RESEARCH

Length of hospital stay after hip fracture and risk of early mortality after discharge in New York state: retrospective cohort study

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Abstract

Study question Can the length of hospital stay for hip fracture affect a patient's risk of death 30 days after discharge?

Methods In a retrospective cohort study, population based registry data from the New York Statewide Planning and Research Cooperative System (SPARCS) were used to investigate 188 208 patients admitted to hospital for hip fracture in New York state from 2000 to 2011. Patients were aged 50 years and older, and received surgical or non-surgical treatment. The main outcome measure was the mortality rate at 30 days after hospital discharge.

Study answer and limitations Hospital stays of 11-14 days for hip fracture were associated with a 32% increased odds of death 30 days after discharge, compared with stays lasting one to five days (odds ratio 1.32 (95% confidence interval 1.19 to 1.47)). These odds increased to 103% for stays longer than 14 days (2.03 (1.84 to 2.24)). Other risk factors associated with early mortality included discharge to a hospice facility, older age, metastatic disease, and non-surgical management. The 30 day mortality rate after discharge was 4.5% for surgically treated patients and 10.7% for non-surgically treated patients. These findings might not be generalizable to populations in other US states or in other countries. The administrative claims data used could have been incomplete or include inaccurate coding of diagnoses and comorbid conditions. The database also did not include patient socioeconomic status, which could affect access to care to a greater extent in New York state than in European countries. Specific cause of death was not available because few autopsies are performed in this population.

What this study adds By contrast with recent findings in Sweden, decreased length of hospital stay for hip fracture was associated with reduced rates of early mortality in a US cohort in New York state. This could reflect critical system differences in the treatment of hip fractures between Europe and the USA.

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Introduction

Hip fracture is common, costly, and often associated with poor outcomes among older adults. Mortality rates after hip fracture have changed little over the past 30 years despite surgical and medical improvements.¹ Nonetheless, mortality rates are universally measured in registries and large databases. Length of hospital stay has fallen over time in both Europe and the United States.² Recent work has suggested that a longer hospital stay after hip fracture is associated with decreased mortality following discharge.³

Healthcare systems in Europe and the USA differ in both length of hospital stay and usual discharge destination. In the USA, 90% of patients with hip fracture are discharged to rehabilitation facilities and receive much of their follow-up care in these facilities.⁴ Rehabilitation facilities in the USA serve a transitional role and could help prevent early mortality after discharge.⁵ By contrast, more patients are discharged home from hospital after hip fracture in other countries such as the United Kingdom.⁶

The New York Statewide Planning and Research Cooperative System (SPARCS) database offers a unique opportunity to measure postsurgical mortality in a complete dataset of US patients and has been used previously to study hip fractures.⁷ We hypothesized that SPARCS data would demonstrate that a shorter hospital stay is associated with lower rates of mortality at 30 days after hip fracture.

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Extra material supplied by the author (see <http://www.bmj.com/content/351/bmj.h6246?tab=related#datasupp>)

Web appendix: Supplementary material

Methods

Patients

This study used the SPARCS database to identify 188 938 patients aged 50 years or older admitted to a public or private hospital in New York state between 1 January 2000 and 31 December 2011 with a hip fracture. SPARCS is a comprehensive, all payer administrative database that collects patient level data from all non-federal, acute care facilities in New York state (233 hospitals during the study period). The database collects information including patient demographics, diagnoses, procedures, and charges for every inpatient hospital admission, ambulatory surgical procedure, and emergency department admission. Individuals are assigned a unique, encrypted identification code, allowing for longitudinal analyses. Estimated reporting completeness obtained from SPARCS inpatient annual reports during the study period (2000-11) ranged from 95% to 100%, with an average of more than 98%.

