



Report on the Value Challenge Pilot

May 2017

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Foreword

Achieving the best value for patients from every pound spent on healthcare has always been a core focus of the NHS. But getting the most from the NHS budget isn't just about monetary value. It's about managing the limited resources that are available more effectively so that we can deliver the best possible outcomes for patients.

Delivering value-based healthcare has to become the focus for clinicians and finance alike as they look to deliver high-quality sustainable healthcare services to meet the needs of a growing and ageing population. But the challenge is how you turn the theory of value into practice.

While much has been written and discussed about the concept of 'value', there are not many examples where the value framework has been put into practice at a local level. HFMA's Healthcare Costing for Value Institute is well placed to support members who are keen to apply the framework to see how they can start delivering better value to patients.

Professor Robert S Kaplan set members of the Institute a challenge at the Institute's April 2015 inaugural value masterclass:

"Take one or two acute care conditions, take on a chronic care condition, and take a primary mental health situation.

Try one pilot in each of these three categories and really try to apply the value framework to see how we can start delivering better value to patients with that medical condition.

What are the set of desired outcomes?

What does it cost to do the right thing, at the right time, in the right place?

Then let's have a payment system that rewards better outcomes and lower cost.

If we can start today, next year we can start taking on more, and in a five year period we'll really be in a very different place to where we are today."

Kaplan April 2015

This first 'value challenge pilot' is our response to Professor Kaplan's challenge. This report describes how we set about the value challenge and the lessons learned. It is very clear that this is only the start of a journey to turn the theory of value into practice, but we hope that this project will provide others with the encouragement and learning to start the journey too.

We are always very interested in sharing and discussing examples of turning the theory of value into practice in the UK and internationally. I do hope some readers of this report will contact me to start a conversation about value-based healthcare catherine.mitchell@hfma.org.uk.

Catherine Mitchell

Head of costing and value, HFMA

Executive summary

This report describes how clinical and finance staff in three acute trusts in England, with support from the HFMA Healthcare Costing for Value Institute, set about translating the theory of value into practice. The aim was to test how easy it is in practice to link costs and outcomes at a patient level, and explore whether there is any correlation between them.

From the outset this project was seen as a pragmatic proof of concept. This was an ambitious pilot with only a short timescale allocated, and the project team recognised the clear limitations from the start.

Nevertheless, significant progress was made over a period of seven months, and the project has demonstrated that it is possible to link costs and outcomes at a patient level, and identify relationships between them.

It would be wonderful to provide a complete narrative of what the analysis showed and what changes the trusts have made to clinical practice as a result. Our project has shown that to achieve this in a few months is not possible. One key message from the project is that doing this type of work takes time. Another big lesson is that it is vital to be very careful in the interpretation of results. Our statistical analysis has highlighted some significant differences between the three trusts, which require further exploration before any conclusions can be drawn.

From the beginning the team recognised that the outcome of the project was unknown, viewing it as an exploration into the theory of value and a start along the journey to link costs to outcomes in the NHS. Significant challenges were encountered on the way, particularly around data sharing and access to data. If greater value is to be unlocked in the NHS, changes need to be made at a national level to support future value projects, and our project has also highlighted learning for local organisations wanting to start their own value projects.

Recognising this value challenge pilot as 'work-in-progress', we are proud with the progress made in such a short time. As well as demonstrating that it is possible to link costs to outcome data in a clinically meaningful way, we have explored the linkages between cost and outcomes in two specialties in three trusts. We are able to describe the challenges and obstacles from both clinical and financial perspectives, and have increased the costing team's access to clinical data.

We hope that this report will provide support and interest to organisations undertaking their own value challenges. The Healthcare Costing for Value Institute will continue to facilitate learning on how to translate the theory of value into practice by working with members and other stakeholders, and sharing examples from both the UK and abroad.

A financial perspective

“Since the first implementation of PLICS in 2011, early implementers of patient level systems have sought to have ‘one version of the truth’ which combines the financial view with the clinical view of patient care.

Whilst this has been achieved within many trusts, the ability for clinical teams to compare themselves with colleagues from other hospitals, has previously not been explored in a systematic way.

The ‘Value challenge pilot’ has provided colleagues from across three trusts located in different health economies to test the concept of a comparable single version of the truth. This is an exceptionally difficult area, challenging paradigms and requiring a high level of trust to be developed across professions and between teams. The work is especially relevant as it provides a methodology to examine, analyse and adapt to the questions posed through the Carter model hospital.

The results clearly demonstrate that clinical and financial teams are able to collaborate between hospitals using PLICS as ‘one version of the truth’. The benefits to the patient will follow.”

Duncan Orme, deputy director of finance, Nottingham University Hospitals NHS Trust

A clinical perspective

“From a clinical perspective being involved in this project has challenged and frustrated in near equal measure: the limited timescale did not allow for exploration of all the ideas but the enthusiasm for developing a fuller understanding of variances in care was evident in all our discussions.

Incomplete, inaccurate or inaccessible clinical data are recurring themes in healthcare but in this small feasibility project we began to appreciate how clinical staff can be included in the analysis of costings data and how they can contextualise such information to improve shared understanding.

While clinicians are comfortable in discussing best care, clinical guidelines and clinical challenges, we did encounter difficulties in developing data sharing agreements among and within organisations which took considerable time to resolve. As a group we were able to describe, and start to link to, other avenues of data collection such as clinical audit, incident reporting, drug usage or drug error and consider how those data complement patient level financial information. Even within the short timescale we developed methods for more consistent data capture across the trusts, and for including patient level clinical data from other hospital systems to examine outcomes for subgroups.

Close partnership working among clinical and financial teams in this proof of concept suggests that there is merit in this approach. We believe it is a methodology worth exploring further if we move towards reducing variance in care, learning from outcomes in comparator organisations and making better use of limited resources.”

