

## Comparison of trauma and elective income in a district general hospital

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### ABSTRACT

We aimed to investigate the income of trauma and elective work in our unit and compare inpatient stay and resource allocation. We performed a prospective study of trauma and elective admissions for a one-week period. We calculated the income received using health resource group coding. 48 trauma patients were admitted of which 36 required operative intervention. This generated £134,321 for primary procedures followed by an extra £18,141 for those requiring no surgery. The total income for the week was £171,941. 71 elective patients underwent surgery. The total income generated was £150,318 for this week. This was a typical week in a busy unit. No consultants were on leave. Although the income was higher in the trauma group this was loss making due to the length of stay of those patients with hip fractures. Attempts at profitability should include enhanced rehabilitation services and more realistic tariff for proximal femur fractures.

KEYWORDS : Trauma, Elective, Income, Health Resource Group Codes, Economics, Coding

### Introduction:

Payment by results was introduced across the National Health Service (NHS) in 2005. Its aim was to provide a pricing structure (tariff) for the whole country with some allowance for geographical variation<sup>1,2</sup>. The system uses Healthcare Resource Group codes (HRG) in which treatments in similar cost brackets have the same code. A price / tariff is derived from each hospital patient episode and the patient's registered Primary Care Trust (PCT) is billed accordingly.

In order to generate an HRG code data is collected by the hospital clinical coding department including primary diagnosis, comorbidity (which incurs an extra charge if applicable), and complications, surgical procedure, age and duration of stay<sup>4</sup>. Diagnoses (either primary, co morbidities or complications) are coded using ICD-10 codes. Surgical procedure is defined using OPCS-4 codes. A piece of software is then utilised to allocate the HRG code. Each HRG code represents a tariff, which is the average cost of a treatment nationwide. Minor regional adjustments are made to reflect the cost of living<sup>2</sup>.

Payment by results covers all admissions, attendance in accident & emergency departments and outpatients attendances<sup>5</sup>. The 2004 NHS Improvement plan designated 18 weeks as a target for referral to treatment (RTT)<sup>6</sup>. It is a common misconception that trauma patients do not account for considerable income within the NHS. Trauma is often seen as the poor relation when compared with elective work where a target based culture now prevails. Elective targets must be met or hospital trusts can incur financial penalty. This situation is not apparent for trauma due to the acute nature of service delivery in the majority of cases. The burden of trauma work can block elective admissions and is seen by some as a barrier to target attainment. At least 36% of orthopaedic surgeons in the United Kingdom

describe trauma as part of their sub-specialist interest. We aimed to assess the throughput and income generated from one week of trauma workload and compared this with the elective throughput in our unit for the same week. This was performed by means of a prospective study. We are not aware of any published work in this specific area.

### Methods:

We followed all acute patients admitted to our trauma unit between 21/02/2008 and 28/02/2008. This represented a "trauma week" which is how the consultant rota is organised in our trust. We then compared this with the throughput in our elective unit for the same calendar period. No surgeons were on leave this week and no theatre sessions were cancelled other than the on call trauma consultant's elective operating sessions. Our trust is a busy district general hospital with over 500 beds and approximately 55,000 emergency attendances per year. The orthopaedic directorate is staffed by ten full time consultants and serves a population of 315,000 patients.

All patient details were recorded prospectively and followed until the end of their inpatient episode. Case notes were then reviewed with the coding department and ICD-10 and OPCS-4 codes were generated. Their length of stay and other required variables were reviewed in order to generate the correct HRG code. Once the analysis was complete income for the trauma and elective groups were calculated.

### Results:

#### Trauma:

48 patients were admitted (22 male) of which 36 required operative intervention. This utilised 14 theatre sessions. Mean age was 53.75 years (range: 7-93, median: 59). Median stay was 4 days with a mean of 13.3. The median and mean trim points

(expected duration of stay before extra charges incurred by PCT) were 14.5 and 26.7 days respectively. Other consultants operated on 6 patients. This was either due to expertise in a specific area or space on an elective list utilised to reduce backlog. The income generated by these cases is included in the trauma total due to them being acute trauma interventions rather than elective cases. These results are summarised in tables 1 and 2.

