in the small, compared to the larger, LTCs (ns). The size of the population centre (PC) within which a LTC facility was located might have affected HF rates because of differences in access to tertiary facilities and possibly other, undetermined factors. Stratified rates of HFs per 1,000 person-years are illustrated in Table 4. As in Table 3, age-adjusted standardized HF rates are shown in the last row of the table. These standardized HF rates in both men and women were lowest in the medium–large PCs, but the age- and sex-stratified HF rates were similar across different sizes of population centres, except in the 90+ females where rates were higher in the med–large centres, compared to smaller population centres.

We were interested in variations of HFs throughout Saskatchewan, so calculated age-stratified rates for each health region (displayed in Table 5). Health regions are named HR1 to HR11, as we chose not to publically identify the regions. As rates of HFs are likely to vary by mean age of a region, this is shown in the second column. It can be seen that one health region (HR02) had markedly higher rates than the other regions, even although the mean age was not higher.

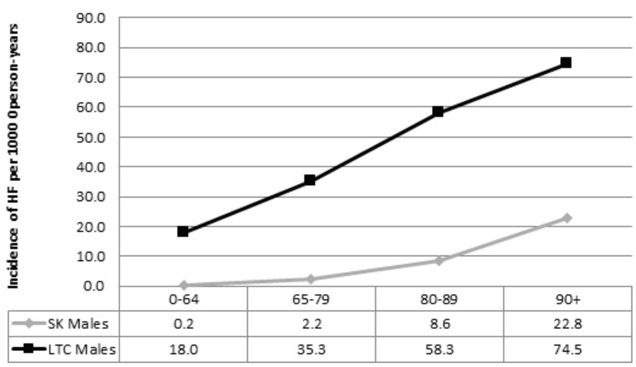

FIGURE 3. Hip fracture (HF) incidence in males in the province of Saskatchewan (SK) and in long-term care (LTC) residents, 2008–2012

DISCUSSION

There are few studies of hip fracture incidence and its predictors in LTC facilities in Canada. While frail older adults are at high risk for fracture, tools to identify them, such as FRAX, do not apply to this population.[14] In this study we examined hip fracture incidence rates in LTC facilities in Saskatchewan over a five-year period, stratifying HF rates by age, sex, facility size, and population centre, and comparing age-stratified rates to those in the province as a whole. Residents in the LTC population were older and more predominantly female than in the province overall. The LTC cohorts in the north of Saskatchewan reflected the underlying population demographics, with a lower proportion of older residents than in the more populous south and, as a result, the overall HF rates were lower. However, age-stratified HF rates were not uniformly lower in the northern regions, where in some age categories the rate was actually higher. In the rest of the province, the less populated rural regions had a greater proportion of older adults, but lower rates of HFs than larger urban centres in the oldest (90+) LTC age groups. This may have occurred because the oldest residents of LTC in rural areas were likely the most active and weight-bearing in their youth, resulting in a higher peak in their bone mass, which might have protected them from HFs in their later years. Another possibility is that the oldest rural residents were institutionalized earlier (and were therefore less frail) than those in the cities where health-care resources were more accessible. This explanation would be consistent with those of others[25-27] who have associated reduced access to health care with earlier institutionalization rates.

Of the 6,230 cases of HFs in SK during the study period, 2,743 (44%) were in the LTC cohort. Incidence rates per 1,000 person-years increased with age and were higher in the LTC group (F = 68.6, M = 49.8) than the overall population (F = 1.62, M = 0.73, which was not unexpected due to the increased frailty of people in LTC

TABLE 3.
Incidence of HF per 1,000 person-years in LTC, 2008–2012, by size of the LTC