Dr Jean MacLeod, consultant physician in medicine and diabetes, North Tees and Hartlepool NHS Foundation Trust

Section A

Project approach

Objective – a pragmatic proof of concept

The overall objective of the pilot was to test how easy it is in practice to link costs and outcomes at patient level, and to explore whether there is any correlation between them.

This project was seen as the next step in developing patient-level costing (PLICS) by those involved. It was also intended to provide insight into how PLICS can be used to drive better value for those organisations who actively use this information within their strategic and operational management.

From the start, a pragmatic approach was adopted for this pilot. There was no doubt that this was an ambitious pilot, with only a three-month timescale allocated, and there were clear limitations identified and accepted by the project team from the start.

That said, the project team felt that this was still an important piece of work and that significant mileage could still be made. The project team framed the challenge as a test to see what outcome data was available for the chosen groups of patients, whether this data could be obtained and shared and how it could be linked to costs.

The project needed to use data that had already been routinely collected in the 2015/16 period. The timescales did not permit additional sample data collections to be put in place. Many outcome measures for patients will only be available in the future because they relate to future assessments of health and wellbeing. Therefore, whilst the project team knew these outcome measures could be not included within this project, whether they are collected and would be available at a future date was investigated.

The HC4V Institute publication 'Introduction to health outcomes' sets out some of the challenges in defining and collecting outcome data:

*'Defining health outcomes can be a major hurdle in progressing to collecting and using outcomes data. There is, as yet, no standard definition of health outcomes in the UK or internationally. It is important to distinguish outcomes from outputs. Health outputs have been the traditional way to quantify healthcare delivery and are an important source of data but do not provide the information required to measure value and improve healthcare. Outcomes include patient reported measures about patients' care and specific data about the efficacy of the treatment patients receive in addressing their condition.'*¹

One of the key limitations of the project was the fact that there is no central repository of NHS data. This was a fundamental limitation of the project, particularly when looking at long term conditions, because it prevented access to information from general practice and primary care, and indeed from other acute hospitals. This is a significant obstacle and prevents value across a patient pathway from being measured, and therefore opportunities to increase value across health economies.

The question could therefore be asked as to why this Value Challenge focused on three acute hospitals. The reason for this is because to succeed the project also required robust cost data. For this proof of concept, it was decided to work with three acute trusts with well-established PLICS systems.

¹ *Introduction to health outcomes* October 2016 Healthcare Costing for Value Institute

Whilst it could be possible to take a small group of patients and obtain cost and outcome measures from all organisations involved in their care over a period of time, this was not part of the scope of this Value Challenge. The aim of this Value Challenge was to test what data is currently available within an organisation and how it might be used to drive increased value to patients.

The project team therefore chose to adopt a pragmatic approach and focus on a section of the patient pathway that could be identified from data routinely collected in an acute setting.

Project aims

The aims of the project are listed in figure 1.

Figure 1 Aims of project

- Establish a multi-disciplinary project team across three NHS acute trusts
- Identify two specialties – one surgical and one medical
- Agree which groups of patients would be identified within each specialty
- Obtain PLICS data for agreed groups of patients in each of the three trusts
- Discuss relevant outcome measures for each specialty and identify which, if any, could be used
- Undertake econometric analysis to identify any correlations between costs and outcomes
- Review results from the analysis and identify ways in which the econometric analysis may be translated into changes to operational or clinical practice to deliver better value healthcare to patients in the future
- Identify learnings from this project and recommend how best to conduct future pilots to expand the specialties involved and / or the number of trusts

The project team

The project team is set out in appendix 1.
The three trusts involved in the pilot were:

- Leeds Teaching Hospitals NHS Trust
- Nottingham University Hospitals NHS Trust
- North Tees and Hartlepool NHS Foundation Trust

These hospitals were self-selected. They were all interested in working with the HC4V Institute to link their PLICS data to outcomes as they believed it was the next development for PLICS and the way forward to driver better value within their organisations.

For this initial pilot, it was important that all three trusts used the same costing software packages. This was important to minimise the number of issues regarding the extraction and comparability of PLICS data. It is also important to note that these three hospitals were not in direct competition with one another.

The team was made up of clinical leads for each specialty from each trust, together with the three costing leads. The Institute provided dedicated project management support to the pilot.

The trusts' costing software provider, Quintiles IMS were involved throughout the project. This involvement was important to ensure that the data could be extracted from each trust in a consistent way, that data could be cleansed prior to the analysis stage and pseudo-anonymised. They were also able to work with the three trusts to identify and resolve inconsistencies in the costing data highlighted during the analysis work.

Cambridge University's Judge Business School provided expert econometric analysis of the PLICS and outcome data. Dr Stefan Scholtes and Dr Michael Freeman provided expert analysis that was shared with the project team and continued to work with the team to incorporate their comments and feedback. Their experience of working with PLICS data was a significant contributing factor to the success of the pilot.

Acknowledgements

The HFMA would like to thank all of those involved. The commitment by the project team was significant, especially given the number of obstacles encountered along the way. It is hoped that those involved found it an interesting and rewarding project. Whilst all three trusts recognise that they are at the start of this journey, we hope this project has provided valuable knowledge, learning, momentum and enthusiasm to continue with this exciting area of work in the future.

Section B

Choosing the specialties

The two specialties chosen were:

- trauma and orthopaedics, and
- diabetes.

Trauma and orthopaedics

Trauma and orthopaedics has a high volume of patients across the three hospitals and reasonably well understood approaches to costing and collection of outcome data.

From the outset, the project team suspected that greater progress would be made with the surgical specialty than the medical specialty. There are a number of national databases available that contain useful outcome measures for trauma and orthopaedics. In addition, surgical departments are generally more used to being managed by numbers and data, particularly in areas where best practice tariffs apply.

The project team started by considering hip replacements. Work was undertaken to investigate access to the National Joint Registry (NJR).² Our investigations showed that clinical leads could obtain access to the NJR to review individual patient records. However, the NJR does not currently make a consolidated extract available to each trust. The three trusts are continuing their efforts to obtain access to the NJR.

