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Enhanced recovery after surgery: An opportunity to improve fractured neck of femur management

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ABSTRACT

INTRODUCTION Approximately 67,000 hip fractures occurred in England, Wales and Northern Ireland in 2014, and annual hospital costs for fracture are around £1.1 billion. We review the potential scope for improving length of stay (LOS).

METHODS Hospital Episode Statistics data on non-elective admissions to 137 hospital trusts between November 2013 and October 2014 with a primary diagnosis of fractured neck of femur were analysed. The primary outcome was superspell LOS, which is the total LOS for all related spells for a single patient during an episode of care. Secondary outcomes were discharge to home, readmission at 28 days and in-hospital mortality.

RESULTS The mean observed LOS was 22.1±3.8 days (range 12.3–33.7 days). The range for case mix-adjusted expected LOS was 21.5–24.4 days. On average, 6.7±1.5% (range 3.6%–10.9%) of patients died while in hospital, at a relative risk of in-hospital mortality of 28.2–182.9. A mean of 12.3±3.2% (range 3.9% to 23.0%) of patients were readmitted at 28 days, at a relative relative risk of 34.8–203.2.

CONCLUSIONS The wide range of observed LOS in our study is unlikely to be due to the case mix, as the case mix-adjusted range of LOS is less than 3 days, but rather due to local processes and pathways. There is therefore considerable scope for quality and efficiency of care improvements in our hospitals. We propose this could be best achieved if clinicians experienced in enhanced recovery focused on FNOF pathways.

KEYWORDS

Femoral neck fractures – Emergency surgery – Enhanced recovery Fast track – Length of stay

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The length of hospital stay (LOS) associated with hip fracture, also known as fractured neck of femur (FNOF), is a major public health issue due to the ageing population. Approximately 67,000 hip fractures were recorded in England, Wales and Northern Ireland in 2014, and annual hospital costs are around £1.1 billion.[1,2] The average age of patients with FNOF is over 80 years, 75% are female and many patients have significant comorbidities that can delay surgery and recovery.[3] Hip fracture is the most serious consequence of falls among older people, with a mortality rate of 10% at 1 month after the fall, 20% at 4 months and 30% at 1 year. Many of those who recover suffer a loss in mobility and independence.[3]

Demographic projections indicate that the UK annual incidence of FNOF will rise to 101,000 in 2020,[4] with an associated increase in annual expenditure. The majority of this expenditure will be on hospital bed days, with a substantial portion on health and social aftercare.

One indicator, or proxy, of quality of care often used within healthcare is that of LOS, as it is considered an appropriate measure of safety and efficacy. Data from the 2014 National Hip Fracture Database (NHFD) annual report revealed significant variations in length of stay,[1] at a mean LOS (both acute and post-acute) in 163 hospitals in England of 19.5±4.9 days (range 8.6–47.9. days). A study based on NHFD data found that hip fracture patients account for at least 1.5 million bed-days per year, which equates to the continuous occupation of 4,106 beds at any one time.[5]

Despite the introduction of NHFD, National Institute for Health and Care Excellence (NICE) and other best practice guidelines having led to measurable improvements in outcomes, the anticipated rise in patient numbers can only contribute towards an increase in the number of deaths through comorbidities and an increase in costs through bed usage.[6]

In recent years, the enhanced recovery (also called fast-track, accelerated recovery or rapid recovery) approach to perioperative care, which was developed by Henrik Kehlet,[7] has been successfully used in the treatment of patients undergoing a range of different surgical procedures.[8] The principles of enhanced recovery include optimising pain relief, reducing the surgical stress response, early mobilisation and empowering the patient to regain independence as quickly as possible post-surgery.

The pathway has been adopted in orthopaedics, and there is strong evidence that its use in hip replacement surgery decreases LOS, with no increases in readmission rates.[9] Enhanced recovery protocols have also been shown to be effective in revision total hip replacement,[10] in elderly co. horts,[11] and in FNOF patients.[12,13]

However, an audit of hospitals in Denmark,[14] where fast-track pathways were introduced in the late 1990s, concluded that, although LOS had been reduced through the introduction of the pathways and improvements were seen in many quality indicators, no single department had implemented the whole package. This resulted in significant variability in the treatment and care of patients, suggesting further potential for improvement.

