

Understanding the reasons for 30-day readmission following a hip fracture: a cohort study in a large urban hospital trust in England

Usama Rahman

hmz433@qmul.ac.uk

Queen Mary University of London

Felicity Evison

PIONEER, Health Data Research UK Midlands, Health Data Research UK

Daisy Wilson

University Hospitals Birmingham NHS Foundation Trust

Antony Johansen

University Hospital of Wales

Annie Topping

University Hospitals Birmingham NHS Foundation Trust

Emma Sutton

University of Birmingham

Research Article

Keywords: Hip fractures, Patient Readmission, Health services research, Frailty, Multimorbidity, Geriatric care

Posted Date: October 5th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10795525/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Rates of emergency readmission within 30-days of discharge vary between hospitals, and are widely used as a marker of poor outcome. However, the factors associated with this are incompletely understood. This study aimed to investigate patient, medical, and surgical factors associated with 30-day readmission following hip fracture at an urban trust in the West Midlands, England.

Methods

In a retrospective observational cohort study of people aged ≥ 65 years presenting to a large hospital trust in England (2019-24) we used Chi-squared or Fisher's exact tests for categorical variables, and Kruskal-Wallis tests for continuous variables to understand univariable associations with 30-day readmission. We also investigated patient-level, medical, and surgical factors associated with 30-day readmission tested using multivariable logistic regression.

Results

Of 5,999 patients with hip fracture over 5 years, 5,524 (92%) survived to discharge; 1,079 (19.5%) of whom were readmitted within 30-days. Half (51%) were readmitted under medical specialties, and only 5% to trauma and orthopaedics. Pneumonia was the commonest reason (629 patients; 58%). After adjusting for relevant covariates, several factors remained independently associated with readmission. Men were 30% more likely to be readmitted (OR 1.28; 95% CI 1.11-1.49). A very similar increase in risk was seen for: white patients compared with unknown ethnicity as coded (OR 1.33, 95% CI 1.08–1.67, $p = 0.011$); those with severe frailty (using Hospital Electronic Record Frailty Index) (OR 1.3, $p=0.007$); cardiac disease (congestive heart failure (OR 1.39, 95% CI 1.16–1.67, $p < 0.001$) and cardiac arrhythmias (OR 1.22, 95% CI 1.05–1.42, $p = 0.009$), and low serum albumin (OR 1.29 CI 1.12–1.48 $p<0.001$).

Conclusions

Most readmissions were for medical reasons, and this is reflected by the association between readmission and markers of frailty and cardiac disease. The 'surgical' factors associated with readmission may themselves be reflections of patient frailty. Early identification of high-risk patients and robust discharge planning may avoid readmissions, but our results do not support hip fracture registries using 30-day readmissions as a marker of surgical care quality.

Background

Hip fracture is a major health challenge in the UK. Around 80,000 hip fractures occur annually (1) with an estimated cost of £2 billion to health and social care services (2). National audit data for England, Wales and Northern Ireland demonstrates continued improvement in survival, with a 30-day mortality of 5.6% in

2025 (3). However, there remains a considerable burden of readmission after hip fracture in the National Health Service (NHS) (4) and this continues to present a significant challenge (5).

Early readmission is common in hip fracture in many global settings (between 10–19%) (4–7) and it is a key metric across healthcare systems (8–11) including the National Health Service (NHS) (12).

The factors associated with 30-day readmission after an index admission for hip fracture are poorly understood. Analysis of emergency readmissions will improve understanding of the reasons for readmission and help develop strategies to address the problem (9).

Multiple patient and organisational factors have been implicated in readmission following hip fracture admission (13, 5, 14). Systematic reviews identify age, male sex, higher American Society of Anesthesiologists (ASA) classification at the time of index surgery, comorbidity burden, nutritional status and frailty as important patient-level determinants of early return to hospital (15–17). The recent REDUCE study examining organisational factors affecting readmission in English and Welsh hospitals found higher rates were associated with busier emergency departments whereas factors such as staffing (defined as a greater number of senior and/or resident doctors) had lower rates (5). Self-care, individualised discharge planning and use of regional anaesthesia are also associated with lower readmission rates following a hip fracture (18). Summary data from medical, surgical and geriatric cohorts in the United States and United Kingdom estimate that an average of 27% of readmissions might be avoidable, highlighting scope for targeted, evidence-based interventions (19). Although national level data in England exists for readmission, substantial regional variation in age, ethnicity and socioeconomic status means that local populations experience differing levels of risk and is incompletely understood.

Rationale and objective

This study looked the factors associated with 30-day hospital readmission following hip fracture at a large urban hospital trust in the West-Midlands region of the United Kingdom.

Nationally care is delivered in line with National Institute for Health and Care Excellence (NICE) guidelines for hip fracture (20), alongside the National Hip Fracture Database (NHFD) (3). The NHFD drives compliance with NICE by monitoring performance and outcomes, promoting standardisation across the health system and reducing unwarranted variation. In the West Midlands distinctive levels of deprivation and ethnic diversity provide a unique setting to explore variations in outcomes (21). This study forms part of a wider programme of funded research - the ARTHUR (Avoiding Readmission afTer Hip fractURe) project (22); the qualitative findings show that 30 day readmission is a persistent, multifactorial problem driven largely by medical complexity, gaps in post-discharge support, and system-level pressures (23).

