

Patient-level costing: can it yield efficiency savings?

Research summary

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The efficiency challenge currently faced by the NHS highlights the desirability of improving the availability and scrutiny of data on the costs and outcomes of health care. Patient-level costing systems were introduced in the NHS in the mid-2000s. The study reported here (Blunt and Bardsley, 2012) analyses new computerised information systems in hospitals set up to track and enable analysis of the costs of care incurred by individual patients. The objective was to examine whether the implementation of information systems for patient-level costing might lead to greater efficiencies. The study examined how trusts are making use of these systems, drawing on the experiences of several early adopters and empirical analyses of data from one NHS trust.

Key Points

- In 2011 less than half of NHS trusts had patient-level information and costing systems (PLICS). Yet when implemented well, PLICS provide a vast array of useful and accurate data on spending per case against income that cannot be provided by traditional costing methods. This can be a significant resource for both clinical teams and directorates, as well as organisations.
- Analysis of patient-level costs from one trust showed considerable variation in cost relative to income for groups of patients with the same healthcare resource group (HRG), and between consultant teams. Only one in six tariff-chargeable cases incurred costs that were within 10 per cent of the tariff price.
- To make efficiencies, a ripe place for scrutiny will clearly be those cases costing more than the tariff price. Without patient-level costing such variations will not be clear to the trust, specialty or consultant team and the reasons for them cannot be understood, meaning that appropriate efficiencies cannot be made.
- Evidence to date shows only modest efficiencies made following introduction of PLICS, but this may be because the systems are not yet used to their full potential: benefits from these systems appear to depend as much on the surrounding managerial support as on the better availability of information. The collection and publication of specific examples of cost-saving and improved clinical engagement should be priorities for policy-makers encouraging the introduction of PLICS.
- The Health and Social Care Act introduces a more robust failure regime for the NHS. This, coupled with the current significant budget pressures for the NHS, might be expected to encourage the wider use of patient-level costing systems. In turn, better information on the costs of care may also help improve the tariff prices set nationally by Monitor, in its new role as economic regulator.



Introduction

Any organisation wanting to become more efficient requires a sound understanding of the costs it incurred against the income it earned. Patient-level costing is a very accurate technique for deriving those costs. It works by identifying the resources used for care of each individual patient as the basis for calculating the actual costs of activities performed by the organisation (which may span over departments). Though patient-level costing is well established in hospitals in some other countries it is comparatively new to the NHS. Relatively recent increases in pressure on trusts to ‘break even’ financially mean the benefits of very granular examinations of costs have started to outweigh the expense of doing so. As recently as 2010 relatively few trusts had systems tracking costs at this level – most collected such information in aggregate across different specialties or ‘service lines’ (Moyes and Kane, 2009). Information on the costs of treating individual patients provides a much more detailed understanding of the real costs of the care incurred, enabling more informed management decisions. It also has the potential to engage clinicians, by making clearer the link between clinical decisions and aspects of efficiency and cost-effectiveness (Audit Commission, 2009).



Information on the costs of treating individual patients provides a much more detailed understanding of the real costs of care

There is growing interest in patient-level information and costing systems (PLICS), and the Department of Health has recommended them as desirable to implement. This study explored the extent to which PLICS are used in the NHS and the potential of such systems to increase efficiency. We used a combination of quantitative data – a year of PLICS data from one major teaching hospital – and qualitative information on the experiences of other trusts that are introducing PLICS. The aim was to assess the potential for improving efficiency of care using PLICS, and to identify some of the implementation issues faced by early adopters.

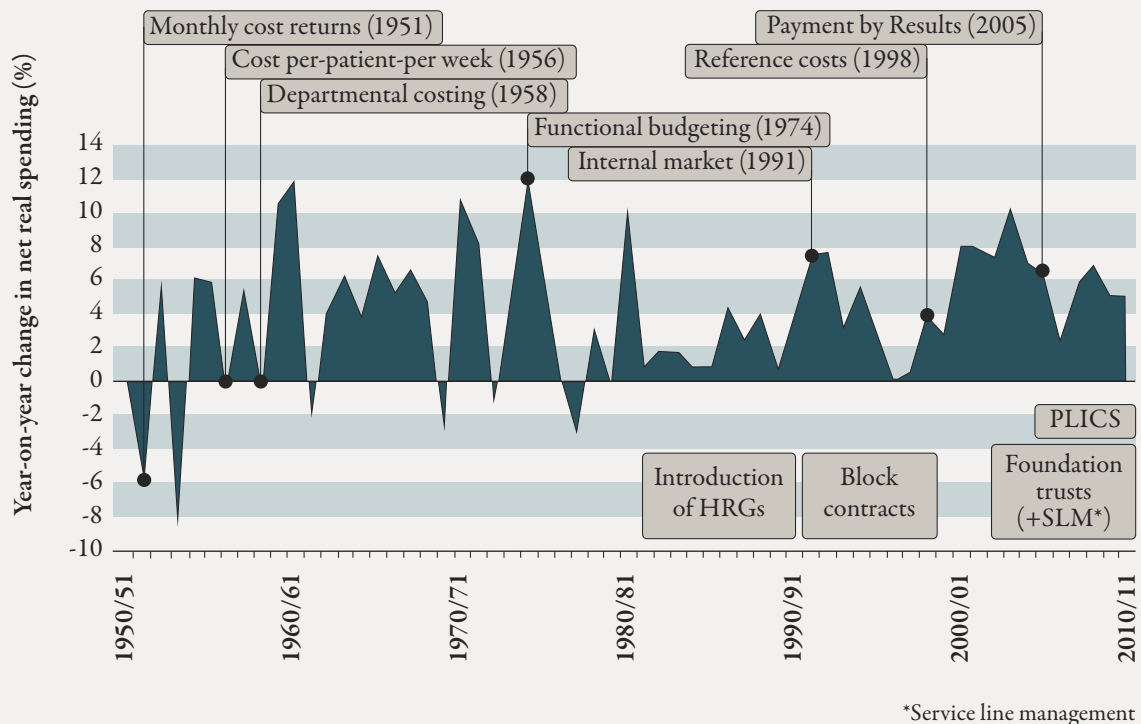
The development of patient-level costing

