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Targets, game playing and queuing theory: impact of the accident and emergency targets in England

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Part 2 of a 3 part series

Replaces (and expands upon) the previous article with the title: **'Costing A&E attendances'**

Key Words: Accident & Emergency, Emergency Department, Costs, Cost shifting, A&E four hour waiting time target, England, NHS, assessment unit admissions, queuing theory, economy of scale, payment by results (PbR), GP commissioning, unintended consequences of health care policy, Department of Health, NHS Data Standards

Conflict of Interest: The author provides actuarial and forecasting services to health care organisations

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Key Points

- The new accident and emergency (A&E) treatment categories introduced in the 2006/07 reference cost collection were poorly interpreted and implemented by acute Trusts
- This is part of a wider issue of adherence to data standards and the unavoidable ambiguity which will always arise at the boundary of any defined group
- Both A&E and emergency assessment unit (EAU) costs must be combined to reveal the true average cost of an A&E attendance
- Less efficient Trusts appear to be shifting large amounts of A&E work into EAU's where the higher price paid creates a large profit margin for zero day stay activities
- Commissioners are strongly advised to check the total cost implied by the annual reference cost collection data against the local cost to ensure that cost shifting into EAU is not distorting the price paid to the local acute Trust.
- This represents the classic case of unintended consequences of policy implementation based on performance targets

Abstract

Part one of this series demonstrated that assessment unit costs are approximately those of an ambulatory assessment, which for reasons known only to the department of health providers are being paid by a tariff which is far higher than the real cost. In this part it is demonstrated that the true average cost of the wider emergency department function is only revealed when Accident & Emergency (A&E) and assessment unit costs are combined. The allocation of patients into treatment categories is shown to be subject to considerable ambiguity which skews local costs when a strict Payment by Results (PbR) framework is applied. Such a framework implicitly assumes that counting and coding is at the national norm. Issues around the application of standards for counting events and the perverse incentives arising out of targets are discussed. Part three looks at the specific situation regarding paediatric assessment costs.

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Introduction

The cost of Accident and Emergency (A&E) services is in excess of £6 billion and accounts for around 21% of non-admitted acute costs. In England the introduction of the four hour target for an A&E attendance has led to the diversion of increasing numbers of patients into medical assessment units (MAU) where the patient is 'admitted' as an emergency and therefore is outside of the scope of the target (Jones 2007, Jones 2009). There are a number of reasons for this shift which relate to the imposition of a fixed performance target formulated with little clinical justification.

1. Queuing theory indicates that smaller units will always find it more difficult to achieve a fixed performance target than larger ones. Simulation of typical A&E performance indicates that in the real world up to 35% of patients can be expected to stay longer than four hours (Hoot et al 2008)
2. England has the highest bed occupancy in Europe (European HFA Database 2010) and high inpatient bed occupancy is a well recognized cause for longer A&E waits (Rathlev et al 2007).
3. For some conditions it may not be clinically possible to reach a definitive diagnosis on 90% of occasions within four hours (Fee & Weber 2007).

Based on the 2006/07 reference cost collection it was anticipated that 12 cost bands would be implemented in A&E for 2009/10. However for reasons discussed in this paper this was not done and these 12 categories were condensed into three cost bands which in 2010/11 are £117 for a high cost attendance, £87 for a standard attendance and £59 for a minor attendance, however, there does not appear to be any national norm for the proportion of activity in each category of A&E treatment and thus on the overall average cost for an A&E attendance and most importantly on the total cost born by purchasers. Issues surrounding the perverse incentives offered by performance targets will be discussed. The wider impact of these issues are also discussed in parts one and three of this series (Jones 2010f, 2011).

Methods

The 2006/07 reference costs data bases were obtained on CD from the Department of Health (DH) (DH 2008). Assessment unit and other costs were extracted using either Trust type or size. A flag was added to the national data to identify those Trusts which reported separate EAU costs from those who had aggregated these costs in with general inpatient emergency admission costs. The 2010/11 tariff was obtained from the DH website: (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_112284).

