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The impact and consequences of hip fracture in Ontario

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Objectives: To assess the magnitude and the burden of hip fracture on the health care system, including time trends in hip fracture rates, in-hospital death rates, length of hospital stay (LHS) and discharge destination.

Design: A retrospective study of discharge abstracts.

Setting: The Province of Ontario.

Patients: All patients (n = 93 660) over the age of 50 years and with a diagnosis of hip fracture discharged from hospital between 1981 and 1992 (excluding transfers).

Main Outcome Measures: Age-sex standardized hip fracture rates per 1000 population, in-hospital death rates and age-adjusted mean LHS.

Results: The overall hip fracture rate was 3.3 per 1000 persons (1.7 per 1000 men and 4.6 per 1000 women). There was no change in rates between 1981 and 1992 (p = 0.089), but there have been increases in the numbers of hip fractures. There was no change in the in-hospital death rate over time (p = 0.78). The age-adjusted mean LHS in 1981 was 28.6 days compared with 22.2 days in 1992. The numbers of hip fractures will increase from 8490 in 1990 to 16 963 in 2010.

Conclusions: Despite stable age-adjusted rates of hip fractures, the doubling of the number of hip fractures by the year 2010 due to an aging population will become an increasing burden on the health care system.

Objectifs : Évaluer l'ordre de grandeur des fractures de la hanche et le fardeau qu'elles imposent au système de santé, y compris les tendances chronologiques des taux de fracture de la hanche, les taux de décès à l'hôpital, la durée de séjour à l'hôpital et la destination à la libération.

Conception : Étude rétrospective de résumés de libération.

Contexte : La province de l'Ontario.

Patients : Tous les patients (n = 93 660) de plus de 50 ans, victimes d'une fracture de la hanche diagnostiquée et qui ont quitté l'hôpital entre 1981 et 1992 (à l'exclusion des transferts).

Principales mesures des résultats : Taux de fracture de la hanche, normalisés selon l'âge et le sexe, par 1000 habitants, taux de décès à l'hôpital et durée moyenne de séjour à l'hôpital corrigée selon l'âge.

Résultats : Le taux global de fracture de la hanche s'est établi à 3,3 par 1000 personnes (1,7 par 1000 hommes et 4,6 par 1000 femmes). Les taux n'ont pas changé entre 1981 et 1992 (p = 0,089), mais le nombre des fractures de la hanche a augmenté. Le taux de décès à l'hôpital n'a pas changé dans le temps (p = 0,78). La durée moyenne de séjour à l'hôpital corrigée selon l'âge en 1981 était de 28,6 jours, comparativement à 22,2 jours en 1992. Le nombre de fractures de la hanche passera de 8490 en 1990 à 16 963 en 2010.

Conclusions : Même si les taux de fracture de la hanche corrigés selon l'âge sont stables, le doublement, d'ici à 2010, du nombre des fractures de la hanche attribuable au vieillissement de la population imposera un fardeau de plus en plus lourd au système de santé.

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Fractures of the hip are responsible for a significant proportion of morbidity and mortality experienced by elderly persons.[1] Population trends indicate that an increasing number of individuals are likely to survive to ages at which hip fracture is common. Therefore, comprehensive, accurate information will be needed to formulate health care policy, in the organization and planning of health services and in clinical decision making for patients with hip fracture.

Currently, we do not know how hip fracture impacts on the health care system. The first step in tackling this issue is establishing the magnitude of the problem. To date, information on hip fracture rates in Ontario have not been reported. Thus, our primary objective was to outline the descriptive epidemiology of hip fracture in Ontario. Using hospital discharge abstracts we calculate rates by person, place and time. We then addressed issues around the impact or burden of this injury in terms of mortality and health care utilization. Our enquiry was limited to information from the hospital discharge abstracts. This includes in-hospital death, length of acute-care hospital stay and discharge destination. Finally, we projected future trends in incidence and bed occupancy.

Methods

Patient data

The data used in this study were collected by the Hospital Medical Records Institute, which collates hospital discharge data in Ontario. These data included the admission date, principal diagnosis (defined as the diagnosis most responsible for admission), case-mix grouping, resource intensity weighting, secondary diagnoses, procedures performed during inpatient stay, history of transfer from another acute-care facility, age, sex, length of hospital stay (LHS), discharge destination and in-hospital death. Patient data were obtained for the fiscal years 1981 through 1992. The fiscal year is defined as the period extending from Apr. 1 of the identified year to Mar. 31 of the following year. Thus, the analyses extend to Mar. 31, 1993.

