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Combining routinely collected data and patient outcomes to measure the outcome/cost ratios of hospital procedures and identify variation across providers

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1. Aims/Objectives:

We aim (i) to assess the relationship between the cost and patient reported health outcomes of four secondary care procedures (ii) to determine whether and the extent to which variations in the outcome/cost ratios are due to differences in provider performance.

2. Background:

From April 2009 the English Department of Health (DH) have required all providers of NHS-funded care to collect patient reported outcome measures (PROMs) from all patients before and after receiving surgery in the NHS for hip and knee problems, varicose veins and hernias.

PROMs are instruments that capture the patient's own assessment of their health. By comparing these measures of health through time, changes in health can be identified and used to better understand the effect of health care. These data are valuable to compare provider performance and sharpen incentives to improve quality.

The legitimate use of PROMs as performance indicators relies on isolating the variation which is under the hospital's control, from that variation which is outside its control (e.g. the characteristics of the patients; and services delivered either before admission or after discharge, which exert an effect on patient reported health). 'Case-mix adjustment' offers a partial solution, but there is a danger that PROMs run into problems similar to those evident in using mortality rates as measures of hospital performance (Lilford et al 2004; Lilford & Pronovost 2010). Our research is designed to help assess whether PROMs can provide robust measures of provider performance.

3. Need:

The NHS is likely to face increased pressure in reducing costs due to the current economic climate. In order to achieve greater efficiency, decision makers need to consider the impact of potential cost reductions on patient outcome. By combining a patient-reported quality dimension to cost data in a recognised framework, these research outcomes will aid decision makers in making more informed and evidence based decisions on cost-containment.

PROMs data are already being collected routinely for all patients who are undergoing one of four procedures: hip and knee problems, varicose veins and hernias. The Department of Health intends to use PROMs to measure and reward hospitals in relation to their performance in securing health outcomes. The research to support these ambitions has not yet conducted – it is not known whether PROMs can provide a robust measure of hospital performance. If the measure is not robust, hospitals may be inappropriately

rewarded or penalized, at the risk of adverse consequences for hospitals and their patients.

4. Methods:

a. Setting

Our analysis includes everyone in England who has one of the four procedures in NHS and independent sector providers during the 2009/10 financial year.

b. Design

We will be analysing patient-level data and using PROMs to assess the relative efficiency of providers in the production of health. The research will require us to tackle three empirical challenges that further enhance the study´s originality:

1) The econometric models we estimate recognize that the empirical distributions of costs and outcomes are likely to be non-normal, This will require regression techniques that account for distributional features but do not suffer from transformation biases so that we are able to explain differences between providers in a meaningful metric.
2) We shall account for patient characteristics (risk-adjustment) and for the clustering of patients within providers. This requires estimation of multi-level multivariate models.
3) We shall use regression modelling to explore the inter-relationship between outcomes and costs. Our models will explicitly attempt to disentangle the causes and effects. The key challenge is to measure the influence of the provider on costs and outcomes and to explore reasons why this influence might vary.

c. Data collection

Our research utilises routinely collected patient-level data and does not require collection of new data. We shall combine three unique datasets:

1) The 2009/10 Hospital Episodes Statistics, which contains detailed information about every patient treated in NHS hospitals.
2) The Reference Cost data, containing disaggregated cost information provided by every NHS hospital. We have devised a means of matching costs to the patient records in HES and demonstrated how the combined HES and cost data can be used to identify which patient characteristics explain costs (Laudicella et al 2010; Kristensen et al 2010).
3) The PROMs data being collected for unilateral hip replacement, unilateral knee replacement, groin hernia repair and varicose vein surgery prior to and shortly after treatment.

d. Data analysis

We are interested in whether PROMs data can be used to make secure inferences about hospital performance. At the heart of the analysis will be a regression framework which we will extend in stages to incorporate the additional complexity of the analysis. Our multivariate regression framework recognises the clustering of patients within providers and the empirical, non-normal distribution of cost and outcomes.

We will start from the simplest descriptive model which is then extended to address the fundamental questions about whether differences in costs and outcomes are functions of differing case-mix and whether additional spending yields better outcomes (and at what value). There are three main steps to the analysis.

1) Produce descriptive 'unadjusted' provider-specific cost and outcome measures. Taking follow-up outcomes and costs only we will produce ratios identifying the systematic differences across providers without allowing for any other explanatory factors. This exercise will identify the range of total variation and will be used as a comparator point for the following steps.

