In-hospital mortality after hip fracture by treatment setting

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Abstract

Background: Where patients with hip fracture undergo treatment may influence their outcome. We compared the risk of in-hospital death after hip fracture by treatment setting in Canada.

Methods: We examined all discharge abstracts from the Canadian Institute for Health Information with diagnosis codes for hip fracture involving patients 65 years and older who were admitted to hospital with a nonpathological first hip fracture between Jan. 1, 2004, and Dec. 31, 2012, in Canada (excluding Quebec). We compared the risk of in-hospital death, overall and after surgery, between teaching hospitals and community hospitals of various bed capacities, accounting for variation in length of stay.

Results: Compared with the number of deaths per 1000 admissions at teaching hospitals, there were an additional 3 (95% confidence interval [CI] 1–6), 14 (95% CI 10–18) and 43 (95% CI 35–51) deaths per 1000 admissions at large, medium and small community hospitals, respectively. For the risk of in-hospital death overall, the adjusted odds ratios (ORs) were 1.05 (95% CI 0.99–1.11), 1.16 (95% CI 1.09–1.24) and 1.44 (95% CI 1.31–1.57) at large, medium and small community hospitals, respectively, compared with teaching hospitals. For the risk of postsurgical death in hospital, the adjusted ORs were 1.06 (95% CI 1.00–1.13), 1.13 (95% CI 1.04–1.23) and 1.18 (95% CI 0.87–1.60) at large, medium and small community hospitals, respectively.

Interpretation: Compared with teaching hospitals, the risk of in-hospital death among patients with hip fracture was higher at medium and small community hospitals, and the risk of in-hospital death after surgery was higher at medium community hospitals. No differences were found between teaching and large community hospitals. Future research should examine the role of volume, demand and bed occupancy for observed differences.

Competing interests: See end of article.

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One in 10 patients with hip fracture die during their hospital stay.[1–3] The risk of death is associated with patient, injury and treatment characteristics.[4,5] Treatment setting may also influence this risk.[1,2,6–8] For example, advanced standards of anesthesia and surgery are associated with teaching hospitals,[9,10] but there is inconsistent evidence for an association between teaching status and in-hospital death.[9,11–13] Comparing teaching hospitals with community hospitals of different bed capacities may further our understanding of the risk of in-hospital death across treatment settings. Bed capacity is associated with factors of care delivery such as resources, treatment styles and standby capacity.[14]

Most patients undergo surgery to repair hip fracture.[15] However, between 6% and 10% of patients do not receive surgery, in some cases because of death while waiting for surgery.[16,17] To better understand the risk of in-hospital death by treatment setting, outcomes of both surgical and nonsurgical care should be considered. Therefore, we conducted this study to compare the risks of in-hospital death, overall and after surgery, between teaching hospitals and community hospitals of various bed capacities providing hip fracture care in Canada.

Methods

Design, setting and population

We obtained all discharge abstracts with diagnosis codes for hip fracture (International Classification of Diseases, ninth revision, code 820; and International Statistical Classification of Diseases and Related Health Problems, 10th revision, codes S72.00, S72.01, S72.09, S72.10, S72.19, S72.20) involving patients 65 years and older who were admitted to hospital with a nonpathological first hip fracture between Jan. 1, 2004, and Dec. 31, 2012, in Canada (except for the province of Quebec) from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database.[18] Multiple abstracts with the same patient identifier were combined into a single care episode using the CIHI rules for hospital transfers.[19,20]

For estimating the risk of postsurgical death, we selected discharge abstracts with procedural codes for hip fracture surgery (Canadian Classification of Health Interventions codes 1VA74^^, 1VA53^^, 1VC74^^ and 1SQ53^^; Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures codes 9054, 9114, 9134, 9351, 9359, 9361, 9362, 9363, 9364 and 9369), a valid surgery date and a hospital stay of at least 1 day after surgery. We considered deaths on the day of surgery as intraoperative, and live hospital discharge on the day of surgery as clinically unjustifiable.

