

Variations in outcome and costs among NHS providers for common surgical procedures: econometric analyses of routinely collected data

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Scientific summary

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Background

The economic downturn makes it even more important that NHS resources are used to their full extent. There is a danger that efforts to reduce costs have an adverse effect on patient outcomes. Our research is designed to provide a better understanding of the inter-relationship between costs and health outcomes among NHS providers (hospitals) for common surgical procedures.

We examine the relationship between the cost of hospital care with the associated improvement in patient-reported outcome measures (PROMs) as measured both by a generic instrument, the EuroQol-5D questionnaire (EQ-5D; European Quality of Life-5 Dimensions), and a condition-specific instrument for each of four surgical procedures: unilateral hip replacement, unilateral knee replacement, groin hernia repair and varicose vein surgery. The analysis includes measures of the variability in outcomes and resources across hospitals, and considers the sensitivity of the results to choices of outcome instrument and measure of resource use.

Objectives

The overall aims are (1) to characterise variation in outcomes in ways that are intuitive to patients and consistent with the original format of the questionnaire, thereby helping patients select a preferred provider of care and (2) to assess the relationship between the cost and outcomes of the four elective procedures for which the PROM data are collected to determine the extent to which variations in outcome and cost ratios are due to differences in hospital performance. In meeting these aims we consider:

- which instrument should be used to measure patient-reported outcomes (PROs)
- the extent to which variations in outcomes and cost of treatment are due to patient characteristics
- the relationship between outcomes and cost of treatment
- the influence of the hospital on outcomes and cost of treatment
- how robust these estimates of hospital influences are to choices about how to conduct the analyses.

Two distinct pieces of work address these aims. The first part of the empirical analysis focuses on econometric techniques to analyse variation in different dimensions of patient self-reported health status. This is designed to provide feedback to patients in a format consistent with their questionnaire responses and to help them select their preferred hospital. The second part of the empirical analysis focuses on the performance of hospitals in terms of the inter-relationship between PROs and resource use. The primary audiences for this analysis are the Department of Health, hospitals and commissioners interested in performance measurement.

Data sources and methods

We link Hospital Episode Statistics (HES) data with reference cost data, and the PROs taken prior to treatment and either 3 months or 6 months after treatment for patients having one of the four treatments between April 2009 and March 2010.

Initially, we analyse data for 27,133 patients undergoing hip replacement in 154 hospitals. We estimate hierarchical ordered probit models separately for each of the EQ-5D dimensions and compare results with those obtained from a linear regression of the EQ-5D utility scores. We control for various patient

characteristics (as risk adjustment), including pretreatment health status and recognise that patients are clustered within hospitals.

For the second part, we analyse 48,008 patients having one of the four procedures. We use random-effects hierarchical models that control for patient characteristics and identify the influence of each hospital on outcomes and resource use. To explore the inter-relationship between outcomes and resource use, we adopt a seemingly unrelated regression framework. We assess the sensitivity of results to the choice of generic or condition-specific measures of PROs and to whether resource use is measured using cost of treatment or length of stay (LoS).

Results

In the first study, we find that:

- With regard to risk adjustment, poorer post-treatment health status for individual patients is related to lower pretreatment health status, higher weighted Charlson score, a greater number of diagnoses and greater deprivation in the neighbourhood of residence.
- Variability in the impact that hospitals have on post-treatment health status is most pronounced on the EQ-5D dimensions mobility and usual activities, and less so for other dimensions.
- Only pain/discomfort and anxiety/depression correlate well with performance measures based on the EQ-5D utility index. This leads to different assessments of hospital performance across metrics. Hence, analysing EQ-5D dimensions provides different insights than the analysis of the EQ-5D index.