Age	*Females*					*Males*				
	Total	*Small LTC*	*Medium LTC*	*Large LTC*	*p value*	*Total*	*Small LTC*	*Medium LTC*	*Large LTC*	*p value*
0–64	14.5±16.8	13.4±20.7	21.7±20.3	8.4±5.7	.48	23.1±27.9	36.6±43.3	17.1±20.1	15.4±10.2	.44
65–79	54.1±16.0	59.9±10.0	57.2±16.5	45.0±19.1	.31	35.3±11.9	35.2±12.9	36.6±12.0	34.2±13.5	.96
80–89	78.0±13.9	78.1±21.1	74.2±8.4	81.6±11.2	.73	58.2±12.5	56.9±4.2	58.0±19.2	59.8±12.3	.94
90+	76.6±21.5	66.0±17.2	68.1±13.4	95.7±21.2	.035	73.8±28.0	70.1±25.0	76.8±20.8	74.4±40.6	.94
All ages	55.8±30.9	54.4±30.0	55.3±25.1	57.7±37.7	.94	47.6±28.9	49.7±28.1	47.1±28.5	46.0±31.4	.92
Stan[a]	22.1	21.6	28.2	16.5		25.5	37.3	20.4	18.7	

[a]Stan = standardized to the overall SK population 2008-2012.
Small = 1–35 beds; medium = 36–100 beds; large = >100 beds.
Incidence rates presented as mean ± SD.
P values based on one-way ANOVA+.

TABLE 4.
Incidence of HFs per 1,000 person-years in LTC, 2008–2012, by population centre

	Females					*Males*				
Age	*Total*	*Rural PC*	*Small Urban PC*	*Med–Large Urban PC*	*p value*	*Total*	*Rural PC*	*Small Urban PC*	*Med–Large Urban PC*	*p value*
0–64	147±23.7	16.9±37.7	18.1±21.3	9.2±5.1	.83	23.9±23.8	28.1±30.8	33.2±26.0	11.4±7.3	.37
65–79	56.4±22,9	70.5±18.7	56.7±27.9	42.1±14.5	.15	35.0±16.4	33.9±17.7	33.8±7.2	37.4±23.7	.93
80–89	77.0±11.9	74.6±18.3	75.1±8.6	81.5±6.9	.63	57.1±14.3	47.5±3.2	63.3±20.5	60.3±10.2	.18
90+	74.0±21.8	60.4±14.6	63.3±10.9	98.4±14.3	.001	75.6±26.9	82.1±17.4	68.2±39.7	76.4±23.2	.74
All ages	55.5±32.1	55.6±32.3	53.3±27.9	57.8±37.0	.91	47.9±28.7	47.9±28.2	49.4±29.3	46.4±29.9	.95
Stan[a]	22.4	25.4	25.1	16.9		26.2	29.5	33.5	15.6	

[a]Stan = standardized to the overall SK population 2008–2012.
Population Centre (PC): Rural = < 1,000); small urban = 1,001–29,999; medium–large urban = 30,000 and over.
P values based on ANOVA.

TABLE 5.
Incidence of HFs per 1,000 person-years in LTC, 2008–2012, by health region and age

Health Region	*Mean Age*	*All Ages*	*< 65*	*65–79*	*80–89*	*90+*
HR01	84.5±10.9	66.33	29.96	42.39	82.74	65.31
HR02	85.3±10.2	124.60	0.00	75.53	126.17	160.09
HR03	85.6±9.7	57.90	9.39	39.71	77.51	48.56
HR04	83.8±11.3	75.24	6.10	51.89	84.17	91.50
HR05	77.0±16.2	46.40	31.53	0.00	53.62	70.65
HR06	82.7±12.7	46.00	12.85	25.20	60.44	50.96
HR07	82.4±12.5	41.96	10.72	26.78	52.35	49.42
HR08	82.0±13.6	61.41	6.86	46.49	64.25	88.09
HR09	81.9±13.8	52.31	15.48	37.82	62.59	64.03
HR10	84.4±10.5	67.77	51.30	60.41	70.33	71.65
HR11	85.2±10.5	61.76	44.37	61.54	69.10	55.82
All	83.2±12.4	62.45	15.25	45.06	71.14	74.94