Outcomes

The primary outcome was in-hospital death identified by destination code in the discharge abstracts. The time to death was calculated as the number of days from the date of admission (counting the admission day) to the date of death, hospital discharge or 30 days, whichever came first. Postsurgical death referred to deaths on abstracts with a code for hip fracture surgery. The time to postsurgical death was calculated as the number of days from the date of surgery to the date of death, hospital discharge or 30 days, whichever came first. In the analysis of deaths without surgery, we calculated the time to death as the number of days from the date of admission (counting the admission day) to the date of death, surgery, hospital discharge or 30 days, whichever came first.

Treatment setting

We used the definitions of CIHI's Canadian Hospital Reporting Project to classify treatment setting. Members of the Association of Canadian Academic Healthcare Organizations were classified as teaching hospitals; all other hospitals were community hospitals, grouped by the number of beds: small (< 50 beds), medium (50–199) and large (≥ 200).[21] Treatment setting at admission was a study variable in the analysis of in-hospital mortality, and treatment setting at surgery was a study variable in the analysis of postsurgical mortality.

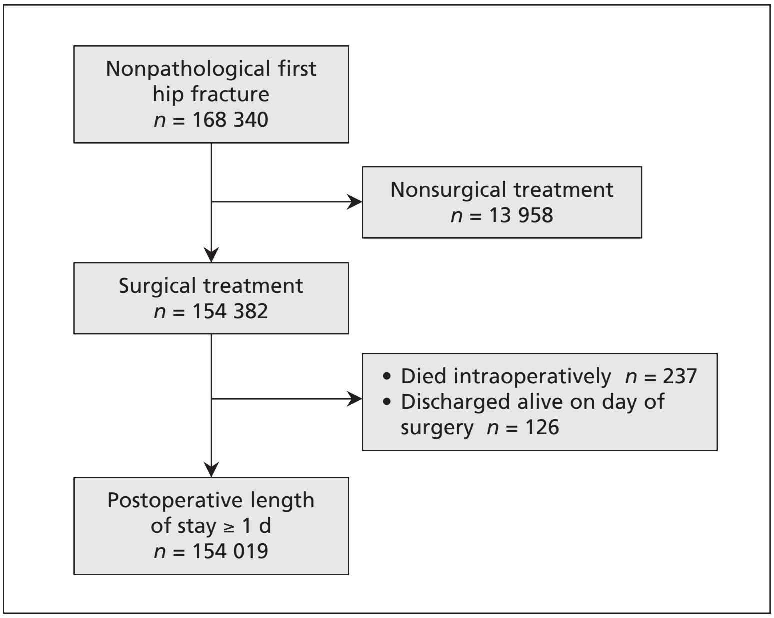

Figure 1: Study population.

Statistical analysis

We used the χ^2 test to compare distributions of patient and care characteristics across treatment settings. We estimated daily rates of death overall and by treatment setting by dividing the number of corresponding events by the total number of inpatient days.

We estimated the cumulative incidence of death as a function of inpatient day, with live discharge as a competing event, assuming patients were at risk of in-hospital death only while they remained in hospital.[22] We identified live discharges by the following destination codes: discharged home, discharge to home with support, or transferred to long-term care, palliative care, hospice or addiction treatment. We treated hospital stays that ended by transfer to acute care, discharges on the day after surgery and stays that exceeded 30 days as right-censored observations.[20] In the analysis of deaths without surgery, surgery was an additional competing event. We used the Pepe–Mori 2-sample test[22] and proportional odds regression models[23] to test whether the cumulative incidences of death differed between teaching hospitals and community hospitals of various bed capacity. The differences were summarized by 30-day risk differences and by odds ratios.[24]

In the regression analysis, the differences between treatment settings were adjusted for patient age, sex, fracture type, comorbidity (heart failure, chronic obstructive pulmonary disease, acute ischemic heart disease, hypertension, diabetes),[25,26] province or territory, and the calendar period (2004–2006, 2007–2009 or 2010–2012), day (weekday v. weekend) and time of admission. We adjusted for type (internal fixation v. arthroplasty)[27] and timing of surgery in the analysis of postsurgical mortality. We conducted the competing-risk analysis using the pseudo-values method[23] with R packages cmprsk,[28] prodlim[29] and geepack.[30] The number of discharge abstracts was sufficient to detect a 1% increase in the risk of in-hospital death (from 7% to 8%), and in the risk of postsurgical death (from 6% to 7%), with 90% power and a 2-sided significance level of 5%.