Patient-level costing has its roots in activity-based costing, which developed in the manufacturing sector of the United States (USA) during the 1970s (Staubus, 1971). Activity-based costing identifies the main activities within an organisation and maps the resources used by each activity to all products. The relative costs of the products depend on the extent that the product uses each activity. This enables accurate understanding of the costs and benefits of each product.

PLICS in health care are already established in some other countries, including the USA, Germany and some parts of Australia (Leister and Stausberg, 2005) and are increasingly being used in the NHS. It can be seen as the latest advance in a long-term trend of gradual development in the level of detail of cost information in hospitals over the last 60 years; from generic hospital cost-per-person or per bed-day; then by department, speciality and treatment type; and now at individual patient-level.

Figure 1 illustrates some of the major changes in hospital accounting and relevant reforms to the NHS, alongside information showing year-on-year changes in NHS net real spending. This indicates the degree of financial pressure the NHS was under at the time reforms were made, and suggests whether new accounting systems are introduced as a result of increased need for efficiency or other reasons.

Figure 1: Year-on-year change in UK NHS net real spending 1950–2011, annotated with major costing reforms and trends



Source: real spend data from Appleby and others (2009)

In recent times the two biggest drivers of improved costing information have been the introduction of greater financial independence with foundation trust (FT) status for hospitals in 2003 and hospitals being paid for individual admissions with Payment by Results (PbR) in 2005 (Department of Health, 2010). With the exception of the earliest NHS accounting reforms, it appears that all changes have been introduced at times when spending growth has been above average. This suggests that accounting reforms are not necessarily introduced as a response to periods of austerity.

The first PLICS were introduced in the NHS in the mid-2000s. In 2011 under half of acute NHS providers had implemented such systems, although another quarter reported they were in the process of doing so (Department of Health, 2011). Monitor, the foundation trust regulator, advocates service line management (SLM). While not requiring full patient-level costing, SLM is a more detailed level of financial reporting than traditional top-down methods (Moyes and Kane, 2009).



The first PLICS systems were introduced in the NHS in the mid-2000s

What patient-level costs can show: data from one trust

We identified one trust that implemented PLICS in 2007. We obtained from that trust patient-level anonymised data for one complete year (2008/09) to examine further. Our data covered inpatient, outpatient and accident and emergency (A&E) activity.

NHS hospitals are paid on a fixed price per admission ('tariff') basis (under PbR). The tariff is derived from the national reference costs, and represents normative costs for each HRG. (HRGs are groups of patient events that share broadly similar diagnoses and have been judged to consume a similar level of resources.) The tariff is supplemented in cases where patients receive specialist care or stay in hospital longer than expected. Where activity is not covered by the tariff, prices are agreed locally between commissioners and providers. Our analysis focused on activity subject to the national mandatory tariff.

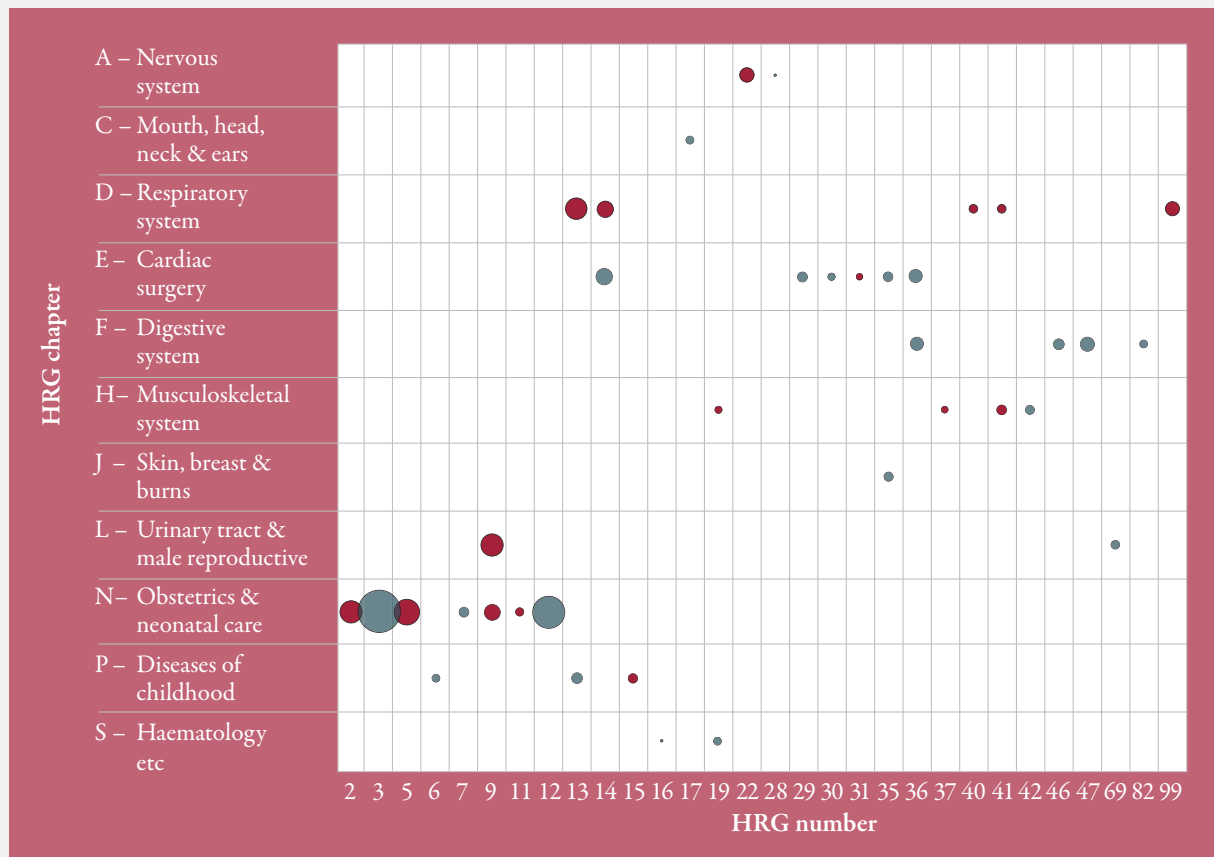
Total income for care relative to total costs