We identified patients in hospital discharge records originating from non-rehabilitation hospitals in New York state and containing an admitting or primary diagnosis code for a hip fracture using the ICD-9-CM classification (international classification of diseases, 9th revision, clinical modification; codes 820.00-820.03, 820.09, 820.20-820.22, 820.8). Patients were excluded if they did not have the unique personal identifier (encrypted combination of name, date of birth, social security number, hospital, and date of admission; n=68) or there were duplicate unique identifiers (n=662). The remaining 188 208 patients were included in the analysis. We determined 30 day mortality data using a linkage with the New York State Department of Vital Statistics and New York City Department of Vital Statistics. Patients who died during the hospital stay were excluded from analyses.

We identified surgical procedures and dates with ICD-9 procedure codes (81.51, 81.52, 78.55, 73.35, 79.15, 79.25, or 79.05) and associated procedure dates. Time to surgery was defined as days between admission and procedure date. We defined comorbidities on the basis of the Charlson comorbidity index using a modified Stata interpretation of a SAS software program obtained from the Boston College Department of Economics in its series statistical software components.⁸ Table 1^{||} shows the coding algorithm used to define comorbidities.

Statistical methods

The primary analysis was designed to determine whether length of hospital stay (categorically defined as 1-5 days, 6-10 days, 11-14 days, and >14 days) was associated with mortality rates at 30 days after hospital discharge. We assessed differences between categorical groups using χ^2 analysis and differences between continuous variables using Student's *t* test. Patients who died before hospital discharge were excluded from analyses related to post-discharge mortality. We made survival estimates using the Kaplan-Meier method. We determined risk of mortality using Cox proportional hazards models while adjusting for comorbid conditions. However, the proportional hazards assumption was violated on testing with $P<0.05$; therefore, multivariate logistic regression analysis evaluated risk of mortality after hospital discharge on the basis of categorical length of stay, while adjusting for covariates in the univariate model.

To test whether the association between length of stay and odds of death within 30 days after discharge was a time dependent interaction, we created a product interaction term. The likelihood ratio test found the test statistic was equal to 15.4492 with three

degrees of freedom and a *P* value of 0.00147. Therefore, the product interaction term was included in the primary multivariate logistic regression model as a covariate.

To evaluate whether non-surgically treated patients were dying soon after hospital discharge and contributing to increased mortality at 30 days, we created three models. The models included all patients with a hip fracture regardless of surgical management, where non-surgical management was included as a covariate; patients treated surgically only; and patients treated non-surgically only.

Subgroup and sensitivity analyses

We did several additional analyses to control for confounding factors. To control for a reduction in length of hospital stay over the 12 year study period, the relation between length of stay and 30 day post-discharge mortality was evaluated for each year separately in both adjusted and unadjusted logistic regression models. To evaluate whether risk of death increases with increasing follow-up time, adjusted logistic regression models compared the odds of death between one and 15 days after discharge and 16 and 30 days after discharge.

A sensitivity analysis evaluated the odds of death between 11 and 30 days after discharge for patients alive at day 10 after admission with a hospital stay of 10 days or fewer, while controlling for other covariates in the primary multivariate model. We calculated odds ratios for the interaction of a one day incremental increase in length of stay over the study period and separately for each individual year of the study. Analyses were performed by Stata statistical software (version 14.0 StataCorp).

Patient involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in the design and implementation of the study. There are no plans to involve patients in the dissemination of results as the nature of the data precludes individual patient identification.

Results

A total of 188 208 patients admitted with a hip fracture between 2000 and 2011 met inclusion criteria; 169 258 were treated surgically and 18 950 treated non-surgically. The average length of hospital stay was 8.1 days (range 1-995 days; standard deviation 8.3). During their hospital stay, 7364 (3.9%) patients died, leaving 180 844 survivors for post-discharge analysis. During the 30 days after discharge, another 9179 patients died (5.1% mortality). During the study, the average length of stay decreased from 12.9 days in 2000 to 5.6 days in 2011.

Most patients were admitted to hospital for fewer than 10 days (patient characteristics shown in table 2^{||}). For surgically treated patients, the average time to surgery was 1.8 days (standard deviation 2.1, range 0-128); a longer time to surgery was associated with longer hospital stay. The percentage of patients with most comorbid conditions increased with increasing length of stay.

