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Does achieving the 'Best Practice Tariff' criteria for fractured neck of femur patients improve one year outcomes?

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ABSTRACT

Introduction: 'Best Practice Tariff' (BPT) criteria have been developed to improve peri-operative care for hip fracture patients. This paper aims to explore the impact of BPT criteria on 1-year outcomes.
Patients and methods: Anonymised data were acquired from the National Hip Fracture Database (NHFD) for patients presenting to Bradford Royal Infirmary with a fractured neck of femur during the period April 2011 to December 2015. Two study groups were defined: those that achieved the BPT uplift criteria, and those that did not. Three primary outcome measures were identified: one year survival, mobility status and residential status. Further analysis was performed to ascertain whether achieving any individual BPT criterion significantly affected 1-year outcomes.
Results: 1414 cases were included, 784 (55%) of whom met the BPT criteria. The 1-year survival rate of the BPT-achieved group was 67.7%, compared with 61.4% in the non-BPT group (relative risk reduction 10.3%, p = 0.014). Mobility status declined by at least one grade in 50.8% of the BPT-achieved group, compared with 60.8% of the non-BPT group (risk reduction 16.4%, p = 0.003). BPT achievement had no significant effect on residential status at one year.
Multivariate analysis identified that post-operative Abbreviated Mental Test Score (AMTS) and falls assessment were significantly associated with reduced 1-year mortality. Similarly, both pre- and post-operative AMTS assessments resulted in greater potential to return to pre-morbid mobility level.
When controlling for potential confounders (age, gender, ASA grade, pre-morbid mobility and residential status) logistic regression modelling showed that achieving the BPT criteria was associated with a 30% increase in the odds of survival at one year (p = 0.046).
Discussion: Achieving the BPT requirements has a significant impact on 1-year mortality and return to pre-morbid mobility level. The effect of AMTS and falls assessments on these outcomes may be due to their properties as surrogate markers for more thorough and considered peri-operative assessment.
Conclusions: Few studies describe the effect of BPT criteria on 1-year outcomes; therefore the results presented here help to vindicate the investments made in the scheme. Furthermore, these results may help steer subsequent revisions to BPT requirements by encouraging greater focus on peri-operative assessment and interventions.

Introduction

Hip fractures are a common injury presenting to orthopaedic departments with an incidence of approximately 65,000 each year in the UK [1], estimated to rise to 100,000 per year by 2020 [2], at a total cost to NHS and social care of around £1 billion [3]. The 30 day mortality rate following hip fracture is 7.1% [3], rising to between 10% and 30% at one year. [2,3], In an attempt to standardise and improve care, in April 2010, the Department of Health introduced the 'Best Practice Tariff' uplift. This represents a financial reward for meeting set criteria when managing patients with fragility fractures of the hip, with the key focus on encouraging prompt surgery and appropriate involvement of geriatric medicine [4]. These criteria are applied to patients aged over 60, and at the time of writing include [4]:

1 Time to surgery within 36 h from arrival in an emergency department, or time of diagnosis if an inpatient, to the start of anaesthesia.
2 Admitted under the joint care of a consultant geriatrician and a consultant orthopaedic surgeon.

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3 Admitted using an assessment protocol agreed by geriatric medicine, orthopaedic surgery and anaesthesia.
4 Assessed by a geriatrician in the preoperative period: within 72 h of admission.
5 Postoperative geriatrician-directed multi-professional rehabilitation team.
6 Fracture prevention assessments: falls and bone health.
7 Pre and post-operative Abbreviated Mental Test Score assessment. (Added to requirements from 1 st April 2012 [5])

Where all of the above criteria are met, initially a tariff uplift of £445 was paid, subsequently increased to £1335 when the BPT was revised [6]. In cases where one or more targets are not met, or documentation is incomplete, the uplift is withheld, with compliance and outcome data collected and stored by the National Hip Fracture Database (NHFD).

