

## Funnel plots for Patient Reported Outcome Measures

Funnel plots are produced quarterly by the NHS Information Centre for Health and Social Care (NHSIC) and are adapted by Yorkshire and Humber Quality Observatory (YHQO) in the quarterly PROMs report. This issue of Data Bites looks at how funnel plots are constructed and explains how to interpret them.

### About Patient Reported Outcome Measures

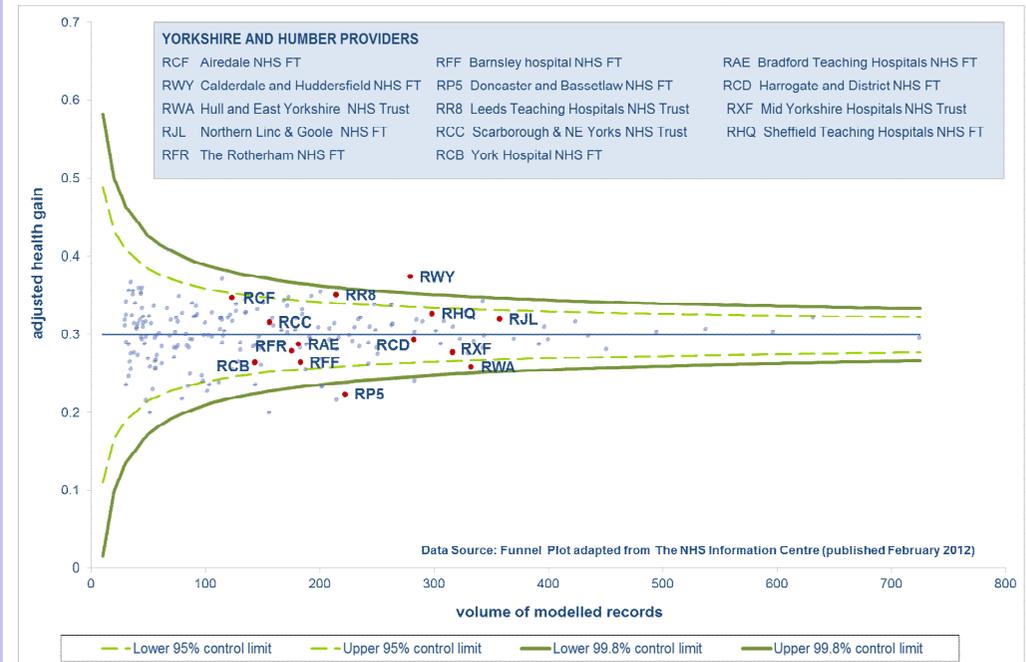
Patient Reported Outcome Measures, or PROMs, are defined as a way of collecting information on the “effectiveness of care from the patient’s perspective” (Department of Health, 2008, p5). Patients are asked to fill in a short questionnaire prior to their operation in hospital and again 3 or 6 months later depending on the procedure. The difference between the scores are seen as the health gain achieved by the intervention. Currently PROMs data are collected from all NHS Trusts and the independent sector on four procedures: groin hernia repair, hip and knee replacements and varicose vein surgery. Data are published quarterly as aggregate scores by trust and PCT.

### How are funnel charts produced and interpreted?

**Figure 1** is an example funnel plot for PROMs health gains for knee replacements. The curved lines are the control limits, the centre line is the national average and the points on the funnel chart represent the provider organisations. Those within the Yorkshire and Humber region have been highlighted red (in bold) and labelled with the trust code.

The horizontal axis is numbers of ‘**modelled**’ records (this is the number of knee replacements that have been carried out where both pre and post operative PROMs questionnaires have been linked together). The vertical axis is the ‘**adjusted**’ health gain calculated by subtracting pre-operative score from post operative score and adjusting for case mix. Adjusting for case mix is a way of enabling organisations to be compared just on health gains regardless of other factors such as age of patient and severity of condition prior to the procedure.

**Figure 1: Yorkshire and Humber acute trusts<sup>1</sup> 2010/11 EQ5D<sup>2</sup> adjusted health gains for knee replacements**



The curved lines on the funnel plot are calculated based on the national average score and standard deviations. The inner funnel lines (dotted green lines on the chart) are set at the 95% significance level, meaning that there is a one in 20 chance that an organisation is an outlier. An ‘**outlier**’ refers to a situation where the point representing an organisation is above the top dotted green line or below the bottom dotted green line (ie outside of the control limits). The solid green control limits are set at the 99.8% significance level meaning that there is only a one in 500 chance that the organisation is an outlier.