On univariate analysis, multiple factors were associated with increased 30 day mortality including non-surgical treatment, male sex, being white, older age, longer time to surgery, blood transfusion, comorbid conditions, and discharge to hospice (table 3^{||}). A shorter hospital stay (<5 days and <10 days) was also associated with decreased 30 day mortality. Mortality rates did not change between the first six years and the last six years of the study. The mortality rate for surgically treated patients

with hip fracture was 4.5% (7407/164 251) in the 30 days after discharge. The corresponding rate for non-surgically treated patients with hip fracture was 10.7% (1772/16 593).

On multivariate regression analysis, discharge to a hospice facility and age older than 90 years were the largest risk factors for 30 day mortality. A hospital stay longer than 10 days, compared with a stay of five days or fewer, was associated with increased odds of mortality during the first 30 days after discharge.

On Kaplan-Meier analysis, patients with a longer hospital stay had a lower rate of 30 day survival after discharge (fig 1). Length of stay was not associated with mortality rates for non-surgically treated patients, when analyzed separately (fig 1). Patients in New York state with a hospital stay longer than 14 days and patients managed non-surgically had similar rates of 30 day survival after hospital discharge. For all patients with hip fracture and for those receiving surgical treatment only, increased length of stay was associated with increased early mortality in both groups.

Sensitivity analyses

The sensitivity analysis attempted to replicate the sensitivity analysis performed in a paper that evaluated mortality against length of hospital stay after hip fracture in the Swedish population.³ For patients alive at day 10 after admission with a length of hospital stay of 10 days or less, each one day increase in stay was associated with an 8% increased odds of death during 11-30 days from hospital admission overall (95% confidence interval 1.07 to 1.10; $P < 0.001$ for a one day increase in length of stay). The interaction variable (each one day incremental increase in length of stay over one day) was significantly associated with increased odds of mortality in seven of the 12 years in the study (web table 1).

Subgroup analysis

After adjustment for comorbid characteristics, injury, and demographics, each year in 2000-11 demonstrated a consistent trend of increasing odds of mortality 30 days after hospital discharge with increased length of hospital stay (fig 2). Web table 2 shows a similar trend in unadjusted odds ratios for 30 day mortality. Year 2009 represented an outlier when the association between hospital length of stay and 30 day mortality was especially pronounced. Exclusion of patients sustaining a fracture in 2009 from the primary adjusted analysis did not substantially alter the findings in this study.

For all discharge dispositions other than patients who went to hospices or left hospital against medical advice, we saw a significant association between hospital stays longer than 14 days and increased odds of 30 day mortality (web table 3). In the skilled nursing facility and inpatient rehabilitation subgroups (the most common dispositions), longer stay was associated with significantly higher mortality odds at stays of 6-10 days, 11-14 days, and longer than 14 days in the adjusted model, when compared with a stay of 1-5 days. For patients discharged to return home, hospital stays longer than 14 days was significantly associated with increased 30 day mortality, but no significant association was seen for shorter stays. Hospital stays longer than five days was associated with significantly higher mortality odds in patients with cancer. For patients with dementia, congestive heart failure, and chronic obstructive pulmonary disease, we saw significantly increased mortality odds for stays longer than 10 days but not for stays lasting six to 10 days. In the subgroup analysis for comorbid conditions, no association was seen between longer hospital stay and decreased odds of

30 day mortality after discharge (web table 4). Hospital stays longer than 10 days were associated with similarly elevated odds of mortality during days 1-15 and 16-30 after discharge.

Discussion

In this study of patients from New York state with hip fracture, a shorter inpatient hospital stay was associated with increased odds of survival at 30 days after discharge. The link between length of stay and mortality is important and likely to be multifactorial. Previous studies and our results suggest that an increased comorbidity burden is associated with increased length of hospital stay,^{9 10} which highlights the relation between a patient's health status before injury and hospital length of stay.