Although there is a wealth of evidence to support interventions such as prompt surgery and thorough peri-operative assessment [7–9], there are relatively few papers exploring the direct influence of the introduction of BPT on hip fracture outcomes, especially at one year post injury. A recent study found that 1-year mortality was reduced in those patients that achieve BPT compared with those that did not (28.6% versus 42% respectively, $p < 0.005$) [10].

Furthermore, multivariate analysis identified AMTS assessment and expedited surgery as individual factors that significantly improved survival both at 30 days and one year. Another study found no significant difference in 1-year mortality between those that achieved the BPT and those that did not [11].

The aim of this study is to examine the effect of achieving BPT on 1-year outcomes, including return to pre-morbid mobility and residential status in addition to survival.

Patients and methods

Anonymised data were acquired from NHFD records, identifying all hip fracture admissions to a single trauma unit in the UK during the period April 2011 to December 2015. Data supplied to the NHFD for each hip fracture episode was collected by a dedicated specialist nurse during the patient's hospital admission for baseline data, and via telephone survey or clinic appointment for one year follow up data. Two study groups were defined: Patients who achieved all BPT criteria (BPT+) and those that did not (BPT-). One year follow up data for all included patients was identified for three primary outcome measures: mortality, mobility and residential status. Mobility and residential status were graded (Tables 1 and 2 respectively), and comparisons were made based on deterioration in each grade observed at one year.

During the study period, revisions were made to the NHFD data collection process that simplified the categories that could be selected to describe mobility status. This necessitated conversion of earlier patient records to the newer version in order to allow direct comparison between all included patients, this process illustrated in Fig. 1. Patients aged under 60 or whose one year follow up data was entirely absent were excluded, however patients with partially complete data sets remain included.

Table 1
Mobility Status Grade.

Freely mobile without aids	5
Mobile outdoors with one aid	4
Mobile outdoors with two aids or frame	3
Some indoor mobility but never goes outside without help	2
No functional mobility	1

Table 2
Residential Status Grade.

Own home/sheltered housing	4
Residential care	3
Rehabilitation unit	2
Nursing care	
Acute hospital	1
This hospital site	
Other hospital trust	
Other hospital site of this trust	
Already in hospital	
Other / Dead	N/A

Statistical analysis

Patient demographics for the two study groups were summarised and compared for systematic differences between groups using a Wilcoxon Rank Sum test or Pearson's Chi-square, as appropriate. Logistic regression modelling was used to control for potential confounders between the two study groups with regard to age, gender, American Society of Anesthesiologists (ASA) grade, pre-morbid mobility and residential status.

Primary outcome measures were analysed using a Chi-squared test, and multivariate regression analysis was performed to identify any statistically significant impact on 1-year outcomes generated by each individual BPT criterion.

Results

Data for 1546 consecutive hip fractures were retrieved from the NHFD. 50 patients were aged under 60 so were ineligible for BPT and were excluded (see Fig. 2). A further 82 cases had completely absent outcome data at one year and were also excluded, effectively a 5.5% loss to follow up. 1414 hip fractures occurring in 1354 patients were included in the analysis. Patient demographics are detailed in Table 3.

There were no statistically significant differences between the demographics of the two study groups with regard to age or gender ($p = 0.219$ and $p = 0.742$ respectively), however there were statistically significant differences with respect to ASA grade, pre-morbid mobility and residential statuses (see Table 3). Logistic regression modelling revealed that patients with an ASA grade of 4 or 5 were significantly less likely to achieve the BPT criteria than ASA 1 patients. Furthermore, patients admitted from residential care were more likely to achieve the uplift than patients who sustained a hip fracture while an inpatient in an acute hospital setting. Although differences in BPT achievement rates between all ASA, mobility and residential grades were identified, no additional comparisons were statistically significant (see Table 4).

784 cases (55%) achieved the BPT criteria (BPT+). One year survival data is shown in Table 5, with 531/784 (67.7%) of the BPT + cases having survived one year, compared with 387/630 (61.4%) in the BPT- group, producing a relative risk reduction of 10.3% ($p = 0.014$, 95% CI 1.93–19.26).