Methods

Study design and setting

We conducted a retrospective observational cohort study using routine health care data. The study was supported by PIONEER, a Health Data Research Hub in Acute Care affiliated with Health Data Research UK.

The study hospital group, located in the West Midlands region of the UK, is one of the largest acute tertiary hospital trusts in Europe delivering care for over 2.2 million patients, including approximately 1,300 patients with neck of femur fractures, every year. Using routinely collected electronic health record data from January 1st 2019 to August 31st 2024, we extracted data to examine patient, surgical, and medical characteristics linked to 30-day readmission from the health data hub (PIONEER).

Ethical approvals

Data curation and licensed access for this study were provided by PIONEER, with approval from the East Midlands Derby Research Ethics Committee (REC reference: 20/EM/0158). PIONEER is approved to analyse data without consent via section 251(20/CAG/0084). Patients were not included if they chose to opt out of the use of their data for research via the NHS National Data Opt-Out (24) or if they chose to opt out of PIONEER specifically; the full details of PIONEER operating guidelines can be found in the published protocol (25). Suppression of results less than five was automatically applied to prevent inadvertent patient identification in line with PIONEER standard processes.

Study population and data extraction

Records of patients aged ≥ 65 years admitted with a diagnosis of hip fracture because of minimal (i.e. falling from standing height) or no trauma during the study period using ICD-10 codes were included (pathological fractures were excluded). Patients who died during their index admission were described but excluded from subsequent readmission analyses.

Outcomes

The primary outcome was all-cause readmission within 30-days of discharge following the index hip fracture admission. Reasons for readmission were identified using diagnostic codes and grouped into medical or surgical admissions.

Statistical analysis

Data were summarised as counts and percentages for categorical variables, and as means (standard deviation) or medians (interquartile range) for continuous variables, depending on distribution. Normality was assessed visually using Q–Q plots and histograms. Univariable associations with 30-day readmission were tested using Chi-squared or Fisher’s exact tests for categorical variables, and Kruskal–Wallis tests for continuous variables. All analyses were performed using R Statistical Software (version 4.4.2; R Core Team, 2024). A p-value of < 0.05 was deemed as statistically significant. Missing demographics were assigned to an unknown category, missing clinical variables were assumed to not be present in terms of diagnoses or not done in terms of procedures, or tests.

A multivariable logistic regression was created investigating factors associated with readmission within 30 days. Multicollinearity was evaluated using the variance inflation factor, laboratory tests were categorised into above, below or within the normal range, and not undertaken. A subset of variables for potential inclusion was chosen *a priori* based on expertise and a review of current literature. A backward selection approach using $p < 0.2$ was then undertaken to identify the final model. Continuous variables were included with and without transformation and categorised, and if the reduction in explained variance using the categorised version was minimal this was then included in the model, due to ease of interpretation.

Results

Between 1 January 2019 and 31 August 2024, a total of 5,999 patients aged 65 years and older were admitted with a hip fracture. Of these, 475 patients (7.9%) died during their index admission and were therefore excluded from the primary readmission analysis. 5,524 patients were eligible for inclusion, of whom 1,079 were readmitted within 30 days of discharge, giving a 30-day readmission rate of 19.5% (Fig. 1).

Figure 1: *Depicts the average re-admission rate across the study period with seasonal variation. The period mean (19.5% re-admission) is plotted as a red dashed line.*

Patient demographics

Table 1 describes the cohort characteristics.

Though patients who were readmitted were predominantly women (67.5%), this is because women account for 72.1% of index hip fractures. Men were more likely (22.8% vs 18.3%, $p < 0.001$) to be readmitted than women. Readmitted patients were more likely to be frail, as assessed independently using the HERFI score on their index admission (20.8% (severe) vs 15.7% (moderate) vs 13.3% (mild)) (Table 1). Readmitted patients were older with a median age of 85 years (IQR 79–90) compared with 84 years old (IQR 78–89) for those not re-admitted.

Table 1

Patient Characteristics by cohort. Data presented as count (and percentage) and p-value is from a Chi-square test, Continuous variable represented by median (Interquartile range) and p-value is from Kruskal Wallis test. Bold values indicate a statistically significant result.