Hip fracture rates are known to increase exponentially from age 50 years.[2,3] Accordingly, we looked at patients aged 50 years and older who were hospitalized between the fiscal years 1981 and 1992 with a discharge diagnosis of fracture of the neck of the femur (hip fracture). Hip fracture was defined according to the International Classification of Diseases (ICD), 9th revision, categories 820.0–820.9, which include transcervical fractures, pertrochanteric fractures and fractures of an unspecified part of the neck of the femur.

Population estimates and projections

Population estimates used in computing rates per 1000 persons were supplied by Statistics Canada. Estimates were obtained for each calendar year from 1981 to 1992. Data were stratified by sex and 5-year age groups, beginning with 50 years and ending at 90+ years. Age standardization was performed by the direct method, using the 1986 Ontario population as the standard to remove any distortion in rates introduced by the aging of the population over the time period. Future population projections provide four possible scenarios of future age and sex distribution. The most recent projections are based on 1990 age and sex characteristics of the Ontario population.[4] The medium growth projection (projection 3) was used for this analysis. It is based on four assumptions: a total fertility rate of 1.7; annual immigration of 200 000 (reached by 1994/1995); and annual emigration of 80 000 by 2011.

Statistical methods

The Mantel–Haenszel χ^2 extension for linear trends procedure was used to analyse and make statistical inferences on time trends in hip-fracture discharge rates, in-hospital death rate and LHS during the 12-year period. Because observations based on sequential time intervals may not be independent, time trends were also analysed by linear regression to confirm the χ^2 findings. This method determines whether the slope (rate of change through time) is significantly different from zero. All analyses were performed with the computer statistical package STATA (v 3.1), (Stata Corporation, College Station, Tex.).

Findings

Age and sex

For the study period, 105 955 hospital discharges were coded for hip fracture. Records of 15 935 patients transferred from another acute-care facility were excluded to avoid duplication. Thus, 93 660 records met the inclusion criteria. The overall hip fracture rate was 3.3 per 1000 persons (1.7 per 1000 men and 4.6 per 1000 women). Hip fracture rates increased exponentially with age for both sexes from 50 to 89 years, nearly doubling each 5 years, from 0.3 per 1000 in the youngest age group to 24.8 per 1000 in the 85 to 89-year age group ($p < 0.0001$) (Table I). Thereafter, the incidence continued to increase but at a reduced rate. In the youngest age group, men and women had equal rates of hospitalization for hip fracture. After age 54 years, the rate was higher in women than in men, and after age 69 years, the rate in

women was twice that of men through age 89 years, falling to 1.6:1 for those over 90 years of age.

Trends in hip fracture rates

Among persons 50 years of age and older, the annual number of hip fracture hospitalizations increased from 6872 in 1981 to 9044 in 1992 (Table II). The overall crude rate of hip fracture hospitalizations increased slightly from 3.2 per 1000 persons to 3.4 per 1000 persons over the 12-year period and was not statistically significant. Approximately 75% of all hip fractures occurred in women. This rate showed no change over time. The mean (and standard deviation) age of hip fracture patients increased significantly from 78.2 (10.5) years in 1981 to 80.1 (9.5) years in 1992 ($p < 0.0001$). Fig. 1 shows the age-standardized hip-fracture rates over time for men and women. These rates have remained fairly constant for men at around 1.7 per 1000, and there was only a slight decrease in the rate for women, from 4.7 per 1000 in 1981 to 4.4 per 1000 in 1992 ($p = 0.089$).

In-hospital mortality

Table III shows in-hospital death rates by age and sex. The overall death rate was 6.9%; this rate was signifi-

Table I

Hip Fracture Discharge Rates (per 1000 Patients) by Age Group and Sex for Ontario for the Period 1981 to 1992

	Men		Women		
Age group, yr	No. of fractures	Age-specific rate	No. of fractures	Age-specific rate	Mean age-specific rate
50–54	836	0.3	860	0.3	0.3
55–59	1 218	0.5	1 804	0.7	0.6
60–64	1 742	0.7	2 977	1.1	0.9
65-69	2 301	1.2	4 733	2.1	1.7
70–74	3 068	2.2	7 541	4.1	3.3
75–79	3 914	4.2	11 713	8.5	6.7
80–84	4 183	8.1	15 472	16.9	13.7
85–89	3 275	14.9	14 803	29.1	24.8
≥ 90	2 194	25.0	11 026	40.1	36.4
Total	22 731	1.7	70 929	4.6	3.3

Table II

Hip Fracture Discharge Rates (per 1000 Patients) in Ontario by Year, Sex and Age for the Period 1981 to 1992