Clinical implications of results

These findings contrast sharply with the results from a recent Swedish study by Nordström and colleagues, in which shortened hospital stay was associated with increased rates of early mortality.³ These conflicting results suggest that different associations with mortality rates exist in these two distinct populations. The Swedish cohort contained 116 111 patients who were managed surgically. In New York state, the prevalent standard of care for hip fracture is surgical treatment in all patients who can tolerate surgery. Non-surgical management is chosen for those patients deemed medically unfit for surgery, unwilling to consent for surgery, or with a short life expectancy where palliative measures are deemed more appropriate.

In our study, non-surgically managed patients fared predictably poorly regardless of length of hospital stay. However, exclusion of these patients from the fracture cohort did not alter the overall improved mortality rates in patients with shorter hospital stays. The Nordström study did not assess the number of patients managed non-surgically or their outcomes with regards to mortality as a function of length of hospital stay. The lack of a non-surgical group likely represents different standards of care for hip fracture in Sweden, where virtually all patients with hip fracture are treated surgically.

Differences also exist in time to management of hip fracture; standard of care in Sweden involves fracture stabilization within 24 h. In our New York state cohort, 19.4% (31 987/164 251) of patients waited for more than two days for surgery, and increased time to surgery was associated with longer hospital stay. With the generally accepted association in the hip fracture literature between longer time to surgery and increased mortality,^{11 12} the extended time to surgery in our cohort would predict higher mortality. However, despite fewer patients treated surgically and longer mean time to surgery, mortality at 30 days after discharge in our cohort was lower than the Swedish study's cohort (5.1% v 5.8%). Inpatient mortality was also lower in our cohort (3.9% v 5.0%), although patient factors could differ among populations. Our findings are in line with those of Grimes and colleagues, who found that time to surgery longer than 24 h was not associated significantly with 30 day mortality after adjusting for comorbid conditions.¹³ There is no way to know whether the mean 0.8 day difference in time to surgery between the Swedish and New York state cohorts (mean 1 v 1.8 days) contributes significantly to mortality. However, it may be that early surgery is more important than surgery within 24 h, as seen by the respective differences in mortality.

The effects of discharge destination on short term risk of death after hip fracture in Sweden has also been evaluated.¹⁴ In a recent Swedish study of 89 301 patients from 2004 to 2012, most patients were discharged to nursing homes (61.8%) or their own homes (31.1%). After adjustment for comorbid characteristics

and functional level, discharge to a nursing home (and especially a short term nursing home) after a hospital stay of up to 10 days was associated with an increased risk of early mortality. By contrast, only 12.9% (n=23 272) of patients in our New York state cohort were discharged to their own homes; the vast majority of patients were discharged to short or long term care facilities where longer hospital stay was associated with higher odds of mortality at 30 days after discharge.

Finally, notable differences exist in length of hospital stay between the Swedish and New York state cohorts. In the New York state cohort, where insurers exert pressure to discharge patients to less costly rehabilitation facilities, nearly 40% of patients were discharged within five days and 82% discharged within 10 or fewer days. By contrast, only 18% of patients were discharged within five days and less than 50% were discharged in 10 days or less in Sweden, where a publicly financed system might not have the same incentives. These major differences in financial considerations and mean length of stay after hip fracture could partly explain the contradictory results seen in the two studies.

Other authors have attempted to determine the relation between length of hospital stay and mortality or other outcomes in patients with hip fracture. Kondo and colleagues compared length of stay and mortality after hip fractures between three Japanese and two US hospitals with vastly different lengths of stay.¹⁵ Although the researchers found lower mortality in the Japanese hospitals with longer lengths of stay, the small sample size make interpretation of the results challenging. Dubljanin-Respovic and colleagues found no effect of length of stay on one year mortality in a consecutive series of 228 Serbian patients with hip fracture,¹⁶ and Heyes and colleagues found increased readmission rate was associated with increasing length of stay after hip fracture in a Northern Ireland hospital system.¹⁷