We review whether there is scope to improve current LOS for FNOF patients within the United Kingdom through service improvement and the introduction of enhanced recovery pathways. Readmission rates at 28 days, in-hospital mortality rate and rates of discharge to home are also examined.

Methods

We interrogated Hospital Episode Statistics (HES) data, which is gathered locally through each hospital's patient administration or information system, and includes all inpatient and day-case activity delivered by NHS hospitals in England. The dataset has over 300 fields, including age, gender, admission method, 14 diagnosis fields, 12 operation fields, LOS, waiting times, ethnic group and method of discharge (including in-hospital mortality). Over 14 million records are collected annually.

Emergency admissions with a primary diagnosis of FNOF between November 2013 and October 2014 to non-specialist acute hospitals were examined. Data on LOS, readmission rates, discharge to home rate and hospital mortality rates were retrieved using Dr Foster's Practice and Provider Monitor tool, while their Quality Investigator tool was used to retrieve data on relative risk. It should be noted that the two tools use slightly different variables to adjust for case-mix, as described in Table 1.

From these data, we determined the observed and case mix-adjusted expected superspell LOS, and the difference in LOS. Superspell LOS, which accounts for all related spells for a single patient during an episode of care, was examined to take into account the differing practices of trusts in transferring patients from an acute setting to either rehabilitation or home. Secondary outcomes included rates of 28-day readmission, discharge to home and in-hospital mortality.

Table 1 Definitions of outcome measures[28]

Term	Definition
Spell	The total continuous stay of a patient using a hospital bed on premises controlled by a health care provider, during which medical care is the responsibility of one or more consultants, or patient is receiving care under one or more nursing episodes or midwife episodes on a ward.
Superspell	Collected term of all the related, or linked, spells for a single patient. It is the time a patient spends within one hospital trust before being discharged. Spells are linked to superspells when: • they have same patient ID, or HES ID in HES years, when available • the discharge date of the first spell is within two days of the next spell
Superspell LOS	For superspell, it is the number of days between date of admission in first spell and date of admission from last spell in superspell. It includes all patients apart from day cases so will include outliers (patients with long LOS and 0 day LOS).
Expected LOS	The England average LOS for inpatient superspells is adjusted for diagnosis/procedures/HRG, subgroup, age, sex, admission type, deprivation quintile and financial year and is applied as a benchmark to each patient. The overall figures for the selected patients is the average of the benchmarks. Benchmarks have been calculated for each of the years up to and including the latest complete year for which there is HES data. The Dr Foster Practice and Provider Monitor tool was used to download the data.
Difference in LOS	Difference between observed LOS and expected LOS
Discharge destination	This comprises: home, other place, transfer (non-acute), transfer (acute), transfer (internal), (transfer unknown), unknown, or death
RR	Ratio of the observed number of outcomes divided by the risk adjusted expected group, multiplied by 100. RR=[n(observed)/n(expected)] x 100 The benchmark figure (NHS England average) is 100. Values greater than 100 represent performance higher than the benchmark. Values lower than 100 represent performance lower than the benchmark The risk adjusted expected group has been adjusted for age, sex, method of admission, socio-economic deprivation, diagnosis CCS subgroup, co-morbidity (Charlson index), source of admission, number of emergency admissions in last 12 months, palliative care, year of discharge, month of admission, interaction between age and Charlson score (please note that this differs from adjustment made for superspell expected LOS as the Dr Foster Quality Investigator tool was used to download data in this instance).