Mobility grade declined by at least one grade (Table 6) in 270/531 (50.8%) of BPT + cases alive at one year, compared with 233/383 (60.8%) of BPT- cases, a relative risk reduction of 16.4% ($p = 0.003$, 95% CI 6.1–25.5).

Decline in residential status (a measure of increased dependence on social care, shown in Table 7) was virtually identical in both groups: 87/531 (16.4%) in BPT+, 63/383 (16.4%) in BPT-.

Logistic regression modelling was performed in order to control for potential confounding factors presented by differences in the patient demographics represented in each study group. The unadjusted odds ratio for 1-year survival was 1.41 ($p = 0.004$, 95% CI 1.12–1.78), and for mobility decline at one year was 0.7

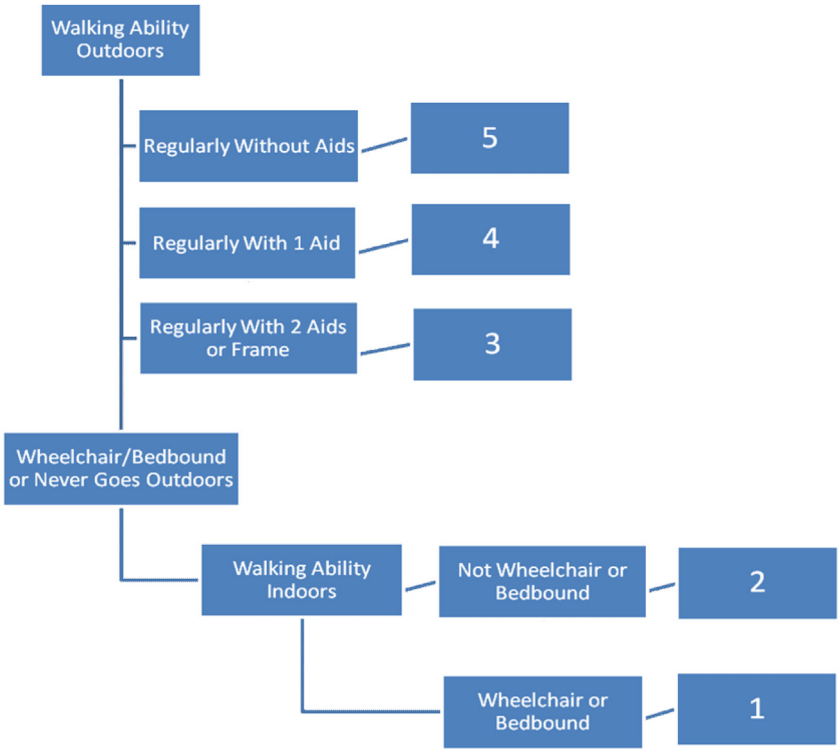

Fig. 1. Mobility conversion flowchart.

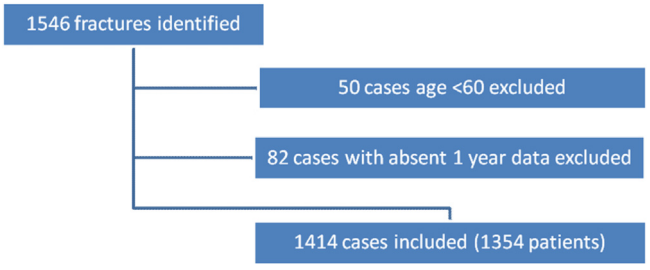

Fig. 2. Case selection flowchart.

(p = 0.014, 95% CI 0.52–0.93). When controlling for age, gender, ASA, pre-morbid mobility and pre-morbid residential status, this resulted in an odds ratio for 1 year survival of 1.3 (p = 0.046, 95% CI 1.004–1.68), and odds ratio for decline in mobility 0.85 (p = 0.337, 95% CI 0.607–1.187).

