bureau of
health
information

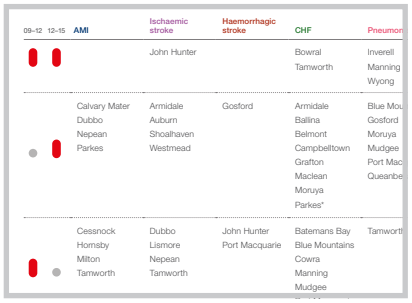
Understanding our graphs

The Bureau of Health Information uses a range of graphs to present key research findings in a simple and visually engaging way.

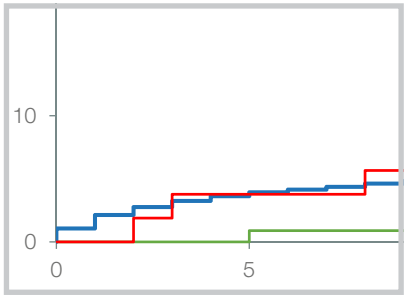
bureau of health information

Below are some of the most common graphs BHI uses. Advice on how to read and interpret each of these can be found on the following pages.

Lozenge graph

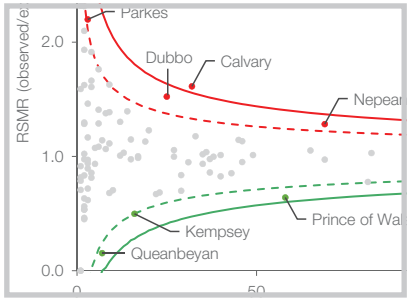


Cumulative mortality graph

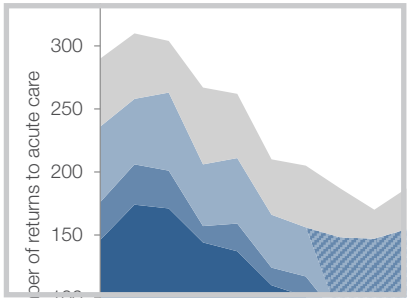


String of pearls graph

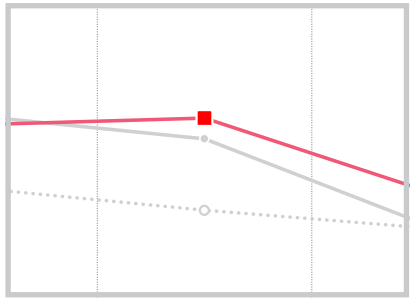
Funnel plot



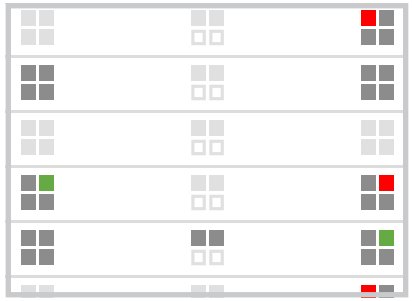
Mountain graph



Double axis line graph



Battenberg graph



Lozenge graph

A lozenge graph is used to compare a unit's results over time.

This example shows the hospitals with a changed or consistent outlier status over the two most recent reporting periods (2009–12 and 2012–15) with regards to mortality for seven different conditions.

The rows show those hospitals with consistent higher or lower than expected mortality results, as well as hospitals that improved or deteriorated between the two time periods.

By showing the hospitals with a changed outlier status over two consecutive time periods, hospital performance can be compared over time.

Hospitals with changed status, 30-day mortality, NSW, 2009–12 and 2012–15

Higher than expected | No different than expected | Lower than expected

09–12	12–15	AMI	Ischaemic stroke	Haemorrhagic stroke	CHF	Pneumonia	COPD	Hip fracture surgery
Higher	Higher		John Hunter		Bowral Tamworth	Inverell Manning Wyong	Cowra Port Macquarie Tamworth	Tamworth
No different	Higher	Calvary Mater Dubbo Nepean Parkes	Armidale Auburn Shoalhaven Westmead	Gosford	Armidale Ballina Belmont Campbelltown Grafton Maclean Moruya Parkes*	Blue Mountains Gosford Moruya Mudgee Port Macquarie Queanbeyan	Belmont Calvary Mater Campbelltown Casino John Hunter Manning Mudgee The Tweed	Dubbo John Hunter Manning Port Macquarie
Higher	No different	Cessnock Hornsby Milton Tamworth	Dubbo Lismore Nepean Tamworth	John Hunter Port Macquarie	Batemans Bay Blue Mountains Cowra Manning Mudgee Port Macquarie Tumut	Tamworth	Mt Druitt	Gosford Orange

What is this graph telling me?