After consideration, the project team chose to focus on **fractured neck of femur patients**. Fractured neck of femur is a very common condition across all three trusts. The pathway for fractured neck of femur patients is also very well documented following the introduction of the best practice tariff (BPT) in 2010/11.

In addition, the clinical leads identified that there is a national data collection for fractured neck of femur patients, called the National Hip Fracture Database (NHFD).³

Diabetes

Medical specialties, particularly long-term conditions, are inherently more complex than surgical specialties, and the project team knew that narrowing down the scope of a long-term condition would be challenging.

Diabetes covers so many different areas of care and treatment that the project team had to break the condition down into smaller areas and decide which of these to focus on, for example, an area with very high cost patients or resources, or areas with the greatest volume in terms of patient numbers.

² The NJR was set up by the Department of Health and Welsh Government in 2002 to collect information on all hip, knee, ankle, elbow and shoulder replacement operations, to monitor the performance of joint replacement implants and the effectiveness of different types of surgery, improving clinical standards and benefiting patients, clinicians and the orthopaedic sector as a whole.

³ The NHFD is a national clinical audit project commissioned by the Healthcare Quality Improvement Partnership and managed by the Royal College of Physicians as part of the Falls and Fragility Fracture Audit Programme. It was established in 2007 as a joint venture of the British Geriatrics Society and the British Orthopaedic Association, and is designed to facilitate improvements in the quality and cost effectiveness of hip fracture care. From 2010 onwards the NHFD has also been used to support the payment of the best practice tariff, allowing NHS trusts to prove compliance to commissioners .

Many different options were considered. The outpatient foot clinic was considered, because of its impact to reduce the frequency of amputations. However, it was felt that costing in outpatients would not be sufficiently sensitive, as most clinic costs are averaged across all patients.

After much discussion the team decided to focus on **inpatients with diabetes** as this is the area where costing per bed day was reasonably robust. In addition, there would be a large volume of patients (16.8% of occupied bed days according to the National diabetes in-patient audit of 2015) to include with care provided across a number of specialties. People with type 1 and type 2 diabetes were included in the study as it was not possible to distinguish between the two types of diabetes from the coded data.

Other factors to take into account in the selection of specialties

It is worth noting other factors which had to be taken into account when selecting the specialties, which others undertaking value projects might find helpful:

- One trust was smaller than the others and did not provide all specialties. Therefore we needed to select specialties that were provided by all three trusts.
- We required dedicated and enthusiastic input from the costing and clinical leads for each trust. The trusts involved found that it was easier to engage with some specialties over others in their trusts. This occurred for many different reasons but an important learning from the project is that success is dependent on the commitment and input from all project team members.
- The costing for each specialty needed to be as robust as possible, with costs sensitive to individual patients. This is more difficult for outpatient based specialties, where there is usually less variability in cost, because costs are averaged across clinics. In addition, there is generally less information captured in outpatients regarding the complexity of appointment and the treatment or care received. Therefore, the project team acknowledged that selecting a specialty that is primarily outpatient based would result in greater challenges with the analysis of costing data.

Section C

Obstacles and challenges

At the start of this pilot, the project team acknowledged that the findings for the project were very much unknown. The project team viewed it as an exploration into the theory of value and a start along the journey to link costs to outcomes in the NHS.

However, it is fair to say that the project team did not anticipate that they would encounter so many obstacles and challenges along the way. Access to data and concerns around sharing data were the most significant and time consuming obstacles that the project team encountered.

The obstacles and challenges are outlined below. They are important because many may limit the ability to identify value opportunities on a wider scale.

Defining the project scope and the limited availability of outcome data

Section B describes how the project team spent considerable time deciding which specialties to focus on for the pilot. Originally three specialties were selected but the project team soon realised that this would be too big a task. Finally, one medical specialty and one surgical specialty were selected. This process took a lot longer than anticipated because of the many selection criteria that the project team considered. It is important to note that this process is incredibly valuable in any such project as it will impact on the overall success of the project.

Narrowing down the scope for each specialty was necessary in order to decide which group of patients the project would focus on. For trauma and orthopaedics this was a fairly easy process, and fractured neck of femur was selected quite quickly. The main reason was the fact that the pathway was well documented and outcome measures were available in the NHFD.

However, the process for diabetes took a lot longer, in fact, the project team were still discussing the scope towards the end of the pilot! As discussed in section B, long-term conditions are inherently complex and therefore it took time to select the part of the patient pathway that would be the focus.

The project team found that even when the group of patients had been narrowed down to inpatients, within an agreed number of medical specialties and with a diagnosis of diabetes, the problems obtaining relevant outcome data prevented many hypotheses from being tested.

However, the project team continued to support this work, as it would provide useful insight into the costs of patients with diabetes, and could identify the differing costs of patients who had also been diagnosed with other chronic diseases as well.

The insistence by the clinical leads on driving access to a limited number of pathology test results, allowed the project team to test whether patients' biochemical parameters (measures of kidney function and average sugar control) influenced the chosen outcome measure (occupied bed days).

Project team capacity

The pilot was essentially an additional piece of work to the daily workload for all project team members. This meant that the time available for the pilot was limited and often sporadic. However, the project team all saw the huge potential in this area of work, and how it could benefit the way care is delivered in the future. Therefore, despite the challenges around timescales and obtaining data, the commitment of the project team never faltered and it is that commitment that has driven its success.

The project lead identified early on that getting the full project team to more than two meetings was going to be very difficult. The decision was therefore taken to have a kick off meeting in September and a meeting to discuss findings in January.

However, despite the incredibly busy schedules for all of those involved, momentum was maintained in a number of ways:

- Meeting dates were set with as much notice as possible.
- Regular update emails were sent from the project lead
- Weekly conference calls were set up between the project lead and the costing leads
- Individual phone calls took place with certain clinicians as and when issues needed to be resolved.