Year	No. of fractures	Discharge rate	% female	Mean age, yr
1981	6872	3.2	75.4	78.2
1982	6840	3.1	76.2	78.6
1983	6922	3.1	75.5	78.4
1984	7452	3.3	76.4	78.6
1985	7498	3.3	75.4	78.8
1986	7498	3.2	76.1	79.1
1987	7707	3.2	76.5	79.0
1988	8124	3.3	75.9	78.9
1989	8212	3.3	73.3	79.3
1990	8940	3.3	75.5	79.7
1991	9001	3.5	75.5	79.7
1992	9044	3.4	75.3	80.1

cantly higher for men (10.3%) than for women (5.8%) ($p < 0.0001$). There were also statistically significant differences by age group ($p < 0.0001$). During the 12-year period there was no change in the in-hospital death rate ($p > 0.708$).

Length of hospital stay

There was a downward trend in mean LHS over the 12-year period (Table IV). The age-adjusted mean LHS in 1981 was 28.6 days compared with 22.2 days in 1992 ($p < 0.001$). The largest decrease was between 1990 and 1992. LHS increases with age. In 1992, those aged 50 to 59 years had a mean LHS of 13.4 days compared with 21.5 days for those aged 70 to 79 years, and 25.5 days for those aged 80 to 89 years.

Trends in discharge destination

Table V shows the discharge destination by year of all patients who were living in the community before their hip fracture and who were discharged alive. Overall, a lower percentage of patients returned directly to their home in 1992 (51.1%) than in 1981 (62.0%) ($p < 0.0001$). Of those discharged home, the proportion receiving home care services doubled between 1981 (8.5%) and 1992 (15.4%) ($p < 0.001$). There also have been increases in the proportions of patients being transferred to acute-care hospitals, and rehabilitation facilities, yet the proportion being discharged to nursing home, chronic-care facilities, or homes for the aged has decreased slightly from 17.7% in 1981 to 15.3% in 1992.

Future trends in incidence and bed occupancy

To calculate the expected number of hip fractures for the years 2000, 2005 and 2010, the age-specific hip fracture admission rate was applied to the age-specific population projections. Results (Fig. 2) showed that for persons aged 50 years and older, the number of fractures will double from 8490 in 1990 to 16 963 in 2010. Assuming no major change in mean LHS, this doubling in the number of hip fractures will result in more than double the number of hospital bed-days taken by these patients, because there will be more patients in the older age groups and these groups stay longer in the hospital. Over the same time period (1990 to 2010), we estimate that the number of bed-days taken will increase from 214 000 to 393 000. The full effect of this combination of increased numbers at risk and the age shift within this group will not be felt until 2030 and beyond.[5]

DISCUSSION

Consistent with the findings of

Table III

In-hospital Death Rates by Age Group and Sex for all Patients 50 Years of Age and Older Seen Between 1981 and 1992 With a Principal Diagnosis of Hip Fracture

	In-hospital death rate, %	
Age group, yr	Men	Women
50–59	2.5	2.0
60–69	5.3	3.6
70–79	13.3	5.4
80–89	20.1	9.5
≥ 90	29.8	16.8
Overall	10.3	5.8

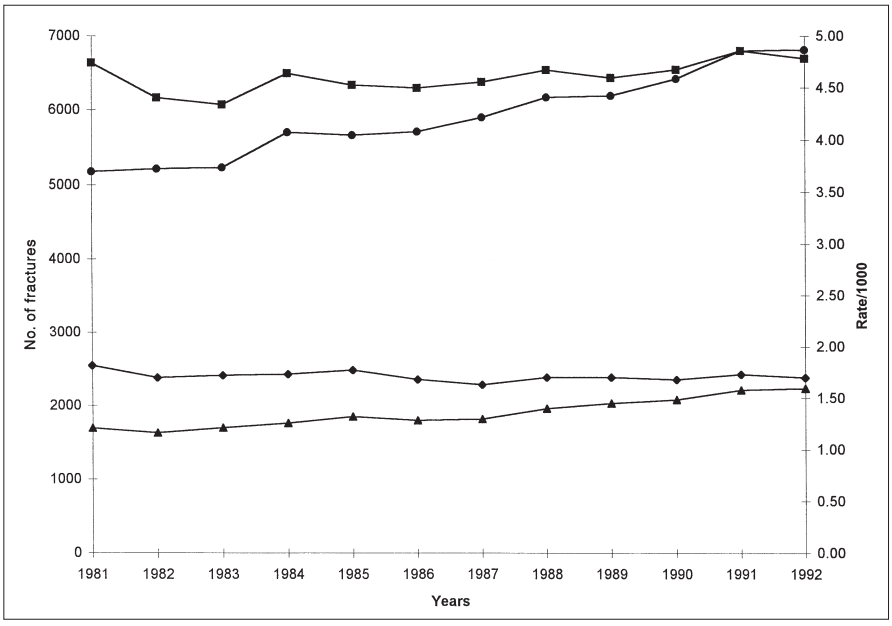

FIG. 1. Numbers of hospital discharges for hip fracture (triangles = men, circles = women) and age-specific rates per 1000 population (diamonds = men, squares = women) by sex, Ontario 1981 to 1992.