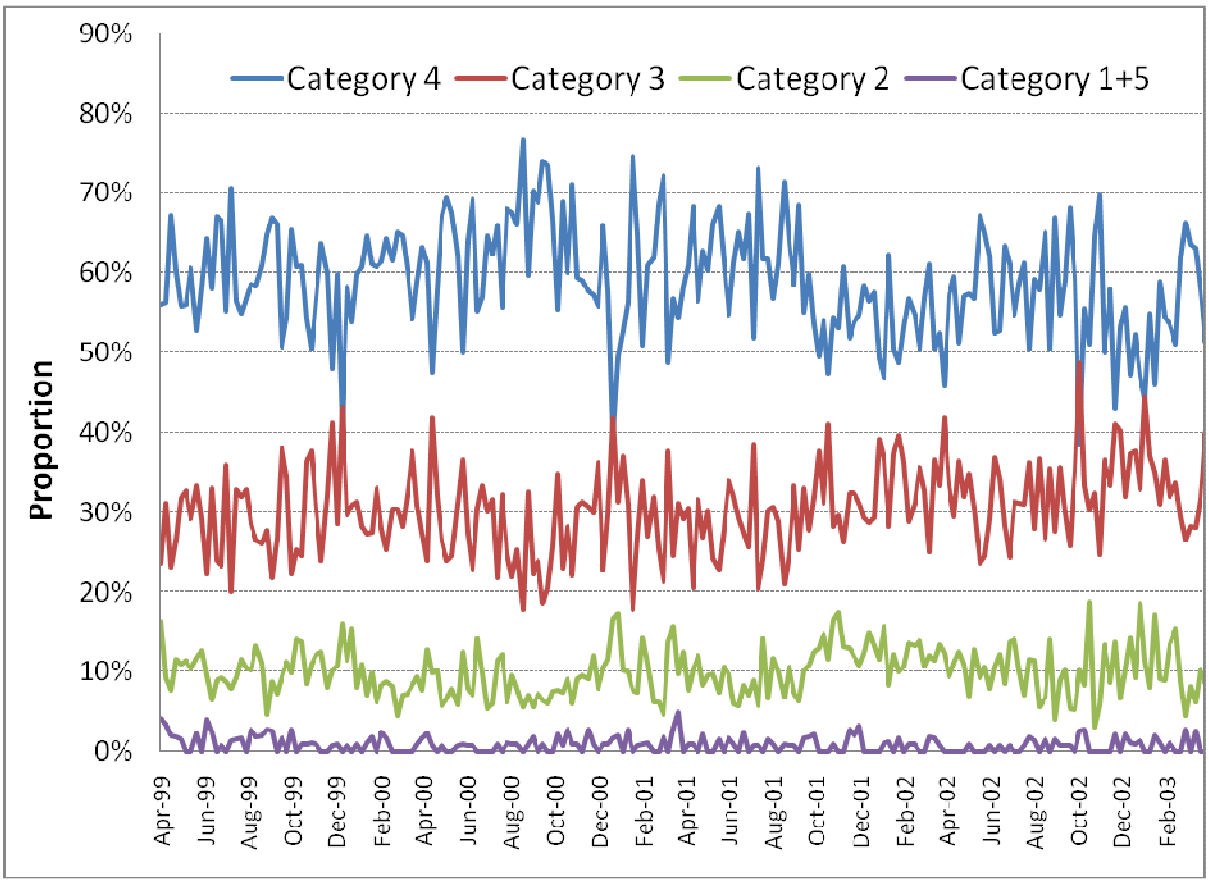
Treatment Categories

The 2006/07 reference cost collection (the intended basis for the 2009/10 tariff) introduced additional treatment categories and in theory provided greater detail behind the costs – provided that the treatment categories were accurately reported.

With respect to the allocation of attendances into categories Figure 1 shows the drift in the use of the usual A&E triage categories at a medium sized A&E unit over a number of years prior to the introduction of payment by results (PbR). The point of this figure is to show that

even in the absence of a financial incentive to skew the collection of treatment categories or change due to the introduction of nearby minor injury units the allocation of patients into different categories is subject to ambiguity of interpretation over time by different staffs. This is a sub-set of the much wider issue around adherence to NHS data standards which forms the rational basis for the formulation of a tariff structure (Jones 2007). From a commissioner perspective the deliberate or even unintended abuse of data standards leads to gaming by providers and consequent 'unfair' costs incurred by particular commissioners.

Figure 1: Change in proportion of triage categories at a medium sized A&E department. Data was collected every Sunday over a four year period.