The association between length of hospital stay and mortality has also been studied in populations with non-hip fracture. Kaboli and colleagues analyzed over four million admissions through the US Veterans Affairs Medical System and found length of hospital stay decreasing for all diagnoses by 1.46 days and a concomitant decrease in all cause mortality at 90 days after discharge.¹⁸ In patients with acute heart failure, Reynolds and colleagues found an association between longer initial hospital stay and increased all cause mortality.¹⁹ Both of these studies included a US population and support the findings of an association between shorter hospital stay and decreased mortality in New York state patients with hip fracture. The contradictory results between US studies and those found in data from the Swedish hip fracture registry highlight the challenges in interpreting studies on length of hospital stay across populations with different systems of care.

Strengths and limitations

Our study cohort could vary from other statewide populations in the USA, and thus our findings might not be generalizable to populations in other US states or countries. Administrative claims data could be incomplete or contain inaccurate coding of diagnoses and comorbid conditions, and different administrative databases could contain different rates of comorbid conditions.²⁰ However, comorbidities that would affect reimbursement and acuity indices would likely have been included. The SPARCS dataset does not contain laboratory values or permit assessment of the severity of comorbid illness, and it does not include the American Society of Anesthesiologists classification.

The fracture date was not recorded in relation to admission date. Some patients sustain a hip fracture while in hospital for another condition, biasing these patient's records toward a longer stay. To control for this effect, we purposely included only patients whose admission or primary diagnosis was for hip fracture. Patient socioeconomic status could affect access to care in New York state more than in single nation European populations,⁴ but is not included in the SPARCS database and therefore could not be assessed as a covariate. The original study design planned to use Cox regression models but the assumption of proportional hazards was not met. Use of a logistic regression model represents a deviation from the original study design and may be considered a limitation. Finally, specific cause of death was not available because few autopsies are performed in this population. Strengths of this study included its similarity to the Swedish dataset in terms of patient numbers, use of unique patient identifiers to allow linkage to statewide death registries, and high completeness in capturing a single population with a different system of care.

Conclusion

The relation between length of hospital stay and 30 day post-discharge mortality after hip fracture in New York state differs significantly from that seen in a Swedish population. Earlier hospital discharge in New York state is associated with improved survival, and longer length of hospital stay probably represents a surrogate for medical comorbidities or complications occurring in the hospital that delayed a safe, early discharge. This critical difference suggests prolonging admission to hospital would not improve mortality outcomes in a New York state population. Caution should be used in extrapolating results of population based studies when healthcare systems are dissimilar.

Contributors: LEN and SLK contributed equally to this work; LEN, SLK, MS, and JE contributed to the conception or design of the work; LEN, MM, BM, and JCE contributed to the acquisition of data; LEN, SLK, MM, BM, and JCE contributed to the analysis; LEN, SLK, MS, MM, BM, and JCE contributed to the interpretation of data for the work; LEN, SK, MS, MM, BM, and JCE contributed to drafting the work and revising it critically for important intellectual content; LEN, SLK, MS, MM, BM, and JCE gave final approval of the version to be published; LEN, SLK, MS, MM, BM, and JCE agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. JCE and LEN are the guarantors.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/doi_disclosure.pdf and declare: support from the National Institutes of Health for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: This study was approved by the New York State Department of Health, Bureau of Health informatics data protection review board, New York State Department of Vital Statistics, New York City Department of Health and Mental Hygiene, and University of Rochester research subjects review board.

What is already known on this topic

Shorter hospital stays have been associated with increased odds of mortality in a Swedish population

In New York state, increased comorbid conditions are associated with increased costs and longer hospital stays following hip fracture

What this paper adds

Hospital stays longer than 10 days were associated with increased odds of death at 30 days after hospital discharge in patients in New York state

Non-surgical treatment of hip fractures was associated 10.7% mortality compared with 4.5% treated surgically at 30 days after discharge

Risk factors associated with early mortality include discharge to a hospice facility, older age, metastatic disease, and non-surgical management

Data sharing: No additional data are available from the authors owing to disclosure agreements with New York Statewide Planning and Research Cooperative System (SPARCS). Data may be obtained through SPARCS at <https://www.health.ny.gov/statistics/sparcs/access/>.