There were eight hospitals with higher than expected mortality for the same condition across both time periods (top row). One of these (Tamworth) did so for three conditions.

For 18 hospitals, mortality improved to 'no different than expected' for at least one condition; and for Tamworth and Port Macquarie, the improvement was for three and two conditions, respectively.

Source: *The Insights Series – Exploring clinical variation in mortality, NSW, July 2012 – June 2015*

Back to menu

Cumulative mortality graph

Cumulative graphs provide information about an indicator over a period of time.

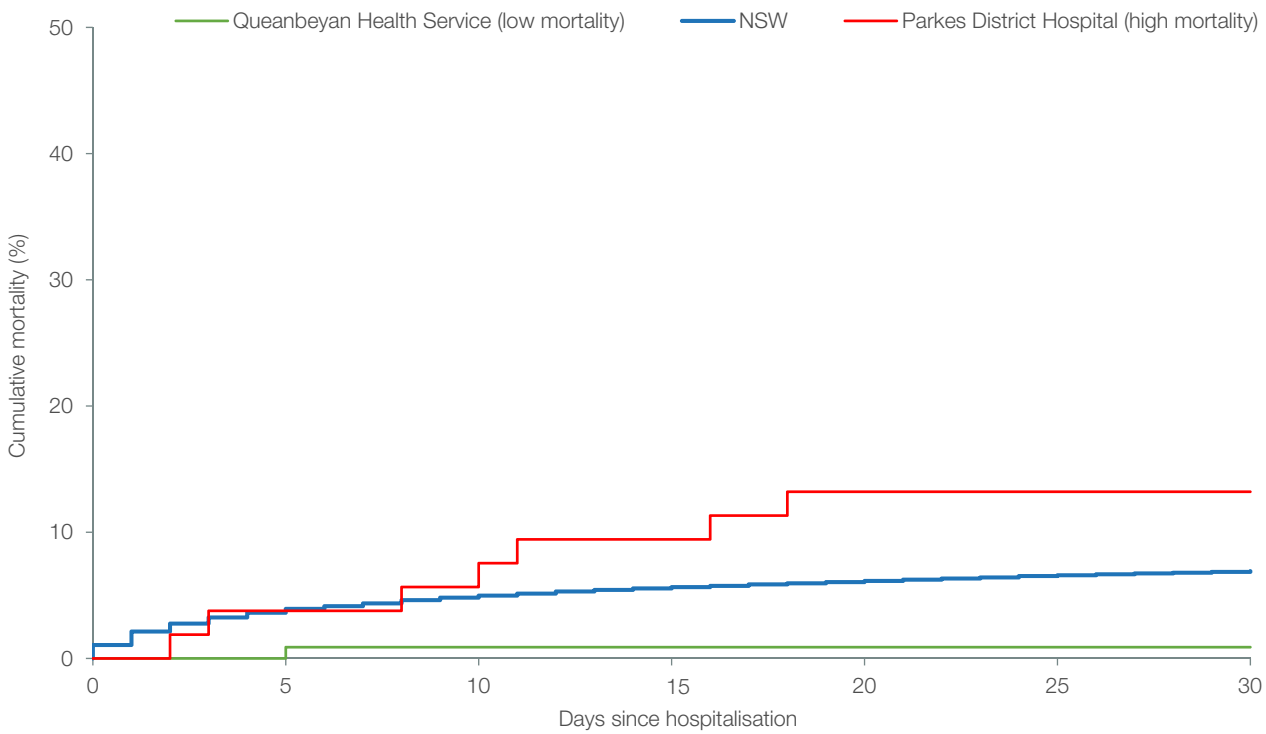
In this example the cumulative graph shows the way patient deaths are distributed over the 30-day period following hospitalisation.

The example shows the percentage of deaths that occurred by day, following hospitalisation.

Results for two example hospitals are shown – Queanbeyan (green line) and Parkes (red line) as well as for NSW overall (blue line).