Average Costs

The appendix (Table 1) gives the national average for A&E attendance by type at a variety of acute and PCT run units. Several points emerge from this data:

1. Costs at PCT run minor injury units appear to be less than half that of an acute setting.
2. PCT costs show very little discrimination between treatment categories.
3. Attendance category at PCT units seems to have no relationship with the corresponding acute A&E attendance category.
4. Costs are generally higher in the small acute and small versus large PCT units reflecting the loss of economy of scale in smaller units.

5. There is broad consensus on the proportion of different attendance types for acute hospitals.
6. The average cost per A&E attendance is a good indicator of overall case mix and should lie in the range £95 to £108.
7. This figure of £95 to £108 appears to indicate that the 2008/09, 2009/10 and 2010/11 tariffs were all too low as the weighted average of £117, £87 and £59 will be much lower than £95 to £108.

One is left with the conclusion that for whatever reason the DH chose to deliberately run with an acute A&E tariff which was below cost between 2008/09 to 2020/11 and that this may have inadvertently led trusts to divert even more patients into the far more lucrative emergency assessment units – based on flawed assumptions within the short stay tariff structure (Jones 2010a). Also one concludes that economy of scale plays a significant part in determining overall costs. The issue of economy of scale has been investigated by others and one US study concluded that for trauma the minimum cost (around £200) was reached near 40,000 attendances per annum, however, for non-trauma the point of minimum cost (around £150) was reached at only 13,000 attendances but rose to reach a maximum cost above 26,000 visits (Bemezau et al 2005).

Trust Specific Factors

Having established the wider cost issues it is now useful to look at the detail behind the overall national averages from the reference cost submissions for a selection of acute Trusts. The appendix (Table 2) gives examples of local counting compared to the national average and it is clear that local definitions of the A&E categories vary enormously. Data for the small acute Trust is included for two reasons.

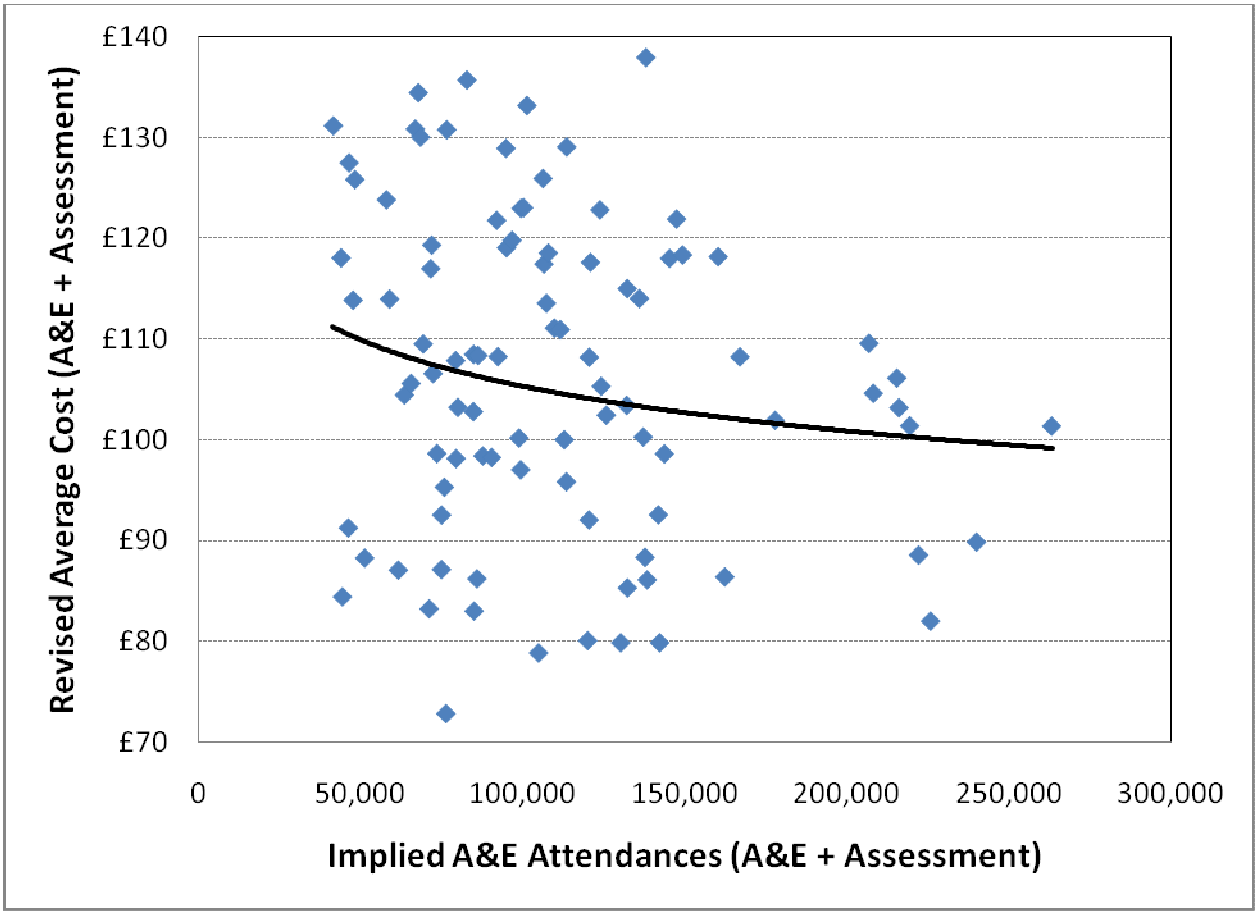
1. This particular Trust adheres to national definitions very closely and does indeed fall very close to the national average in terms of proportions in each category, i.e. it is possible to count correctly.
2. This Trust has one of the smallest A&E departments and as a result has higher costs due to a lack of economy of scale.
3. There is no local PCT run minor injury unit to complicate the issue of counting in particular categories.