Table 1: Demographic & Income Data of Trauma and Elective Patients

	Trauma	Elective
Median age (yrs)	59	47
Number of Patients	47	71
No of Males	26	30
Median stay (days)	4	1
Range of stay (days)	1 – 107	1 - 7
Total bed days	637	118
Estimated Bed Costs (£)	203,840	26,550
Mean income per pt (£)	3658.32	2117.15
Total Income (£)	171,941	150,318

Of the 48 patients admitted 12 required no operative intervention. These cases were general 'run of the mill' admissions such as soft tissue infections for intravenous antibiotics, undisplaced fractures where home circumstances obstructed discharge, soft tissue injuries for further investigation and back pain. These will not be discussed further but the income generated (£31,127) does go towards the total. The median stay was 2 days with a mean stay 8.5 days (range: 1 – 47). This reflects the broad comorbidities and social circumstances of this subset.

The group requiring operative intervention included hip fractures (11 patients). Of these, seven required dynamic hip screw fixation but were deemed "complex" due to their comorbidities and therefore attracted the higher tariff rate (£6685). One displaced intracapsular fracture required total hip replacement, attracting a tariff of £7261. One patient required revision from a dynamic hip screw to an intramedullary device and then revision to a total hip arthroplasty. The tariff price was £19,479. The remaining fractured neck of femur patients attracted between £4379 and £6711 dependent on operative procedure. The median stay was 26 days (mean: 14, range 9 – 107). One patient required closed manipulation of a dislocated total hip replacement attracting a tariff price of £1034 and an inpatient stay of one day. In addition one acetabular fracture was sustained requiring open reduction and internal fixation. It attracted a tariff price of £4262 and an inpatient stay of seventeen days.

One patient required open reduction and internal fixation of a patella fracture attracting a tariff of £2405 and was an inpatient

for 10 days. Another patient with septic arthritis required two arthroscopic knee washouts, attracting a tariff of £5941 and was an inpatient for 26 days.

Seven ankle fractures were admitted requiring operative intervention, all of these attracted a tariff of £2405 except one, which attracted £4262 due to co morbidity and complexity of injury. The median stay in this group was six days (mean: 4.9, range: 2-7).

Thirteen patients sustained hand and wrist injuries requiring operative intervention. Of these there were two tendon repairs, two abscesses drained and one digital terminalisation. Five wrist fractures required either manipulation and plaster application, closed reduction and Kirschner wiring or open reduction and internal fixation by means of a volar plate. Three fractures of the base of the thumb were manipulated and percutaneously K-wired. These patients attracted a tariff of between £1048 and £3227. Median stay was one day (mean: 1.36, range: 1 – 3). Three of these cases were managed by our hand surgeon on a trauma list.

One patient admitted with cauda equina syndrome required microdiscectomy attracting a tariff of £1271 and was an inpatient for one day. This was performed by one of our spinal surgeons on a trauma list.

#### Elective:

71 procedures were performed (36 female). This utilised 22 theatre sessions. Mean age was 49.51 years, (11 – 87 median: 47). Mean stay was 2.3 days. The median and mean trimpoints were 2 and 6.35 days respectively. Cases were divided by anatomical region. A table of income for both trauma and elective patients by anatomical region is included (Table 2).

Twelve patients had hip procedures performed. These included hip injections (n=2, tariff £615), sciatic nerve exploration (n=1, tariff £1217), cemented total hip arthroplasty (n=2, tariff £4304), uncemented total hip arthroplasty (n=1, £5305), resurfacing hip arthroplasty (n=5, £4023) and revision hip arthroplasty (n=1, £7185).

Twelve patients had knee procedures performed. These consisted of total knee replacements (n=3, tariff £5613), unicompartmental knee replacements (n=4, £5613), one anterior cruciate ligament reconstruction (£1863), knee arthroscopies (n=2, tariff £1063), one removal of metal work (tariff £1063) and one scar revision (tariff £1091).

Four patients had foot and ankle procedures performed and these all attracted £1217 tariff price. They consisted of one ganglion excision, one hallux valgus correction, one excision of Morton's neuroma and one ankle arthroscopy.