In order to identify whether any individual BPT criterion has a significant impact on 1-year outcomes, multivariate regression analysis was performed (Tables 8–10). This revealed both post-operative AMTS and falls assessment were associated with improved 1-year survival (risk ratio 1.195 and 1.301 respectively, $p < 0.01$). For mobility status at one year, cases who underwent pre- and post-operative AMTS assessment were significantly more likely to return to pre-morbid mobility levels (mobility grade declined by ≥ 1 grade: risk ratio 0.818 and 0.829 respectively, $p < 0.01$). With regard to residential status, undergoing bone protection assessment was a statistically significant risk factor for decline in residential grade at one year (risk ratio 2.04, p = 0.04).

Discussion

There are numerous studies highlighting the impact on hip fracture outcomes that each of the factors included in the BPT criteria can generate. Inpatient mortality has been shown to be greater in patients who underwent delayed surgery (>48 h from the event) [12], although it is acknowledged that patients with multiple co-morbidities are more likely to experience delays to surgery. A meta-analysis has shown that even after adjusting for such confounding pre-operative factors, surgical delay still had a significant influence on mortality [13]. Numerous studies have investigated the effect of delayed surgery on 1-year mortality and demonstrated patients undergoing surgery within two days had lower 1-year mortality [14–16].

With regard to effect on mobility, one study examined the influence of delayed surgery on functional outcomes following hip fracture surgery [17]. Of patients with no delay to surgery, 79% were ambulatory on post-operative day 3, compared to 38% in the group with delayed surgery [17].

There are however several studies that suggest delays in hip fracture surgery do not necessarily cause worse outcomes [18]. A recent paper showed there was no significant difference in either 3-month or 1-year mortality in patients operated on within two days and those operated on at 3–4 days [19]. A delay of longer than 4 days, however, was associated with a higher 1-year mortality [19]. A similar study showed that, when adjusting for age, dementia, chronic co-morbidities and functionality, there was no difference in mortality in delays up to 120 h [20]. A recent systematic review found studies adopting a more careful methodology were less likely to report beneficial effects of early surgery [21], while another suggests that early surgery within 12–48 h may be beneficial in fitter (ASA 1–2) patients, but potentially inappropriate in patients with significant correctable comorbidities [22].

The results presented by our study support the efforts made by clinicians to achieve the BPT criteria for hip fracture patients as successful achievement of BPT uplift significantly improves 1-year survival and return to pre-morbid mobility. Previous studies have highlighted the importance of early operative intervention for hip fracture outcomes [10], however the data presented here suggests peri-operative AMTS and falls assessment were more influential on

Table 3
Patient Demographics.

	BPT+ (784 cases)	BPT- (630 cases)	Comparison
Age	60.2–102.5 (Mean 83.4)	60.1–101.6 (Mean 82.9)	Wilcoxon rank sum: p = 0.219
Gender	Male: 224 (28.6%) Female: 560 (71.4%)	Male: 175 (27.8%) Female: 455 (72.2%)	Pearson Chi^2: p = 0.742
ASA			
1	12 (1.5%)	6 (1.0%)	**Pearson Chi^2: p < 0.001**
2	149 (19.0%)	79 (12.5%)	
3	466 (59.4%)	249 (39.5%)	
4	152 (19.4%)	156 (24.8%)	
5	5 (0.6%)	20 (3.2%)	
Unknown	0	120 (19.0%)	
Pre-Morbid Mobility			
1	9 (1.1%)	14 (2.2%)	**Pearson Chi^2: p = 0.009**
2	232 (29.6%)	140 (22.2%)	
3	75 (9.6%)	64 (10.2%)	
4	177 (22.6%)	137 (21.7%)	
5	291 (37.1%)	275 (43.7%)	
Pre-Morbid Residential Status			
1	42 (5.4%)	48 (7.6%)	**Pearson Chi^2: p < 0.001**
2	57 (7.3%)	59 (9.4%)	
3	129 (16.5%)	52 (8.3%)	
4	556 (70.9%)	465 (73.8%)	
Unknown	0	6 (1%)	

Table 4
Logistic regression - Odds of achieving BPT criteria by patient demographics.