LEN and JCE affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; no important aspects of the study have been omitted; and any discrepancies from the study as planned have been explained.

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Tables

Table 1| Coding algorithm for comorbid conditions in patients with hip fracture in New York State

Comorbidities	ICD-9-CM codes
Myocardial infarction	410.x, 412.x
Congestive heart failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4-425.9, 428.x
Peripheral vascular disease	093.0, 437.3, 440.x, 441.x, 443.1-443.9, 47.1, 557.1, 557.9, V43.4
Cerebrovascular disease	362.34, 430.x-438.x
Dementia	290.x, 331.x, 437.0x, 333.4, 292.82, 294.10, 291.2x, 292.82, 24.10, 294.11, 294.20, 294.21
Chronic pulmonary disease	416.8, 416.9, 490.x-505.x, 506.4, 508.1, 508.8
Diabetes mellitus	250.0-250.3, 250.8, 250.9
Renal disease	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 582.x, 583.0-583.7, 585.x, 586.x, 588.0, V42.0, V45.1, V56.x
Cancer	140.x-172.x, 174.x-195.8, 200.x-208.x, 238.6, V10.x
Metastatic disease	196.x-199.x
Diabetes with complications	250.4-250.7

Table 2| Characteristics of 180 844 patients with hip fracture in New York state, 2000-11, stratified by length of hospital stay (excluding patients who died before hospital discharge)

	Length of hospital stay (days)			
	0-5	6-10	11-14	>14
Demographics and mortality				
No of patients	71 780 (39.7)	76 700 (42.4)	17 063 (9.4)	15 301 (8.5)
Female sex	55 119 (76.8)	57 389 (74.8)	11 964 (70.1)	9944 (65.0)
Mean age in years (mean (SD))	80.7 (10.3)	81.8 (9.5)	81.7 (9.6)	80.9 (10.0)
Non-surgical treatment	8609 (12.0)	3987 (5.2)	1725 (10.1)	2272 (14.8)
30 day mortality if treated surgically	1864 (3.0)	2991 (4.1)	1033 (6.7)	1519 (11.7)
30 day mortality if treated non-surgically	910 (10.6)	446 (11.2)	171 (9.9)	245 (10.8)
Main diagnosis				
Femoral neck fracture	21 184 (29.5)	22 023 (28.7)	4677 (27.4)	4090 (26.7)
Intertrochanteric fracture	50 596 (70.5)	54 677 (62.3)	12 386 (72.6)	11 211 (73.3)
Surgical variables				
Hemiarthroplasty	17 084 (23.8)	22 756 (29.7)	5084 (29.8)	4303 (28.1)
Total hip arthroplasty	1820 (2.5)	2224 (2.9)	442 (2.6)	371 (2.4)
Open reduction internal fixation	29 379 (40.9)	36 083 (47.0)	7828 (42.7)	6620 (43.3)
Other fixation	14 933 (20.8)	11 679 (15.2)	1994 (11.7)	1742 (11.4)
Time to surgery if treated surgically (mean (SD))	0.9 (0.7)	1.8 (1.3)	2.9 (2.3)	4.2 (5.1)
Required transfusion	22 551 (31.4)	33 326 (43.4)	7996 (46.9)	7384 (48.3)
Comorbid conditions				
Dementia	16 161 (22.5)	18 120 (23.6)	4202 (24.6)	3698 (24.2)
Acute myocardial infarction	3810 (5.3)	5597 (7.3)	1862 (10.9)	2033 (13.3)
Cerebrovascular disease	3144 (4.4)	4531 (5.9)	1383 (8.1)	1350 (8.8)
Chronic obstructive pulmonary disease	11 640 (16.2)	14 401 (18.8)	3736 (21.9)	3750 (24.5)
Diabetes mellitus	11 529 (16.1)	13 942 (18.2)	3313 (19.4)	2817 (18.4)
Renal disease	3603 (5.0)	4991 (6.5)	1463 (8.6)	1580 (10.3)
Cancer	8819 (12.3)	9672 (12.6)	2097 (12.3)	1944 (8.6)
Metastatic disease	660 (0.9)	940 (1.2)	270 (1.6)	377 (2.5)
Diabetes with complications	884 (1.2)	1430 (1.9)	432 (2.5)	555 (3.6)
Congestive heart failure	6726 (9.4)	11 555 (15.1)	3835 (22.5)	4448 (29.1)
Weighted Charlson score (mean (SD))	0.9 (1.2)	1.1 (1.3)	1.4 (1.4)	1.6 (1.6)
Discharge disposition				
Long term care	519 (0.7)	746 (1.0)	145 (0.8)	191 (1.2)
Skilled nursing facility	39 691 (55.3)	47 059 (61.4)	10 485 (61.4)	9443 (61.7)
Left hospital against medical advice	360 (0.5)	81 (0.1)	22 (0.1)	30 (0.2)
Cancer hospital	6016 (8.4)	8013 (10.4)	1677 (9.8)	1197 (7.8)
Home	4921 (6.9)	4823 (6.3)	1456 (8.5)	1511 (9.9)
Home health agency	4116 (5.7)	3571 (4.7)	1101 (6.5)	1280 (8.4)
Hospice	333 (0.5)	314 (0.4)	149 (0.9)	291 (1.9)
Inpatient hospital	3063 (4.3)	1174 (1.5)	297 (1.7)	289 (1.9)
Inpatient rehabilitation	12 641 (17.6)	10 791 (14.1)	1704 (10.0)	1024 (6.7)

