

## The use of rehabilitation beds following hip fracture leads to an increased length of stay

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The aim of this paper is to identify if there is a difference in length of stay following hip fractures when using rehabilitation beds. Prospective data was collected on all hip fracture admissions in patients over 50 years from May 2016 to February 2018 from ISD NHS Scotland to identify length of stay. It was found that patients discharged home via rehabilitation wards were less likely to have returned to their own home by 30 days post admission and were also significantly more likely to stay in hospital for 40 days or more when compared to patients discharged directly home. In conclusion, the use of community rehabilitation units has been thought to improve functional outcome scores for activities of daily living compared to discharge from surgical wards. This study has highlighted increased length of stay using rehabilitation beds also that further analysis is required for care pathways to make the best use of resources available to minimise hospital stay, bed usage/cost of care and quicker return to the patient's place of residence. It has also highlighted the huge variation across Scotland in the process of hip fracture care.

**Keywords:** Hip fracture, rehabilitation, hospital stay.

### INTRODUCTION

Hip fracture represents one of the most common, serious orthopaedic injuries to affect the elderly population. Changes in population demographics mean that the prevalence of this injury is likely to increase significantly over the next 10-15 years<sup>1</sup>. Approximately 76,000 hip fractures occurred in 2018 in the UK<sup>2</sup>. This injury represents a significant financial burden to the National Health Service associated with a relatively

long period of hospital stay in addition to surgical costs. Several authors have attempted to quantify the cost incurred during the inpatient treatment of a hip fracture patient. Both Judge et al and Lawrence et al. reported the mean total cost to be approaching £15,000 with the cost per night thought to be between £500 and £700 with around 85% of the cost attributable to ward care, highlighting the need to optimise the efficiency of inpatient care<sup>3</sup>.

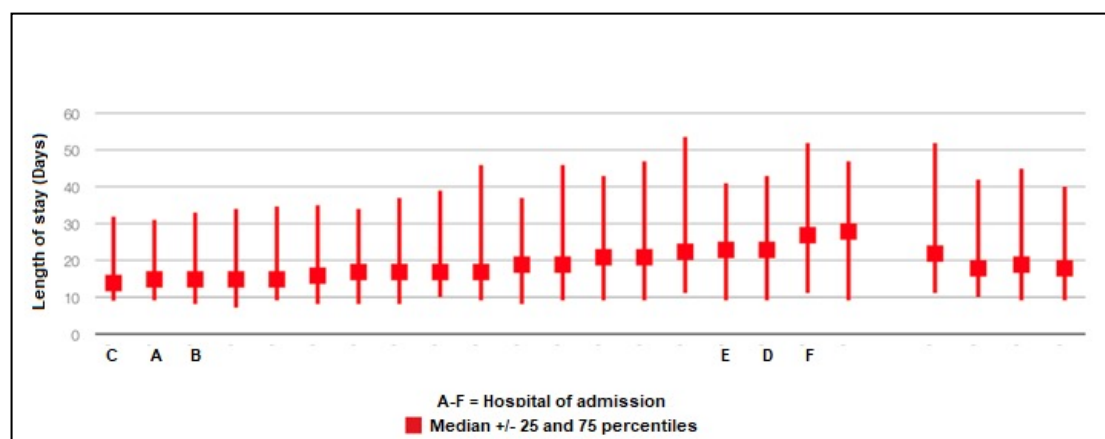


Fig. 1 — Variation in length of stay for hip fracture patients in Scotland.