Demographic	Odds Ratio	p-value	95% CI
ASA 1	1		
ASA 2	0.927	0.885	0.332–2.588
ASA 3	0.752	0.579	0.275–2.059
ASA 4	**0.341**	**0.041**	**0.122–0.956**
ASA 5	**0.083**	**0.001**	**0.02–0.342**
Residential Grade 1	1		
Residential Grade 2	1.124	0.7	0.619–2.04
Residential Grade 3	**2.841**	**<0.001**	**1.607–5.021**
Residential Grade 4	1.304	0.276	0.809–2.103
Mobility Grade 1	1		
Mobility Grade 2	1.989	0.169	0.747–5.294
Mobility Grade 3	1.478	0.457	0.528–4.131
Mobility Grade 4	1.701	0.296	0.629–4.602
Mobility Grade 5	1.179	0.742	0.442–3.147

Table 5
One year survival.

1 year Survival	BPT+	BPT-
Alive	531	387
Dead	253	243
Total	784	630
Risk	0.677	0.614
Risk Ratio	**1.103 (95% CI: 1.019–1.192, p = 0.014)**	

Table 6
One year mobility status.

	BPT+	BPT-
No Change/Improved	261	150
Decline by ≥1 grade	270	233
Total	531	383
Risk	0.508	0.608
Risk Ratio	**0.836 (95% CI: 0.744–0.939, p = 0.003)**	

1-year outcomes. The individual beneficial effect of these criteria could be explained by their properties as surrogate markers for more focused and considered peri-operative care and assessment. Conversely, AMTS and falls assessments may not be performed peri-operatively when a patient is too unwell to successfully engage with each test.

The impact of these findings would be to place greater emphasis on peri-operative care in future revisions to the BPT criteria. Previous studies have highlighted the impact of post-operative delirium on functional outcomes following hip fracture [23], and there is increasing evidence highlighting the impact on outcomes by greater orthogeriatrician involvement in hip fracture patient care [24]. Indeed, a recent revision in April 2017 to the BPT criteria that replaces post-operative AMTS assessment with the 4AT delirium screen [25], a more detailed cognitive assessment, as well as adding physiotherapy and nutritional assessments to the requirements would appear to echo this conclusion [26]. There is scope for future studies examining 1-year outcomes following this change that may well add further weight to this theory.

Although overall achieving the BPT had no significant impact on residential status at one year, individual analysis identified bone protection assessment as a risk factor for decline in residential status at one year. This might again be a reflection of more thorough medical and social care needs assessment peri-operatively, and rather than resulting in a greater chance of returning to the patients previous level of independence, it may actually identify those patients who already required higher levels of social care before their admission with a hip fracture.

Table 7
One year residential status.

	BPT+	BPT-
No Change/Improved	444	320
Decline by ≥1 grade	87	63
Total	531	383
Risk	0.164	0.164
Risk Ratio	0.996 (95% CI: 0.741–1.34, p = 0.979)	

Table 8
One year survival - Multivariate analysis.

BPT Criteria	Achieved	Not Achieved	Risk ratio	95% CI	p-value
Surgery <36h	677/1011 (67%)	232/358 (64.8%)	1.033	0.946 – 1.128	0.457
Orthogeriatric review <72h	737/1138 (64.8%)	180/274 (65.7%)	0.986	0.896 – 1.085	0.772
Pre-operative AMTS assessment	727/1110 (65.5%)	191/304 (62.8%)	1.042	0.947 – 1.148	0.388
Post-operative AMTS assessment	**734/1088 (67.5%)**	**184/326 (56.4%)**	**1.195**	**1.077 – 1.326**	**<0.001**
Falls Assessment	**876/1331 (65.8%)**	**42/83 (50.6%)**	**1.301**	**1.048 – 1.614**	**0.005**
Bone Protection	832/1283 (64.8%)	86/131 (65.6%)	0.988	0.867 – 1.125	0.855

Table 9
Decline in mobility grade at one year - Multivariate analysis.