Each death results in a step increase in the cumulative mortality line.

Cumulative mortality, by day, acute myocardial infarction, NSW and highest and lowest RSMR hospitals, July 2012 – June 2015



Comparing individual hospital results with NSW puts their performance in context – showing where NSW stands and where to look to guide improvement.

What is this graph telling me?

Compared with the NSW cumulative mortality profile, mortality among patients hospitalised at Parkes increased more sharply around day 10; while for patients at Queanbeyan, fewer deaths over the 30-day period are reflected in a much flatter curve.

Source: *The Insights Series – Exploring clinical variation in mortality, NSW, July 2012 – June 2015*

Back to menu

String of pearls graph

A 'string of pearls' graph is used to show the distribution of unit (often hospital or local health district) results and highlight differences from the NSW result.

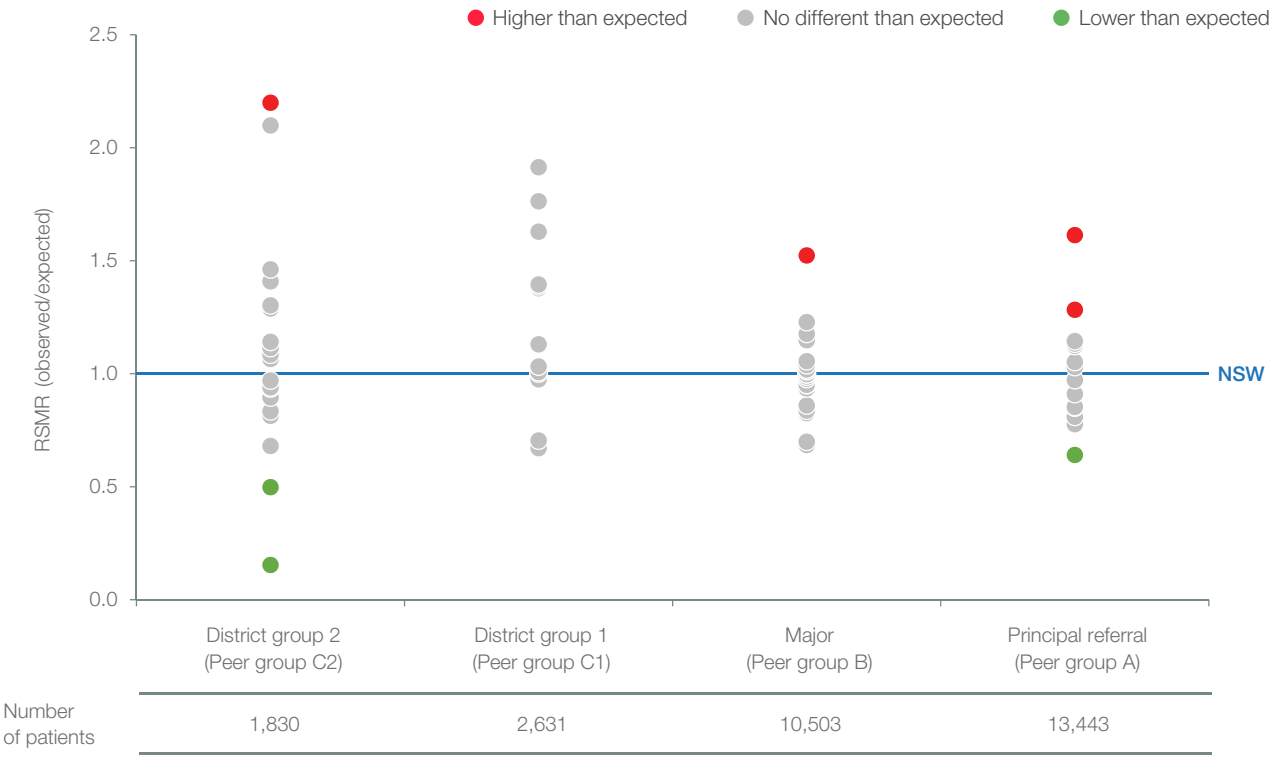
This example shows a series of string of pearl graphs for individual hospital's risk-standardised mortality ratio (RSMR), by peer group.