<sup>1</sup> Independent sector providers will be included in the next PROMs report

<sup>2</sup> Further information on PROMs instruments is available here: <http://www.hesonline.nhs.uk/Ease/servelet/ContentServer?siteID=1937&categoryID=1433>

## Why is it important to identify outliers?

Generally for PROMs (with the exception of the Aberdeen Varicose Vein Questionnaire) outliers that are above the top lines are classed as **positive outliers**, meaning that the health gain is better than expected compared with other organisations, and points below the lines are **negative outliers** (the health gain is worse than expected). An outlier below the 95% control limit is classed as an **'alert'** and an outlier below the 99.8% limit is called an **'alarm'** which suggests that it is very likely to be a 'special cause' (a reason) why this is an outlier.

Identifying positive outliers is important so that we can learn from them.

Negative outliers, particularly "alarms", need to be investigated further to understand the cause in order that action can be taken to improve health gains for patients (Department of Health, 2012). **Figure 2** summarises the regional position across all procedures for general and condition-specific measures in 2010/11 (as at February 2012).

**Figure 2: Yorkshire and Humber acute trusts 2010/11 PROMs procedures with outliers**

Confidence Level	Positive Outliers		Negative Outliers	
	Upper 99.8%	Upper 95%	Lower 95% <i>ALERT</i>	Lower 99.8% <i>ALARM</i>
Groin Hernia Repair - EQ5D		Northern Linc & Goole FT		
Hip Replacement - EQ5D		Leeds Teaching NHS Trust Northern Linc & Goole FT	Mid Yorkshire NHS Trust	Barnsley hospital NHS FT Donc & Bassetlaw NHS FT Sheffield Teaching NHS FT
Hip Replacement - Oxford Score			Bradford Teaching NHS FT Sheffield Teaching NHS FT	Barnsley hospital NHS FT Don & Bassetlaw NHS FT Mid Yorkshire NHS Trust
Knee Replacement - EQ5D	Cald & Hudd NHS FT	Leeds Teaching NHS Trust	Hull & E Yorks NHS Trust	Donc & Bassetlaw NHS FT
Knee Replacement - Oxford Score	Cald & Hudd NHS FT	Airedale NHS FT Leeds Teaching NHS Trust Northern Linc & Goole FT		Donc & Bassetlaw NHS FT
Varicose Vein Surgery - EQ5D		Hull and E Yorks NHS Trust	Mid Yorks NHS Trust	

## Next Steps

If an organisation is identified as an outlier, particularly an 'alarm', it is helpful to drill down and find out more about what makes up the organisations aggregate score. A special interest topic on patient level data was published alongside the quarterly PROMs data (NHSIC, 2012), it is worth organisations exploring this in more detail. Additionally YHQO can access patient level PROMs data which can be used to understand more about; variations in scores, differences in outcomes for procedures and between consultants, differences in responses to specific questions and others. Please contact YHQO for more information on this (details below).

The funnel plot is a useful technique for PROMs but could also be applied to many other areas as a method of comparing organisations and flagging only 'special cause' variation having allowed for natural variation between scores.

## References

Department of Health (2008) Guidance on the routine collection of Patient Reported Outcome Measures (PROMs). Available at: [www.dh.gov.uk/en/Publicationsandstatistics/DH\\_092647](http://www.dh.gov.uk/en/Publicationsandstatistics/DH_092647)

Department of Health (2012) *PROMs in England: the case-mix adjustment methodology*. Available at: [www.dh.gov.uk/en/Publicationsandstatistics/DH\\_133445](http://www.dh.gov.uk/en/Publicationsandstatistics/DH_133445)

Department of Health (2011) *PROMs in England: a methodology for identifying outliers*. Available at: [www.dh.gov.uk/en/Publicationsandstatistics/DH\\_128440](http://www.dh.gov.uk/en/Publicationsandstatistics/DH_128440)

The NHSIC (2012) *HES Online: PROMs data*. Available at: [www.hesonline.nhs.uk/se/servlet/ContentServer?siteID=1937&categoryID=1582](http://www.hesonline.nhs.uk/se/servlet/ContentServer?siteID=1937&categoryID=1582)

Yorkshire and Humber Quality Observatory (2012) *PROMs*. Available at: [www.yhpho.org.uk/proms](http://www.yhpho.org.uk/proms)

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