Inevitably managing a disparate team introduced delay at times, and perhaps sometimes confusion, in the fact that all relevant team members couldn't get together at the appropriate time to talk issues through. However, it is hoped that these issues were managed in the ways outlined above.

Sharing data

Sharing data, both between NHS organisations, and with an external third party organisation, was a lengthy and complex process. Even with many in the project team having experience of working with external parties to share PLICS data, in particular for benchmarking or individual research projects, it was still a difficult process. The project team encountered nervousness within their organisations regarding whether PLICS data should be shared, and there was no standard agreement that could be used to achieve this. In the end there were several ways in which this issue was tackled:

1. Firstly, the PLICS data for each trust was pseudo-anonymised. Each trust also reviewed the data to ensure that any one specific patient could not be identified.
2. A data processing agreement was drafted. This process took considerable time, as it needed to incorporate comments from all those involved in the project, and then needed to be reviewed by each information governance lead. Finally, the wording of the agreement was agreed and each trust signed the agreement in turn, with a copy containing a hard copy of all signatures held by the HFMA.

The information governance processes were also difficult to navigate. In each trust, there was a different person (in the form of job title and seniority) responsible for signing off the data processing agreement. Each information governance lead also had very different concerns and questions regarding the process and the specific agreement.

Once approval had been obtained to share the data, the project team had to find a secure method of transferring the data to the Judge Business School, who were undertaking the analysis. In the NHS there is no secure platform available to share data either with other NHS organisations or with external organisations. The file sizes are certainly too big to be sent via email, and it is not feasible to send encrypted memory sticks when dealing with multiple organisations. In our project, the method of transfer agreed was to use a secure platform managed by the costing software supplier. With appropriate controls in place this system worked well for this particular project.

Use of ICD10 and OPCS codes to identify sample group of patients

The clinicians on the group were nervous about using clinical codes to identify patients because of a belief that not all patients would be accurately captured. However, clinical codes were used to identify the patients in the PLICS data, because we needed a consistent approach across the three trusts using data that was readily available. Discussions did take place regarding the use of patient population databases, such as the retinal screening database for diabetes. However, these databases are often owned and maintained in primary care, and are therefore not accessible to acute organisations.

When the PLICS extract for fractured neck of femur patients was compared to the NHFD, it was found that 34% of patients in the PLICS extract were not on the NHFD. Two issues were identified which explained the discrepancy.

Firstly, it was a result of the combination of ICD10 and OPCS codes used. For fractured neck of femur patients three ICD10 codes were used, when combined with 10 OPCS codes. On reflection, only the three diagnosis codes should have been used so that no elective hip procedures were pulled through as well. This shows the care required to ensure the combination of ICD10 and OPCS codes reflect the characteristics of the patient groups. Secondly, it was identified that the NHFD was only capturing patients who were aged 65 or over, whereas PLICS would pick up any patients of any age.

Clinical databases – access and data quality

Fractured neck of femur

The project team identified the NHFD as the main source of outcome data for fractured neck of femur patients. It was believed that because it is used to support best practice tariffs, it would be available and would be reasonably robust. The NHFD was accessed easily by two trusts. In the third trust, clinical staff were initially more reticent about allowing access to the NHFD to finance colleagues. Their concern was over whether patients had consented for their data to be used in this way. The project team feel that if another specialty had been selected and other databases found, it is likely that this issue would also have been raised.

The project team were disappointed at the level of completion of some of the data fields in the NHFD, which meant that the database could not be used as fully as had been hoped. Many of the fields require input of data after the patient has left the hospital. This requires processes to be set up in outpatient clinics to collect this data, or follow-up of patients once they have been discharged from outpatients, which is likely to be unworkable. In addition, it is likely that many of the fields that were of interest to this project will never have been analysed in this way before. The project team concluded that as with all information, it will only improve once it is shared, reviewed and understood.

Inpatients with diabetes

Access to outcome data for inpatients with diabetes was a major stumbling block to the progress of this specialty. Many of the outcome measures related to pathology test results. Each of the three trusts involved use pathology test information in their costing but not the results of those tests. At the final meeting it was agreed that each trust would have a final push to see if pathology test results could be obtained. Two out of the three trusts managed to obtain the results data within a two week window.

However, in this process, several issues were identified:

- Each trust defined a ‘test’ differently.
- Each trust included different tests within their order sets.
- The pathology departments extracted results for the three tests requested. This included results for patients within our pilot and results for patients who were not included in the pilot, which was a significant volume of data. The teams then had to link the pathology test results back to their PLICS data.

Inconsistent costing approaches

One of the reasons why the three trusts involved were selected was because of their strength in costing. All three trusts have been developing PLICS for a number of years, and all have been involved in national work to improve costing. In addition they all use, and are very familiar with, one particular costing system.

In addition, the costing software supplier was on hand to assist in ensuring the data was as consistent as possible, in terms of ensuring all headings were consistent and so on.

However, despite this, the analysis showed a significant number of discrepancies in the cost information provided. For example, only one trust had costs in a category called implants. A number of decisions had to be taken to aggregate costs and essentially roll costs up in order to ensure greater consistency for benchmarking.

The results also showed that one trust had significantly higher theatre costs than the other trusts. Further investigation revealed that the other two trusts used a method of sessional costing for theatres, which can shift costs significantly between specialties. The trust that currently used time in theatre to allocate costs is looking at introducing sessional costing to see if this explains their higher costs for theatres.

It is hoped that NHS Improvement’s new Healthcare costing standards will make it easier in the future to benchmark costs.

Section D

Tips for tackling a value project

The project team identified a number of areas where, with the benefit of hindsight, a different approach would have been adopted or something would have been done differently. These learnings, together with other tips, are set out below to support future work in this area.