Table 2: Income by Anatomic Region

	Trauma				Elective			
	Length of stay (median) days	No of pts	Total income (£)	Mean income per patient (£)	Length Of Stay (median) days	No of pts	Total income (£)	Mean income per patient (£)
Upper limb	1	18	32,455	1,803	1	9	11,469	1,274
Spine	1	5	10,327	2,065	0	34	44,887	1,320
Hip	26	13	90,891	5,494	4	12	43,660	3,638
Knee	5	5	19,576	3,915	2	12	45,434	3,786
Foot and ankle	6	7	18,692	2,670	1	4	4,868	1,217
<b>Total</b>		<b>47</b>	<b>171,941</b>	<b>3658</b>		<b>71</b>	<b>150,318</b>	<b>2117</b>

Nine patients had upper limb procedures performed. These comprised carpal tunnel decompression (n =1 £1217), radial head excision (n=1 £1217), shoulder stabilisations (n=3 £1217), subacromial decompression (n=1 £1217), acromioclavicular joint excision (n=1 £1063), diagnostic shoulder arthroscopy (n=1 £1217) and arthroscopic cuff repair (n=1 £1887).

34 patients had spinal procedures performed. Inpatient stay ranged from 0 to 5 days with trimpoints of 1 – 13 days. These ranged from nerve root injections (n=23, tariff £522), discography (n=3, tariff £615), microdiscectomy and interspinous distraction (n=2, tariff £3192), decompression, fusions and instrumentation (n= 5, tariff £4252 - £5140), and kyphoplasty (n=1, tariff negotiated: no HRG code. Income £1506). Total income for the spinal group was £44,887.

It can be seen from the data that a wide range of trauma and elective surgery was performed and that the elective group was admittedly younger and had a shorter hospital stay (Table 1). Our unit has the benefit of two spinal surgeons who operate a local and tertiary practice, which changes the demographic of our cohort slightly; other units may not have this factor adjusting their income.

The tariff income for the elective group was £150,318, which was lower than that for the trauma group of £171,941.

#### Discussion:

This paper is, as far as we are aware the first to compare elective and trauma orthopaedic throughput in a busy district general hospital. It would be bold not to draw attention to our studies limitations. We analysed only one week in the financial year and we accept that seasonal variation may occur. The weather for the week in question involved no snow or ice and was warmer than average for this time of year (5.2°C)<sup>10</sup>. We do not feel that severe weather influenced our admissions. Previous studies have assessed the effect of seasonal variation on admissions rate. One was in a winter sports resort in Switzerland and unsurprisingly showed a positive correlation between season and fracture incidence<sup>11</sup>. Another study based in

Tasmania showed no variation in either vitamin D levels or incidence of femoral neck fracture<sup>12</sup>. This goes against the findings of a study based at three latitudes, which showed a high seasonal peak in Scotland, Hong Kong and New Zealand. Our locality has a temperate climate with no local winter sports resorts; our experience of seasonal variation is minor.

Miscoding and therefore error in calculations may have occurred; as both the authors and experienced coders reviewed the casenotes the likelihood of this is limited.

Our most important finding was that the mean income per trauma patient (£3658.32) was higher than that for an elective patient (£2045.13) and was statistically significant (p=0.001). The HRG code and income generated represents the money actually received by the hospital from the primary care trust. We openly admit that trauma patients represent a larger burden for the hospital. They have a tendency to be older, have complex co-morbidity and have increased length of stay. They are therefore more costly than elective patients. One study performed in a large university hospital calculated the mean cost for a hip fracture to be £8978.56 (range £3450 - £72,564), this rose to £25,940.44 if there was a superficial wound infection (range £4387 - £93,976) and £34,903 if there was a deep infection (range £9408 - £93,976)<sup>14</sup>.

Although actual income from the PCT was higher the trauma group will have been loss making on account of the hip fracture group. Whilst this is hard to quantify it seems likely given the calculations portrayed in the Nottingham study of 3686 patients. Inpatient costs for the trauma group ignoring theatre costs amount to approximately £204,000. This exposes a lack of appreciation of this group's requirements in comparison with fit elective hip patients and probably inequality in trauma coding for these patients.