2) Produce risk-adjusted provider-specific cost and outcome measures. If, as likely, particular providers are receiving disproportionate amounts of complex patients who may have both higher costs and poorer outcomes then their unadjusted performance scores may be misleading. This second step will risk-adjust the provider specific measures of performance by including the impact of the patient case-mix on both follow-up outcomes and costs. These variables will be constructed from HES and baseline PROMs data. We will compare these adjusted results with the unadjusted results. Specifically we look for significant changes in provider ratios and at the overall distribution of ratios to ask: does risk-adjustment bring provider performance closer together or does it highlight greater variation?

3) Identify whether cost above case-mix adjustment is a driver for improved outcomes or indicative of inefficiency. We will address whether some providers may have additional costs that yield better outcomes after allowing for any higher costs due to more complex patients i.e. the explanation that a provider may have higher costs because it delivers higher benefits. This step is probably the most challenging methodologically as it requires that we fully disentangle the system of relationships between patient characteristics, different types of costs (what is deemed due to patient characteristics and what appears in excess) and outcomes. Again we will compare results with unadjusted and adjusted ratios and draw attention to any divergences across hospitals.

5. Contribution of existing research:

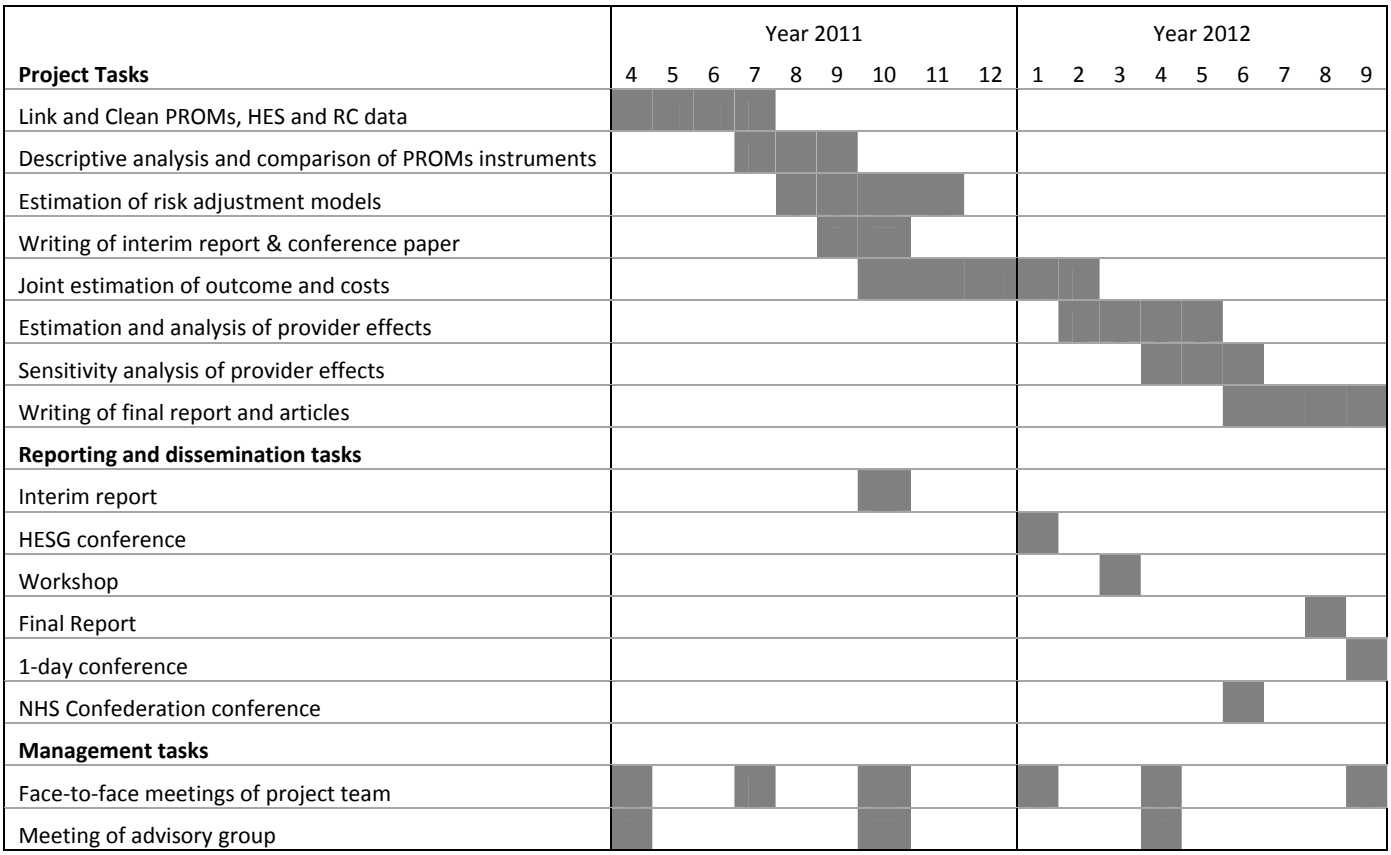
We have pioneered analysis of patient-level data to identify which patient characteristics drive costs and whether costs are related to the hospital in which the patient is treated (Olsen and Street 2008; Laudicella et al 2009). We