Characteristic	Not readmitted within 30 days, N = 4445	Readmitted within 30 days, N = 1079	p-value
Age on admission	84.0 (78.0, 89.0)	85.0 (79.0, 90.0)	0.003
Sex			< 0.001
Female	3,254 (81.7%)	728 (18.3%)	
Male	1,191 (77.2%)	351 (22.8%)	
Ethnicity			0.037
White	3,632 (79.8%)	918 (20.2%)	
Asian or Asian British	193 (82.5%)	41 (17.5%)	
Black, Black British, Caribbean or African	13 (68.4%)	6 (31.6%)	
Any other ethnic group	35 (85.4%)	6 (14.6%)	
Not known	572 (84.1%)	108 (15.9%)	
HERFI (Frailty)			< 0.001
Robust	5	*	
Mild	202 (86.7%)	31 (13.3%)	
Moderate	876 (84.3%)	163 (15.7%)	
Severe	3,359 (79.2%)	882 (20.8%)	
Unknown	*	*	
IMD quintile			0.4
1 (most deprived)*	1,547 (79.9%)	390 (20.1%)	
2*	824 (80.5%)	200 (19.5%)	
3*	771 (79.4%)	200 (20.3%)	
4*	587 (82.4%)	125 (17.6%)	
5 (least deprived)*	701 (81.9%)	155 (18.1%)	
Unknown*	15	< 5	

Characteristic	Not readmitted within 30 days, N = 4445	Readmitted within 30 days, N = 1079	p-value
Length of index stay (days)	15.7 (10.7, 23.7)	17.7 (11.5, 25.8)	< 0.001

*small numbers less than 5 have been suppressed and remaining results rounded to nearest 5

Legend: IMD: Index of Multiple Deprivation; HERFI: [Hospital Electronic Record Frailty Index]

Ethnicity data extracted from the Electronic Health Record (EHR) was frequently incomplete therefore interpretation of these results difficult. The ethnicity of 12.3% of the cohort was coded as “Not known”.

Ward-based assessments and comorbidities

Length of stay during the index admission was significantly longer for those who were subsequently readmitted (median: 17.7 days (IQR 11.5–25.8) vs 15.7 days (IQR 10.7–23.7)).

Reduced post-operative mobility, as assessed during the index admission was associated with readmission. Readmitted patients more often experienced two or more chronic conditions at the time of their index admission. Pre-hip fracture co-morbidities - stroke, cardiovascular disease, renal disease, depression and hospital-acquired infection during the index admission were all strongly associated with readmission. Patients who were readmitted had significantly lower albumin, higher C-reactive protein, higher Waterlow pressure ulcer risk score (26), higher Malnutrition Universal Screening Tool (MUST) (27) scores (reflecting poorer nutritional status) and continence issues during their index admission (Supplemental Tables 1 and 2).

Several factors did not appear associated with readmission including polypharmacy (use of more than five prescribed medicines), dementia, diabetes, multiple sclerosis, anaemia, malignancy, smoking status, and pressure ulcer grade (Supplemental Table 3).

Surgical factors

Patients receiving cemented implants were less likely to be readmitted than those receiving uncemented implants (OR 0.83, $p = 0.044$) (Table 2). Patients who were subsequently readmitted had a longer length of time from index admission to their hip fracture surgery (24.1 hours vs 20.5 hours, $p = 0.002$). Duration of surgery, measured as time on operating table categorised in two-hour increments, was also associated with readmission as shown in Table 2.

Table 2

Table 2

*Surgical Factors by cohort. Data presented as count (and percentage) and p-value is from a Chi-square test, continuous variable represented by median (Interquartile range) and p-value is from Kruskal Wallis test. Bold values indicate a statistically significant result. *Small numbers less than 5 have been suppressed and remaining results rounded to nearest 5*

Characteristic	Not readmitted within 30 days, N = 4445	Readmitted within 30 days, N = 1079	p-value
Procedure Type			
DHS (Dynamic Hip Screw)	48 (77.4%)	14 (22.6%)	
Intramedullary Nail	205 (82.0%)	45 (18.0%)	
Replacement			
Uncemented Hemiarthroplasty	552 (78.7%)	149 (21.3%)	
Cemented Hemiarthroplasty	1,165 (81.5%)	264 (18.5%)	
Cement Usage	1,333 (82.1%)	290 (17.9%)	0.044
Time to surgery (hours)	20.5 (10.7, 34.3)	24.1 (11.9, 37.6)	0.002
Surgical Time on table*			0.036
Not recorded	843 (78.2%)	235 (21.8%)	
Up to 2 hours	3,445 (80.8%)	820 (19.2%)	
2–6 hours	145 (87.9%)	20 (12.1%)	
6 hours or more	10	< 5	

Readmission variables

The causes of readmission were predominantly medical rather than surgical. Most patients (51%) were re-admitted under the care of medical specialties with only 5% being re-admitted to trauma & orthopaedics. The median length of stay for readmissions was 8.9 days (IQR 2.3–16.9).

Emergency Department attendance was also common: 850 of the 1,079 readmitted patients came via the Emergency Department, 730 (67.6%) attended the Emergency Department at least once during the previous 30 days since discharge, 103 patients (9.5%) attended twice, and 17 patients (1.6%) attended three times.

Multivariable analysis

After adjusting for relevant covariates, several factors remained independently associated with 30-day readmission (Table 3). Men had 28% higher odds of readmission compared to females (OR 1.28, 95% CI

1.11–1.49, $p < 0.001$), and those with severe frailty as measured by the HERFI index had a 27% increased readmission risk (OR 1.27, 95% CI 1.07–1.52, $p = 0.007$). Cardiac co-morbidities, namely congestive heart failure (OR 1.39, 95% CI 1.16–1.67, $p < 0.001$) and cardiac arrhythmias (OR 1.22, 95% CI 1.05–1.42, $p = 0.009$) were also strongly associated with risk of readmission. Hypoalbuminaemia present on the last blood test before discharge from the index admission, was linked to a 29% increased chance of readmission (OR 1.29, 95% CI 1.12–1.48, $p < 0.001$).