Project team communication and membership

It was felt that the multidisciplinary team approach, including clinical and finance staff, worked well with this project. It was challenging managing a project remotely across three trusts, but in the end the process used worked well. This included regular emails from the project lead to ensure consistency of message, weekly conference calls with the costing leads and the project lead, and two project meetings at the start and the end of the project.

However, in hindsight, separate meetings with each trust's project team would also have been set up at the start of the project. This is because several members of the project team were unable to attend the kick off meeting, and therefore missed discussions around the context and purpose of the project. If these had been explained at an onsite team meeting, perhaps with the medical director and finance director present, it may have resulted in better communication and understanding between project team members.

It was suggested that perhaps the project team could have been widened to include other teams within each trust. For example, clinical audit could have been included, which might have led to the identification of other data sources. If pathology teams had been included this might have resolved the issue over access to pathology test results more quickly.

In future, consideration should also be given to including patients in this team approach to ensure that the outcomes that matter most to patients are included. This approach would ensure that the patient remains at the centre of work to improve the value of the care they receive.

Data sharing

The information governance requirements were known and understood from the start of the project. However, the time required to write and agree a data processing agreement was considerable. In addition, the project had to overcome the challenges of how to share the datasets with an external organisation securely, and how to ensure that all organisations involved were in agreement around the processes of sharing data. These issues will need to be factored in any future work as there appears to be no standard guidelines and understandably many in the NHS remain nervous about the sharing of any data, even if it is pseudo-anonymised.

Understanding the differences in approach to cost data

As previously mentioned, considerable work was undertaken to cleanse the cost data. For example, making sure that all headings were consistent. This work took longer than anticipated, and would need to be factored into future projects. Analysis also showed that different costs had been included within different categories and this needed to be unpicked before the analysis could be completed.

With hindsight, more time would have been allocated to reviewing how costs were allocated to identify differences in approach which could have a material impact on cost information.

It is recommended that as much time as possible is allocated to this process at the start so that differences in costs can be explained and understood.

Outcomes data

It is important to think about what outcomes are important and relevant to the patient group in question, and not just what the organisation may think is important. Gap analysis is then required to work through whether the outcomes are collected. Our pilot highlighted that some datasets may be available that contain relevant outcome data, however, if they have not been used in this way previously, the data quality may not be as robust as it could be. This will need to be considered and data quality checks built into the analysis phase.

In addition, it is important to test the boundaries. The clinical leads for diabetes felt that the pathology test results were a vital part of the proposal for inpatients with diabetes and it was with their help that the data was finally obtained. Many obstacles will be encountered along the way with regards to accessing outcomes data but with the support of the project team they can usually be resolved.

Analysis of data

The project team identified at the outset that an academic partner would be required for this pilot, to ensure that the appropriate skills were available at the analysis stage. Given the timescales involved, it was important that the team could work with a person skilled in econometric analysis and who was familiar with analysing and interpreting patient level cost information, and large NHS datasets.

The Judge Business School agreed to participate in the project, and their input and skill has been critical to its success. The project team expresses huge thanks to Dr. Scholtes and Dr. Freeman.

It is acknowledged that skills to undertake statistical and econometric analysis in the NHS are limited. This will need to be addressed by information departments if similar projects are to be undertaken.

Identifying easy wins

The project team acknowledged from the beginning that a pragmatic approach was required and also that early successes were important. Therefore the choice of specialty and the patients selected are vital to achieving early success.

Section E

Issues to be raised at a national level to support future value projects

If greater value is to be unlocked in the NHS, changes need to be made at a national level to support future value projects.

The following organisations were identified as national stakeholders for this project:

- NICE
- NHS Digital
- NHS England - including the Chief Clinical Information Officer and NHS RightCare
- NHS Improvement – including the 'Getting it Right First Time programme'
- Royal Colleges

A number of issues were identified during the project which we would like to raise with national stakeholders.

Data sharing

There are inconsistent approaches to information governance within organisations, for example, there is not a consistent approach about what information is required in a data sharing agreement and who is responsible for signing off the agreement

Significant time was spent writing a data sharing agreement, and securing agreement by all parties. It would be helpful if this process could be streamlined to support benchmarking between organisations.

We experienced difficulties sharing data between NHS organisations and with external organisations. Even where appropriate steps had been taken in terms of information governance, the technological platforms were not in place to share data easily. This project required support from the costing software supplier to facilitate this process securely.

Accessing clinical data

We came across some nervousness about sharing clinical data with other departments, in this case the costing team. There was also a nervousness about whether PLICS and outcome data could and should be shared in this way, and whether this is consistent with how patients provide consent for how their data is to be used. Clarity at a national level would be helpful.

The National Joint Registry does not currently provide consolidated extracts to trusts. Access to this information could provide a better understanding of the quality and variation of care delivered to patients, as well as significantly improve the quality of costing.

Better use of existing data

Our pilot highlighted that a lot of data is collected in the NHS by many different departments. However, not all this data is reviewed, analysed or used. The NHFD contains many fields of data, many of which are very important measures of outcomes for fractured neck of femur patients. Significant time is spent collecting and inputting this data. However, this time will only have been well spent, if the quality of the data is reviewed and the data is used. If datasets are to be used in a way that they have not been used for previously, it is important to work with the owners of those datasets to ensure they are understood and interpreted correctly. It is also important to share the data in a safe environment as soon as possible to test findings and ensure that no incorrect conclusions are reached.

Inconsistencies in cost data

The project identified inconsistencies in how costs were allocated between the three trusts, which made it harder to benchmark. There were also inconsistencies in how costs were grouped and then extracted from the costing system, which we believe will be even more challenging if the trusts use different costing systems. It is hoped that NHS Improvement's Costing transformation programme will improve consistency in costing across the NHS.

Measuring value across a patient pathway

A great source of frustration to the project team, particularly for diabetes, was the inability of this pilot to be able to look at cost and outcome data across the patient pathway. This project was acute focused because of the access to better quality cost and outcome data. There is no central repository of patient data, and therefore data collected in general practice or primary care cannot easily be accessed or used by secondary care. This is a major stumbling block to any work to identify value opportunities across the patient pathway and across organisations.