Each circle shows a hospital's RSMR and highlights whether it is higher than expected, no different than expected or lower than expected, compared to the NSW result (shown as a blue line).

Note: String of pearls graphs can be shown vertically and horizontally.

Hospital peer groups are used to cluster similar hospitals together so that fair comparisons can be made.

Acute myocardial infarction 30-day risk-standardised mortality ratio, by peer group, July 2012 – June 2015



What is this graph telling me?

Across peer groups, higher and lower than expected mortality occurred in principal referral and district hospitals. Among smaller district hospitals (peer group C2), there was one hospital with higher than expected mortality (coloured red) and two hospitals with lower than expected mortality (coloured green).

Source: *The Insights Series – Exploring clinical variation in mortality, NSW, July 2012 – June 2015*

Back to menu

Funnel plot

Funnel plots are used to help interpret whether differences in unit (often hospital) results are significant, taking into account the number of patients seen in the hospital.

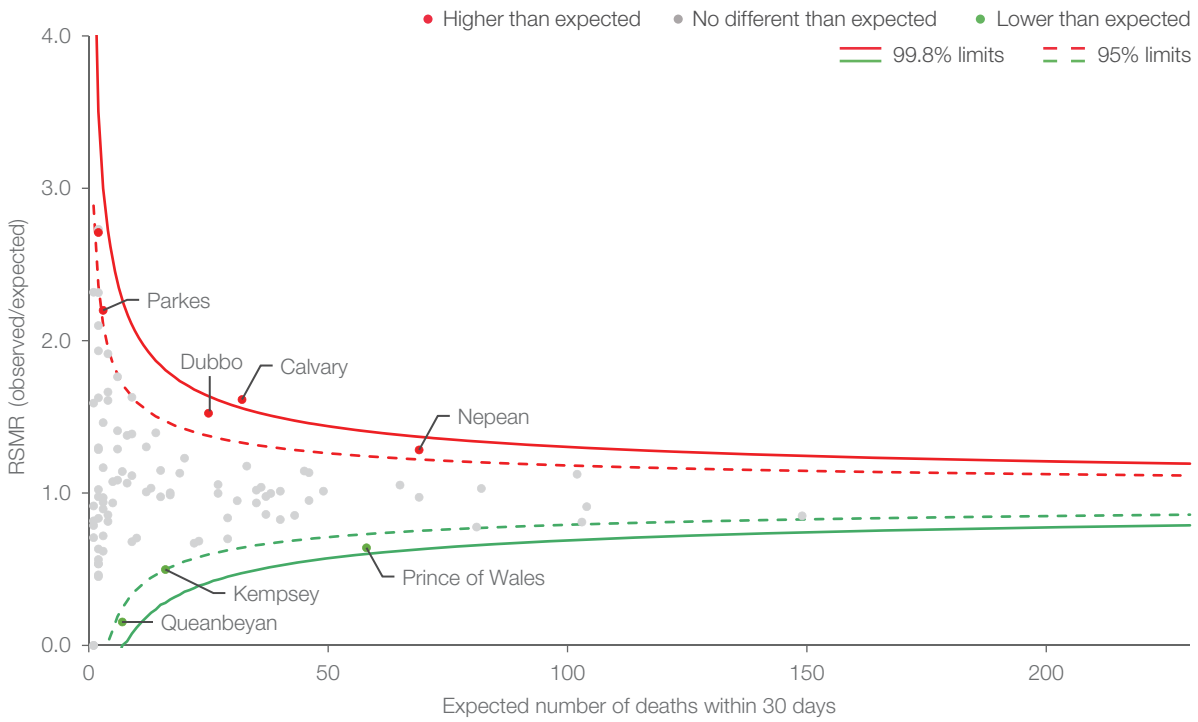
Mortality is influenced by a wide range of factors, meaning there will always be some level of variation in patient outcomes. The 'funnel' shape used here indicates the tolerance around this variability.

Hospitals with fewer hospitalisations (with a relatively low expected number of deaths, and appearing towards the left hand side of the plot) will display greater variability and may have a high or low ratio by chance. Fair assessment about performance should take this into account.

Hospitals above the upper 95% control limit of the funnel are considered to have higher than expected mortality ratios; those below the lower 95% limit are considered to have lower than expected RSMRs. For hospitals outside 99.8% limits, there is greater confidence about their outlier status.