other similar studies in the United States, Britain and Scandinavia, we found that hip fracture rates in Ontario increase with age and are higher among women.[2,3,6–10] Each year in Ontario, an increasing number of elderly patients present with these injuries. However, when adjusted for the aging population, our results indicate that hip fracture hospitalization rates remained fairly constant for men and women throughout the 12-year period from 1981 to 1992. In some studies of trends in hip fracture rates, the number of hip fractures in the elderly has increased dramatically during the last 30 to 40 years, owing to an increase in the population at risk

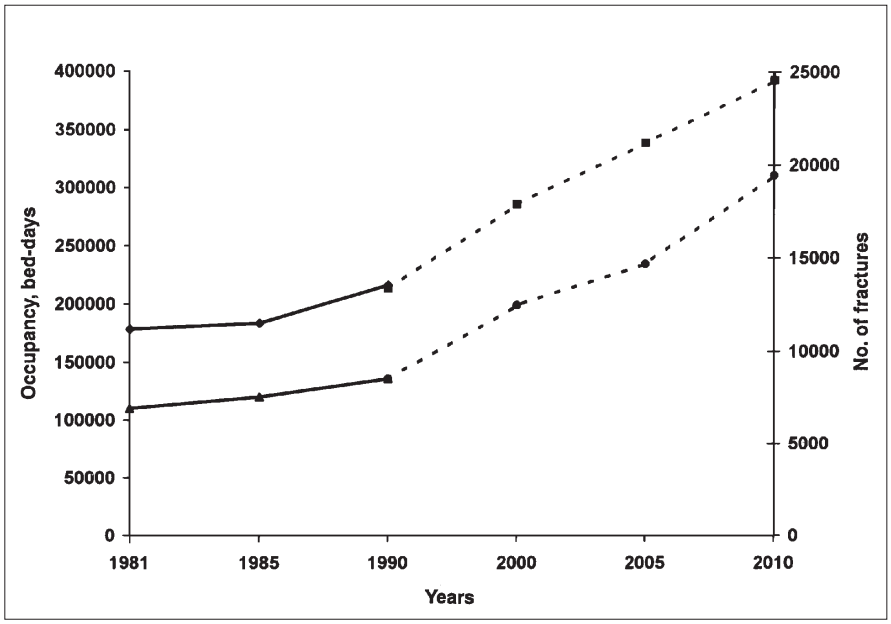

FIG. 2. Total number of hip fractures and bed-days occupied 1981 to 1990 and projected trends for years 1995 to 2010 (solid line with circles = occupancy, solid line with triangles = fractures, dotted line with squares = projected occupancy, dotted line with circles = projected fractures).

Table IV

Mean Age-Adjusted Length of Hospital Stay by Year

Year	Hospital stay, d
1981	28.6
1982	29.1
1983	28.3
1984	29.3
1985	26.6
1986	28.0
1987	29.3
1988	26.4
1989	27.2
1990	28.8
1991	25.8
1992	22.2

Table V

Discharge Destination by Year of Patients* Who Were Living in the Community Before Their Hip Fracture

	Discharge destination, % of patients				
Year	Acute-care hospital	Rehabilitation hospital	Nursing home†	Home care	Home
1981	6.0	13.7	17.7	8.5	53.5
1982	6.3	15.6	15.9	9.1	52.3
1983	6.4	16.2	15.3	8.6	52.9
1984	5.7	16.5	15.1	9.6	52.1
1985	*6.5*	17.5	13.9	11.6	49.4
1986	6.5	16.2	14.8	12.6	49.1
1987	7.0	18.1	13.9	11.2	48.8
1988	7.2	15.8	13.3	13.0	49.8
1989	7.0	18.1	14.9	13.0	45.8
1990	7.9	19.5	15.4	15.3	40.9
1991	9.1	21.1	14.5	15.1	39.2
1992	9.9	22.6	15.3	15.4	35.7