CCS = Clinical Classification System; HES = Hospital Episode Statistics; HRG = healthcare resource group; ID = identification; LOS = length of stay; RR = relative risk

Table 2 Trusts included in the analysis

Name of trust
Aintree University Hospital NHS Foundation Trust
Airedale NHS Foundation Trust
Ashford and St Peter's Hospitals NHS Foundation Trust
Barking, Havering and Redbridge University Hospitals NHS Trust
Barnsley Hospital NHS Foundation Trust
Barts Health NHS Trust
Basildon and Thurrock University Hospitals NHS Foundation Trust
Bedford Hospital NHS Trust
Blackpool Teaching Hospitals NHS Foundation Trust
Bolton NHS Foundation Trust
Bradford Teaching Hospitals NHS Foundation Trust
Brighton and Sussex University Hospitals NHS Trust
Buckinghamshire Healthcare NHS Trust
Burton Hospitals NHS Foundation Trust
Calderdale and Huddersfield NHS Foundation Trust
Cambridge University Hospitals NHS Foundation Trust
Central Manchester University Hospitals NHS Foundation Trust
Chelsea and Westminster Hospital NHS Foundation Trust
Chesterfield Royal Hospital NHS Foundation Trust
City Hospitals Sunderland NHS Foundation Trust
Colchester Hospital University NHS Foundation Trust
Countess Of Chester Hospital NHS Foundation Trust
County Durham and Darlington NHS Foundation Trust
Croydon Health Services NHS Trust
Dartford and Gravesham NHS Trust
Derby Hospitals NHS Foundation Trust
Doncaster and Bassetlaw Hospitals NHS Foundation Trust
Dorset County Hospital NHS Foundation Trust
East and North Hertfordshire NHS Trust
East Cheshire NHS Trust
East Kent Hospitals University NHS Foundation Trust
East Lancashire Hospitals NHS Trust
East Sussex Healthcare NHS Trust
Epsom and St Helier University Hospitals NHS Trust
Frimley Health NHS Foundation Trust
Gateshead Health NHS Foundation Trust
George Eliot Hospital NHS Trust
Gloucestershire Hospitals NHS Foundation Trust
Great Western Hospitals NHS Foundation Trust
Guy's and St Thomas' NHS Foundation Trust
Hampshire Hospitals NHS Foundation Trust
Harrogate and District NHS Foundation Trust
Heart Of England NHS Foundation Trust
Heatherwood and Wexham Park Hospitals NHS Foundation Trust
Hinchingbrooke Health Care NHS Trust
Homerton University Hospital NHS Foundation Trust
Hull and East Yorkshire Hospitals NHS Trust
Imperial College Healthcare NHS Trust
Ipswich Hospital NHS Trust
Isle Of Wight NHS Trust
James Paget University Hospitals NHS Foundation Trust
Kettering General Hospital NHS Foundation Trust
King's College Hospital NHS Foundation Trust
Kingston Hospital NHS Foundation Trust
Lancashire Teaching Hospitals NHS Foundation Trust
Leeds Teaching Hospitals NHS Trust
Lewisham and Greenwich NHS Trust
Luton and Dunstable University Hospital NHS Foundation Trust
Maidstone and Tunbridge Wells NHS Trust
Medway NHS Foundation Trust
Mid Cheshire Hospitals NHS Foundation Trust
Mid Essex Hospital Services NHS Trust
Mid Staffordshire NHS Foundation Trust
Mid Yorkshire Hospitals NHS Trust
Milton Keynes Hospital NHS Foundation Trust
Norfolk and Norwich University Hospitals NHS Foundation Trust
North Bristol NHS Trust
North Cumbria University Hospitals NHS Trust
North Middlesex University Hospital NHS Trust
North Tees and Hartlepool NHS Foundation Trust
Northampton General Hospital NHS Trust
Northern Devon Healthcare NHS Trust
Northern Lincolnshire and Goole NHS Foundation Trust
Northumbria Healthcare NHS Foundation Trust
Nottingham University Hospitals NHS Trust
Oxford University Hospitals NHS Trust
Pennine Acute Hospitals NHS Trust
Peterborough and Stamford Hospitals NHS Foundation Trust
Plymouth Hospitals NHS Trust
Poole Hospital NHS Foundation Trust
Portsmouth Hospitals NHS Trust
Royal Berkshire NHS Foundation Trust
Royal Cornwall Hospitals NHS Trust
Royal Devon and Exeter NHS Foundation Trust
Royal Free London NHS Foundation Trust
Royal Liverpool and Broadgreen University Hospitals NHS Trust
Royal Surrey County Hospital NHS Foundation Trust