Data are no (%) of patients unless stated otherwise. SD=standard deviation.

Table 3| Variables associated with odds of 30 day mortality following hospital discharge for femoral neck fracture (excluding patients who died before discharge)

	Unadjusted analysis			Adjusted analysis	
	Survived (n=171 665)	Deceased (n=9179)	P	Odds ratio (95% CI)	P
No surgery	14 821 (8.63)	1772 (19.3)	<0.001	1.95 (1.80 to 2.12)	<0.001
Female sex	128 467 (74.84)	5949 (64.81)	<0.001	0.59 (0.56 to 0.62)	<0.001
Ethnic origin					
White	147 800 (86.1)	8157 (88.9)	<0.001	Reference	—
Black	7188 (4.2)	278 (3)	<0.001	0.70 (0.61 to 0.79)	<0.001
Other	13 792 (8)	639 (7)	<0.001	0.92 (0.84 to 1.01)	0.07
Age (mean (SD))	81.0 (9.9)	86.0 (8.0)	<0.001	—	—
50-59 years	7411 (4.3)	66 (0.7)	<0.001	Reference	—
60-69 years	14 947 (8.7)	296 (3.2)	<0.001	1.87 (1.42 to 2.48)	<0.001
70-79 years	40 107 (23.4)	1295 (14.1)	<0.001	2.68 (2.07 to 3.47)	<0.001
80-89 years	77 166 (45)	4250 (46.3)	0.011	4.24 (3.28 to 5.48)	<0.001
>90 years	32 034 (18.7)	3272 (35.7)	<0.001	7.63 (5.90 to 9.86)	<0.001
Femoral neck fracture	49 407 (28.78)	2567 (27.97)	0.09	1.01 (0.96 to 1.06)	0.7
Days to surgery (mean (SD))	1.7 (2.0)	2.2 (3.0)	<0.001	—	—
>2 days	29 903 (19.1)	1994 (26.9)	<0.001	1.11 (1.05 to 1.18)	<0.001
Received transfusion	67 119 (39.1)	4138 (45.1)	<0.001	1.19 (1.14 to 1.25)	<0.001
Comorbidities					
Dementia	38 338 (22.3)	3843 (41.9)	<0.001	2.02 (1.92 to 2.12)	<0.001
Cardiac disease (acute)	12 192 (7.1)	1110 (12.1)	<0.001	1.23 (1.15 to 1.33)	<0.001
Cerebrovascular disease	9700 (5.7)	708 (7.7)	<0.001	1.20 (1.10 to 1.31)	<0.001
Chronic obstructive pulmonary disease	31 199 (18.2)	2328 (25.4)	<0.001	1.44 (1.37 to 1.52)	<0.001
Diabetes	30 057 (17.5)	1544 (16.8)	0.09	1.01 (0.95 to 1.08)	0.7
Renal disease	10 583 (6.2)	1054 (11.5)	<0.001	1.43 (1.33 to 1.55)	<0.001
Cancer	20 969 (12.2)	1563 (17.0)	<0.001	1.18 (1.10 to 1.26)	<0.001
Metastatic disease	1840 (1.1)	407 (4.4)	<0.001	3.54 (3.08 to 4.07)	<0.001
Diabetes with complications	3141 (1.8)	160 (1.7)	0.55	1.02 (0.86 to 1.22)	0.8