BPT Criteria	Achieved	Not Achieved	Risk ratio	95% CI	p-value
Surgery <36h	359/674 (53.3%)	139/231 (60.2%)	0.885	0.78 – 1.001	0.069
Orthogeriatric review <72h	394/736 (53.5%)	108/177 (61.0%)	0.877	0.766 – 1.005	0.072
Pre-operative AMTS assessment	**382/726 (52.6%)**	**121/188 (64.4%)**	**0.818**	**0.72 – 0.928**	**0.004**
Post-operative AMTS assessment	**387/732 (52.9%)**	**116/182 (63.7%)**	**0.829**	**0.729 – 0.944**	**0.008**
Falls Assessment	482/875 (55.1%)	21/39 (53.8%)	1.023	0.76 – 1.376	0.879
Bone Protection	457/831 (55%)	46/83 (55.4%)	0.992	0.81 – 1.215	0.941

Table 10
Decline in residential status at one year - Multivariate analysis.

BPT Criteria	Achieved	Not Achieved	Risk ratio	95% CI	p-value
Surgery <36h	109/674 (16.2%)	41/231 (17.7%)	0.911	0.657 – 1.263	0.578
Orthogeriatric review <72h	123/736 (16.7%)	26/177 (14.7%)	1.138	0.77 – 1.68	0.513
Pre-operative AMTS assessment	116/726 (16%)	34/188 (18.1%)	0.883	0.624 – 1.25	0.487
Post-operative AMTS assessment	118/732 (16.1%)	32/182 (17.6%)	0.917	0.643 – 1.308	0.634
Falls Assessment	147/875 (16.8%)	3/39 (7.7%)	2.184	0.729 – 6.542	0.133
Bone Protection	**143/831 (17.2%)**	**7/83 (8.4%)**	**2.04**	**0.989 – 4.21**	**0.04**

Although there were statistically significant differences identified between the two study groups with respect to ASA, pre-morbid mobility and pre-morbid residential status, the clinical significance of these differences is not clear. It was shown that patients with higher ASA grades (as an indicator of multiple comorbidities and higher surgical risk) were more likely to miss BPT criteria and not achieve the uplift. This is perhaps not unexpected, as patients with more complex medical problems often require more comprehensive medical optimisation prior to surgery and experience an appropriate delay which may cause them to breach the 36 h to surgery target. Similarly, patients admitted from residential care were statistically more likely to achieve the criteria than patients who sustained a hip fracture while already an inpatient in hospital. This may again reflect a higher level of fitness for surgery in more independent patients, with an associated reduced risk of delay to surgery.

In order to control for these potential confounders, logistic regression modelling was performed. This showed that even when controlling for age, gender, ASA grade, pre-morbid mobility and residential status, achieving the BPT criteria was associated with a 30% increase in the odds of survival at 1 year.

One limitation to note in this study is that the data was obtained primarily from NHFD records alone, with only selective corroboration with hospital held records in certain cases to correct obvious errors, such as negative values for time to surgery or orthogeriatrician review. Data collection became increasingly comprehensive throughout the study period, reflecting the increase in BPT achievement rate that was also observed. The implication of this is that a proportion of patients in the BPT- group may well have in fact received treatment of a sufficient standard to achieve the BPT criteria, but were not recorded as having done so due to inadequate documentation. This may influence the results so as to underestimate the overall impact of achieving the BPT criteria on outcomes.

Furthermore, data could only be collected up to December 2015, as beyond this date the NHFD ceased collating one year outcome data, preventing further expansion of the study cohort. The adjustments to the BPT criteria that occurred in April 2017, replacing post-operative AMTS assessment with a more comprehensive delirium assessment may also limit further direct comparison with future cohorts of hip fracture patients.

The overall success rate for achieving the BPT uplift in our unit during the study period was 55%, however the quarterly values for BPT achievement improved significantly, with 0% during the first year rising to between 80–90% for the last year of the study, the trend shown in Fig. 3. The dramatic improvement in BPT achievement rate noted after the first year likely represents a lag time between introduction of the scheme and full implementation within the trust systems. In particular, improved accuracy and completion of data capture is likely to account for a significant proportion of the early rate increase, rather than a drastic shift in clinical care standards, which serves to explain why a similarly dramatic improvement in 1-year survival is not observed over the same time period. However, the aim of the BPT scheme is to improve hip fracture care as a whole, and the high rate of BPT achievement attained does reflect a significant improvement in the hip fracture service provided at the unit. While the 1-year survival rate overall remains relatively static throughout the study period at approximately 65%, there are fluctuations that appear to mirror the rate of BPT achievement at each time point. This further supports the notion that improving perioperative care of hip fracture patients via the BPT scheme does improve survival even at 1 year post-injury.