Section F

Project progress report

Our ambition to complete the project in three months has turned out to be unrealistic. We are writing up this report seven months after the project started, and we recognise that the analysis remains work-in-progress.

The three trusts have received detailed reports on the statistical analysis carried out on FNOF and inpatients with diabetes, which they have found interesting and helpful. A summary of the work is included in appendices 2 and 3. We are unable to publish the detailed reports as further work is required to ensure that the conclusions are accurate and robust.

That said, we believe that we have made significant progress over the last seven months (see figure 2).

Figure 2 Our achievements so far

- We have shown that it is possible to link costs to outcome data in a clinically meaningful way
- We have explored the linkages between cost and outcomes in two specialties in three trusts
- We have described the challenges and obstacles from both clinical and financial perspectives
- We have developed the costing team's access to clinical data
- We have developed consistency in costing approaches

Section G

Conclusions

This pilot has been a true test of the practicalities of linking cost to outcome data for patients in the NHS. In the three-month timescale set, significant challenges and obstacles have been encountered. Some of these were anticipated, many were not. The Value Challenge was set to be a proof of concept to test whether costs and outcomes could be linked. It is therefore seen as having been successfully achieved.

This pilot has always been viewed by the project team, as the starting point on a journey. The project team all see the huge potential for this area of work and the benefits that could be derived, and therefore rather than a conclusion they feel it is a starting point for further work and investigations.

As a proof of concept, the pilot has shown that linking costs to outcomes was easier for the surgical specialty, trauma and orthopaedics. It is incredibly difficult to narrow down the scope, and identify outcome data that is routinely collected and available for long-term conditions, in this case diabetes.

This pilot was set up in the knowledge that timescales were tight and therefore a pragmatic approach had to be adopted. It also acknowledged that only outcomes that are routinely collected and recorded could be used, and that this would potentially rule out the use of many outcomes measures that may be of importance to patients.

However, it has provided a very useful starting point into the practicalities of work in this area. It has allowed the project team to test the data that is available and how it can be used. It has allowed the team to undertake econometric analysis to see which ways of analysing and presenting data permit the best interpretation of results.

To drive improvements in value, it is important that the three trusts take the findings from the econometric analysis and start to ask why there are differences. What is done differently in one trust over another? It is recommended that the three trusts involved continue to work with each other to investigate the differences identified, as it is only by doing this, and making changes to how services are provided, that the value of the care delivered to future patients can be increased.

The pilot has already resulted in a number of positive changes across the three trusts involved:

- The learning about how costs and outcomes can be linked, and becoming aware of the sources of data available, have been applied to other projects within the three trusts.
- Discussions between clinical leads, particularly around the NHFD have resulted in improvements to the quality of the NHFD and investigations into the differences highlighted in some of the fields. This has led to conversations about whether the variations are due to different clinical practice or the way data is captured and recorded.
- Two of the three trusts now have access to pathology test results for three tests for patients for diabetes. This was not believed possible at the start of the process.
- Improvements have been made to the allocation of theatre costs in one of the trusts. This relates to the move to sessional costing from an allocation based purely on actual theatre minutes.
- Costing teams in all three trusts now have access to the NHFD, which they can use to improve the quality of their costing and to continue work to link costs and outcomes for fractured neck of femur patients
- Discussions are continuing between the three trusts regarding access to the NJR.

The HC4V Institute would like to thank all of the project team for their enthusiasm, commitment and support to this project. It is hoped that this report will provide support and interest for organisations to undertake their own value challenges both within and across organisations.

The HC4V Institute plan to communicate with the stakeholders identified in section E to open the debate around the national challenges that have been highlighted.

Appendix 1 – The project team

Leeds Teaching Hospitals NHS Trust

Vinod Bassi	Assistant director of finance – business support & costing
Joe Selfridge	Information manager – finance
Mr. Sanjeev Ananad	Consultant orthopaedic knee surgeon
Dr. Michael Mansfield	Clinical director and consultant physician and diabetologist
Mr. Stuart Murdoch	Clinical director abdominal medicine and surgery CSU, chair of PLICS Board, consultant in anaesthesia and intensive care medicine

Nottingham University Hospitals NHS Trust

Scott Hodgson	Head of costing
Dr. Tasso Gazis	Consultant physician and clinical lead for Nottingham Diabetic Eye Screening Programme

North Tees and Hartlepool NHS Foundation Trust

Stuart Burney	Head of contracting, income and costing
Neil Waters	Senior cost accountant
Dr. Jean MacLeod	Consultant physician and diabetologist
Mr. Chris Tulloch	Consultant orthopaedic surgeon, clinical director, associate medical director

QuintilesIMS

Gavin Mowling	Director of costing and transformation
Mauli Hewavitarne	Senior costing consultant

Judge Business School, University of Cambridge

Dr. Stefan Scholtes	Dennis Gillings Professor of health management, Director of the Doctoral and Master of Research Programmes, Academic director of the Centre for Health Leadership & Enterprise
Dr. Michael Freeman	Ph.D. in Management Studies – Judge Business School, University of Cambridge

HFMA

Helen Strain	Independent consultant and project lead
Catherine Mitchell	Head of costing and value
Becky Vine	Head of Institute development, Healthcare Costing for Value Institute

Appendix 2 Analysis and findings for fractured neck of femur

Review of datasets

Two data extracts were obtained for fractured neck of femur patients:

- an extract of PLICS information including the total costs and the breakdown of cost for each patient, demographic information, coding information and the length of stay
- the National Hip Fracture Database for each trust.