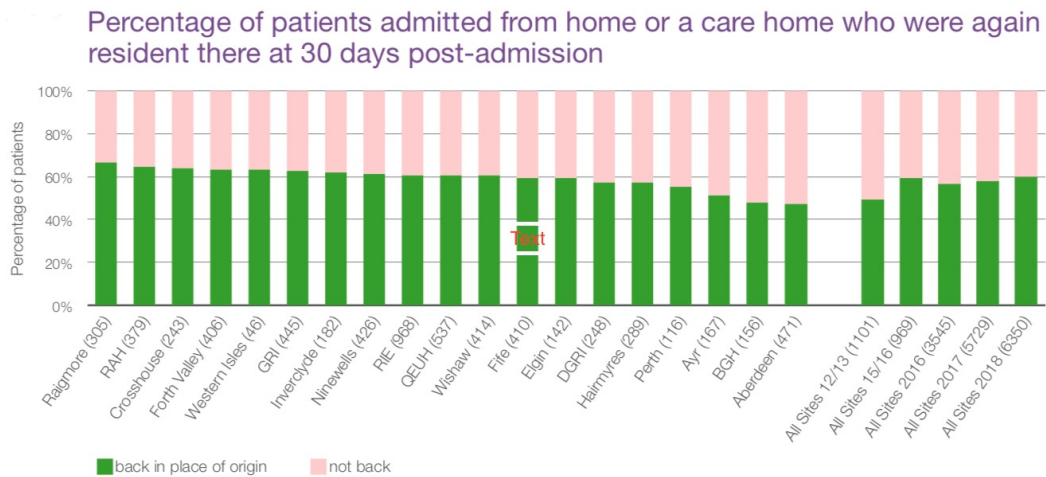


Fig. 2 — Percentage of patients admitted from a home or care home who were at original place of residence by 30 days post-admission.

The Scottish Hip Fracture Audit (SHFA) is a national quality improvement program tasked with monitoring and improving the standard of care for hip fracture patients across Scotland. This is achieved by monitoring care against published national standards. One of the principle aims of the SHFA is to standardise the management of hip fracture patients and to remove unnecessary variation.

Since the re-introduction of the SHFA in 2013, the median length of stay for hip fracture patients has fallen from 22 days to 17 days, however, there remains a significant and unexplained variation in the total length of stay (including hospital and step-down unit stay) across the country from 14 days to 28 days (Figure 1). Similar findings have been reported by the NHFD<sup>2</sup>.

One of the principle aims of the SHFA quality improvement program is to ensure that as many patients as possible are safely discharged to their pre-fracture place of residence. Again, there is significant variation noted across orthopaedic units in Scotland ranging from 65% achieving this in the best performing unit to 45% in the poorest performing unit based on the 2019 SHFA report. (Figure 2)

The pathway for most hip fracture patients involves a period of perioperative care in an acute orthopaedic ward followed by post-operative rehabilitation in

either the acute ward (with direct discharge to previous place of residence) or transfer to step-down care in an orthogeriatric rehabilitation unit. In this study we assess the relationship between the routine use of orthopaedic rehabilitation units and total length of stay following hip fracture.

### PATIENTS AND METHODS

Data were obtained from the Scottish Hip Fracture Audit (SHFA) database. This is a prospectively collected dataset administered by the Information Services Division of National Health Service Scotland to record information on all hip fracture admissions in patients over the age of 50 years. For the purposes of this study, patients who had been admitted from their own home (74% of all patients) and had a surgically managed neck of femur fracture between May 2016 to February 2018 were included. Patients who had sustained their fracture while either in residential care or while a hospital inpatient (total of 26% of patients) were excluded to avoid data contamination from case mix variation. After exclusions, 8208 patients were included in this study.

Initially, data were recorded and analyzed at an individual level using forward stepwise regression

Table I. — The impact of whether patients are discharged to home via rehabilitation on rate of discharge at 30 days and ongoing hospital stay at 40 days post-admission for surgically managed hip fracture

Dependent Variable	Independent Variable	Odds ratio (95% confidence interval)	p-value
Home by 30 days post-admission	Patient not discharged via rehabilitation unit	1	<0.001
	Patient discharged via rehabilitation unit	0.117 (0.104-0.132)	
Still in hospital on Day 40 post admission	Patient not discharged via rehabilitation unit	1	<0.001
	Patient discharged via rehabilitation unit	17.86 (5.12-21.11)	

analysis models. The dependent variables recorded were “Return to home within 30 days of admission”, and “Total hospital stay of 40 days or greater”. This was chosen rather than a total duration of hospital stay as for the purposes of the SHFA, follow up ends at 60 days post-discharge and so this would have left incomplete data for the almost 20% of patients yet to be discharged. The independent variables recorded were discharge via a rehabilitation unit, hospital of admission, age, gender, and surgical procedure. These were selected as measures of case mix. In both regression models, discharge via rehabilitation ward was the first variable selected in the forward stepwise procedure. The other independent variables were subsequently entered into the model. Length of stay in acute surgical ward and total length of hospital stay were also recorded although these variables were not entered into the model. Odds Ratios (O.R.), 95% confidence intervals (C.I. 95%) and p values were calculated with p values of <0.05 considered statistically significant.