The next Trust in the table is a large Teaching Hospital where costs are typically higher although counting discrimination is not as good. This is followed by a series of acute Trusts exhibiting considerable differences in category selection. The acute Trust labeled ‘Minor Injury Unit’ diverts all non-minor work to its emergency assessment unit (EAU) and so this is effectively an acute run minor injury unit. This is then followed by a series of Trusts who chose to lump all attendances into a single category.

In spite of wide differences in counting the average price remains the most reliable indicator of the correct value of costs to be paid to the respective Trusts and this avoids the gaming being practiced by some Trusts who are diverting large volumes of otherwise A&E work to emergency assessment units (Jones 2010a). The issue of gaming is pursued in Figure 2 where the combined cost of A&E attendances and so-called emergency assessment unit ‘admissions’ is shown for a wide range of Trusts. The spread in costs for the combined data

lies in a fairly tight cluster between £80 and £140 per attendance and this is far less than the A&E data alone which ranges between £36 to £206 (as per the appendix). By comparison the average cost of A&E attendances in Scotland ranges between £80 to £130 (middle 75%) where over 50% of hospitals admit more than 80% of patients via A&E (Audit Scotland 2010).

Figure 2: Revised average cost for 'real' A&E attendances



Some spread in the costs shown in Fig 2 is to be expected given the proximity of community-run minor injury units to some acute sites and the higher costs incurred in newer private Finance Initiative (PFI) hospitals. The previously observed economy of scale in assessment unit costs is also evident in the combined data. By comparison the data for Scottish A&E departments shows economy of scale up to around 20,000 to 40,000 attendances per annum with more modest economy of scale above this level (Audit Scotland 2010) and this concurs with the general trend line in Fig 2. This suggests that Trusts which divert higher volumes of A&E via an emergency assessment unit will gain in two ways, namely, shifting higher cost work into an assessment unit allows the Trust to make a profit from the artificially low A&E tariff and then make an even higher profit from the short stay tariff for emergency admissions (Jones 2010a).

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Discussion

The DH plays a central role in the implementation of government policy for the NHS, irrespective of the rationality or evidence base for such policies. This role places them in a rather unenviable position. With respect to the four hour A&E target, queuing theory (which is widely applicable in healthcare) could easily have informed a debate regarding the rational formulation and implementation of such a policy (Fomudam & Herrmann 2007). Alas political haste prevailed and the only possible way of 'achieving' such a target was to 'fiddle' the figures (Lane et al 1998, Gunal & Pidd 2006, Mayhew & Smith 2007, Smith 2008, Hoot et al 2008, Jones 2006, 2009e) or on this occasion to divert A&E patients into assessment units where the patients were 'admitted' and thereby outside of the scope of the target. The department was left to turn a blind eye (Jones 2007) but in doing so created an even greater dilemma.