The first question examined was the difference between total costs of patient care and the total income for this care paid for through the national tariff price. In our example trust, we examined the costs of patient care relative to the calculated tariff income. This revealed patterns of excess of income over cost ('surplus') and excess of cost over income ('deficit'). These patterns varied by the form of care delivered. Overall, tariff income for elective inpatient care exceeded the costs incurred. Within that setting, the costs of elective care for patients staying longer than two days exceeded the tariff income; however, this deficit was outweighed by the surplus created by care for shorter-stay inpatients and day cases. Although the same pattern was observed for non-elective inpatient care, the surplus from short stays did not eliminate deficits caused by longer stays. The costs of both outpatient and A&E care overall exceeded the total tariff income.

These patterns of surplus and deficit also varied between HRGs. Figure 2 (opposite) summarises non-elective inpatient activity in the example trust, focusing on elective inpatient HRGs with 250 or more cases in the study period. It shows which HRGs are creating large surpluses or deficits.

The figure shows, for example, large surpluses from neonates with one minor diagnosis (HRG N03) and antenatal admissions not related to delivery (N12), contrasted against smaller deficits from neonates with multiple minor diagnoses (N02) and neonates with

Figure 2: 'Heat map' of surplus/deficit and cost variation for high-volume non-elective inpatient cases



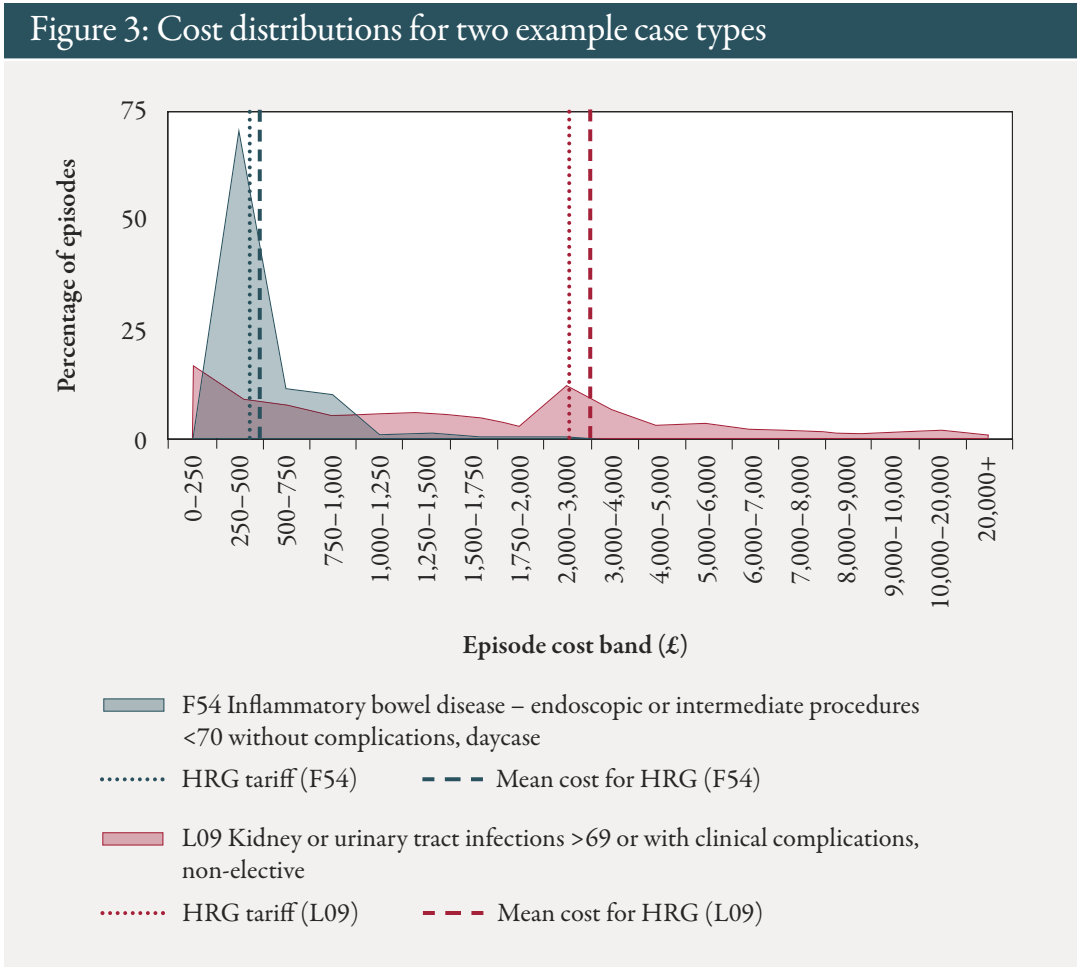
The difference between total cost and PbR tariff payments (including adjustments for patients staying in hospital longer than expected) is shown by the size of the bubble; the colour indicates surplus (teal) or deficit (red). Each cell represents a different HRG (of those with more than 250 cases), with the chapter across the columns and the HRG number in its rows.