Ethics approval

The University of British Columbia Behavioural Research Ethics Board approved this study.

Table 1: Patient and care characteristics of 168 340 patients with a first hip fracture, by hospital type at admission

Characteristic	Hospital type; no. (%) of patients				
	All *n* = 168 340	Teaching *n* = 58 799	Community, large *n* = 68 743	Community, medium *n* = 29 684	Community, small *n* = 9343
Age at admission, yr					
65–74	25 314 (15.0)	9188 (15.6)	9921 (14.4)	4399 (14.8)	1503 (16.1)
75–84	65 684 (39.0)	22 768 (38.7)	26 991 (39.3)	11 629 (39.2)	3537 (37.9)
85–94	68 154 (40.5)	23 548 (40.0)	28 107 (40.9)	12 093 (40.7)	3763 (40.3)
≥ 95	9188 (5.5)	3295 (5.6)	3724 (5.4)	1563 (5.3)	540 (5.8)
Female sex*	122 696 (72.9)	42 680 (72.6)	50 280 (73.1)	21 746 (73.3)	6684 (71.5)
Fracture type†					
Transcervical	87 248 (51.8)	30 491 (51.9)	35 056 (51.0)	15 644 (52.7)	5180 (55.4)
Pertrochanteric	73 093 (43.4)	25 312 (43.0)	30 360 (44.2)	12 781 (43.1)	3798 (40.7)
Subtrochanteric	7999 (4.8)	2996 (5.1)	3327 (4.8)	1259 (4.2)	365 (3.9)
Calendar year of admission					
2004	18 927 (11.2)	6738 (11.5)	7352 (10.7)	3215 (10.8)	1115 (11.9)
2005	18 971 (11.3)	6703 (11.4)	7424 (10.8)	3285 (11.1)	1122 (12.0)
2006	18 393 (10.9)	6456 (11.0)	7163 (10.4)	3334 (11.2)	1106 (11.8)
2007	18 492 (11.0)	6438 (10.9)	7363 (10.7)	3357 (11.3)	1135 (12.1)
2008	18 446 (11.0)	6427 (10.9)	7580 (11.0)	3263 (11.0)	1079 (11.5)
2009	18 575 (11.0)	6501 (11.1)	7727 (11.2)	3236 (10.9)	1031 (11.0)
2010	18 583 (11.0)	6383 (10.9)	7857 (11.4)	3280 (11.0)	971 (10.4)
2011	18 628 (11.1)	6505 (11.1)	7906 (11.5)	3278 (11.0)	914 (9.8)
2012	19 325 (11.5)	6648 (11.3)	8371 (12.2)	3436 (11.6)	870 (9.3)
Comorbidity‡					
Heart failure	14 250 (8.5)	5048 (8.6)	5709 (8.3)	2488 (8.4)	840 (9.0)
COPD	9315 (5.5)	3117 (5.3)	3604 (5.2)	1816 (6.1)	651 (7.0)
Ischemic heart disease, acute	10 614 (6.3)	3928 (6.7)	4151 (6.0)	1864 (6.3)	550 (5.9)
Cardiac dysrhythmia	16 023 (9.5)	5526 (9.4)	6733 (9.8)	2758 (9.3)	848 (9.1)
Ischemic heart disease, chronic	2955 (1.8)	1048 (1.8)	1240 (1.8)	481 (1.6)	147 (1.6)
Hypertension	9982 (5.9)	3453 (5.9)	4254 (6.2)	1688 (5.7)	495 (5.3)
Diabetes	7862 (4.7)	2877 (4.9)	3125 (4.5)	1325 (4.5)	463 (5.0)
Transferred to another facility	14 273 (8.5)	531 (0.9)	697 (1.0)	6238 (21.0)	6653 (71.2)
Province/territory					
Newfoundland and Labrador	3821 (2.3)	2243 (3.8)	631 (0.9)	783 (2.6)	164 (1.8)
Prince Edward Island	1208 (0.7)	0	1116 (1.6)	33 (0.1)	59 (0.6)
Nova Scotia	7164 (4.3)	2820 (4.8)	1320 (1.9)	2820 (9.5)	204 (2.2)
New Brunswick	5908 (3.5)	1228 (2.1)	2943 (4.3)	1516 (5.1)	189 (2.0)
Ontario	81 556 (48.4)	21 576 (36.7)	39 527 (57.5)	15 563 (52.4)	3163 (33.9)
Manitoba	9625 (5.7)	794 (1.4)	5940 (8.6)	2106 (7.1)	778 (8.3)
Saskatchewan	8802 (5.2)	6686 (11.4)	439 (0.6)	722 (2.4)	955 (10.2)
Alberta	18 330 (10.9)	11 739 (20.0)	4080 (5.9)	634 (2.1)	1876 (20.1)
British Columbia	31 660 (18.8)	11 713 (19.9)	12 747 (18.5)	5404 (18.2)	1792 (19.2)
Northwest, Nunavut or Yukon Territories	266 (0.2)	0	0	103 (0.3)	163 (1.7)
Day of admission					
Weekday	121 857 (72.4)	42 293 (71.9)	49 517 (72.0)	21 722 (73.2)	7052 (75.5)
Weekend	46 483 (27.6)	16 506 (28.1)	19 226 (28.0)	7962 (26.8)	2291 (24.5)
Time of admission§					
0000–0559	23 742 (14.1)	10 844 (18.4)	8829 (12.8)	2989 (10.1)	890 (9.5)
0600–1159	23 632 (14.0)	7046 (12.0)	10 653 (15.5)	4329 (14.6)	1313 (14.1)
1200–1759	56 881 (33.8)	17 809 (30.3)	23 249 (33.8)	11 696 (39.4)	3496 (37.4)
1800–2359	63 987 (38.0)	23 067 (39.2)	25 949 (37.7)	10 669 (35.9)	3643 (39.0)
Type of surgery¶	*n* = 154 382	*n* = 54 847	*n* = 64 054	*n* = 26 576	*n* = 7302
Internal fixation	92 445 (59.9)	32 160 (58.6)	38 844 (60.6)	16 006 (60.2)	4411 (60.4)
Arthroplasty	61 937 (40.1)	22 687 (41.4)	25 210 (39.4)	10 570 (39.8)	2892 (39.6)
Timing of surgery¶**					
Admission day or day after	98 532 (63.8)	32 150 (58.6)	45 476 (71.0)	17 271 (65.0)	2599 (35.6)
≥ 2 d after admission	55 845 (36.2)	22 697 (41.4)	18 576 (29.0)	9305 (35.0)	4703 (64.4)