Patient outcomes always vary across hospitals. Risk-standardisation helps make fair comparisons by taking into account patient characteristics that may influence outcomes, regardless of the care provided (e.g. age, and other co-existing diseases (comorbidities)).

Acute myocardial infarction 30-day risk-standardised mortality ratio, NSW public hospitals, July 2012 – June 2015



What is this graph telling me?

This funnel plot shows 30-day RSMRs for each hospital in NSW. Of the 67 hospitals that admitted 50 or more AMI patients in the three year period, there were three (Queanbeyan, Kempsey, and Prince of Wales) with lower than expected mortality and five (including Parkes, Dubbo, Calvary Mater and Nepean) with higher than expected mortality.

Source: *The Insights Series – Exploring clinical variation in mortality, NSW, July 2012 – June 2015*

Back to menu

Mountain graph

Mountain graphs show how the volume and type of outcome changes over time.

This example shows for AMI patients, the number of readmissions (or returns to acute care) by the number of days from the time patients were discharged from hospital.

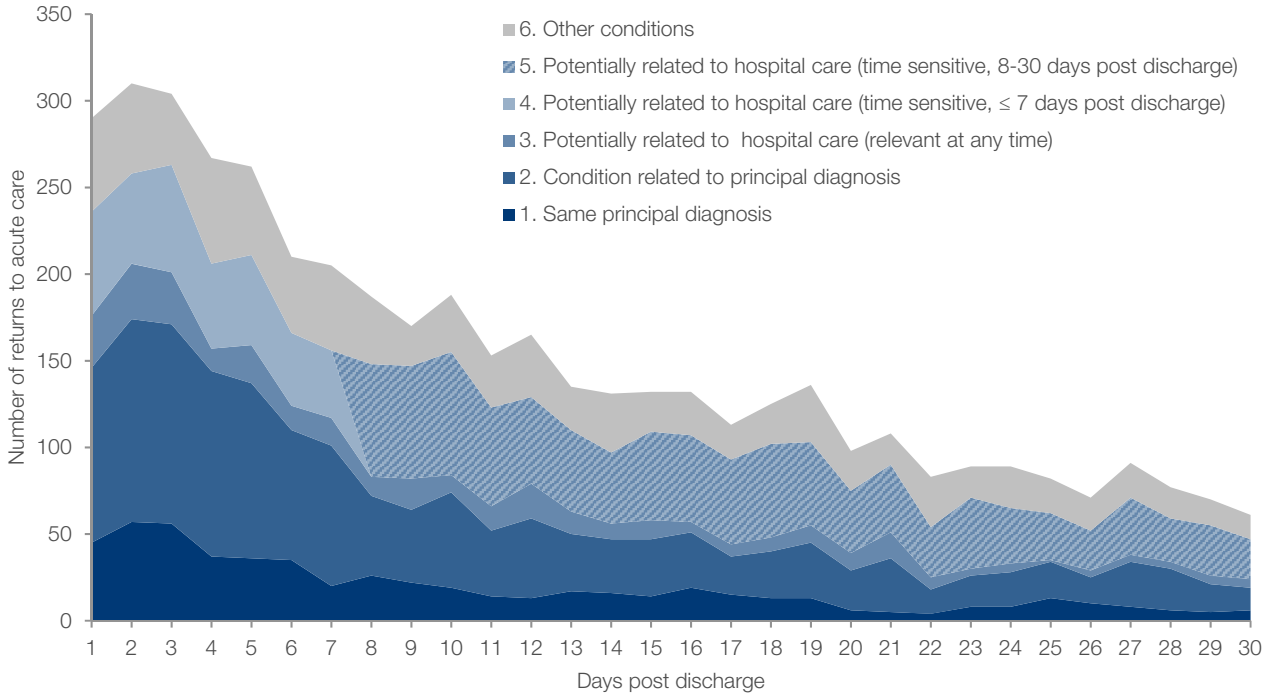
The readmissions are separated (stratified) into groups according to the main reason for readmission.

These categories show whether the readmission was for:

- The same, or a condition related to the principal diagnosis (categories 1 and 2)
- For a complication or other issues related to hospital care (categories 3, 4 or 5)
- For an unrelated reason.