Due to missingness in coding we analysed ethnicity as White vs unknown ethnicity as has been done previously (28). White patients had 33% higher odds of readmission than those with unknown ethnicity (OR 1.33, 95% CI 1.08–1.67, $p = 0.011$).

The model's overall discrimination was modest (C-statistic = 0.60), indicating limited utility for predicting individual risk.

Table 3

Table 3

Multivariable Analysis – factors independently associated with 30-day readmission. Results of a multivariable logistic regression looking at the factors associated with a readmission. Significant results are bolded. OR: Odds ratio.

Aged over 85	OR (95%CI)	p-value
	1.14 (0.99, 1.31)	0.07
Male (vs Female)	1.28 (1.11, 1.49)	< 0.001
White vs (non-white)	1.15 (0.85, 1.59)	0.368
White vs (Unknown ethnicity)	1.33 (1.08–1.67)	0.011
Severe HERFI (not severe)	1.27 (1.07, 1.52)	0.007
Continence Not Recorded (vs complete/catheterised)	1.26 (1.06, 1.50)	0.009
Urinary/faecal incontinence (vs complete/catheterised)	1.12 (0.95, 1.32)	0.184
Stroke	1.30 (0.97, 1.72)	0.069
Congestive Heart Failure	1.39 (1.16, 1.67)	< 0.001
Cardiac arrhythmias	1.22 (1.05, 1.42)	0.009
Last Albumin below normal range of test (vs within normal range)	1.29 (1.12, 1.48)	< 0.001
Albumin not tested	1.50 (0.74, 2.85)	0.23

Discussion

We report a cohort of 5,524 patients aged 65 or older discharged following hip fracture surgery at a large urban NHS Trust in the West Midlands, England. The 30-day readmission rate was 19.5%, which is higher

than the national average (12.6%) (3) and lies at the upper end of estimates from other single-centre and administrative data studies, that reported rates between 10–12% (4, 16). The West Midlands region ranks among the most deprived in England and socio-economic deprivation is known to be associated with readmission following hip fracture (29, 30). Our data mirrors findings (15–17) identifying comorbidity burden, hypoalbuminaemia and frailty as important patient-level determinants of early return to hospital.

Readmissions were predominantly for medical rather than surgical reasons. This could reflect the susceptibility of hip-fracture patients to respiratory infection due to frailty-related immune dysfunction, the physiological stress of trauma, and reduced mobility, which facilitates respiratory colonisation (31). These risks are compounded by the high burden of viral and bacterial pathogens in hospital settings (32). Established predictors of postoperative pneumonia such as advanced age, male sex, reduced functional status, coronary heart disease, arrhythmia, delayed surgery, and low pre-operative serum albumin (33) were associated with higher 30-day readmission in our cohort. Pneumonia has been reported in 14% of readmissions after hip fracture in the US (34) and 18% in Denmark (35), perhaps suggesting a disproportionately high burden of respiratory complications in our study which may reflect an especially frail population, be the result of seasonal variation, or be sequelae from COVID which was included in the study period.

Some factors associated with readmission, such as age, and sex, are not modifiable. Others offer opportunities for improvement. While not predictive the multivariable regression model suggests that severe frailty, congestive heart failure, cardiac arrhythmias, indeterminate continence status, and hypoalbuminaemia were all independently associated with increased odds of readmission, which is consistent with earlier work (15, 17, 36). Early identification of frailty and medical complexity, including cardiac conditions, may support more proactive in-hospital assessment, discharge planning and targeted post-discharge follow-up. The REDUCE study (5) examined potentially modifiable organisational factors that could impact readmission- including pre-operative fluid management protocols, increased non-consultant orthopaedic staffing, data monitoring on time between discharge and initiation of community rehabilitation and having plans in place to reconfigure hip fracture services. These findings align with our own by identifying known risk points in hip-fracture care, such as peri-operative optimisation, and mobility which may be especially beneficial for frail patients who are vulnerable to deconditioning as shown in the qualitative work from the ARTHUR study (23). The very small proportion of patients who were readmitted under orthopaedic services (either due to wound complications or further injury) underscores the importance of managing post-operative medical complications in the early recovery period reinforcing the role of proactive orthogeriatric and multi-disciplinary support within the index admission.

Surgical factors such as delays between admission and surgery, duration of surgery and the use of uncemented hemiarthroplasty were linked to a higher risk of readmission. Our finding that surgical delay was associated with readmission reinforces the case for prompt surgery, as emphasised by NICE CG124 (20). Patients with frailty may require longer for pre-operative optimisation, contributing to delays in

reaching theatre, and they may also experience more time on the operating table once surgery begins. Identification and correction of issues including cardiac arrhythmias, electrolyte abnormalities, pre-existing anaemia, and fluid imbalance is therefore essential (37) as these factors are themselves associated with a higher likelihood of postoperative readmission.