one major diagnosis (N05). Another example is one whole HRG chapter (F – digestive system) where all high-volume HRGs generated a surplus. However, all HRGs in chapter D (respiratory system) created a deficit.

Variability in costs within HRG categories relative to the national tariff

We demonstrated that variation existed between care settings and between HRGs. It is possible to perform these analyses, albeit less accurately, using traditional costing methods. The next question examined, which can only be answered using patient-level costing, was to what extent the surplus or deficit varied between each case within an HRG.

Figure 3 (overleaf) shows the distribution of patient-level costs obtained from PLICS for patients in two example HRGs (F54: inpatient care for inflammatory bowel disease; and L09: emergency inpatient care for kidney or urinary tract infections in persons older than 69 years or those with complications). In the figure, the dotted vertical line shows the tariff price for each of the two HRGs, while the dashed vertical line shows the average



cost for patients in each of the two HRGs (the lowest level of cost information available to hospitals without PLICS) assuming no extra care is given.

The figure shows that in this particular trust, the average cost of care for patients in each HRG was higher than the national tariff price (the income for that care), particularly for L09. The figure also shows the large distribution of costs of care around the mean in L09, with the treatment of some patients costing less than £500, and others costing over £10,000.

Not all causes of this variation will be under the trust’s control. For example, the social and economic circumstances of patients may add to the costs of care, if the person stays longer in hospital (Sanderson, 2010). However, some of the variation will be

under the control of management or clinical staff and could be investigated further.

17%

number of cases with costs within 10% of tariff payment

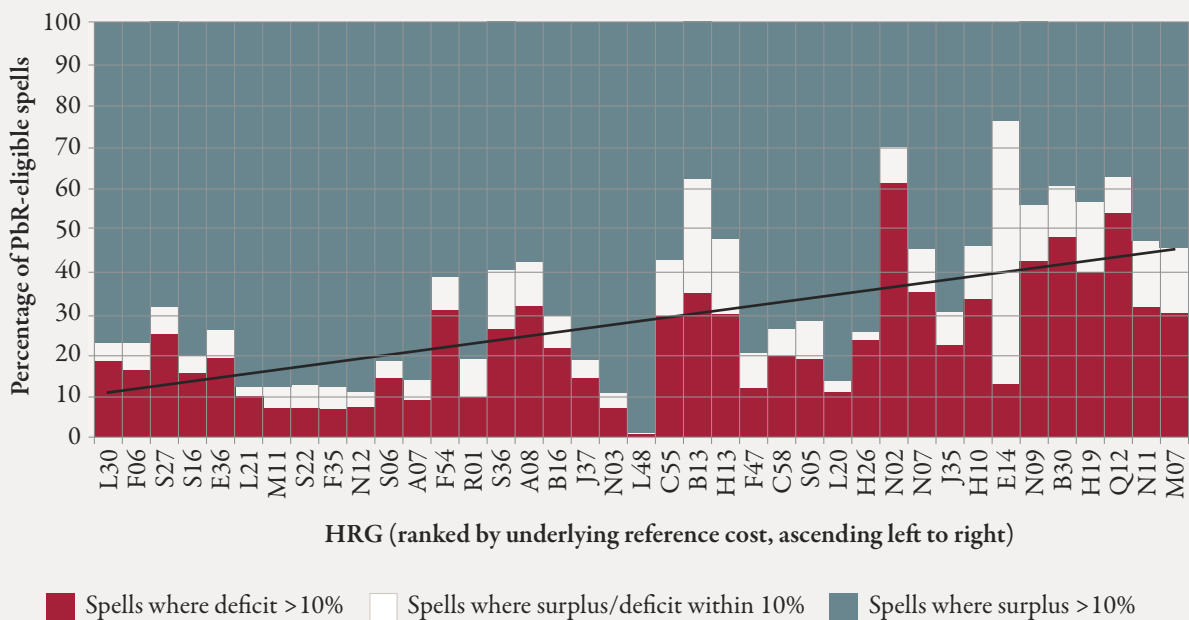
Relationship of ‘margin’ to the tariff price

We found a relatively poor match in the costs of care for individuals and the tariff income across all HRGs. Only 17% of all cases had costs that fell within 10% of the appropriate tariff payment (including adjustments for patients staying longer than expected). However, because the total number of cases in surplus was roughly equal to

the number of cases making a deficit, the overall totals are similar. Nevertheless, the poor alignment at case level means if there were any slight changes in case type within the HRG, or any change in the price of the tariff, these could result in significant changes to the surplus to deficit ratio.

We also found a clear relationship between tariff price and the chances of an inpatient spell being either in surplus or deficit: the higher the tariff price the more likely the actual cost of care would exceed the tariff. For example, the costs of care exceeded the tariff income by more than 10% in only around one in six admissions with a low tariff price (£500–£750), compared to two thirds of admissions with a high price tariff (more than £20,000). Figure 4 shows the distribution of surplus/deficit by HRG in order of increasing expected cost.