The first step in the analysis was to compare the two datasets. This step identified that there were 744 more patients in the PLICS extract than the NHFD extract. Further investigations found that the NHFD only includes patients who are over 60 years in age, accounting for 348 (47%) of the mismatches. In addition, in order to identify relevant patients from the PLICS dataset, a range of ICD10 codes were provided (S72.0-S72.2) and also a range of OPCS codes (W46, W47, W24.6, W24.1, W19.1, W19.2, W37, W38, W93, W94). Using this criterion, 262 patients in the PLICS dataset were found to have an assigned an HRG that did not begin HA1x (where HA1x is the HRG corresponding to major and intermediate hip procedures for trauma). However, only 4% of those patients with a HRG that did not begin HA1x were present in the NHFD. This suggests, on reflection, that in order to obtain a more accurate sample of patients, a better selection criteria may have been to only include those patients with a HRG beginning HA1x.

For the purposes of the analysis, patients were only included if they appeared both in the PLICS data and the NHFD. This resulted in 1,446 patients across the 3 trusts being included in the sample at this stage.

The data was then cleaned to exclude patients who had died during their admission, patients where the episode was recorded as being 'work in progress' and patients who had been assigned a HRG other than HA1x. This resulted in a final sample size of 1,317.

The next stage was to test the robustness of the NHFD. In order to identify which fields could be used as outcome measures we needed to know whether all relevant fields had been completely recorded at each trust. Analysis found that the fields that are required for the calculation of the best practice tariff were almost entirely complete in each trust. However, other fields which were deemed relevant outcome measures for FNOF such as mobility at 30, 120 and 365 days were not well completed. In addition, it was found that for some fields there was a great deal of variation in the scores or information recorded. This is likely to be due to the subjectivity allowed in completing this database and the level of national guidance available. Fields where variation was identified included: ASA grade and pre-fracture mobility.

As a result, only the fields used to calculate the best practice tariff were used as relevant outcomes measures in this pilot.

Process of analysis

Once the datasets had been compared, cleaned and checked for completeness, the analysis followed the following route:

1. The demographic information for patients within each trust was compared for each trust. The mean, median and confidence intervals were calculated for each calculation. Age and male/female splits were calculated.
2. The coding was analysed for identify the percentage of patients within each HRG, the number and type of OPCS and ICD10 codes assigned to patients and the proportion of patients assigned to HRGs within complications and comorbidities.
3. The analysis then moved on to compare activity information. The median and mean time to surgery was calculated as was length of episode and length of spell. The distribution of length of stay proved very helpful in identifying patterns within each trust.
4. The analysis moved on to the cost information, where the average cost for each trust was calculated and the average breakdown by cost pool was also compared.
5. Finally the best practice tariff was recalculated using the information in the NHFD. This was taken to be a proxy outcome measure.

Once the two data extracts had been cleaned, the analysis focused on the 'hard' data available, such as age, sex, AMTS score. The analysis showed that there was no statistical difference in the mean or median age of patients across the three trusts, the proportion of females in the sample was similar across the three trusts and the AMTS scores were similar across the three trusts.

The analysis then moved on to look at the coding of the patients in the sample. This was undertaken to identify whether there was any difference in the complexity of patients treated in any of the trusts. Differences in coding practices were identified between the three trusts, specifically in relation to more subjective information (e.g. mobility), the assignment of diagnosis codes to patient episodes, and also the way in which spells within a hospital are split into different episodes.

A separate report with detailed statistical analysis has been provided to the three trusts, providing a number of interesting insights where the trusts may wish to explore the data further.

Appendix 3 Analysis and findings for inpatients with diabetes

For the analysis on inpatients with diabetes, three datasets were used:

- an extract of PLICS information including the total costs and the breakdown of cost for each patient, demographic information, coding information and the length of stay
- a summarised extract from PLICS information for a selected number of medical specialties that contained the total cost of the patient, length of stay and the HRG assigned
- pathology test results for 3 tests (Creatinine, Glomerular filtration rate, HbA1c) for the inpatients with diabetes selected.

Inpatients with diabetes were identified in each trust's PLICS system by extracting all episodes containing the following ICD10 codes – E100 to E119. This resulted in 51,690 inpatient episodes being extracted. The episode data for the selected medical specialties resulted in a sample of 1,052,793 patient episodes.

The following exclusions were applied to the data in order to improve the quality and consistency of the data:

- only non-elective episodes were included
- patients were only included if they stayed in hospital for at least one night
- patients were excluded if their episode was recorded as 'work in progress'
- patients were only included if they were aged 20 or above.

This resulted in 33,014 records being included in the PLICS dataset for inpatients with diabetes and 138,920 records.

Process of analysis

A similar approach to fractured neck of femur was followed for the analysis of inpatients with diabetes.

First of all the rates of diabetes were calculated using the two PLICS datasets. This showed that Trust 2 had a lower recorded rate of diabetes than Trusts 1 and 3 by approximately 4 to 5%. In Trusts 1 and 3, 20% of patient episodes in the medical specialties selected were inpatients with a diagnosis of diabetes.

Trust 2 also appeared to have a slightly younger diabetic patient population than Trusts 1 and 3. This younger demographic is also reflected in the full patient population of the medical inpatient episodes. The proportion of inpatients with diabetes who are female was consistent across the 3 trusts.

The analysis then moved on to look at the costs of treating the patients in the sample. The mean episodic cost of all of the medical inpatients across the 3 trusts was £2,368. The mean cost of the episodes for those medical inpatients with diabetes was £2,504, i.e. approximately £100 higher. Likewise for length of stay the mean length of stay for medical inpatient episodes was 11.18 days whereas for those patients with diabetes it was 12.99 days.

Care needs to be taken with this level of analysis, however, as the results did vary between hospitals and no account was taken for the fact that diabetic and non-diabetic patients may differ based on other factors such as the nature of their primary condition.

HRG subchapter analysis

The analysis then moved on to identify whether there appear to be any HRG subchapters where the average cost of a diabetic and non-diabetic patient appear to be statistically different. The average costs (with 95% confidence intervals), median cost and the number of patients for each subchapter was calculated separately for patients with and without diabetes.