*Excludes those who died in hospital
†Includes chronic care facilities and homes for the aged

and changes in age-sex specific rates.[6,8,11–14] However, other studies using more recent data have also found that rates have stabilized.[15–17]

A review of hip fracture rates among various populations in North America, Scandinavia and Europe indicates that rates in Ontario were comparable to those in Saskatchewan[17] and to those in two populations from England — Oxford[7] and Newcastle-upon-Tyne.[18] The highest rates were seen in Scandinavia[19–21] and the United States.[2,10,22] A possible explanation for the similarity of hip fracture rates in Ontario and Saskatchewan with those in England may be genetic, since both Ontario and Saskatchewan residents in these older age cohorts are predominantly of English ancestry. Some of the observed differences among the various studies of hip fracture may be due to differences in the ranges of ages studied, ethnic composition, the time periods evaluated, the data sources used and the definition of hip fracture.

Approximately 94% of patients with hip fracture survive their hospitalization. In a study of hip fracture hospitalizations in the United States, the in-hospital death rate decreased from 11.3% in 1970 to 6.1% in 1983.[6] We did not show this decrease probably because the time period examined is more recent than in the US series. The observed in-hospital death rate is very similar to that reported in other studies for a similar time period, indicating that in-hospital death rates have stabilized.[23–27] This low in-hospital death rate probably reflects improvements in surgical techniques and in the post-surgical care after hip fracture compared with earlier periods. There is also confirmation of the finding that men have a higher death rate after hip fracture than women.[24,26,28] Myers and colleagues[28] hypothesized that the higher death rate in men may be due to more severe falls, illness before the fall, less psychological support, marked delirium at the time of admission, poor pre-fracture functional status and more serious concomitant illness. This sex difference requires further study.

There have been significant changes in discharge destination, with more patients being transferred to rehabilitation units. These changes were most marked between 1990 and 1992 and coincide with a reduction in mean LHS which decreased from 29 days in 1990 to 22 days in 1992. This may reflect the need for increased fiscal restraint by hospitals, the availability and uptake of home-care services and the increase in beds for specialist rehabilitation hospitals.[29] Whether these result in improvements in the management of hip fracture patients and decreased cost to the health care system requires investigation.

The process of aging and the longer life expectancy of women compared with men, has produced dramatic changes in the age and sex distribution of the Canadian population. Unprecedented growth in the number of persons over the age of 65 years is projected.[5] In 1991, 12% of Canada's population was 65 years of age or older, and this will increase to 15% in 2011 and to 25% by the year 2036. Therefore, as the "baby boomers" reach 65 years of age and beyond, even more dramatic increases in the numbers of hip fractures can be expected. Patient age has a major impact on LHS. Older patients tend to stay in hospital longer, most likely because with increased age comes increased morbidity. The doubling of the number of hip fractures coupled with longer hospital stays for patients over the age of 70 years (the age group in which 75% hip fractures occur) will more than double the costs of caring for these patients in the year 2010. In addition, finding caregivers for elderly relatives will become a more pressing problem because many of today's families are smaller and family members are dispersed geographically. Thus, additional institutional facilities as well as new approaches to care may be required in the future.

The limitations of this study need to be addressed. For the years 1981 to 1989, unique identifiers were not available on the data. Without identifiers the number of readmissions for hip fracture could not be determined, limiting this study to hospitalizations. The validity of our study also depends on the accuracy of the hospital discharge abstracts. There is the possibility that not all hip fractures were recorded on the hospital discharge abstracts, resulting in an underestimate of hip fracture rates. The assumption that all hip fractures necessarily result in hospitalization is probably valid, because hip fractures are associated with a great deal of pain and incapacity; but patients who do not survive long enough to be hospitalized would be missed. This is unlikely to affect our findings because hip fracture is one of the most reliably coded hospital diagnoses.[17,30,31]

Conclusions

In summary, despite the stable age-adjusted rate of hip fractures, the absolute increase in the number of hip fracture patients due to the aging population will become an increasing burden on the health care system. Projections of future trends are a cause for major concern. First, from conservative assumptions of an aging population, the total number of hip fractures in Ontario will double by the year 2010. Second, caring for hip fracture patients requires four times the resources of the average patient. Superimposed on this is the increased LHS of the older patient. The combined ef-

fect of these factors is a greater than twofold increase in the number of bed-days taken by patients suffering from hip fracture if no action is taken to reduce acute-unit mean LHS.

The full impact of the "baby-boomer" generation will not be felt until well into the next century. If we are unable to achieve a reduction in the incidence of hip fractures, the implications for the health care system and society are staggering, with a further doubling of the number of persons over 65 years between 2010 and 2036.

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