Royal United Hospital Bath NHS Trust
Salford Royal NHS Foundation Trust
Salisbury NHS Foundation Trust
Sandwell and West Birmingham Hospitals NHS Trust
Sheffield Teaching Hospitals NHS Foundation Trust
Sherwood Forest Hospitals NHS Foundation Trust
Shrewsbury and Telford Hospital NHS Trust
South Devon Healthcare NHS Foundation Trust
South Tees Hospitals NHS Foundation Trust
South Tyneside NHS Foundation Trust
South Warwickshire NHS Foundation Trust
Southend University Hospital NHS Foundation Trust
Southport and Ormskirk Hospital NHS Trust
St George's Healthcare NHS Trust
St Helens and Knowsley Hospitals NHS Trust
Stockport NHS Foundation Trust
Surrey and Sussex Healthcare NHS Trust
Tameside Hospital NHS Foundation Trust
Taunton and Somerset NHS Foundation Trust
The Dudley Group NHS Foundation Trust
The Hillingdon Hospitals NHS Foundation Trust
The Newcastle Upon Tyne Hospitals NHS Foundation Trust
The Princess Alexandra Hospital NHS Trust
The Queen Elizabeth Hospital, King's Lynn, NHS Foundation Trust
The Rotherham NHS Foundation Trust
The Royal Wolverhampton NHS Trust
The Whittington Hospital NHS Trust
United Lincolnshire Hospitals NHS Trust
University College London Hospitals NHS Foundation Trust
University Hospital Of North Staffordshire NHS Trust
University Hospital Of South Manchester NHS Foundation Trust
University Hospital Southampton NHS Foundation Trust
University Hospitals Birmingham NHS Foundation Trust
University Hospitals Bristol NHS Foundation Trust
University Hospitals Coventry and Warwickshire NHS Trust
University Hospitals Of Leicester NHS Trust
University Hospitals Of Morecambe Bay NHS Foundation Trust
Walsall Healthcare NHS Trust
Warrington and Halton Hospitals NHS Foundation Trust
West Hertfordshire Hospitals NHS Trust
West Middlesex University Hospital NHS Trust
West Suffolk NHS Foundation Trust
Western Sussex Hospitals NHS Foundation Trust
Weston Area Health NHS Trust
Wirral University Teaching Hospital NHS Foundation Trust
Worcestershire Acute Hospitals NHS Trust
Wrightington, Wigan and Leigh NHS Foundation Trust
Wye Valley NHS Trust

Following exclusion of trusts with fewer than 60 superspells, data from 137 institutions were analysed (Table 2). Individual trusts were not examined separately, as the analysis focused on variations in LOS and the scope for improvement.

Statistical analysis

The mean and standard deviation, alongside the minimum and maximum values, were determined for all outcomes. Descriptive statistics were calculated using SPSS Statistics Version 19.0 (IBM, Armonk, NY, USA). The relative risk calculation were based on 135 trusts, as data were unavailable for two trusts. As quality of the available data for other discharge outcomes (discharged other than to home, non-acute, acute, internal and unknown transfer, and unknown) was poor, they were not included in the analysis. Only the first 9 months of the 28-day readmission data were assessed as the final 3 months were not available at the time of analysis.

Results

There were 63,011 inpatient superspells across 137 trusts during the study period.

Table 3 shows the observed and case mix-adjusted expected superspell LOS and the difference in LOS, as well as 28-day readmission, discharge to home and in-hospital mortality rates. The mean observed superspell LOS was only 1.3 days less than the mean case-mix expected superspell LOS, at 22.1 days versus 23.4 days. However, there was a wide variation in observed LOS, at 21.4 days (range 12.3–33.7 days) versus 2.9 days (range 21.5–24.4 days) for the case mix-adjusted expected LOS. Figure 1 shows the mean superspell LOS for the 137 trusts; Figure 2 shows the difference between the expected and observed superspell mean LOS.