This data reported the use of uncemented hemiarthroplasty which may reflect ongoing clinical caution among anaesthetists and surgeons, who sometimes avoid cementation in the frailest patients because of concerns about the physiological stress associated with bone cement implantation syndrome. Nevertheless, NICE guidance (20) recommends cemented fixation, citing superior functional outcomes and lower reoperation and complication rates (38). These findings suggest that routine use of cemented implants may contribute to improved short-term outcomes in the form of lower 30-day re-admission, and they support highlighting uncemented surgery as a factor associated with increased readmission risk (though this was not statistically significant in this analysis and prone to significant bias).

Across the variables associated with 30-day readmission, a consistent pattern has emerged in which frailty appears to be the defining characteristic of patients who return to hospital. Most readmissions were medical rather than surgical, with pneumonia accounting for over half of cases, reflecting the susceptibility of frail, immobile patients to respiratory infection (39). Independent predictors of readmission included severe frailty scores, cardiac comorbidity, and low serum albumin which are markers of reduced physiological reserve. Male sex was also associated with higher readmission risk, likely reflecting the fact that men who sustain hip fractures are likely frailer than women who sustain hip fractures. Peri-operative factors such as delays to surgery, prolonged operative duration, and the use of uncemented implants similarly point to greater clinical complexity and the need for more extensive optimisation in frailer patients. Taken together, these findings indicate that frailty is a central feature characterising those most likely to be readmitted.

A key strength of this study is the collection of routinely collected data from a centralised hip fracture service serving a large diverse urban population. This allowed for capture of comprehensive non-identifiable patient information of index admissions and readmission data. The retrospective design and reliance on accuracy of administrative coding are limitations. Incomplete ethnicity data within electronic health records was a constraint, preventing detailed analyses by ethnic group. This is a recognised limitation of observational datasets derived from linked hospital records (28), with up to one in ten patients in both primary and secondary care lacking recorded ethnicity (40). This is particularly relevant in our setting, where 31% of the local population identify as Asian compared with 9.3% nationally, and there are known ethnic differences in hip-fracture care and outcomes. For example, non-White patients may experience lower short-term mortality following discharge, potentially reflecting differences in social support or post-acute care pathways, although the underlying mechanisms remain unclear. Without complete data, the ability to examine intersectional determinants of care and outcomes remains limited.

A final limitation of this study is that the analysis spans the COVID-19 pandemic years (2020–2023), during which patterns of admission and readmission among older adults were atypical. COVID-19 introduced new reasons for hospital readmission while simultaneously placing unprecedented pressure on hospitals to avoid non-essential returns to preserve bed capacity, which may have influenced clinical decision-making and discharge planning. The study site was among the most heavily impacted NHS trusts in England during the COVID-19 pandemic (41). These pandemic-related factors should be considered when interpreting the findings.

Implications for practice and research

These results are exploratory and help to improve our understanding of the nature, and underlying causes of readmission risk following hip fracture: highlighting that particular attention that future research should place on frailty, cardiac disease, and poor nutrition, and early identification of medical complexity. These results are not expected to change an individual patient's care but provide a local snapshot in a busy hip fracture service.

This data suggests that multidisciplinary models of orthogeriatric hip fracture care may be beneficial when extended beyond the surgical ward with ongoing multi-disciplinary care in the community and primary care settings as being beneficial.

This paper suggests that 30-day readmission after hip fracture is multi-factorial. In this cohort, 30-day readmission is characterised as a marker of population frailty, and not as an indicator of hip-fracture surgical quality. It is not recommended for its inclusion in hip fracture registries, which should prioritise frailty measures, mortality, functional recovery and hip-fracture-specific process metrics. However, 30-day readmission may retain value as a whole-hospital utilisation indicator of the broader frailty burden within the population served. Improving routine local level data collection, especially around ethnicity and functional assessments, will also be essential to understanding and addressing disparities in outcomes.

Conclusion

This study highlights a high 30-day readmission rate following hip fracture surgery in an urban population with most readmissions occurring for medical reasons. Readmission was associated with both patient-level factors such as pre-existing frailty, cardiac comorbidities, and low albumin and surgical factors including delayed surgery. Missing data, particularly around continence and ethnicity, may obscure markers of wider systemic gaps. These results support the multidisciplinary model of orthogeriatric hip fracture, and the need for care to extend beyond the surgical ward to ensure robust and co-ordinated post-operative oversight.

Declarations

Ethics approval and consent to participate

Data curation and licensed access for this study were provided by PIONEER, with approval from the East Midlands Derby Research Ethics Committee (REC reference: 20/EM/0158). PIONEER is approved to analyse data without consent via section 251(20/CAG/0084). Patients were not included if they chose to opt out of the use of their data for research via the NHS National Data Opt-Out or if they chose to opt out of PIONEER specifically; the full details of PIONEER operating guidelines can be found in the published protocol. Suppression of results less than five was automatically applied to prevent inadvertent patient identification in line with PIONEER standard processes.

Consent for publication

All authors provide consent for publication.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

All authors report no conflicts of interest.