compared to the province in general. Crilly *et al*.[13] found that for London, Ontario, their "LTC" cohort had 31% of the HFs, which was lower than our 44%. Their overall "LTC" rates were also considerably lower than ours in males and females. However, their "LTC" cohort included not only LTC, but also residential homes (which provide care to less complex residents), and their "community" cohort did not include the LTC residents while our SK cohort did. Because of these differences in methodology, the difference in HF rates and proportion of provincial HFs from LTC was not unexpected. However, the pattern of fracture incidence with age in our study was almost identical to that in the Crilly study. Both studies showed a progressive, age-related increase of hip fracture rates in the community in males and females, whereas in the LTC cohort this uniform increase was only seen in males, while the rates in the oldest female residents plateaued.

Because of differences in methodology, an Ontario study[12] of HF rates in community and LTC was not directly comparable to ours. However, the Ontario study showed similar, uniform, age-related increases in HFs in the community, whereas in LTC, HF rates plateaued. Differences among provinces may be expected, however. Regional health authorities in Canada have reported variation in fall rates among specific facilities ranging 10–24%.[15] These differences may be due to complex interactions among factors such as admission criteria, operating budgets, and educational opportunities for staff.[16] These factors themselves may vary by size and other institutional level characteristics, proximity to tertiary resources, and size of the population centre. For example, larger institutions might have access to more internal resources, potentially resulting in lower rates of HFs, although some researchers have found that larger facilities may also be negative predictors of other resident measures.[17] The same authors found that staffing factors, such as increased activity staff hours per resident per day, were more important predictors of positive resident indicators. Characteristics of care providers may have impact on various resident outcomes, such as HFs. Esterbrooks *et al*.[18] reported that the majority of care in LTC is provided by people who were not born in Canada, did not speak English as a first language, experienced high levels of burnout, and rarely attended educational sessions. As many of the fall-prevention strategies rely on caregiver education, this is clearly an important variable to consider.

In terms of facility size and population centre, we found that women 90+ years in larger LTCs had significantly higher (p = .035) HF rates than those in smaller LTCs, and also had significantly (p = .001) higher rates in medium–large compared to smaller population centres. It may be that the larger LTCs and larger population centres tend to admit more complex, aggressive (often male) and younger patients, resulting in only the most frail of the oldest women being admitted, which might account for their higher HF rates. However, after age standardization to the overall SK population, it was apparent that the larger LTC facilities and the medium–large population centres had overall lower HF rates than the small and medium LTC facilities and the small urban and rural PCs, respectively. This could have been because of better access to specialty expertise including educational resources in those settings, but may also have been as result of differences in institutional policies.

Most puzzling to us was the difference in HF rates within health regions. Although the mean age of the health region H2 was not higher than that of other regions, the age stratified, as well as the summated HF rates, were considerable higher. We wondered whether there might have been differences in prescribing practices, as well as differences in the use of non-pharmacological prevention strategies, such as the use of hip protectors, which may have accounted for this difference.

Limitations in our study include over- and under-classification of HFs in our sample, based on challenges with case ascertainment. We considered records of HFs occurring more than 28 days after the previous admission date for HF as new events of HF. However, some of the readmissions after 28 days (part of the dataset because the diagnosis of HFs was included as one of the discharge diagnoses) could have been related to complications of a previous fracture, such as infected hardware, loss of fixation or avascular necrosis. Conversely, LTC residents suffering an unrelated fracture within 28 days of the previous facture would have been excluded from our dataset. Lastly, although we tried to remove all cases of HF which occurred while the person was at a LTC in respite rather than as a permanent resident, there may have been some errors related to this because of errors in the charting of dates by facility personnel. However, our data selection was consistent with other researchers using administrative data to study HFs.[28-30] In particular, Lix *et al*.[31] used Canadian data to explore the validity of using this method, comparing similar ICD-10 administrative data for HFs with clinically validated data and concluding that this was a valid method of HF case ascertainment.

