Hospital Standardised Mortality Ratio
Quarterly Release
Publication date – 16 February 2016

SAMPLE REPORT

This is a sample report demonstrating how the HSMR publication report may look following the updates made to the model methodology in August 2016.

Please note that the data provided is based on dummy July-September 2015 data, and is solely for illustrative purposes.

Highlighted text represents links that will be added to the document at a later date.
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Introduction

This report by the Information Services Division provides quarterly Hospital Standardised Mortality Ratios (HSMR) at Scotland, NHS Board and hospital levels. It includes additional information and commentary on patterns of mortality by key demographic factors. There is extensive information on the development of the measure and how it compares to similar information used in other parts of the UK.

These latest statistics reflect completeness of validated hospital returns as at 12 July 2016. This information has previously been released to NHS Boards as management information.

Hospital Standardised Mortality Ratios

Hospital Standardised Mortality Ratios (HSMRs) adjust death data (referred to in this report as mortality data) to take account of some of the factors known to affect the underlying risk of death.

The calculation uses information from acute inpatient and daycase patients admitted to all medical and surgical specialties in NHSScotland (apart from obstetrics and psychiatry which are excluded). The calculation takes account of patients who died within 30 days from hospital admission. This means that the HSMR also includes deaths that did not happen in a hospital.

These statistics are updated on a quarterly basis and reflect the HSMR for each quarter independently. All data is presented quarterly to show trends. A link to the relevant Excel data table has also been provided alongside each chart.
Main points

- The Scottish HSMR for July to September 2015 is currently 0.90, this is a reduction of 3.6% since the previous year July to September 2014 where the HSMR was 1.01.
- For the period July to September 2015, there were no hospitals considered as outliers. Outliers are defined as more than three standard deviations above the national average.
- Unadjusted hospital mortality has fallen for all types of admission. Emergency or unplanned medical admissions consistently account for the largest proportion of deaths within 30-days of admission.
- Patients from the least deprived areas of Scotland consistently have lower levels of crude 30-day mortality than patients from more deprived areas.
Comparing HSMR with previous years

During 2015/16, ISD undertook a review of the methodology used to calculate HSMR. A Review Paper was subsequently produced with recommendations for refining the model methodology following the end of the Scottish Patient Safety Programme aim. This is the first release of the HSMR using the refined methodology and as such is not comparable to any previous releases.

A Technical Document is available on how the HSMR is now calculated and describes the methodology used in more detail. A Frequently Asked Questions document is also available, answering questions on the differences between the methodologies.

Interpreting HSMR results

The HSMR value for NHSScotland for the baseline period is one. This allows quarterly hospital values to be compared to the baseline period for Scotland. The baseline period for this report is January 2011 to December 2013.

- If an HSMR value is less than one: This means the number of deaths within 30 days of admission for a hospital is fewer than predicted.
- If an HSMR value is greater than one: This means the number of deaths within 30 days for a hospital is more than predicted.

If the number of deaths is more than predicted this does not necessarily mean that these were avoidable deaths (ie that they should not have happened), or that they were unexpected, or attributable to failings in the quality of care.
How HSMR information is used
Safety is a priority ambition for the Healthcare Quality Strategy for NHSScotland and a national reduction in HSMR should reflect work in individual hospitals to review mortality, and reflect reduction in serious adverse events and infections under the Scottish Patient Safety Programme and other improvement initiatives.

Health Improvement Scotland reviews the data with the Information Services Division to identify potential patterns in the data and start dialogue with NHS Boards where appropriate. Healthcare Improvement Scotland may also initiate a dialogue with an NHS Board if a hospital is identified as having:

- a high quarterly HSMR value compared with the national average or its own historical average values;
- an increasing trend over time, or;
- a series of HSMR values which are consistently above the Scottish average.

Should there be any evidence on either basis that an unusual pattern of mortality exists or may be emerging for a particular hospital, then a formal dialogue is initiated with the NHS Board concerned in a written communication from the Clinical Director of Healthcare Improvement Scotland.

The Scottish Government use these statistics to: monitor change in hospital mortality over time; inform policy decision making; respond to parliamentary and public business. For example, commissioning the NHS Lanarkshire Rapid Review Assessment.