In conclusion, these results serve to vindicate the efforts employed by trusts to achieve the BPT targets, as a method of improving inpatient management of hip fracture patients, as well as suggesting potential avenues to pursue in future revisions to the

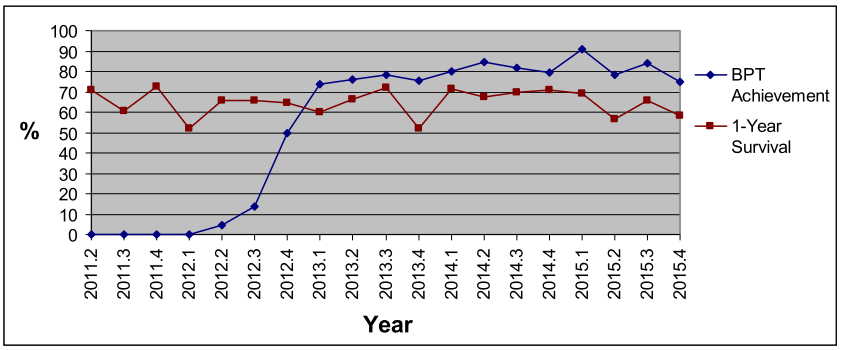

Fig. 3. Hip fracture trends at Bradford Royal Infirmary.

BPT criteria in the form of greater focus on peri-operative medical and social care assessment, with the aim of further improving long term outcomes for hip fracture patients.

Conflict of interest

None.

References

[1] Royal College of Physicians. National Hip Fracture Database (NHFD) Annual Report. 2017 Available at https://nhfd.co.uk/files/2017ReportFiles/NHFD-AnnualReport2017.pdf [Accessed 24 November 2018].

[2] Baker PN, Salar O, Ollivere BJ, Forward DP, Weerasuriya N, Moppett IK, et al. Evolution of the hip fracture population: time to consider the future? A retrospective observational analysis. BMJ Open 2014;4(4)e004405.

[3] Royal College of Physicians. National Hip Fracture Database annual report 2016. London: RCP; 2016 Available at https://www.nhfd.co.uk/Report2016 [Accessed 24 November 2018].

[4] Royal College of Physicians. National Hip Fracture Database - Best Practice Tariff User Guide. London: RCP; 2010 Available at https://www.nhfd.co.uk/20/hipfractureR.nsf/0/9b0c5ea2e986ff56802577af0046b1df/$FILE/Best%20Practice%20Tariff%20User%20Guide.pdf. [Accessed 25 November 2018].

[5] NHFD February newsletter. 2017 Available at http://www.nhfd.co.uk/20/hipfractureR.nsf/0/1d3307340c2ef4cb802579b1005af6a4/$FILE/NHFD%20%20Newsletter%20February%202012.pdf [Accessed 13 June 2017].

[6] Department of Health. Payment by results guidance for 2013–14. Leeds: Payment by Results Team, Department of Health; 2013.

[7] Neuburger J, Currie C, Wakeman R, Johansen A, Tsang C, Plant F, et al. Increased orthogeriatrician involvement in hip fracture care and its impact on mortality in England. Age Ageing 2017;46(2):187–92.

[8] Nyholm AM, Gromov K, Palm H, Brix M, Kallemose T, Troelsen A, et al. Time to surgery is associated with thirty-day and ninety-day mortality after proximal femoral fracture: a retrospective observational study on prospectively collected data from the danish fracture database collaborators. J Bone Joint Surg Am 2015;97(16):1333–9.