Understanding reasons for readmission can tell us about the role hospital care plays in potentially avoidable readmissions.

Acute myocardial infarction: number of, and reasons for readmission, day 1–30 post discharge, NSW public hospitals, July 2012 – June 2015



What is this graph telling me?

Readmissions occurred more frequently soon after discharge. On the third day after discharge following AMI hospitalisation there were about 300 readmissions, about 60 of these were for the same principal diagnosis (i.e. AMI) and about 115 were for a condition related to the principal diagnosis.

Source: *The Insights Series – Exploring clinical variation in readmission, NSW, July 2012 – June 2015*

Back to menu

Double axis line graph

This graph explores for a particular hospital, whether changes in its risk-standardised mortality ratio (RSMR) over time is a result of changes in case mix or changes in observed mortality.

This example shows a hospital's results for three different measures for mortality, using two axes, by five three year time periods.

Using the left axis, the graph shows:

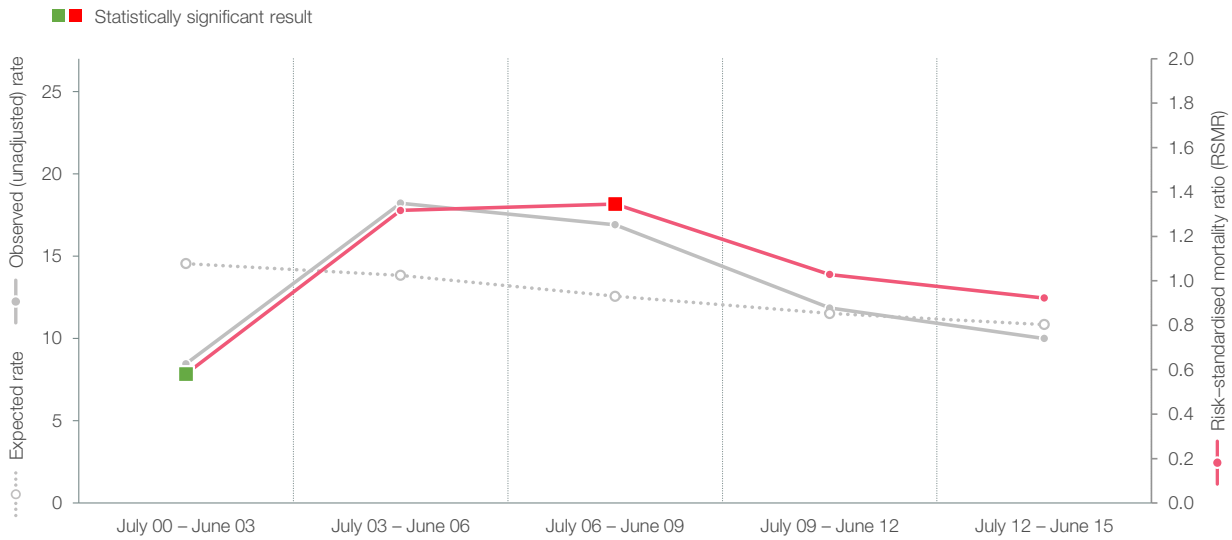
1. How many patients died in or out of hospital within 30 days of admission (the observed rate, shown as a grey line) and
2. How many deaths were expected within 30 days of admission, given the characteristics of the hospital patients (the expected rate, shown as a dashed line).

Using the right axis, the graph shows the RSMR (shown as a coloured line).

RSMRs that are significantly different from the NSW expected mortality, for that period, are highlighted by a coloured square. Each line shows results over time for each of these three measures.

A statistically significant difference is one that we can be confident is a real difference, and is not only due to chance.

Pneumonia, this hospital's risk-standardised mortality ratio, expected mortality rates and observed (unadjusted) mortality rates, July 2000 – June 2015



What is this graph telling me?

In this example, this hospital's case mix has not changed substantially over the 15 year period – the dotted line showing expected mortality has trended down. The actual (observed) mortality rate has changed markedly however and the RSMR closely follows those changes in actual mortality.

For patients hospitalised with a principal diagnosis of pneumonia, the hospital had lower than expected mortality (green square) in July 00 – June 03 and higher than expected mortality (red square) in July 06 – June 09.