**RESULTS**

Logistic regression analysis indicated that patients discharged home via rehabilitation wards were less likely to have returned to their own home by 30 days post-admission (O.R. 0.117, 95% C.I. 0.104-0.132)  $p < 0.001$  and were also significantly more likely to stay in hospital for 40 days or more when compared to those patients discharged directly to home (O.R. 17.86, 95% C.I. 5.12-21.11)  $p < 0.001$ .

The other four independent variables were also entered into each model (Table II). This included the treating hospital and indicated a hospital-specific influence on length of stay and return home rates.

**Table II.** — Other factors contributing to rate of discharge at 30 days and ongoing hospital stay at 40 days post-admission for surgically managed hip fracture

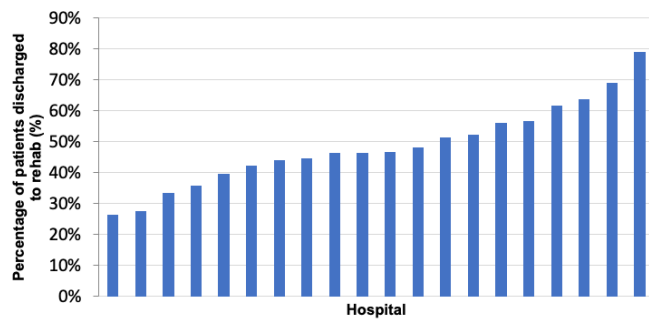
Dependent Variable	Independent Variable	p-value
<b>Home by 30 days post-admission</b>	Age (5 categories)	<0.001
	Type of operation (7 categories)	<0.001
	Hospital (20 hospitals)	<0.001
	Gender	<0.001
<b>Still in hospital on Day 40</b>	Hospital (20 hospitals)	<0.001
	Age (5 categories)	<0.001
	Type of operation (7 categories)	<0.001
	Gender	0.003

Large variation was observed in individual patient length of admission between hospitals, and this was

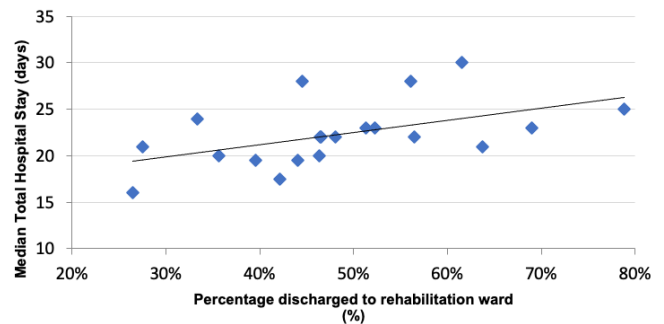
suggestive of significant variation in practice. For this reason, the two dependent variables were analysed at a hospital level regarding use of rehabilitation beds.

The previously mentioned relationship between total length of stay and the use of rehabilitation wards was analysed. Figure 3 demonstrates the wide variation between hospitals in the use of rehabilitation beds ( $p = <0.001$ ).

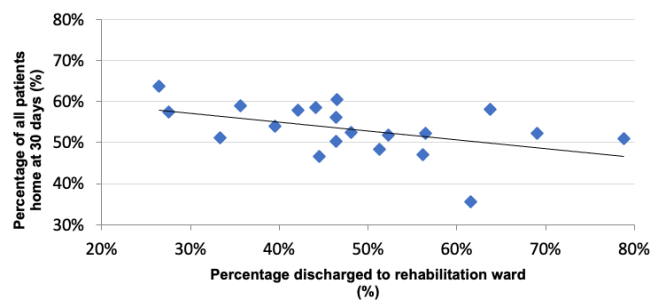
It might reasonably be assumed that units which were higher volume users of rehabilitation beds would have greater lengths of total hospital stay. Figure 4 confirms a positive correlation between median length of hospital stay and the percentage of patients from a unit discharged following transfer to a rehabilitation ward ( $p = 0.02$ ).



**Fig. 3** — Percentage of hip fracture patients discharged home via rehabilitation, units by hospital.



**Fig. 4** — Length of stay in relation to percentage of hip fracture patients discharged to rehabilitation ward in each hospital.



**Fig. 5** — Percentage of all patients home at 30 days in relation to the percentage of patients discharged to rehabilitation ward in each hospital.