An average of 62.0% of patients (range 34.4%–89.6%) were discharged to home. A mean of 6.7% of patients died while in hospital (range of 3.6%–10.9%). The relative risk of in-hospital mortality ranged from 28.2 to 182.9 (Table 4). An average of 12.3% of patients were readmitted at 28 days (range 3.9%–23.0%). The relative risk of re-admission ranged from 34.8 to 203.2 (Table 4).

Discussion

A long LOS for FNOF patients is not desirable, as they have an increased risk of developing complications and losing their independence.[15] Studies show that patients who have early surgery have better mobilisation subsequently, and are

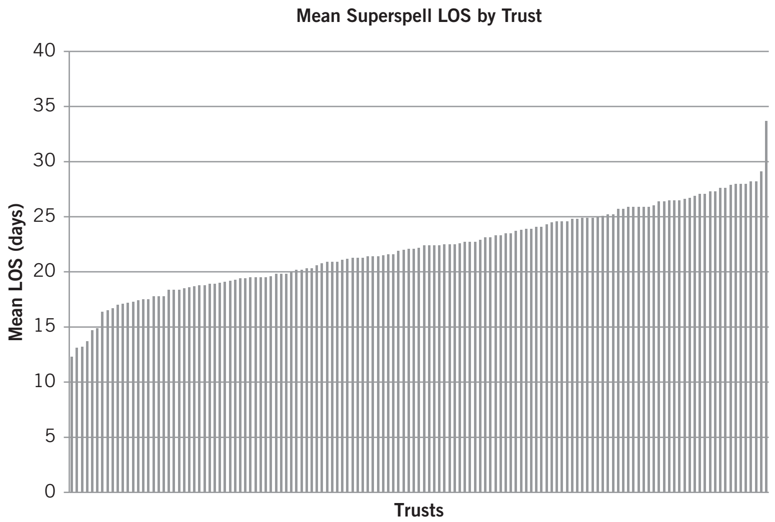

Figure 1 Mean superspell length of hospital stay (LOS) for all 137 trusts, by LOS

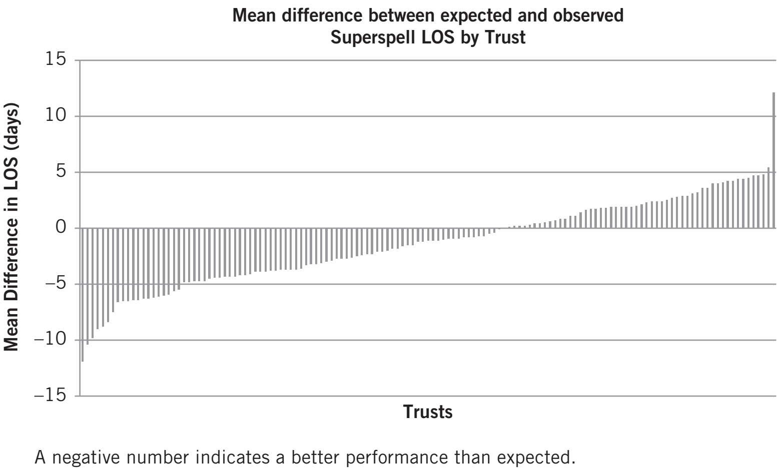

Figure 2 Difference between observed length of hospital stay (LOS) and case mix-adjusted expected LOS

therefore more likely to go home independently.[13,16] The wide range of observed LOS in our study is not likely to be due to case mix alone, as the range of case mix-adjusted expected LOS was less than 3 days. The factors taken into account by case mix-adjustment are comprehensive and include diagnosis/procedures/healthcare resource group, subgroup, age, sex, admission type, deprivation quintile and financial year. If the difference in LOS between trusts of 21 days is therefore not due to case-mix it is highly likely that the differences will be due to local processes and pathways. This finding is in line with the NHFD annual report,[1] which describes and challenges the variations in practice around England, Wales and Northern Ireland, and Egerod et al's audit,[14] which found significant variability in the treatment and care of FNOF patients in Denmark. Our finding also supports a 2014 study by Holt et al,[17] in which they found that the inter-hospital variation in outcomes for emergency admissions in England was related within individual providers, suggesting that systemic structural and process factors play a role.