Figure 4: Degree of surplus and deficit, by spell cost



With regression line on mid-point of surplus/deficit, for PBR-applicable inpatient spells (based on high-volume HRGs).

Identifying why costs might vary

One real advantage of PLICS is in providing information that allows managers and clinicians to explore why the costs of an HRG are high and judging the legitimacy of those costs patient by patient. PLICS can reveal how clinical practice by an individual consultant or clinical team or management style of ostensibly similar patient types might be leading to higher or lower than average costs. While such analysis does not include any measure of the outcome for patients, information from PLICS can point to relative inefficiencies between teams and what might be done about them.

Variation by consultant team

The ability to analyse costs by consultant team is just one example of what is possible.

Figure 5 shows a ‘heat map’ in the same style as for HRGs above, but this time focusing on consultant team (columns) and HRG (rows) and coloured by mean episode cost.

Figure 5: Heat map showing mean episode costs by consultant team for various HRGs

HRG	Description	Consultant team										
		1	2	3	4	5	6	7	8	9	10	11
L02	Kidney major open procedure >49 or w cc	Orange	Yellow			Yellow		Green				Green
L03	Kidney major open procedure <50 w/o cc		Orange					Green				Green
L04	Kidney major endoscopic procedure	Orange								Green		
L12	Ureter major endoscopic procedure	Yellow					Orange	Orange		Yellow		Green
L13	Ureter intermediate endoscopic procedure	Green				Orange		Green		Orange		
L17	Bladder major endoscopic procedure	Green	Orange	Yellow	Green	Green	Green	Orange	Yellow	Yellow		Green
L18	Bladder intermediate endoscopic procedure w cc		Yellow	Green	Orange		Green		Green		Green	Orange
L19	Bladder intermediate endoscopic procedure w/o cc			Green	Green	Green			Green	Orange		
L20	Bladder minor endoscopic procedure w cc				Orange	Green						
L21	Bladder minor endoscopic procedure w/o cc				Orange	Green	Green					
L27	Prostate transurethral resection procedure >69 or w cc	Yellow	Yellow	Yellow			Orange	Green	Yellow	Green	Orange	Yellow
L28	Prostate transurethral resection procedure <70 w/o cc										Orange	Green
L34	Urethra intermediate or minor procedures >69 or w cc		Orange	Green		Green	Green		Orange			Yellow
L35	Urethra intermediate or minor procedures <70 w/o cc		Yellow						Orange			Green
L43	Scrotum testis or vas deferens open procedures <70 w/o cc	Green						Orange	Orange			
L68	Cystectomy with urinary diversion and reconstruction				Orange	Green						
S22	Planned procedures not carried out	Green	Orange		Yellow			Green		Green	Green	Green

The heat map shows mean episode costs by consultant team for HRGs where the consultant team performed five or more cases as elective inpatients in 2008/09 for the urology specialty in two or more HRGs, and HRGs had two or more consultant teams active. Cells are coloured green (lowest mean episode cost) to pink (highest) within HRG.

The figure shows the summary costs between consultants. Comparing consultants 2 and 7, for example, reveals that number 7’s average costs are consistently lower than 2’s across all comparable HRGs. However, this must not be taken as implying that consultant 7 is highly efficient while number 2 is wasteful; the underlying data need to be inspected.

The patient-level data show that consultant 2 performed nearly twice as many episodes as consultant 7, and the patients consultant 2 treated tended to be older than those treated by consultant 7. However, they also show that consultant 2’s average ward costs are much higher than consultant 7’s in each HRG. The proportional distribution of costs across different cost categories is generally similar between the two consultants, although in two