CONCLUSION

Rates of HFs showed sex and age patterns that were mostly consistent with those in the published literature, although differences in methodology made comparisons difficult. More unique were our findings of differences in HFs by size of the LTC and size of the population centre within which the facility was located, as these have not to our knowledge been reported. Of greatest interest to those developing active strategies in prevention of HFs was the marked discrepancy in HFs in one of our health regions, which could not be accounted for by differences in age or sex distribution. This discrepancy might point to differences in care which might be amenable to modification and eventual improvement in overall HF rates in the population.

ACKNOWLEDGEMENTS

The study design, data collection, analysis, interpretation, and manuscript preparation were supported by a grant from the Saskatchewan Health Research Foundation (SHRF), which is the provincial agency responsible for funding, facilitating, and promoting innovative, collaborative health research in Saskatchewan. The SHRF did not have any role in the research after the initial funding approval. The Authors would like to acknowledge the help of Muhammad Owais (paid from the above grant) in the initial literature review and correlation of institutional data from the ISCH with LTC listings obtained separately from the Ministry of Health.

CONFLICT OF INTEREST DISCLOSURES

None of the authors declare any conflicts of interest in the conduct of the research or preparation of the manuscript.

REFERENCES

1. Castronuovo E, Pezzotti P, Franzo A, *et al*. Early and late mortality in elderly patients after hip fracture: a cohort study using administrative health databases in the Lazio region, Italy. *BMC Geriatr*. 2011;11:37.
2. Neuman MD, Silber JH, Magaziner JS, *et al*. Survival and functional outcomes after hip fracture among nursing home residents. *JAMA Intern Med*. 2014;174(8):1273–80.
3. Hansson S, Rolfson O, Åkesson K, *et al*. Complications and patient-reported outcome after hip fracture. A consecutive annual cohort study of 664 patients. *Injury*. 2015;46(11):2206–11.
4. Keene GS, Parker MJ, Pryor GA. Mortality and morbidity after hip fractures. *Br Med J*. 1993;307(6914):1248–50.
5. Ronald LA, McGregor MJ, McGrail KM, *et al*. Hospitalization rates of nursing home residents and community-dwelling seniors in British Columbia. *Can J Aging*. 2008;27(1):109–15.