Funding

The author (Dr ES) disclosed receipt of the following financial support for the research, protocol development and publication of this article: this work was supported by a grant from Birmingham Health Partners

Authors' contributions

UR is the guarantor of the work. All authors contributed to the design, conception and preparation of the manuscript. FE, UR and ES conducted data analysis.

Acknowledgements

NA

References

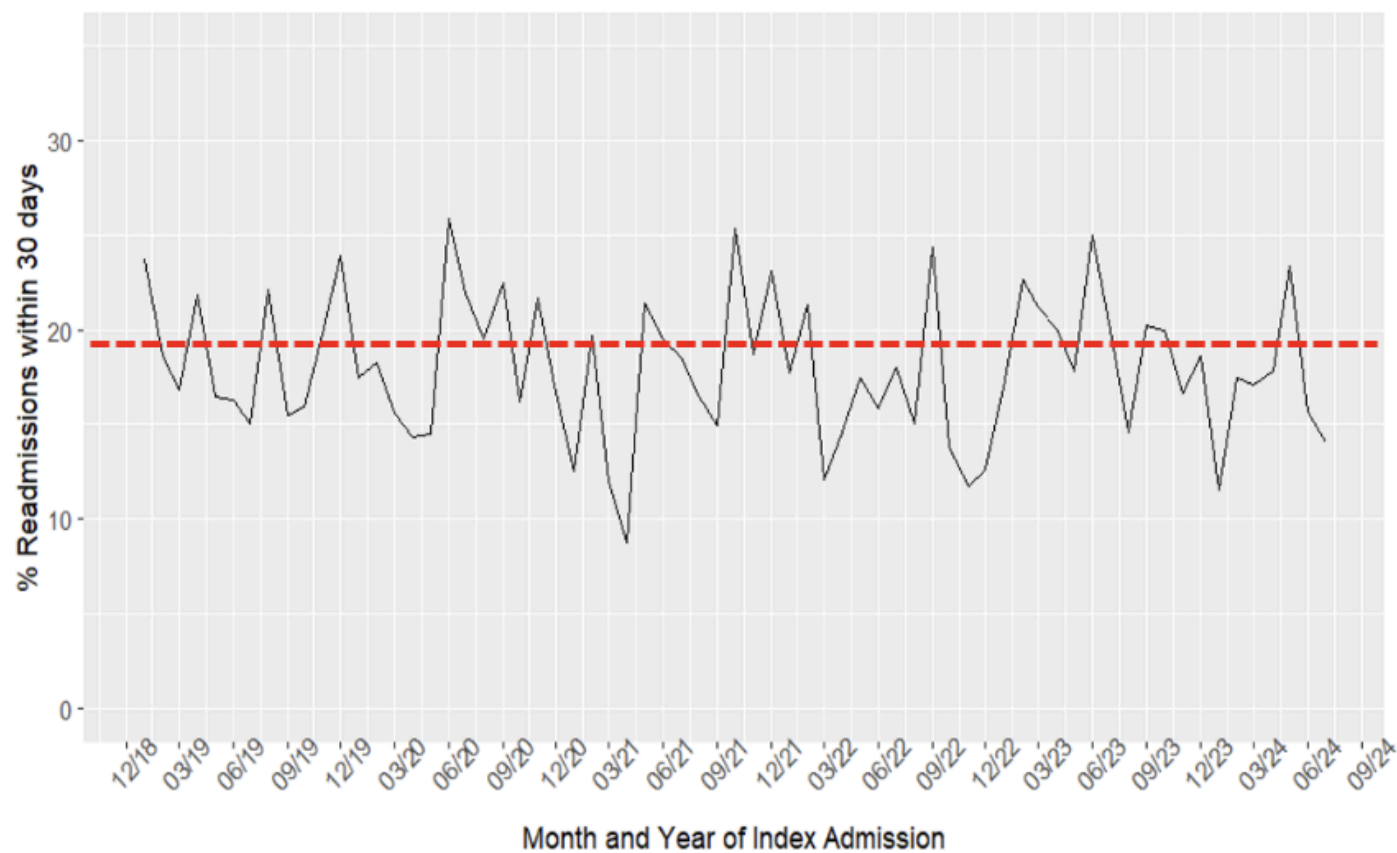
1. Census. 2021 Ethnicity and Religion by Age [Internet]. [cited 2026 Mar 19]. Available from: https://cityobservatory.birmingham.gov.uk/explore/dataset/census-2021-ethnicity-and-religion-by-age/table/?utm_source=copilot.com
2. Goh EL, Png ME, Metcalfe D, Achten J, Appelbe D, Griffin XL, et al. The utilisation and cost of social care after hip fracture: a prospective observational cohort study. *Age Ageing*. 2026;55(1):afaf358. 10.1093/ageing/afaf358.