Payment by Results (PbR) and the healthcare resource group (HRG) tariff are another government policy supported by both the former and current governments. A comprehensive series of papers in this journal have explored the many fundamental limitations of the HRG tariff (Jones 2008a-e, 2009 a-d, 2010a-g) and like the A&E target the department is left to protect the policy. On this occasion aspects of A&E assessment and observation were moved into the arena of the tariff covering inpatient admission – a role which the tariff was not designed to fulfill. The department responded by implementing a short stay tariff which for reasons known only to the department grossly over-remunerated acute Trusts for these activities. We now have three perverse incentives! An A&E tariff which is too low to cover costs, a four hour target which is unattainable and a short stay tariff which is begging to be abused due to financial advantage.

In this respect it is heartening to see that the current coalition government has acted decisively to relax many of the performance targets, however, an uncomfortable legacy remains. On the negative side it is possible to speculate that the proposed policy regarding GP commissioning may be implemented with undue haste and will ignore certain uncomfortable studies which suggest that the policy may have serious flaws in particular areas relating to financial risk and the nature of growth in health care demand (Jones 2010b-e). Surely there is a clear message here about policy and targets.

Conclusions

In conclusion, the PbR team eventually abandoned their attempt to set a 2009/10 tariff based on the poor allocation of attendances to the correct category in the 2006/07 reference costs. Admittedly the accuracy of allocation into categories has improved over time however the author is occasionally contacted by A&E consultants eager to find out what the categories mean. Considerable national effort is needed to ensure that categories are appropriately applied. However it is clear that the tariff for A&E between 2008/09 to 2010/11 has been too low and that the costs associated with size play an important role. In this respect the DH guidance for Payment by Results (PbR) in 2010/11 has indicated that a review of A&E funding is in progress investigating a mix of fixed and variable costs (implied by economy of scale) with a possible new tariff commencing in 2011/12 (DH 2010). However no mention was made that there is any recognition of the potential skewing effect of variable proportions of patients being diverted to MAU's.

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The department will need to allow considerable scope for a locally agreed process which ensures that the effective average price paid by commissioners for both A&E and assessment unit activities is roughly consistent with the reference costs submitted by each Trust. This has become necessary as this route appears to be the only reliable source of costing information which ensures that a fair price is paid for the real case mix and not a price which is merely an artifact of local coding and counting. The question is – can the department do this for fear of acknowledging that the tariff has fundamental flaws?

Some tricky issues are now being passed on to the enlarged Monitor responsible for the technical aspects of the costs within the tariff and supervision of financial performance of acute Trusts delivering against the tariff and the new Commissioning board who will decide the future shape of the tariff. Some may argue that there is still room for the issues to remain 'muddled'.

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Table 1: Proportion of A&E attendances by category and costs

Treatment Type	Teaching	Large Acute	Medium Acute	Small Acute	All Acute	Large PCT	Medium PCT	Small PCT
Any category 5 treatment	0.1%	0.1%	0.1%	0.0%	0.1%	7.2%	8.1%	14.3%
Category 1 (category 1-2 treatment)	28.7%	19.4%	22.4%	22.5%	22.4%	38.8%	18.2%	26.2%
Category 1 (category 3-4 treatment)	1.5%	2.4%	2.3%	1.8%	2.1%	2.3%	1.8%	0.0%
Category 2 (category 1 treatment)	16.6%	28.5%	27.0%	26.9%	25.7%	1.6%	6.6%	4.7%
Category 2 (category 2 treatment)	4.4%	4.7%	4.2%	8.0%	4.9%	3.8%	0.6%	5.8%
Category 2 (category 3 treatment)	2.7%	1.5%	2.1%	1.4%	1.9%	2.7%	0.0%	0.2%
Category 2 (category 4 treatment)	4.7%	1.1%	1.7%	0.8%	1.9%	0.0%	0.0%	0.0%
Category 3 (category 1-3 treatment)	1.0%	0.7%	1.9%	3.8%	1.5%	0.0%	3.7%	2.4%
Category 3 (category 4 treatment)	0.1%	0.1%	0.2%	0.0%	0.1%	0.0%	1.7%	0.0%
Dental Care	0.4%	1.1%	0.2%	0.0%	0.6%	0.3%	0.2%	0.0%
Dead On Arrival	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
No significant treatment	39.9%	40.4%	38.0%	34.6%	38.8%	43.4%	59.2%	46.4%