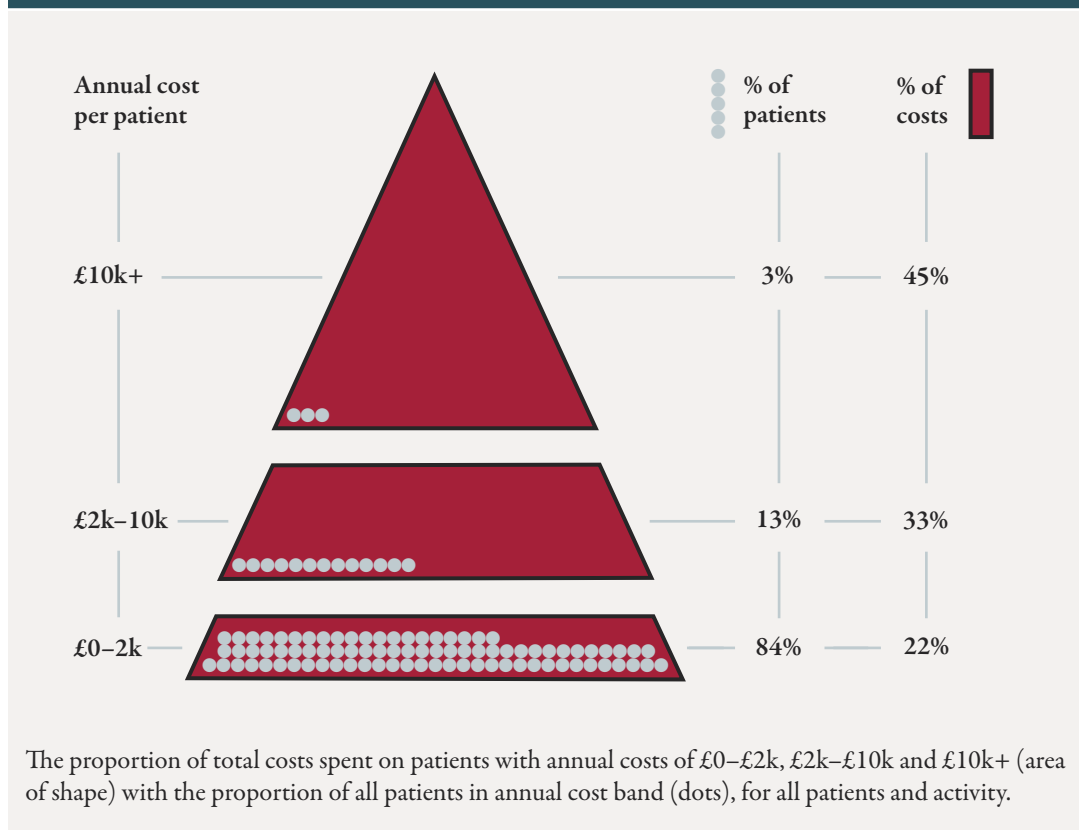
HRGs consultant 7 spends more on theatres and less on wards, which could indicate a cost trade-off that allows consultant 7 to have lower overall costs. In another HRG a similar pattern appears between ward and pathology costs. Primary diagnoses are very mixed, but the consultants treat matching primary diagnoses in 42% of cases. Consultant 2 also has some outlying high-cost episodes, but only two episodes (in L03 and S22) are more than twice as expensive as the next highest cost episode in the HRGs, so the impact of these is debatable. One possible explanation of consultant 2's higher ward costs is that older patients are more likely to incur pre-operative bed days. It also needs to be considered that this analysis does not include any measure of patient outcomes between the consultants.

Over all specialties and consultants there was evidence that the higher the number of consultants providing treatment for a condition in a particular HRG, the higher the variation in costs per patient, particularly for elective procedures.

Variation by patient

The overwhelming majority of analysis of PLICS data performed by the NHS focuses on the costs of single stays in hospital. Yet it is possible to analyse costs over a period of time at an individual patient-level. Using data from our example trust, Figure 6 illustrates the importance in cost terms of a relatively small number of high-cost patients. Though the majority of patients have low annual costs per head (60% cost under £500) these collectively accounted for less than 8% of total patient costs. On the other hand, the 3% of patients whose costs exceeded £10,000 per person per year were responsible for nearly half the total patient cost.

Figure 6: Proportion of total costs spent on patients by their annual costs

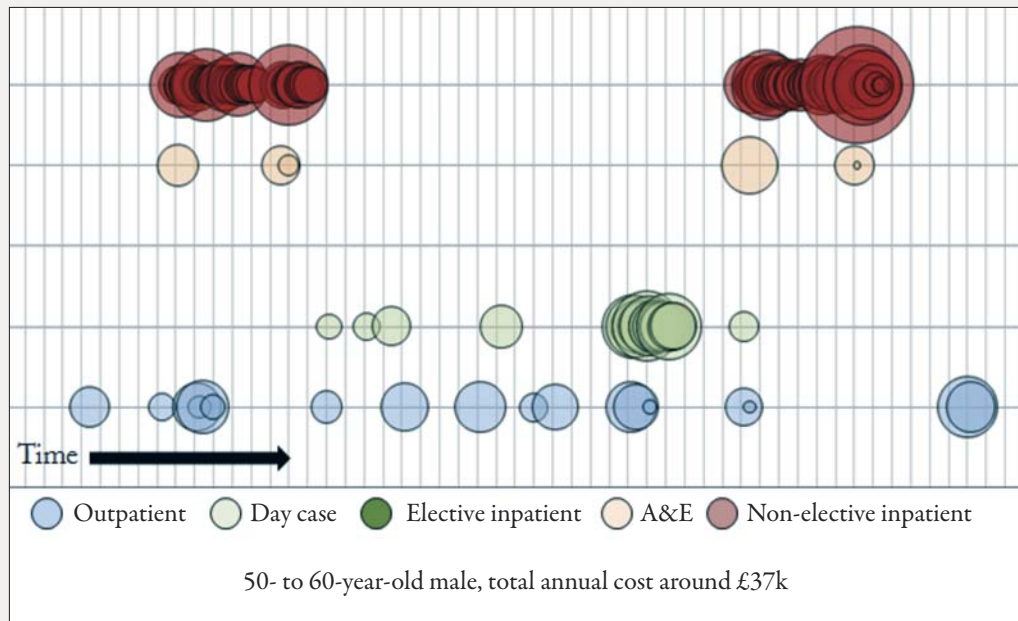


The fact that patient costs are so skewed has prompted the use of various tools for risk adjustment and case finding (Nuffield Trust, 2011b) to identify patients for preventive care. The effectiveness of such targeting clearly depends not just on whether patients can be identified earlier, but also whether the interventions available are successful in managing the need for future acute care, or can reduce the intensity of acute care.

“ Some trusts are using their PLICS data to examine the cost of care pathways

Some trusts are using their PLICS data to examine the cost of the care pathways by individual patients (Moore and Goodier, 2010), which could be extended to activity linked across primary, secondary and social care (Nuffield Trust, 2011a). Figure 7 shows the interaction that one (anonymised) individual had with the trust in one year.