It is therefore likely that the trusts with the shortest LOS have used interventions to organise care more effectively, and have introduced pathway changes that optimise the patient medically and physically pre-, intra- and postoperatively. An integrated multimodal approach is analogous and extremely similar to that of an enhanced recovery pathway. Enhanced recovery interventions adapted for FNOF may include the use of improved analgesia, such as femoral

Table 3 Mean (SD) and minimum and maximum values for all outcomes

	Trusts (N)	Mean (SD)	Minimum	Maximum
LOS superspells (days)				
Observed LOS	137	22.1 (3.8)	12.3	33.7
Expected LOS	137	23.4 (0.5)	21.5	24.4
Difference in LOS	137	-1.3 (3.8)	-11.9	12.1
Discharge outcome %				
Discharge home (usual place of residence)	137	62.0 (10.9)	34.4	89.6
In-hospital mortality	100	6.7 (1.5)	3.6	10.9
Readmission at 28 days* %	137	12.3 (3.2)	3.9	23.0

* Only the first 9 months of data were available for 28-day readmissions.
LOS = length of hospital stay; SD = standard deviation.

Table 4 Range of relative risk for mortality and readmission at 28 days

Relative Risk	Trusts (N)	Minimum	Maximum
Mortality	135	28.2*	182.9**
Readmission at 28 days	135	34.8*	203.2**

* The relative risk is outside the lower 95% confidence limit.
** The relative risk is outside the upper 95% confidence limit.

nerve block, improved medical optimisation, reduced time to surgery, early anaesthesiology assessment, a systematic approach to nutrition, fluid and oxygen therapy and urinary retention, geriatrician involvement in the medical management team, and effective discharge planning and liaison with social and community services.[13,18–21]

The large variability in patients being discharged to their usual place of residence (home) also suggests that there is a wide variation in discharge procedures and in the social and community support available. Hospitals with low rates of discharge to home may benefit from adopting procedures in line with the best-performing trusts. There is also a large variation across trusts in readmission rates at 28 days, the upper range being almost double the mean rate of readmission. The relative risk data again indicate that this variability is not due to the case mix. However, the figures give little insight into the reasons for readmission, and there are calls for further work to disaggregate surgical and medical reasons for readmission to understand more fully whether they could be reduced.[22] Previous research suggests that early readmission after FNOF surgery is largely due to medical causes, and is associated with higher mortality rates at 1 year.[23]

There is a very strong economic argument for adopting enhanced recovery pathways for FNOF patients, as top-performing trusts utilise their resources and capacity better than poorer performers. FNOF patients are reported to occupy 20%–25% of hospital beds and make up half of all hospital days for all fractures.[24] By reducing bed occupancy, both financial and resource pressures will be eased.[25]

While a strength of our study is the use of HES data, a potential weakness is the quality of the data coding. However, systematic reviews have found acceptable coding accuracy rates within HES data, with the quality of data improving in recent years.[26,27] It is nevertheless possible that there may be inter-hospital coding variability.[18] There may also be inaccuracies in the risk adjustment models used in HES data, although the covariates used have produced regression models with a discriminatory power comparable to those using clinical databases. It is therefore likely that the case mix-adjustment used here reflects a real difference in the quality of care, rather than simply inadequate adjustment.[18] A further limitation is that our analysis uses aggregated data. The next step would be to analyse the raw data, and produce regression models to examine the different outcomes. However, this would depend on gaining access to unsuppressed Health and Social Care Information Centre data, and on its validity and accuracy.

Conclusions

FNOF is the most frequent emergency surgical pathway seen in most English hospitals. There is considerable variation in LOS between trusts, with case-mixed adjusted data suggesting that this is due to differences in practice rather than the nature of the patients treated. There is significant scope for considerable improvements in the quality and efficiency of care in our hospitals, and we propose that this could be best achieved if clinicians experienced in enhanced recovery focused on FNOF pathways.

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