NHS Boards use these statistics to reflect on the quality of patient care, monitor local hospital mortality and report on their progress. A considerable amount of activity is being carried out in individual hospitals nationwide to use this tool to reflect on clinical practice and facilitate improvements in patient care eg through Preventing Harm Action Plans.

In addition, a guide for NHS Boards –has been developed ‘Using the Hospital Standardised Mortality Ratio to help improve patient care’.

To help local users better understand their data, and to encourage a sense of ownership of the information an infrastructure has been put in place, in partnership between ISD and Healthcare Improvement Scotland, offering:

- sub-group analysis;
- individual audit of case-listing;
- our assistance in interpretation of the national statistics and local intelligence.
Results and Commentary

1 Time in Point Comparisons

Funnel Plots

A funnel plot is a type of ‘Statistical Process Control’ chart that helps to show data at a particular point in time. Funnel plots in this report allow comparisons to be made between each hospital and the average for Scotland for a particular period.

Chart 1 below provides an illustration of a funnel plot. The rate of the process, the HSMR, is plotted on the vertical axis. The denominator, predicted deaths, is plotted on the horizontal axis.

There are three lines in the funnel plots in this report.

The first line in dark blue is the average for Scotland. Plotted on either side of the average are two sets of curved lines called control limits (red). The red control limits are plotted at three standard deviations from the average. Orange warning limits have also been plotted on the charts presented here, at two standard deviations from the average. In the example below data points presented as circles represent hospitals.

The limits are wider at the left hand side of the graph because the data points plotted here represent smaller hospitals which are made up of fewer observations and subject to greater variability. This means that smaller hospitals will appear towards the left hand side of the graph and larger hospitals towards the right.

Data points outwith the control limits (referred to here as ‘outliers’) are said to exhibit ‘special cause variation’. Variations may reflect a number of factors, such as characteristics of the patients being cared for (case-mix), the quality of clinical care, errors in the data submitted by hospitals or even variation by chance. A single apparently high value of the HSMR is not sufficient evidence on which to conclude that a poor quality or unsafe service is being provided. This is why it is important not to focus solely on ‘outliers’ when making reliable judgements about the quality of patient care.

Chart 1: Example Funnel Plot
Chart 2 shows the funnel plot for the latest quarter. Individual hospitals can be identified using the key under the graph, which lists the hospitals in the order in which they are plotted along the horizontal axis. This shows that there are no hospitals over the upper control limits for the period July to September 2015; however there are two hospitals above the upper warning limits; namely Hospital 6 and Hospital 21.

**Chart 2: HSMR for deaths within 30-days of admission (Funnel Plot); Jul-Sep 2015**

The data relating to this chart can be found in Table A1b.
2 Trends at Scotland Level

Scotland (Overall)

Chart 3 shows the HSMR at Scotland-level between January to March 2011 and July to September 2015. Although the HSMR has remained relatively flat over this time period, it does show clear seasonal patterns with slightly higher HSMRs around the winter quarters (ie October to March).

The Scottish HSMR has decreased by 3.6% between July to September 2014 and July to September 2015. The same year-end to year-end percentage reduction is used to measure the change in HSMR for each participating hospital (Table 2).

Possible factors contributing to changes in the HSMR include:

- improvements in the quality of care and treatment;
- reductions in injury or harm to people from healthcare they receive;
- changes in the severity of illnesses in patients admitted to hospital that are not fully corrected for (standardised) by the statistical model used to produce HSMR;
- changes in the provision of palliative and end-of-life care (currently not explicitly factored into the case-mix adjustment due to existing practices for capturing the information), and:
- changes to the completeness and accuracy of hospital discharge summaries/clinical coding (See Data Quality and Timeliness section for further information).

Chart 3: HSMR for deaths within 30-days of admission; Scotland, Jan-Mar 2011 to Jul-Sep 2015

The data relating to this chart can be found in Table A1b.