Figure 7: One individual's encounters and costs during the study year (50- to 60-year-old male; total cost around £37k)



Each bubble represents a daily cost, with colour indicating care setting and size indicating expenditure. This patient had regular outpatient care of broadly the same cost throughout the period shown, as well as a concentrated period of day case activity near the middle of the period. Their annual costs were significantly influenced by two periods of emergency admission, both of which consisted of an emergency admission through A&E

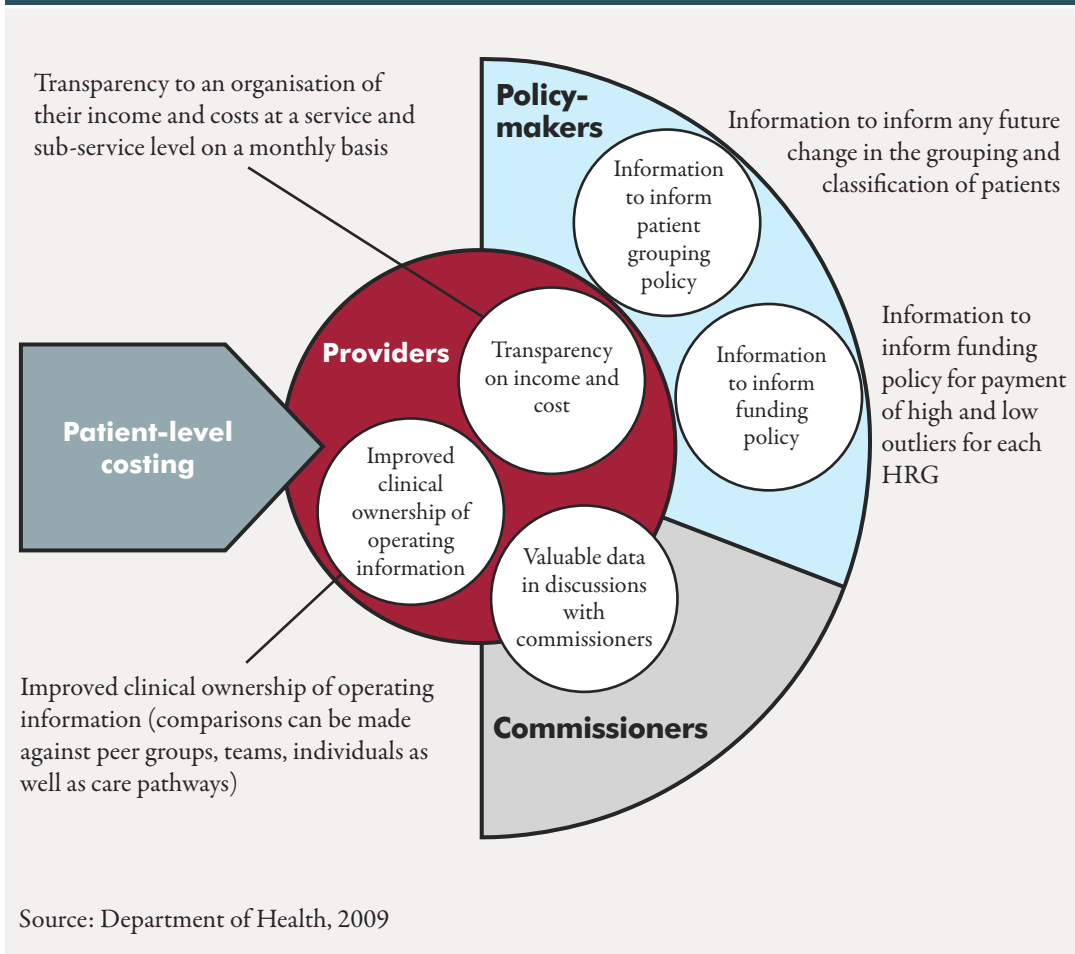
followed by an emergency readmission shortly after discharge. The second emergency readmission was particularly expensive. Most of the activity was related to the same underlying medical condition.

Implementing and using patient-level costing in practice

The move towards PLICS represents a fundamental shift in costing practices, and requires the integration of hitherto isolated information systems. One NHS trust estimated start-up and staff costs in the region of £250,000 to £500,000 (Healthcare Financial Management Association, 2008). This is a significant investment, but not huge given the income of NHS acute trusts, together with suggested efficiency gains.

However, there are a number of possible approaches hospitals can take to improving efficiency (Hurst and Williams, 2012) and, given the current financial landscape, prioritisation and guaranteed results are vital. We tested the hospitals' experiences of the five suggested benefits of PLICS set out by the Department of Health (Department of Health, 2009), and shown in Figure 8.

Figure 8: The potential benefits of PLICS, as set out by the Department of Health, showing the main potential beneficiaries



Improving transparency of income and cost

In most trusts, integrating PLICS with existing information systems has been a major undertaking, and is often further complicated by the requirement to run PLICS alongside existing systems. There are choices to be made as to which costs to capture in PLICS; these will be informed by trade-offs between the benefits of more detailed information against the costs of linking the data. In practice many PLICS develop incrementally, feeding in information from other information systems over time. Merchant and Shields (1993) describe how organisations are often pragmatic in choosing the level of accuracy for their costing systems, based on the minimum level required to drive change rather than the best levels available.

The Chartered Institute of Management Accountants (CIMA) reported that some early adopters of PLICS have found that it had refocused their attentions on areas of costs that had previously not been considered to be major cost drivers (Chartered Institute of Management Accountants, 2008).

Our example trust pointed to an analysis where patients with similar conditions were having differing numbers of tests requested. After discussions with clinical directors three tests were removed from the order set, resulting in savings of around £15,000 per year.