Treatment Type	Teaching	Large Acute	Medium Acute	Small Acute	All Acute	Large PCT	Medium PCT	Small PCT
Any category 5 treatment	£408	£440	£216	£264	£339	£31	£34	£43
Category 1 (category 1-2 treatment)	£87	£88	£100	£103	£94	£35	£29	£35
Category 1 (category 3-4 treatment)	£131	£137	£121	£120	£128	£27	£28	£56
Category 2 (category 1 treatment)	£139	£118	£132	£137	£131	£42	£33	£39
Category 2 (category 2 treatment)	£154	£143	£136	£127	£138	£23	£24	£49
Category 2 (category 3 treatment)	£180	£165	£150	£207	£174	£30	£26	£47
Category 2 (category 4 treatment)	£109	£271	£156	£168	£145	£23	£103	£57
Category 3 (category 1-3 treatment)	£172	£226	£163	£111	£143		£43	£44
Category 3 (category 4 treatment)	£322	£330	£331	£295	£328		£19	£46
Dental Care	£63	£54	£118	£126	£62	£21	£168	
Dead On Arrival	£180	£28	£95	£93	£86			
No significant treatment	£84	£65	£80	£79	£77	£34	£43	£34
Average All Treatments	£103	£95	£107	£108	£104	£34	£39	£37

Footnote: Excludes one Teaching hospital where all A&E activity was reported as low cost category five activity. All data is from the 2006/07 reference costs collection.

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Table 2: Local counting by category (as a proportion) and average price per A&E attendance

Treatment Categroy	All Acute	Small Acute	Teaching	Acute A	Acute B	Acute C	Acute D	Minor Injury Only	Acute F
Any Cat 5 treatment	0.1%	0.1%	0.6%	0.4%	0.0%	0.2%	0.1%	0.3%	0.1%
Cat 1 (Cat 1-2 treatment)	22.4%	29.3%	24.2%	20.3%	12.1%	12.7%	38.1%	35.2%	7.6%
Cat 1 (Cat 3-4 treatment)	2.1%	1.8%		2.2%	16.7%	3.3%	4.4%	2.4%	0.3%
Cat 2 (Cat 1 treatment)	25.7%	35.9%	32.7%	14.1%	12.1%	43.2%	12.5%	23.1%	34.1%
Cat 2 (Cat 2 treatment)	4.9%	1.0%	0.9%	14.1%	12.1%	1.7%	3.3%	17.3%	1.2%
Cat 2 (Cat 3 treatment)	1.9%	0.6%		14.1%	4.6%	1.0%	4.2%	1.0%	0.1%
Cat 2 (Cat 4 treatment)	1.9%			14.1%	4.6%	1.6%	2.6%	0.3%	0.0%
Cat 3 (Cat 1-3 treatment)	1.5%	0.2%	0.5%	1.7%	0.7%	1.1%	0.2%	0.6%	
Cat 3 (categ 4 treatment)	0.1%			0.6%	12.9%				
Dental Care	0.6%				12.1%				
Dead On Arrival	0.0%						0.2%		
No significant treatment)	38.8%	31.1%	41.0%	18.5%	12.1%	35.1%	34.3%	19.9%	56.5%
Any Cat 5 treatment)	£339	£164	£389	£146		£469	£700	£311	£141
Cat 1 (Cat 1-2 treatment)	£94	£187	£106	£117	£105	£88	£87	£29	£39
Cat 1 (Cat 3-4 treatment)	£128	£181	£212	£117	£109	£151	£143	£50	£55
Cat 2 (Cat 1 treatment)	£131	£219	£312	£151	£105	£151	£110	£50	£55
Cat 2 (Cat 2 treatment)	£138	£244	£177	£151	£105	£201	£150	£67	£68
Cat 2 (Cat 3 treatment)	£174	£232	£248	£151	£109	£252	£223	£83	£82
Cat 2 (Cat 4 treatment)	£145	£186	£283	£151	£109	£352	£300	£116	£109
Cat 3 (Cat 1-3 treatment)	£143	£251	£319	£262	£109	£235	£360	£78	
Cat 3 (Cat 4 treatment)	£328	£315		£262	£354	£411	£500	£136	
Dental Care	£62				£105		£46		
Dead On Arrival	£86						£34		
No significant treatment	£77	£208	£78	£93	£105	£34	£50	£11	£23
Average attendance cost	**£103**	**£206**	**£165**	**£135**	**£138**	**£109**	**£94**	**£39**	**£36**