3. Partnership HQI. National Hip Fracture Database annual report 2024 [Internet]. 2025 [cited 2025 Jun 5]. Available from: <https://www.data.gov.uk/dataset/4726da8e-72ad-4e34-9180-d7b7c2fa261e/national-hip-fracture-database-annual-report-2024#>
4. Hahnel J, Burdekin H, Anand S. Re-Admissions Following Hip Fracture Surgery. *Ann R Coll Surg Engl*. 2009;91(7):591–5. 10.1308/003588409X432374.
5. Patel R, Judge A, Johansen A, Marques EMR, Griffin J, Bradshaw M, et al. Multiple hospital organisational factors are associated with adverse patient outcomes post-hip fracture in England and Wales: the REDUCE record-linkage cohort study. *Age Ageing*. 2022;51(8):afac183. 10.1093/ageing/afac183.
6. Gálvez Márquez G, Muñoz Pascual A, Ojeda Thies C, García Cruz G, Sáez López MP, Cordero Ampuero J. Can we improve early readmission after hip fracture of the adult? A retrospective analysis of 57.544 patients from SNHFR. *Injury*. 2025;56(10):112680. 10.1016/j.injury.2025.112680.
7. Pettit CJ, Herbosa CF, Ganta A, Rivero S, Tejwani N, Leucht P, et al. Can We Predict 30-Day Readmission After Hip Fracture? *J Orthop Trauma*. 2025;39(4):200–6. 10.1097/BOT.0000000000002946 PubMed PMID: 39655937.
8. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med*. 2009;360(14):1418–28. 10.1056/NEJMsa0803563 PubMed PMID: 19339721.
9. Nuffield Trust [Internet]. [cited 2026 Aug 16]. Emergency readmissions. Available from: <https://www.nuffieldtrust.org.uk/resource/emergency-readmissions>
10. Characteristics of 30-Day. All-Cause Hospital Readmissions, 2016–2020 [Internet]. [cited 2026 Aug 16]. Available from: https://hcup-us.ahrq.gov/reports/statbriefs/sb304-readmissions-2016-2020.jsp?utm_source=copilot.com
11. All Patients Readmitted to Hospital | CIHI [Internet]. [cited 2026 Aug 16]. Available from: https://www.cihi.ca/en/indicators/all-patients-readmitted-to-hospital?utm_source=copilot.com
12. NHS England Digital [Internet]. [cited 2026 Aug 16]. Emergency readmissions to hospital within 30 days of discharge: indirectly standardised percent trends broken down by age bands and sex (I02040 / I00712). Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/compendium-emergency-readmissions/current/emergency-readmissions-to-hospital-within-30-days-of-discharge>
13. Baji P, Patel R, Judge A, Johansen A, Griffin J, Chessier T, et al. Organisational factors associated with hospital costs and patient mortality in the 365 days following hip fracture in England and Wales (REDUCE): a record-linkage cohort study. *Lancet Healthy Longev*. 2023;4(8):e386–98. 10.1016/S2666-7568(23)00086-7.
14. Ireland A, Kelly P, Cumming R. Associations between hospital-based rehabilitation for hip fracture and two-year outcomes for mortality and independent living: An Australian database study of 1,724 elderly community-dwelling patients. *J Rehabil Med*. 2016;48(7):625–31. 10.2340/16501977-2108.

15. Lee KJ, Kim JW, Kim CH. Risk Factors for Readmission Within 30 Days After Discharge Following Hip Fracture Surgery: A Systematic Review and Meta-Analysis. *J Clin Med*. 2025;14(8):2779. 10.3390/jcm14082779.
16. Martin CT, Gao Y, Pugely AJ. Incidence And Risk Factors For 30-Day Readmissions After Hip Fracture Surgery. *Iowa Orthop J*. 2016;36:155–60. PubMed PMID: 27528853; PubMed Central PMCID: PMC4910810.
17. Bhavnani SK, Dang B, Penton R, Visweswaran S, Bassler KE, Chen T, et al. *JMIR Med Inf*. 2020;8(10):e13567. 10.2196/13567 . PubMed PMID: 33103657; PubMed Central PMCID: PMC7652691. How High-Risk Comorbidities Co-Occur in Readmitted Patients With Hip Fracture: Big Data Visual Analytical Approach.
18. Sutton EL, Kearney RS. What works? Interventions to reduce readmission after hip fracture: A rapid review of systematic reviews. *Injury*. 2021;52(7):1851–60. 10.1016/j.injury.2021. 04.049 PubMed PMID: 33985752.
19. van Walraven C, Bennett C, Jennings A, Austin PC, Forster AJ. Proportion of hospital readmissions deemed avoidable: a systematic review. *CMAJ Can Med Assoc J J Assoc Medicales Can*. 2011;183(7):E391–402. 10.1503/cmaj.101860 . PubMed PMID: 21444623; PubMed Central PMCID: PMC3080556.
20. Overview | Hip fracture: management | Guidance | NICE [Internet]. [cited 2025 Jun 5]. Available from: <https://www.nice.org.uk/guidance/cg124>
21. Council BC. Population and census [Internet]. [cited 2026 Aug 16]. Available from: https://www.birmingham.gov.uk/info/20057/about_birmingham/1294/population_and_census/5
22. Sutton E, Rahman U, Reilly H, Miller C, Vedutla T, Melody T, et al. Understanding readmission after hip fracture: a mixed methods study protocol. *BMJ Open*. 2025;15(7):e094163. 10.1136/bmjopen-2024-094163.
23. Sutton E, McMullan C, Reilly H, Miller C, Topping A, Lees Deutsch L. 30-day readmission risk after hip fracture: a qualitative study in the Midlands, United Kingdom. *BMC Geriatr*. 2026;26(1):432. 10.1186/s12877-026-07183-6.
24. NHS England Digital [Internet]. [cited 2026 Mar 18]. National Data Opt-Out. Available from: <https://digital.nhs.uk/services/national-data-opt-out>
25. Gallier S, Price G, Pandya H, McCarmack G, James C, Ruane B, et al. *BMJ Health Care Inf*. 2021;28(1):e100294. 10.1136/bmjhci-2020-100294. Infrastructure and operating processes of PIONEER, the HDR-UK Data Hub in Acute Care and the workings of the Data Trust Committee: a protocol paper.
26. Waterlow J. Pressure sores: a risk assessment card. *Nurs Times*. 1985;81(48):49–55. PubMed PMID: 3853163.
27. Elia PM. Nutritional screening of adults: a multidisciplinary responsibility.
28. Nisar S, Lamb J, Johansen A, West R, Pandit H. The impact of ethnicity on care and outcome after hip fracture in England and Wales. *Bone Jt J*. 2024;106–B(10):1182–9. 10.1302/0301-