In the second study we find that:

- Poorer post-treatment health status for individual patients is related to lower pretreatment health status, higher weighted Charlson score, a greater number of diagnoses and greater deprivation in the neighbourhood of residence. The influence of age and gender on the health status of patients varies by procedure.
- Healthcare Resource Groups are significantly explanatory for variation in resource use among patients. The significance of other variables varies according to the procedure and to whether resource use is measured by cost of treatment or LoS.
- After controlling for patient characteristics, we find substantial unexplained variation among hospitals in the post-treatment health status of patients having either hip or knee replacement.
- In contrast, there is no substantial unexplained variation among hospitals in post-treatment health status for patients having groin hernia repair, rendering the information redundant for benchmarking hospital performance for these patients. Hence, we do not jointly analyse resource use and post-treatment health status for these patients.
- For varicose veins, variation across hospitals in post-treatment health status is evident if using the condition-specific, but not the generic, PROMs.
- We also find that, for all four procedures, there is significant unexplained variation in resource use among hospitals, whether this is measured by cost of treatment or LoS. These results suggest room for improvement among hospitals with regard to their utilisation of resources.
- At the patient level, we find a negative correlation between risk-adjusted resource use and post-treatment health status for patients having hip or knee replacement. With regard to varicose veins, this relationship was not significant.
- There is no general evidence at hospital level that reducing resource use has an adverse effect on health outcomes. There is a significant correlation for varicose veins, but this is sensitive to the choice of resource use and PRO measures. For knee replacement there is no correlation and for hip replacement the correlation is negative (though weakly significant), implying that promoting health outcomes and controlling costs are not contradictory objectives.

- We are able to identify a few hospitals that achieve better than expected levels of outcome for their patients who also have lower than average levels of resource utilisation.

Limitations

Our analyses are based on routinely available secondary data, notably the information recorded in the HES, the accuracy of which may be questioned. However, hospitals are mandated to provide HES data for all patients, coding guidelines have been developed over many years and various forms of quality control are implemented. The HES data derive originally from the medical record, so if data are inaccurate or missing in the medical record, or if the hospital fails to extract and code these data accurately, errors will arise. We believe that it is the responsibility of hospitals and their staff to minimise these errors.

Our study suffers from a high number of missing data, mainly because some hospitals were better than others at administering the baseline survey. Participation by hospitals has since improved. Even so, future research needs to consider how best to handle missing data for performance evaluation.

Conclusions

We argue that, instead of focusing on the EQ-5D utility scores, it is more appropriate statistically, and more informative, to assess each of the EQ-5D dimensions in its own right. Our approach does not require assumptions to be made regarding how to aggregate across health dimensions and offers insight regarding which dimensions are particularly affected by hospital heterogeneity.

In recognition of the expectation that PROMs data are to be widely used, we have suggested an intuitively appealing way of summarising the differential impact that hospitals have on PROs. Our graphical representation indicates the probability of reporting a given health outcome and shows how these probabilities vary across health dimensions and hospitals. We argue that this information should be of value in helping prospective patients choose which hospital they wish to provide their treatment.

We find significant variation among hospitals in both the post-treatment health status experienced by their patients and their resource use. This variation persists after controlling for a wide range of patient characteristics and is generally robust to the choice of instrument used to measure PRO and to whether resource use is measured by cost of treatment or LoS. This variation suggests improved performance among hospitals is possible both in promoting health outcomes and controlling costs. For hip replacement and knee replacement, these objectives do not appear to be subject to trade-off, as we found no positive correlation between outcomes and resource use after controlling for patient characteristics. Indeed, a few hospitals were able to deliver superior outcomes despite utilising fewer resources. We believe regulators, hospitals and commissioners should evaluate both outcome and resource use information in this fashion to draw robust conclusions about relative hospital performance.

Future research should focus on improving methods to deal with missing data, collecting richer data to characterise patient severity, evaluating hospital performance in the context of the broader health economy, incorporating PROMs in the broader quality assurance framework, investigating means of communicating information regarding variations in hospital PROM performance to patients, evaluating the impact of the PROMs initiative on patient choice and provider behaviour, and measuring and evaluating PROMs for chronic conditions.

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