Note: COPD = chronic obstructive pulmonary disease.
*Does not include 19 patients with unknown sex.
†At admission; for 2084 patients with different fracture types at admission and surgery, the fracture type at surgery is presented.
‡Identified using diagnosis codes from all hospital admissions in the year before the index admission.
§Does not include 98 patients with unknown time of admission.
¶Only for patients who underwent surgery.
**Does not include 5 patients with unknown timing of surgery.

Results

Patient and care characteristics

A total of 168 340 patients were admitted with a nonpathological first hip fracture between Jan. 1, 2004, and Dec. 31, 2012 (Figure 1). Most (72.9%) were women and almost half (45.9%) were 85 years or older. Fracture type was similarly distributed between transcervical (51.8%) and trochanteric (48.2%) fractures. Overall, 27.9% of the patients had major comorbidities, with cardiac dysrhythmia being the most prevalent (9.5%) (Table 1).

Overall, 58 799 (34.9%) of the patients were admitted to teaching hospitals, and 68 743 (40.8%) were admitted to large, 29 684 (17.6%) to medium and 9343 (5.6%) to small community hospitals (Table 1); type of hospital was unknown for 1771 patients. More patients admitted to small community hospitals (71.2%) were transferred to another facility than were patients admitted to teaching (0.9%), large (1.0%) or medium (21.0%) community hospitals. Admissions between midnight and 0600 were more frequent at teaching hospitals (18.4%) than at large (12.8%), medium (10.1%) or small (9.5%) community hospitals. Weekend admissions were more frequent at teaching hospitals (28.1%) and large community hospitals (28.0%) than at medium (26.8%) or small (24.5%) community hospitals. More patients in Alberta, Saskatchewan, and Newfoundland and Labrador were admitted to teaching hospitals than to large, medium or small community hospitals, compared with patients in other provinces and territories (Table 1).