have been able to incorporate some indicators of patient outcome in these analyses, including infections and 30-day mortality. PROMs provide a broader measure of outcome and promise to offer deeper insight into why costs differ among patients. PROMs measure the patients' own assessment of their health. From April 2009 PROMs data have been collected from patients before and after receiving surgery for hip and knee problems, varicose vein and hernias. The differences between patient reported health before and after surgery can be used to examine the effect of surgery; variations between providers in changes in patient health also provide a basis for examining differences in hospital performance (Browne et al 2007; Devlin et al 2009; Devlin and Appleby 2010).

Our research is set within a growing literature concerning the measurement of quality of care, the relationship between quality and cost and the assessment of providers' performance. Specifically, our research builds on a collaborative project with Professor Nick Black at LSHTM. This utilises data generated by the Patient Outcomes in Surgery (POIS) Audit and will provide an initial understanding of the nature of the relationships between costs and outcomes, using a small dataset. We build on work to develop a risk adjustment methodology for PROMs data currently being undertaken by Northgate & CHKS Ltd on behalf of the Department of Health. This will ensure that our proposed research builds on sound foundations.

6. Plan of Investigation:

The main project tasks will be addressed in a sequential but overlapping manner, as depicted in the flow diagram. These are to (i) link and clean PROMs, HES and RC data; (ii) undertake descriptive analysis and comparison of PROMs instruments; (iii) estimate risk adjustment models of outcomes and cost; (iv) undertake joint estimation of outcome and costs; (v) estimate and analyse provider effects; and (vi) undertake sensitivity analysis of provider effects to choice of instruments and modelling choices.



7. Project Management:

Andrew Street will be responsible for the overall management and delivery of the project and Chris Bojke will be responsible for the day to day management of the project. Nancy Devlin will provide leadership on the analysis of the PROMS data and comparison of instruments. Silvio Daidone will be responsible for the merging of data, data cleaning and advising on the econometric analysis. Nils Gutacker will be responsible for data management and manipulation, and for execution of the econometric analyses, supervised on a day-to-day basis by Chris Bojke.

The project team will hold video conferences every two weeks and we shall have quarterly face-to-face meetings. All team members will contribute to formulating the econometric analysis, evaluating and interpreting the emerging findings, writing the final report, and disseminating the results. An advisory

group consisting of stakeholders from the DH, the EuroQOL group and academic, clinical, professional and lay communities will meet in London on three occasions during the 12 month course of the project: at initiation and prior to delivery of the interim and final reports.

8. Service users/public involvement:

We shall secure service user involvement, firstly, by including lay representation on the project's advisory group, which will give initial and ongoing overall guidance to the project. Secondly, we shall hold a workshop to share our draft final results with various interested parties, including representatives of the service user community, such as patient choice advisors and existing lay members of the Royal College of Surgeon's or the BMA's Patient Liaison Groups. This workshop will include presentations by the project team followed by breakout sessions. Thirdly, we shall organise a 1-day conference at which we will present the final results of this project, alongside presentations on the general topic of PROMs by other speakers.

As the results of our work are likely to impact on providers of care, we are particularly interested in the views of acute NHS Trusts. We shall therefore aim to secure input from members of the NHS Confederation and participants of the NHS Strategic Financial Leadership Programme, Executive Education, Cass Business School, London.

9. References:

Browne J et al (2007) Patient Reported Outcome measures (PROMs) in elective surgery. Report to the Department of Health.

Devlin N, Parkin D, Browne, J. (2009) Using the EQ-5D as a performance measurement tool in the NHS. Discussion Paper 09/03, London: City University

Devlin N, Appleby J (2010) Getting the most out of PROMs. Putting health outcomes at the heart of NHS decision making. London: King's Fund.

Kristensen, T., Laudicella, M., Ejersted, C. & Street, A. 2010. Cost variation in diabetes care delivered in English hospitals. Diabetic Medicine, 27, 949-57.

Laudicella, M., Olsen, K. R. & Street, A. 2010. Examining cost variation across hospital departments-a two-stage multi-level approach using patient-level data. Social Science & Medicine, 71, 1872-81.

Lilford R, Mohammed MA, Spiegelhalter D, Thomson R. 2004. Use and misuse of process and outcome data in managing performance of acute medical care: avoiding institutional stigma. Lancet, 363, 1147-1154.

Lilford R, Pronovost P. 2010. Using hospital mortality rates to judge hospital performance: a bad idea that just won't go away. British Medical Journal, 340, c2016

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