The balance of contributions to the reducing HSMR from improved quality of care and changes in case-mix are not fully standardised by the model, and improvements or changes in completeness or accuracy of coding, remains unclear. It is expected that there will be a better understanding of this in future as further work is carried out to refine and further utilise this measure.
Scotland Long Term Crude Mortality Trends – from 2005

Chart 4 shows that overall crude hospital mortality (%) at Scotland level from April - June 2005 to July – September 2015, according to the existing definition of deaths within 30-days of admission, has fallen from a level consistently above 3% prior to the baseline period. The seasonal pattern previously highlighted is again exhibited in this chart.

Chart 4: Overall crude mortality rates (%) for deaths within 30-days of admission;
Scotland, Apr-Jun 2005 to Jul-Sep 2015

The data relating to this chart can be found in Chart4-Chart8

p - Provisional (see Appendix A1 - Data Quality and Timeliness)
3 Scotland (Sub-Groups)

Scotland – by type of admission

HSMR is by definition an overall indicator that encapsulates mortality outcomes against overall hospital activity. It is possible to examine trends in the same 30-day mortality outcome for some of the underlying factors.

Chart 5 shows the mortality trend according to the four broad categories of patients treated in hospital. The categories describe a composite measure that combines whether the patient was an elective or non-elective admission with whether the patient was admitted to a medical or surgical specialty.

It shows that non-elective medical patients consistently account for the largest proportion of deaths within 30-days of admission and that elective surgical admissions account for the smallest.

Chart 5: Crude mortality rates (%) for deaths within 30-days of admission by type of admission; Scotland Apr-Jun 2005 to Jul-Sep 2015p

The data relating to this chart can be found in Chart 4 - Chart 8

p - Provisional (see Appendix A1 - Data Quality and Timeliness)
Scotland – by age-group

Chart 6 shows that mortality within 30-days of admission increases with age.

**Chart 6: Crude mortality rates (%) for deaths within 30-days of admission by age group; Scotland, Apr-Jun 2005 to Jul-Sep 2015p**

The data relating to this chart can be found in Chart4-Chart8

Provisional (see Appendix A1 - Data Quality and Timeliness)

Scotland – by gender

Chart 7 shows that mortality rates are consistently higher for males throughout the time period. The difference between the mortality for males and females has also remained relatively constant.

**Chart 7: Crude mortality rates (%) for deaths within 30-days of admission by sex; Scotland, Apr-Jun 2005 to Jul-Sep 2015p**

The data relating to this chart can be found in Chart4-Chart8

Provisional (see Appendix A1 - Data Quality and Timeliness)
Scotland – by Scottish Index of Multiple Deprivation

The Scottish Index of Multiple Deprivation presents a picture of multiple deprivation across Scotland. It identifies small area concentrations of multiple deprivation across all of Scotland in a fair way based on six domains - employment, income, health, education, access and crime. Chart 8 shows that patients from the least deprived areas of Scotland consistently have lower levels of 30-day mortality than patients from more deprived areas.

**Chart 8: Crude mortality rates (%) for deaths within 30-days of admission by deprivation; Scotland, Apr-Jun 2005 to Jul-Sep 2015p**

The data relating to this chart can be found in Chart4-Chart8

![Chart 8](chart.png)

- Provisional (see Appendix A1 - Data Quality and Timeliness)
4 Hospital and NHS Board Trends

HSMR data are provided by ISD to allow an individual hospital to monitor its progress over time. The process was not primarily designed to compare hospitals and, therefore, we present information in a way that focuses on individual hospitals progress over time.

There are a number of factors which will influence HSMR values and the % change over time, these can include the following.

- Random variation in the number of observed deaths particularly in smaller hospitals.
- Data quality variations in the completeness and accuracy of the recording of data from patient records, particularly misattribution and coding of main diagnosis.
- Palliative care and terminal care support services in the community for the local populations served.
- Specialist services and changes to service configuration.
- Hospitals with lower initial HSMR values may find less opportunity to reduce their HSMR at a rate achieved by an otherwise similar hospital but with a higher initial level of HSMR.

As there are fluctuations within and between quarterly observations, a single apparently high value of the HSMR is not sufficient evidence on which to conclude that a poor quality or unsafe service is being provided. It should be regarded as a trigger for further investigations.

**Combined Institutions**

In order to reflect current service configuration, some hospitals are presented as combined institutions for the purposes of these reports. This applies to the following NHS Boards.