More patients underwent arthroplasty at teaching hospitals (38.6%) than at large (36.7%), medium (35.6%) or small (31.0%) community hospitals. Of the 154 382 patients who underwent surgery, more underwent surgery on admission day or the day after at large community hospitals (66.2%) than at teaching hospitals (58.6%) or at medium (65.0%) or small (35.6%) community hospitals.

In-hospital mortality

By day 30 after admission, 11 672 (6.9%) hospital stays ended with death, 101 817 (60.5%) ended with live discharge, 26 994 (16.0%) had right-censoring events, and 27 857 (16.6%) stays were longer than 30 days. The average rate of in-hospital death was 4.7 (95% confidence interval [CI] 4.6–4.7) per 1000 patient-days overall, varying from 4.0 (95% CI 3.8–4.1) per 1000 patient-days at teaching hospitals, to 4.8 (95% CI 4.6–4.9), 5.5 (95% CI 5.3–5.8) and 6.3 (95% CI 5.8–6.7) per 1000 patient-days at large, medium and small community hospitals, respectively (Table 2).

Compared with the number of deaths per 1000 admissions at teaching hospitals, there were an additional 3 (95% CI 1–6), 14 (95% CI 10–18) and 43 (95% CI 35–51) deaths per 1000 admissions at large, medium and small community

Table 2: Cumulative incidence of death in hospital and death after surgery, by hospital type

Outcome; hospital type*	No. of patients	No. of deaths†	Rate of death (95% CI)‡	30-d CIF (95% CI)§	Risk difference (95% CI)§	*p* value¶	Adjusted OR of CIF (95% CI)**
Overall in-hospital mortality††							
Teaching hospital	58 799	3809	4.0 (3.8–4.1)	72 (70–74)	–	–	1.00 (ref)
Community, large	68 743	4739	4.8 (4.6–4.9)	75 (73–77)	3 (1–6)	< 0.01	1.05 (0.99–1.11)
Community, medium	29 684	2199	5.5 (5.3–5.8)	86 (83–90)	14 (10–18)	< 0.001	1.16 (1.09–1.24)
Community, small	9343	799	6.3 (5.8–6.7)	115 (107–123)	43 (35–51)	< 0.001	1.44 (1.31–1.57)
Postoperative mortality‡‡							
Teaching	59 326	2941	3.5 (3.4–3.6)	58 (56–60)	–	–	1.00 (ref)
Community, large	68 921	3694	4.3 (4.2–4.4)	60 (58–62)	4 (0–8)	< 0.01	1.06 (0.99–1.13)
Community, medium	22 986	1234	4.7 (4.5–5.0)	64 (61–68)	11 (5–27)	< 0.001	1.13 (1.04–1.23)
Community, small	1145	70	4.4 (3.4–5.5)	71 (55–87)	10 (4–23)	< 0.05	1.18 (0.87–1.60)

Note: CI = confidence interval, CIF = cumulative incidence function, OR = odds ratio, ref = reference category.
*Excludes 1771 patients with unknown hospital type at admission.
†At 30 d from admission for analysis of overall in-hospital mortality; at 30 d after surgery for analysis of postsurgical mortality.
‡Per 1000 patient-days.
§Per 1000 admissions for in-hospital mortality; per 1000 surgeries for postoperative mortality.
¶Pepe-Mori test (2–sample test), compared with teaching hospital.
**Adjusted for age, sex, fracture type, calendar period of admission, comorbidity, province/territory, day of admission, time of admission (also procedure type and time to surgery for postoperative deaths). CIF regression at in-patient days 3, 4, 6, 8, 12, 16, 20, 24 and 30.
††Does not include 18 patients with unknown sex.
‡‡Does not include 13 958 patients treated nonsurgically, 363 patients discharged on the day of surgery for any reason, and 17 patients with unknown sex or procedure time.

hospitals, respectively (Table 2, Figure 2). For the risk of in-hospital death overall, the adjusted odds ratios (ORs) were 1.05 (95% CI 0.99–1.11), 1.16 (95% CI 1.09–1.24) and 1.44 (95% CI 1.31–1.57) at large, medium and small community hospitals, respectively, compared with teaching hospitals (Table 2).