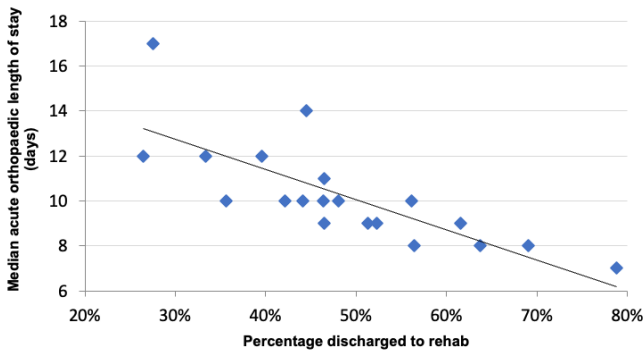


Fig. 6 — Acute ward length of stay in relation to percentage of patients discharged to rehabilitation ward in each hospital.

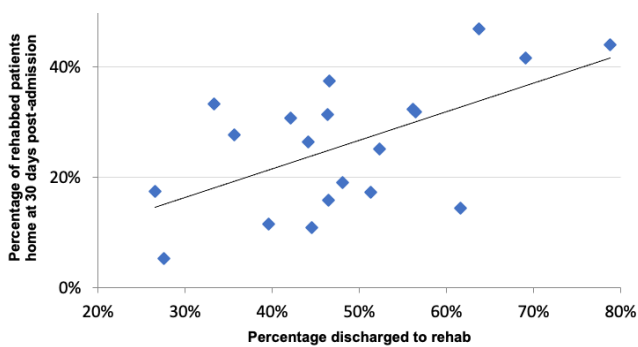


Fig. 7 — Percentage of patients discharged to home via rehabilitation at 30 days in relation to the percentage of patients discharges to rehabilitation ward in each hospital.

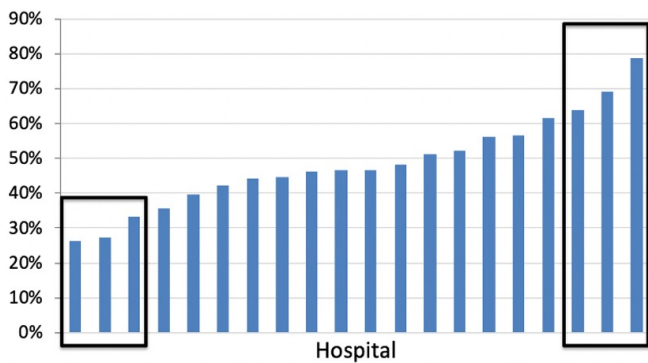


Fig. 8 — Percentage of patient discharged to rehabilitation by hospital.

Similarly figure 5 demonstrates a negative correlation between the percentage of patients discharged back to their own to home within 30 days of admission and the percentage of patients transferred to a rehabilitation ward ( $p= 0.04$ ).

Figure 6 documents the relationship between length of acute orthopaedic ward stay and the use of rehabilitation wards. The length of acute orthopaedic stay is negatively correlated with the use of rehabilitation ward use highlighting the practice of routine early discharge from the acute hospital setting.

Figure 7 documents the relationship between the percentage of patients discharged to rehabilitation wards and the percentage of patients from these wards who are home by 30 days following initial admission. Units with a higher percentage of patient transfer to rehabilitation wards in fact have a higher relative percentage of patients discharged home by 30 days following initial admission ( $p=0.007$ ). This finding most likely reflects the fact that hospitals with low levels of rehabilitation ward use tend to transfer patients who are likely to have longer period of hospitalisation following hip fracture.

The percentage of hip fracture patients who survived to 60 days post-admission was not related to percentage of patients who were discharged to rehab ( $r=-0.28$ ,  $p=0.24$ ), median total hospital stay ( $r=-0.18$ ,  $p=0.45$ ) or percentage who were home at 30 days ( $r=0.36$ ,  $p=0.11$ ). Mean age and the percentage discharged to rehab were not strongly related ( $r=0.20$ ,  $p=0.40$ ).

To investigate this issue further subgroup analysis was completed on the 3 lowest and 3 highest users of orthopaedic rehabilitation in order to determine more clearly the effect of both high and low use of this service on median length of hospital stay.