Source: *The Insights Series – Exploring clinical variation in mortality, Goulburn Base Hospital Performance Profile, July 2012 – June 2015*

Back to menu

Battenberg graph

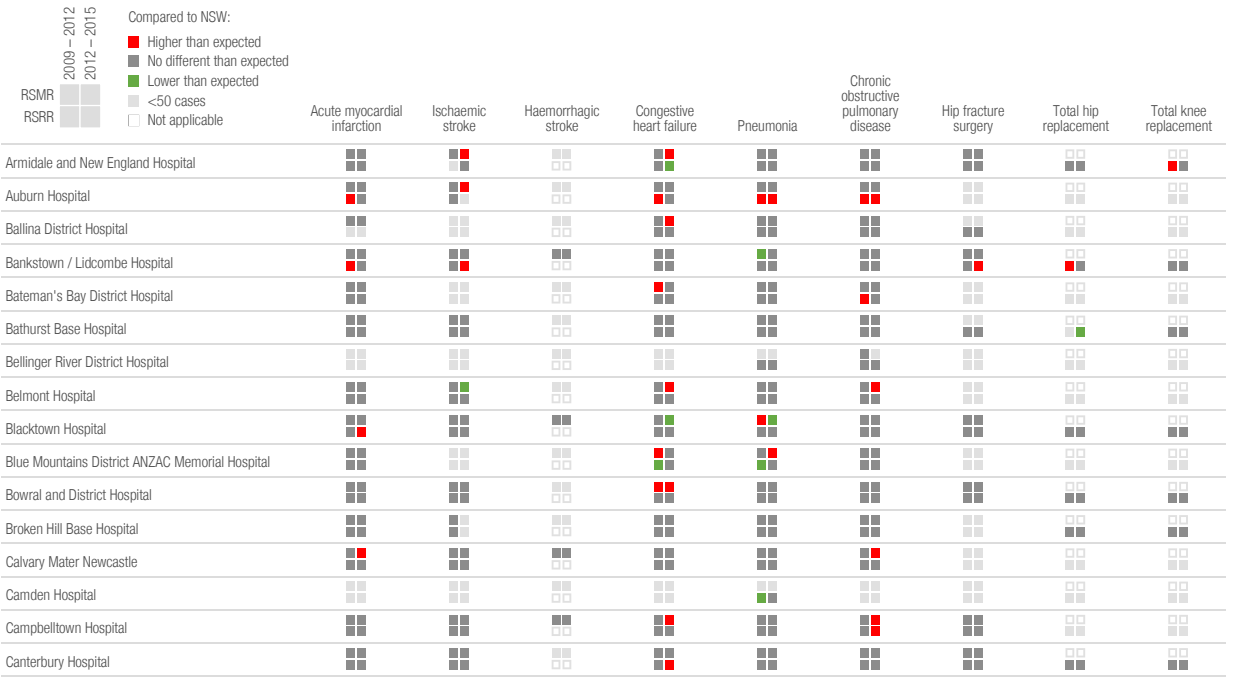
Battenberg graphs provide an overview of hospital level results across mortality and readmission analyses for two time periods.

In this example, hospital level results are shown across nine conditions. Each Battenberg shows the significance of two measures. Across, it shows the risk-standardised mortality ratio (RSMR) and risk-standardised readmissions ratio (RSRR). Down, it shows how these measures change across the two consecutive three-year time periods (09-12 and 12-15).

Each square represents either an RSMR or RSRR. The colour of each cell shows the significance of that hospital's result compared to the NSW result.

By showing different types of measures (here, RSMR and RSRR) across two consecutive time periods, hospital performance can be compared over time.

Overview of hospital results, UCV – An overview report



What is this graph telling me?

The overwhelming majority of hospital results were no different than expected (coloured grey), given their patient case mix.

For the mortality analyses*, there were 398 individual hospital results, and of those 45 were higher than expected (coloured red) and 20 were lower than expected (coloured green).

For the readmission analyses*, there were 435 individual hospital results, and of those 31 were higher than expected and 27 were lower than expected.

* Not all hospitals are shown in this example. Please refer to the original graph for details.

Source: *The Insights Series – Exploring clinical variation in mortality and readmission, An overview, July 2012 – June 2015*

Back to menu