Postsurgical mortality

For this analysis, we included 154 019 surgically treated patients after excluding patients who died intraoperatively (n = 237) or were discharged alive on the day of surgery (n = 126) (Figure 1). By day 30 after surgery, 8035 (5.2%) hospital stays ended with death, 95 039 (61.7%) ended with live discharge, 29 324 (19.0%) had right-censoring events, and 21 621 (14.0%) hospital stays were longer than 30 days. The average rate of postsurgical death was 4.0 (95% CI 3.9–4.1) per 1000 patient-days, varying from 3.5 (95% CI 3.4–3.6) at teaching hospitals, to 4.3 (95% CI 4.2–4.4), 4.7 (95% CI 4.5–5.0) 4.4 (95% CI 3.4–5.5) at large, medium and small community hospitals, respectively (Table 2).

Compared with the number of deaths per 1000 surgeries at teaching hospitals, there were an additional 4 (95% CI 0–8), 11 (95% CI 5–27) and 10 (95% CI 4–23) deaths per 1000 surgeries at large, medium and small community hospitals, respectively (Table 2). For the risk of postsurgical in-hospital death, the adjusted ORs were 1.06 (95% CI 0.99–1.13), 1.13 (95% CI 1.04–1.23) and 1.18 (95% CI 0.87–1.60) at large, medium and small community hospitals, respectively, compared with teaching hospitals (Table 2).

Mortality without surgery

For this analysis, we included 13 958 nonsurgically treated patients. By day 30 after admission, 3649 (26.1%) died without surgery, 6778 (48.6%) were discharged without surgery, and 3531 (25.3%) had right-censoring events. The average rate of death without surgery was 6.3 (95% CI 6.1–6.5) per 1000 patient-days, varying from 5.3 (95% CI 5.0–5.6) at teaching hospitals, to 5.9 (95% CI 5.6–6.2), 7.7 (95% CI 7.2–8.3) and 8.6 (95% CI 7.8–9.4) per 1000 patient-days at large, medium and small community hospitals, respectively. Among the 13 958 patients treated nonsurgically, the cumulative incidence of death by inpatient day 30 was 19 (95% CI 18–20) per 1000 admissions at teaching hospitals, and 19 (95% CI 18–20), 29 (95% CI 27–31) and 52 (95% CI 48–57) per 1000 admissions at large, medium and small community hospitals, respectively. Compared with the number of deaths without surgery per 1000 admissions at teaching hospitals, there were an additional 10 (95% CI 8–12) and 34 (95% CI 29–39) deaths per 1000 admissions at medium and small community hospitals, respectively. There was no difference between teaching and large community hospitals. The adjusted ORs for death without surgery were 1.02 (95% CI 0.92–1.14), 1.50 (95% CI 1.33–1.69) and 2.64 (95% CI 2.30–3.03) at large, medium and small community hospitals, respectively, compared with teaching hospitals.

Interpretation

Compared with teaching hospitals, the risk of in-hospital death was higher at medium and small community hospitals, and the risk of in-hospital death after surgery was higher at medium community hospitals. The difference in postsurgical mortality between teaching hospitals and small community hospitals, although large, was not significant after adjustment. No differences in outcomes were found between teaching hospitals and large community hospitals.

Our findings are consistent with those from previous reports of increased risk of death among patients treated at community hospitals after hip fracture,[9,11,13] and among patients treated at hospitals with fewer available beds at admission.[31] As argued elsewhere, the risk of death in hospital also depends on time spent in hospital, which varies by treatment setting.[32]

We recently showed a reduction in hospital stay after hip fracture following changes in bed management and changes in policy on access to hip fracture surgery in Canada.[20] How these changes were implemented and how effective they were at reducing hospital stay likely varied by treatment setting. Teaching hospitals may shorten stays more