Our study has not tackled implant costs partly due to the fact that inpatient costs have significantly dwarfed these but also due to the fact that we consider these a relatively fixed overhead, costs being determined by local bulk purchase agreements. The

consequence on overall study outcome would be minimal given that trauma implants are several orders of magnitude cheaper than elective joint prostheses.

It became apparent to us during the course of our study that trauma can be under resourced when compared with elective care. The background team currently provided for trauma patients include the on call medical team (Consultant Orthopaedic Surgeon, Specialist Registrar and Senior House officer). In addition there are ward nursing staff, anaesthetist, theatre staff, occupational therapists and physiotherapists. On the elective side there are 4 waiting list clerks, 3 surgical assistants, 3 preoperative clinic sisters as well as reception staff and the background medical team (anaesthetist, consultant orthopaedic surgeon, specialist registrar and senior house officer). In the elective setting the aim is identification and optimisation of comorbidities pre-operatively and discharge planning to ensure throughput and turnover of patients. We admit that pre admission screening is not applicable to trauma but faster throughput could ensure improved efficiency and reduced duration of stay.

Our elective patients have a 30-bed ward with an additional 8-bed day case unit; the trauma ward has 24 inpatient beds. The elective unit has 7 registered nurses and 4 health care assistants; on the trauma ward this figure is 4 and 3 respectively. Our elective patients have 2.5 full time equivalent physiotherapists whilst our trauma patients have 1.5.

This situation is probably not dissimilar to the situation in many units elsewhere in the country. This work has shown that trauma income is higher than that for elective work and from this we can infer that if resources were directed accordingly then length of stay could be reduced and profit could be a possibility. A recent paper using hospital episode statistics (HESS) data has shown that length of stay fell quickly once payment by results was implemented<sup>15</sup>. What was unclear was whether this represented a real change in efficiencies or simply a change in data manipulation by trusts. HESS data has repeatedly been noted to be inaccurate with a range from 10 to 98% dependent on region and disease group.<sup>16-17</sup>. In a 2006 statement by the then Health Minister Mr. A Burnham it was quoted that £88m pounds was being wasted from 390,000 extra unnecessary bed days<sup>18</sup>. This was based on the cost of an elective bed being £225 per day with acute beds being significantly more (approximately £320 in one study) The total stay for 66 elective patients was 118 days whereas that for 48 trauma patients was 637 days. Several outliers hugely increased the figure for trauma. Ten trauma patients represented 464 days of inpatient care. If the inpatient stay was reduced by one day for fractured neck of femur patients alone, this amounts to 500 less days per year and approximately £160,000 per year reduction in overhead costs for the trust.

One study in the USA assessed the use of a caseworker to expedite discharge for elderly patients with hip fractures<sup>19</sup>. The

study did not utilise extra physiotherapy and occupational therapy support. Findings were increased theatre, anaesthetic and blood product costs in elderly patients. Increasing age did not correlate with length of stay, cost of stay or income for the hospital. They found that a case manager did reduce the average stay but did not reduce the overall cost. The NHS would do well to note these findings - in many trusts patient flow practitioners are being employed to try and expedite discharge and increase patient turnover. We feel that this money could be channelled into rehabilitation services to effect prompt rehabilitation and discharge.

One final issue is the variation in income between secondary and tertiary centres for certain injuries. One acetabular fracture underwent fixation generating £4262. If this had been referred to a tertiary centre a supplementary specialised service code would have been applicable generating more income (up to 70% in some cases) when intervention was identical. We agree that certain injuries require tertiary treatment by a team with high volume experience and specialised skills. There is an income chasm between the income generated between secondary and tertiary centres for the same injury, which seems perverse.

Overall trauma income was higher than elective income, but still ran at a loss. This was on account of the length of stay of the hip fracture patients and current coding underestimating their true cost to the trust. There is a disparity between rehabilitation services provided for trauma and elective patients, which needs to be addressed to improve efficiency.

#### Competing Interests

None declared

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