6. van Dijk PA, Bot AG, Neuhaus V, *et al*. Admission from nursing home residence increases acute mortality after hip fractures. *Geriatr Orthop Surg Rehabil*. 2015;6(3):123–29.
7. Becker DJ, Yun H, Kilgore ML, *et al*. Health services utilization after fractures: evidence from Medicare. *J Gerontol A Biol Sci Med Sci*. 2010;65(9):1012–20.
8. Brainsky A, Glick H, Lydick E, *et al*. The economic cost of hip fractures in community-dwelling older adults: a prospective study. *J Am Geriatr Soc*. 1997;45(3):281–87.
9. Braithwaite RS, Col NF, Wong JB. Estimating hip fracture morbidity, mortality and costs. *J Am Geriatr Soc*. 2003;51(3):364–70.
10. Haentjens P, Autier P, Barette M, *et al*. The economic cost of hip fractures among elderly women. A one-year, prospective, observational cohort study with matched-pair analysis. *J Bone Joint Surg Am*. 2001;83-A(4):493–500.
11. Haentjens P, Lamraski G, Boonen S. Costs and consequences of hip fracture occurrence in old age: an economic perspective. *Disabil Rehabil*. 2005;27(18-19):1129–41.
12. Papaioannou A, Kennedy CC, Ioannidis G, et al. Comparative trends in incident fracture rates for all long-term care and community-dwelling seniors in Ontario, Canada, 2002-2012. *Osteoporos Int*. 2016;27(3):887–97.
13. Crilly RG, Tanner DA, Kloseck M, *et al*. Hip fractures in long-term care: is the excess explained by the age and gender distribution of the residents? *J Aging Res*. 2010;2010:291258.
14. Papaioannou A, Santesso N, Morin SN, *et al*. Recommendations for preventing fracture in long-term care. *CMAJ*. 2015;187(15):1135–44.
15. Canadian Institute for Health Information. When a nursing home is home: how do Canadian nursing homes measure up on quality? Ottawa, ON: CIHI; 2013. Available at: https://secure.cihi.ca/free_products/CCRS_QualityinLongTermCare_EN.pdf
16. Canadian Healthcare Association. New directions for facility-based long term care. Ottawa: CHA; 2009. Available from: https://www.advantageontario.ca/oanhssdocs/Issue_Positions/External_Resources/Sept2009_New_Directions_for_Facility_Based_LTC.pdf
17. Shippee TP, Henning-Smith C, Kane RL, *et al*. Resident- and facility-level predictors of quality of life in long-term care. *The Gerontologist*. 2015;55(4):643–55.
18. Estabrooks CA, Squires JE, Carleton HL, *et al*. Who is looking after Mom and Dad? Unregulated workers in Canadian long-term care homes. *Can J Aging*. 2015;34(1):47–59.
19. Coburn AF, Bolda EJ. Rural elders and long-term care. *West J Med*. 2001;174(3):209–213.
20. Goodridge D, Lawson J, Rennie D, *et al*. Rural/urban differences in health care utilization and place of death for persons with respiratory illness in the last year of life. *Rural Remote Health*. 2010;10(2):1349.
21. Ministry of Health, Government of Saskatchewan. Program guidelines for special-care homes. April 2013, updated May 2016. Regina, SK: Ministry of Health, Government of Saskatchewan; 2016. Available at: http://publications.gov.sk.ca/documents/13/98649-Program%20Guidelines%202016.pdf
22. Stadnyk, RL, Lauckner H, Clarke B. Improving quality of care in nursing homes: What works? *CMAJ*. 2011;183(11):1238–39.
23. Morris JN, Hawes C, Mor V, et al. Resident Assessment Instrument (RAI) RAI-MDS 2.0 user's manual. Canadian version. Ottawa, ON: Canadian Institute for Health Information; 2010.
24. Statistics Canada. Census Dictionary, Census year, 2011. Catalogue no. 98-301-X2011001 ISBN 978-1-100-19623-7. Ottawa, ON: Statistics Canada.
25. Browne A. Issues affecting access to health services in northern, rural and remote regions of Canada [online article]. Available at: http://www.unbc.ca/assets/northern_studies/northern/issues_affecting_access_to_health_services_in_northern.pdf. Accessed 20 April, 2016.
26. Coward RT, Netzer JK, Mullens RA. Residential differences in the incidence of nursing home admissions across a six-year period. *J Gerontol B Psychol Sci Soc Sci*. 1996;51(5):S258–67.
27. Greene VL. Premature institutionalization among the rural elderly in Arizona. *Public Health Rep*. 1984;99(1):58–63.
28. Ray WA, Griffin MR, West R, *et al*. Incidence of hip fracture in Saskatchewan, Canada, 1976–1985. *Am J Epidemiol*. 1990;131(3):502–09.
29. Sund R. Utilization of routinely collected administrative data in monitoring the incidence of aging dependent hip fracture. *Epidemiol Perspect Innov*. 2007; 4:2.
30. Hudson M, Avina-Zubieta A, Lacaille D, *et al*. The validity of administrative data to identify hip fractures is high—a systematic review. *J Clin Epidemiol*. 2013;66(3):278–85.
31. Lix LM, Azimaee M, Osman BA, *et al*. Osteoporosis-related fracture case definitions for population-based administrative data. *BMC Publ Health*. 2012;12:301.

Correspondence to: Lilian U. Thorpe, MD, PhD, FRCP, Community Health and Epidemiology, College of Medicine, Box 7, Health Science Building, 107 Wiggins Rd., University of Saskatchewan, Saskatoon, SK, Canada S7N 5E5
E-mail: lilian.thorpe@usask.ca