Congestive heart failure	23 796 (13.9)	2768 (30.2)	<0.001	1.76 (1.67 to 1.85)	<0.001
Weighted Charlson sum (mean (SD))	1.0 (1.3)	1.8 (1.8)	<0.001	—	—
Length of stay (days)					
1-5	69 006 (40.2)	2774 (30.2)	<0.001	Reference	—
6-10	73 263 (42.7)	3437 (37.4)	<0.001	1.06 (0.98 to 1.15)	0.1
11-14	15 859 (9.2)	1204 (13.1)	<0.001	1.32 (1.19 to 1.47)	<0.001
>14	13 537 (7.9)	1764 (19.2)	<0.001	2.03 (1.84 to 2.24)	<0.001
Discharge disposition					
Skilled nursing facility	100 454 (58.5)	6224 (67.8)	<0.001	Reference	—
Long term care	1507 (0.9)	94 (1)	0.145	1.10 (0.88 to 1.36)	0.4
Left hospital against medical advice	474 (0.3)	19 (0.2)	0.216	0.7 (0.44 to 1.12)	0.1
Cancer center	16 400 (9.6)	503 (5.5)	<0.001	0.69 (0.62 to 0.76)	<0.001
Home	12 317 (7.2)	394 (4.3)	<0.001	0.68 (0.61 to 0.76)	<0.001
Home health	9825 (5.7)	243 (2.7)	<0.001	0.50 (0.43 to 0.57)	<0.001
Hospice	224 (0.1)	863 (9.4)	<0.001	37.9 (32.34 to 44.42)	<0.001
Inpatient hospital	4488 (2.6)	335 (3.7)	<0.001	1.20 (1.06 to 1.36)	0.005
Inpatient rehabilitation	25 678 (15)	482 (5.3)	<0.001	0.47 (0.43 to 0.52)	<0.001
Year 2006-11	85 553 (49.8)	4505 (49.1)	0.157	0.74 (0.68 to 0.80)	<0.001
Length of stay 6-10 days during years 2006-11	—	—	—	1.08 (0.97 to 1.20)	0.1692
Length of stay 11-14 days during years 2006-11	—	—	—	1.26 (1.09 to 1.47)	0.002
Length of stay >14 days during years 2006-11	—	—	—	1.25 (1.09 to 1.43)	0.001

Table 3 (continued)

Unadjusted analysis			Adjusted analysis	
Survived (n=171 665)	Deceased (n=9179)	P	Odds ratio (95% CI)	P

Data are no (%) of patients unless indicated otherwise. SD=standard deviation.

Figures

Fig 1 Kaplan-Meier graphs showing survival at 30 days after hospital discharge for patients with hip fracture. Graphs are separated by groups of all patients (n=180 844) and of non-surgically treated patients (n=16 593)

Fig 2 Adjusted odds ratios for mortality at 30 days after hospital discharge for patients with hip fracture, with adjustment for comorbid characteristics, injury, and demographics at each year in 2000-11