- 620X.106B10.BJJ. -2024-0217.R1 PubMed PMID: 39348896.
29. Bethell MA, Mahoney HR, Kiwinda LV, Sassoon AA, Little MT, Clark AG, et al. Does Neighborhood Deprivation Impact Readmission and Associated Costs After Hip Fracture Surgery? *J Am Geriatr Soc.* 2025;73(12):3690–9. 10.1111/jgs.70123 . PubMed PMID: 41061191.
 30. Kay RS, Hall AJ, Duckworth AD, Clement ND. Socioeconomically-deprived patients suffer hip fractures at a younger age and require more hospital admissions, but early mortality risk is unchanged: The IMPACT Deprivation Study. *Musculoskelet Care.* 2023;21(2):417–25. 10.1002/msc.1711 . PubMed PMID: 36333838.
 31. Rehabilitation for hospital-. associated deconditioning - PubMed [Internet]. [cited 2026 Aug 16]. Available from: <https://pubmed.ncbi.nlm.nih.gov/18688198/>
 32. Magill SS, Edwards JR, Bamberg W, Beldavs ZG, Dumyati G, Kainer MA, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. *N Engl J Med.* 2014;370(13):1198–208. 10.1056/NEJMoa1306801.
 33. Lawrence VA, Hilsenbeck SG, Mulrow CD, Dhanda R, Sapp J, Page CP. Incidence and hospital stay for cardiac and pulmonary complications after abdominal surgery. *J Gen Intern Med.* 1995;10(12):671–8. 10.1007/BF02602761 . PubMed PMID: 8770719.
 34. Martin CT, Gao Y, Pugely AJ. Incidence And Risk Factors For 30-Day Readmissions After Hip Fracture Surgery. *Iowa Orthop J.* 2016;36:155–60. PubMed PMID: 27528853; PubMed Central PMCID: PMC4910810.
 35. Kj P. Hip fracture in Denmark: Quality of in-hospital care and clinical outcomes.
 36. Tischler EH, Vummidi S, McDermott JR, Tiburzi HA, Gross JM, Suneja N. The implications of preoperative hypoalbuminemia on postoperative readmission, reoperation, and mortality among orthopaedic trauma patients: A systematic review and meta-analysis. *J Clin Orthop Trauma.* 2025;67:103108. 10.1016/j.jcot.2025.103108.
 37. Parke S, Eaves C, Dimond S, Bainbridge C, Bellwood J, Mattinson D. Perioperative optimization of hip fracture patients. *Orthop Trauma.* 2020;34(2):80–8. 10.1016/j.mporth.2020.01.004.
 38. Fernandez MA, Achten J, Parsons N, Griffin XL, Png ME, Gould J, et al. Cemented or Uncemented Hemiarthroplasty for Intracapsular Hip Fracture. *N Engl J Med.* 2022;386(6):521–30. 10.1056/NEJMoa2108337.
 39. Lee SH, Kim KU. Risk Factors for Postoperative Pneumonia in the Elderly Following Hip Fracture Surgery: A Systematic Review and Meta-Analysis. *Geriatr Orthop Surg Rehabil.* 2022;13:21514593221083825. doi:10.1177/21514593221083825 PubMed PMID: 35634259; PubMed Central PMCID: PMC9133882.
 40. Pineda-Moncusí M, Allery F, Delmestri A, Bolton T, Nolan J, Thygesen JH, et al. Ethnicity data resource in population-wide health records: completeness, coverage and granularity of diversity. *Sci Data.* 2024;11(1):221. 10.1038/s41597-024-02958-1.
 41. Statistics. Statistics » COVID-19 Hospital Activity [Internet]. [cited 2026 Aug 16]. Available from: <https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-hospital-activity/>

Figures



19.5% readmission rate within 30-days

Figure 1

Depicts the average re-admission rate across the study period with seasonal variation. The period mean (19.5% re-admission) is plotted as a red dashed line.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementalTables.docx](#)