[9] Moja L, Piatti A, Pecoraro V, Ricci C, Virgili G, Salanti G, et al. Timing matters in hip fracture surgery: patients operated within 48 hours have better outcomes. A meta-analysis and meta-regression of over 190,000 patients. PLoS One 2012;7(10)e46175.

[10] Oakley B, Nightingale J, Moran CG, Moppett IK. Does achieving the best practice tariff improve outcomes in hip fracture patients? An observational cohort study. BMJ Open 2017;7(2)e014190.

[11] Khan SK, Shirley MD, Glennie C, Fearon PV, Deehan DJ. Achieving best practice tariff may not reflect improved survival after hip fracture treatment. Clin Interv Aging 2014;9:2097–102.

[12] Shah AA, Kumar S, Shakoor A, Haroon R, Noordin S. Do delays in surgery affect outcomes in patients with inter-trochanteric fractures? J Pak Med Assoc 2015;65(11 Suppl 3):S21–4.

[13] Simunovic N, Devereaux PJ, Sprague S, Guyatt GH, Schemitsch E, Debeer J, et al. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. CMAJ 2010;182(15):1609–16.

[14] Rosso F, Dettoni F, Bonasia DE, Olivero F, Mattei L, Bruzzone M, et al. Prognostic factors for mortality after hip fracture: operation within 48 hours is mandatory. Injury 2016;47(Suppl 4) S91–S7.

[15] Shiga T, Wajima Z, Ohe Y. Is operative delay associated with increased mortality of hip fracture patients? Systematic review, meta-analysis, and meta-regression. Can J Anaesth 2008;55(3):146–54.

[16] Colais P, Di Martino M, Fusco D, Perucci CA, Davoli M. The effect of early surgery after hip fracture on 1-year mortality. BMC Geriatr 2015;15:141.

[17] Cohn MR, Cong GT, Nwachukwu BU, Patt ML, Desai P, Zambrana L, et al. Factors associated with early functional outcome after hip fracture surgery. Geriatr Orthop Surg Rehabil 2016;7(1):3–8.

[18] Brogan K, Akehurst H, Bond E, Gee C, Poole W, Shah NN, et al. Delay to surgery does not affect survival following osteoporotic femoral fractures. Injury 2016;47(10):2294–9.

[19] Lizaur-Utrilla A, Martinez-Mendez D, Collados-Maestre I, Miralles-Muñoz FA, Marco-Gomez L, Lopez-Prats FA. Early surgery within 2 days for hip fracture is not reliable as healthcare quality indicator. Injury 2016;47(7):1530–5.

[20] Vidán MT, Sánchez E, Gracia Y, Marañón E, Vaquero J, Serra JA. Causes and effects of surgical delay in patients with hip fracture: a cohort study. Ann Intern Med 2011;155(4):226–33.

[21] Khan SK, Kalra S, Khanna A, Thiruvengada MM, Parker MJ. Timing of surgery for hip fractures: a systematic review of 52 published studies involving 291,413 patients. Injury 2009;40(7):692–7.

[22] Lewis PM, Waddell JP. When is the ideal time to operate on a patient with a fracture of the hip?: a review of the available literature. Bone Joint J 2016;98-B(12):1573–81.

[23] Zakriya K, Sieber FE, Christmas C, Wenz JF, Franckowiak S. Brief postoperative delirium in hip fracture patients affects functional outcome at three months. Anesth Analg 2004;98(6)1798–802 table of contents.

[24] Neuburger J, Currie C, Wakeman R, Johansen A, Tsang C, Plant F, et al. Increased orthogeriatrician involvement in hip fracture care and its impact on mortality in England. Age Ageing 2017;46(2):187–92.

[25] Bellelli G, Morandi A, Davis DH, Mazzola P, Turco R, Gentile S, et al. Validation of the 4AT, a new instrument for rapid delirium screening: a study in 234 hospitalised older people. Age Ageing 2014;43(4):496–502.

[26] News: BPT changes April 2017 v10A. 2017 Available at http://www.nhfd.co.uk/20/hipfractureR.nsf/docs/newsArchive [Accessed 28 August 2017].