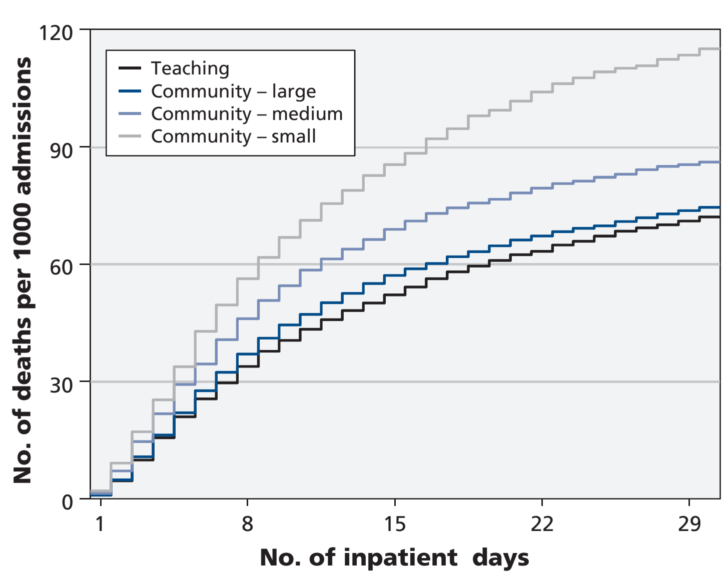

Figure 2: Cumulative incidence of in-hospital death by inpatient days across treatment settings among all patients admitted with first hip fracture.

effectively because discharge options such as rehabilitation and residential care facilities are more prevalent than in community hospitals.[33] Our study accounted for this potential bias. In particular, we used the cumulative incidence to estimate the proportion of patients who died in hospital among all patients admitted to hospital with hip fracture while being exposed to the competing risk of live discharge during the follow-up period.

Postsurgical mortality was higher at medium community hospitals than at teaching hospitals. The difference may be attributable to medium community hospitals having fewer beds, staff and equipment available to ensure access to timely hip fracture care,[31,34] or to their having a less aggressive treatment style, leaving more patients exposed to potentially fatal immobilized and inflammatory states.[1,7,35–38] Whether additional resources for medium community hospitals may improve outcomes in this vulnerable patient population requires further investigation.

The risk of death without surgery was higher at medium and small community hospitals than at teaching hospitals. It is not clear whether this difference reflects a need to transfer patients for specialist care not available at medium and small community hospitals. The time required to transfer patients from medium and small community hospitals for care contributes to potentially harmful surgical delay.[39] It may be necessary to prioritize these patients on arrival at larger hospitals.

Other structures and processes may influence outcomes of hip fracture care. Previous studies have shown an association between a higher volume of hip fracture surgeries and delays, complications and death.[40,41] The studies suggest underprioritization of hip fracture over other surgeries at high-volume sites.[40,41] Hospital occupancy has also been associated with risk of in-hospital death after hip fracture.[31] Future research should explore the association among teaching status, bed capacity, occupancy and volume to better our understanding of outcomes of hip fracture care delivery.

Limitations

We conducted a secondary analysis of discharge abstracts with limited variables for adjustment. In particular, patients with hip fracture in different treatment settings may differ by pre-fracture function, level of dependency, injury severity, body composition, cognition, and presence of liver disease, anemia, stroke and secondary hyperparathyroidism.[42] Further, the abstracts do not provide indication for nonsurgical treatment. Palliative care may have been more frequent at medium and small community hospitals. Classification of treatment settings was based on data from the second half of the study period.[43] This may have led to misclassification of medium and small community hospitals if the number of beds increased across the study years. Bed capacity was not available for teaching hospitals; therefore, we did not investigate difference in mortality by hospital size separately. The hospitals were not identified by their geographic location, which precluded adjustment for urban, rural or remote location. Whether medium and small community hospitals serve more remote populations, or whether Canada's geography could facilitate access to larger hospitals was not factored into our analysis. Few patients underwent surgery at small community hospitals, which, combined with the lack of clinical data, requires some caution in interpretation of the observed differences. Finally, the province of Quebec compiles hospital discharge data in a separate database and does not contribute to the CIHI Discharge Abstracts Database; therefore, the results may not be generalizable to Quebec.

Conclusion

Compared with teaching hospitals, the risk of in-hospital death overall was higher at medium and small community hospitals, and the risk of postsurgical death was higher at medium community hospitals. The difference in postsurgical mortality between teaching hospitals and small community hospitals, although large, was not significant after adjustment. We found no difference between teaching hospitals and large community hospitals. Future research should examine the role of volume, demand and bed occupancy for the observed differences by treatment setting.

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