Our example trust routinely shares PLICS-based reference costs with commissioners

Improving clinical ownership of operating information

Many with experience of PLICS recommend clinicians being involved in the design of the system and identifying clinical ‘champions’ within the organisation who can set aside dedicated time. Yet specific examples of changed clinical behaviour towards providing more efficient care as a result of introducing PLICS are surprisingly rare. Though PLICS may help improve the quality of the dialogue between managers and clinicians, and between clinicians about costs, as with any initiative to identify and tackle inefficiencies with clinical staff, good management will be essential.

Informing the grouping and classification of patients and funding policy for payment

Our example trust saw one of the main purposes of its PLICS system as being the ability to lobby on and inform future tariff development. It also highlighted volatility in the tariff as a disincentive to base efficiency programmes on surplus/deficit (as opposed to absolute costs), and the demotivating effects on staff of realising that their costs have stayed the same one year to the next, but that they have moved from surplus to deficit because of a change in tariff price.

When our example trust negotiated local prices with the regional specialist commissioning group, it typically negotiated for a package of care and rehabilitation, not just the single hospital spell as in PbR. PLICS are used to inform the package price.


Data for discussion with commissioners

We noted that our example trust found that PLICS data were particularly valuable in justifying prices to the commissioning primary care trusts (PCTs) and routinely shares PLICS-based reference costs with commissioners during contract negotiations. There are other examples of trusts employing this technique:

For our patients on the costing system, we were able to demonstrate that we were bringing in women to have a mastectomy, and then some months later they'd come back and have a reconstruction under the tariff, and (we would) get paid £6,000 for that procedure. Our general surgeons and plastic surgeons wanted to work together in the theatre and do it all in one day [...] and you only get paid once under the tariff, so it costs you £12,000 but you only get £6,000, but because of PLICS we could demonstrate that to the PCT, and they've agreed to take it out of tariff and pay us separately for it.

Management accountant, NHS trust (quoted in Chapman and Kern, 2010)

Debate about the cost-effectiveness of implementation is not limited to patient-level costing; a review of cost and benefits of health information technology (IT) (Shekelle and Goldzweig, 2009) noted that published evidence on the cost-effectiveness of health IT in general was weak. The authors point out that this is partly because the complex nature of organisational health IT interventions interacts with a wide range of system components, making evaluation challenging. However, while this means that the cost-effectiveness of PLICS is unknown, it is possible that improvements in patient-level accounting information such as PLICS will make it possible to perform detailed evaluation of health IT projects in the longer term.

 In future, PLICS could be extended from hospitals into primary care and community services

Discussion and future developments

PLICS is a useful tool that, when implemented well, can provide a vast array of useful and accurate data on spending per case against income. This is far more detailed than traditional methods of costing care in hospitals, such as using top-down cost apportionment methods. Current evidence for short-term savings directly attributable to PLICS is modest, and it should be viewed as a long-term investment that can support management decision making in the quest for greater efficiency.

The benefits of PLICS are not necessarily limited to retrospective analysis of costs. Other uses for PLICS data include enhancing the accuracy of budget projections, and as planning tools to model changes in certain patient groups. In future, PLICS could be extended from hospitals into primary care and community services, both as a vehicle for improving efficiency in those services and also to understand the full costs of care for an individual across all services. There is precedent for using PLICS in primary care outside the UK, albeit at a small scale (Engström and others, 2006).

There is also potential for developing the way costs are monitored. If PLICS information can be delivered on a more frequent (daily or weekly) basis, costs could be amenable to the surveillance techniques currently applied to monitoring in-hospital mortality (Healthcare Commission, 2009), allowing immediate intervention in a service if costs were consistently deviating from some expected value.

Changes brought about by the Health and Social Care Act 2012 signal important changes for NHS providers. In addition to greater independence from central control, there will also be a much tougher position on overspends. This affects the take-up and use of PLICS in two ways. Firstly, the move to increase provider independence means the Department of Health is unlikely to mandate PLICS in NHS trusts, reducing the speed of adoption. Secondly, the consequences for providers of not understanding and being in control of their costs are much greater, making adoption of PLICS more attractive.

Short of central directives, there may be a number of ways to encourage the implementation of PLICS. For example the body that sets prices (at the time of writing this is likely to be Monitor) could follow the German model of only using costs from PLICS trusts to help set the prices. This would also encourage more accurate setting of the tariff price.

The advent of PLICS means that providers have a very advanced understanding of their costs, something to which the commissioners are not guaranteed access. This creates information asymmetry, which can have a detrimental effect on the efficiency of a market. To guard against this, policy-makers could mandate some level of cost information-sharing between all providers and commissioners, possibly following the model of regulatory accounts used in the utilities industry.

If providers shift their behaviour from 'income maximising' to 'surplus maximising' it is possible that some providers may try to reduce their activity in areas that are not profitable. Continuity of access to care must be ensured for the public. While locally this will be the job of the local clinical commissioning group, it will be important that in a 'national' health service there is monitoring to ensure continued equity of access. The primary responsibility here is that of the NHS Commissioning Board.

In short, patient-level costing is a powerful tool for health care organisations. When implemented well it provides a vast array of useful and accurate data on distributions of expenditure and profitability against income. However, it then relies on the provider to make use of this information in terms of influencing practice to become more efficient and setting prices. There is limited evidence for cost savings as a result of PLICS, and those that are documented involved relatively small amounts. It would seem that PLICS is a long-term investment rather than a short-term saving. Despite this, trusts without access to high-quality cost information will find it challenging to ensure their efficiency savings are cutting waste, not care.

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