Overall, only 27% of patients were discharged via a rehabilitation from the three lowest users of rehabilitation units. This contrasted markedly with the 71% of patients discharged via rehabilitation from the three highest users of rehabilitation. This represents a difference of more than 2.5 times. Can this difference be explained by patient case mix, or does it simply reflect difference in routine practice? Of the case mix variables analysed only age and type of operation, were found to show statistically significant differences. Patients discharged via rehabilitation were more likely to be older (mean age of 83 vs 75 years) and less likely to have undergone Total Hip Replacement (2% Vs 13%)  $p<0.001$ . The difference in use of rehabilitation is so large that the case mix differences alone cannot account for the difference observed.

We subsequently analysed the total length of stay for each of these cohorts. Length of stay was 16 days for the low rehabilitation use group versus 23 days in the high use group. The percentage of patients discharged home at 30 days was 57% vs. 53% respectively.

## DISCUSSION

This study highlights the huge variation in the process of hip fracture care throughout Scotland. At a time when efforts are being made to standardise care, this behaviour bucks the trend. The data also

shows the secondary effect on the time taken for these patients to return to their own homes if discharged via a rehabilitation unit. The SHFA has focussed on reducing length of stay to both benefit patients and reduce the cost of inpatient care which has been shown to increase significantly with length of stay<sup>4</sup>. Use of community rehabilitation units has previously been shown to increase length of stay after hip fracture<sup>5</sup>. Some might suggest that it leads to improved functional outcome scores for activities of daily living compared to discharge from acute surgical ward<sup>6</sup>. This would be contested by the authors of other studies that show that most patients in step-down units fail to achieve the 10 minutes of activity per day that has been recommended for this cohort by many sources<sup>7,8,9</sup>. Furthermore, these patients may be inactive for up to 23 of 24 hours per day<sup>10</sup> probably contributing to why patients admitted to hospitals that are greater users of rehabilitation units spend longer in hospital as shown in Figures 4 and 5.

Since the start of the project in 2013, the Scottish Hip Fracture Audit has led to a marked reduction in the median length of total hospital stay from 22 to 17 days in the 2019 report<sup>1</sup>. Despite this, there is still room for improvement. The reasons for prolonged hospital stay are numerous and hip fracture patients represent a heterogeneous group of patients ranging from the fit, independently mobile individual to the bed bound patient with multiple, severe medical co-morbidities, however the huge variation across the country cannot be explained by difference in patient case-mix alone. Whether the model of care is discharge to home from acute ward or early discharge via rehabilitation ward, the focus of care must be the same, to optimise rehabilitation to expedite fitness for discharge to home. There are various strategies to address this. Earlier aggressive rehabilitation with more frequent, larger daily amounts of postoperative rehabilitation in acute-care hospitals is independently associated with better recovery in activities of daily living at discharge from the acute-care hospital after hip fracture surgery in patients with dementia<sup>11</sup>. It is likely that these results can be extrapolated through to those without cognitive impairment, but these results can only be achieved in either cohort with a significant increase in resources on the acute orthopaedic/orthogeriatric wards or in the step-down units.

Given the complexity of these patients, it seems unlikely that a “one size fits all” approach to therapy will in reality “fit all”. Individualised rehabilitation programs have been shown to reduce length of stay after hip fracture<sup>12</sup> and these can be applied in the acute or step-down setting without a significant upheaval. It

is also required in the community where an increase in both therapy and care at home resources would be beneficial to support this frail cohort and allow quicker return to home. Resource however comes at a cost. Studies from Norway have demonstrated that the care in the community already accounts for up to 50% of total cost of care<sup>13</sup>. This reiterates the need for earlier engagement with these patients in the hope of optimising rehabilitation, expediting independence and discharge for those who may achieve it.

Prolonged rehabilitation with continuity of therapy from inpatient stay through to the home has been shown to increase activity levels at longer follow up, sustained up to 1-year post injury<sup>14</sup>. It is yet to be proven if this is cost effective. There is ongoing work to assess the benefit of prolonged functional home-based physiotherapy on the likes of community ambulation, a huge landmark for this patient cohort<sup>15</sup>.

It is acknowledged that there are various models of care for the rehabilitation of hip fracture patients, be it discharge to home from the acute ward, or following a period in a rehabilitation unit. This study has highlighted that further analysis is required throughout Scotland to streamline care pathways for these patients and make the most of the resources that are available with the aim being to minimise duration of hospital stay, reduce bed usage and cost of care, resulting in quicker return to the patient’s regular place of residence.

Data were obtained from the Scottish Hip Fracture Audit (SHFA) database.

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