The results showed that diabetic patients cost more on average (and were statistically significant) in the following HRG subchapters:

- AA: Nervous System Procedures and Disorders
- DZ: Nervous System Procedures and Disorders
- EB: Cardiac Disorders
- MB: Female Reproductive System Disorders
- WA: Immunology, infectious diseases, poisoning, shock, special examinations, screening and other healthcare contacts
- WD: Treatment of mental health patients by non-mental health service providers

Note: HRG subchapters MB, WA and WD have a low volume of patients.

ICD10 analysis

The HRG subchapter analysis is still of limited use since there are a large number of subchapters and even within subchapter there may be a lot of variation in the types of condition treated. The analysis therefore moved to focus on the primary ICD10 code assigned to a patient's spell in hospital.

It was observed that 50% of all diabetic patients correspond to 10 main subgroups. These are:

- E08-E13 Diabetes Mellitus
- I20-I25 Ischemic heart diseases
- I30-I52 Other forms of heart disease
- I60-I52 Cerebrovascular disease
- I60-I69 Influenza and pneumonia
- J09-J47 Chronic lower respiratory diseases
- L00-L08 Infections of the skin and subcutaneous tissue
- N30-N39 Other diseases of the urinary system
- R00-R09 Symptoms relating to circ. and respiratory systems
- R50-R69 General symptoms and signs

Note that the first group (Diabetes Mellitus) was unsurprisingly almost never observed in the 'non-diabetic'- subsample and so was not used in the further analysis undertaken.

The costs were then compared for the nine ICD10 subgroups. It was found that for these groups the costs of patients with diabetes was approximately £160 higher. When this analysis was repeated for length of stay it was found that the patients with diabetes stayed approximately one night longer in hospital.

A range of regression analysis was run on the data, the results of which continue to be explored. One piece of analysis that the project team felt was important was to look at the impact on the costs and length of stay of inpatients with diabetes, when the patient has additional comorbidities, primarily chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD) and myocardial infarction (MI). The early results show that, compared to inpatients without diabetes, CKD, COPD or MI:

- Inpatients with diabetes (but without CKD, COPD or MI) cost approximately 2% more;
- Inpatients with both diabetes and CKD (but without COPD or MI) also cost approximately 2% more;
- Inpatients with both diabetes and COPD (but without CKD or MI) cost approximately 6% more;
- Inpatients with both diabetes and MI (but without CKD or COPD) cost approximately 6% more.

These results are taken *after* stripping out length-of-stay changes, i.e. they are the additional effect on cost after accounting for the fact that these patients may also stay longer in the hospital. If the impact on length of stay is analysed separately the results are interesting. Compared to inpatients without diabetes, CKD, COPD or MI:

- Inpatients with diabetes and CKD (but without COPD or MI) stay in hospital approximately 23% longer;
- Inpatients with diabetes and COPD (but without CKD or MI) stay approximately 7% longer;
- Inpatients with diabetes and MI (but without CKD or COPD) spend approximately 16% less time in hospital.

The reduction in length of stay for patients with both diabetes and MI may be because these patients are more likely to die in hospital, artificially shortening their hospital stay.

Pathology test results analysis

Obtaining pathology results data was only successful in two of the trusts. The results data was also only obtained at the very end of this pilot and therefore the investigation of all of the analysis for inpatients with diabetes is ongoing with the trusts involved. The following analysis was undertaken:

- Distribution of test scores by trust and analysis of the average scores with 95% confidence intervals and median scores, as well as minimum and maximum recorded scores.
- The numbers of tests conducted in each trust. This found that the HbA1c test had a very low test rate for the two trusts, which means it would be difficult to establish any relationship between this test and other outcome measures.

Preliminary analysis then moved on to look at the relationship between pathology test results and costs and length of stay. This was done by looking at how a one standard deviation increase (or decrease) in test results above or below their mean value impacts on the costs and length of stay.

The early findings showed that:

- An increase in creatinine by one standard deviation increases cost by approximately 2.2%.
- A decrease in GFR by one standard deviation increases cost by approximately 3.0%.
- There is no statistically significant effect of HBA1C on cost, which is unsurprising given we have only very limited data on this.

It is important to note that the results of the analysis on inpatients with diabetes are still being investigated. It took far longer than the project team expected to obtain the data and therefore less time was available to scrutinise the analysis and undertake further work. However, the preliminary analysis has shown that it is possible to link costs to some basic outcome measures for inpatients with diabetes. In particular, at the start of the project pathology test results data had not previously been obtained or used by the costing teams. Two trusts managed to obtain this data and some interesting analysis has been possible on it. The trusts will now work to better understand the analysis and interpret the findings onto the care being given to inpatients with diabetes.

Appendix 4 About the HFMA and the Healthcare Costing for Value Institute

About the HFMA

The Healthcare Financial Management Association (HFMA) is the UK representative body for finance professionals working in the NHS and the wider healthcare sector. Our aim is to support the NHS finance function, to promote good practice in financial management and to improve the general understanding of NHS finance issues.

Our work is informed by a number of committees and special interest groups made up of healthcare finance practitioners. We publish numerous guides and briefings aimed at finance professionals, non-executive directors and non-finance staff. We also provide training and development opportunities – including a suite of web based learning modules – across all of these groups.

About the Healthcare Costing for Value Institute

The HFMA Healthcare Costing for Value Institute provides a platform for support and ideas exchange helping NHS provider and commissioner organisations to:

- Apply the theory of value-based healthcare in practice
- Improve patient-level costing
- Maximise the value of patient-level costing information

NHS organisations can join the Institute as a member in order to access the training, resources and wider programme. For enquires about membership to the Healthcare Costing for Value Institute, please contact richard.sawyer@hfma.org.uk.

Published by the Healthcare Financial Management Association (HFMA)

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