- **NHS Fife:** In order to reflect current service configuration, the HSMRs for Queen Margaret Hospital and Victoria Hospital have been combined. This change has been applied to all time points retrospectively back to the initial reporting period. Gynaecology activity from the former Forth Park Hospital has also been retrospectively incorporated within this new NHS Fife combined HSMR; obstetric activity is not included in the definition of the Scottish HSMR.

- **NHS Forth Valley:** In order to reflect current service configuration, the HSMRs for the former Falkirk & District Royal Infirmary, Stirling Royal Infirmary and the new Forth Valley Royal Hospital are combined. This change has been applied to all time points retrospectively back to the initial reporting period.

- **NHS Greater Glasgow and Clyde:** In order to reflect current service configuration, the HSMRs for Stobhill Hospital and Glasgow Royal Infirmary have been combined as have the activity for Royal Alexandra Hospital and Vale of Leven. Additionally the Queen Elizabeth University Hospital opened to patients in April 2015, since then services from the Southern General, Victoria Infirmary and Western Infirmary/ Gartnavel have transferred to this new hospital. These changes have been applied to all time points retrospectively back to the initial reporting period.

Individual hospital level data for these combined sites are available on request.
5 In-patient mortality and deaths within 30-days of discharge

Chart 9 shows the trend in mortality at Scotland level according to a definition similar to the Summary Hospital-level Mortality Indicator in England. SHMI takes account of in-patient mortality and deaths within 30-days of discharge. The Scottish HSMR does not include patients that die in-hospital more than 30-days from admission. In Scotland the decision was to associate the outcome with decisions made at the point of admission (see Inter-UK Comparisons: England and Wales section for more information on the differences between the Scottish and English approaches).

For the latest quarter (July – September 2015) there were 5,822 deaths within 30-days of admission to hospital in Scotland, and 7,038 deaths within 30-days of ultimate hospital discharge (including all in-hospital deaths). The mortality rates are inevitably higher than the admission-based method, reflecting the longer opportunity for follow-up. The trend is however consistent with the admission based mortality patterns, and show that although exhibiting seasonal variation, hospital mortality has fallen over the past ten years.

Chart 9: Crude mortality rates (%) for deaths within 30-days of ultimate hospital discharge (includes all in-hospital mortality); Scotland, Jul-Sep 2005 to Jul-Sep 2015

The data relating to this chart can be found in Table A2a

Table A2a provides a chart similar to Chart 8 containing the trend for each NHS Board of treatment plotted against Scotland.
6 Population-based Mortality

HSMR shows the ratio of observed to predicted deaths. It is therefore possible for an HSMR to fall whilst death rates increase. For this reason HSMRs should be considered alongside crude death rates which are useful for getting an overall picture of the number of deaths relative to the population.

Trends in crude underlying population mortality rates have been derived from the total number of deaths (numerator), and mid-year population estimates (denominator), both available from the National Records of Scotland at Scotland level and by NHS Board of residence.

Chart 10 shows the trend in overall population mortality for Scotland between July – September 2005 and July – September 2015. The series, although exhibiting seasonal characteristics, demonstrates a general downward trend in overall mortality, which has started to level off in recent quarters.

Chart 10: Underlying Population Death Rates (crude rates per 1,000 population); Scotland, Jul-Sep 2005 to Jul-Sep 2015

The data relating to this chart can be found in Chart A1

p - Provisional (see Appendix A1 - Data Quality and Timeliness)

Chart A1 provides a series of mortality charts for the resident populations of each NHS Board area.
Data Files

The latest NHSScotland data from quarters ending September 2015 and comparable information by NHS Board of treatment and Hospital are given in the Excel files that accompany this publication. Please note the following.

Table A1a
The data within Table A1a contains a ‘drop-down’ selection option for NHSScotland combined or a choice of any of the NHS Boards. The following series of tables and charts are presented.

- Table 1: Observed deaths, predicted deaths, hospital standardised mortality ratio, number of patients and crude mortality rate.
- Figure 2: Hospital standardised mortality ratio for all Scotland combined, and for the selected Health Board of treatment in Table 1.

Table A1b
The data in Table A1b contain a similar ‘drop-down’ selection option for NHS Scotland combined or a choice of any of the SPSP participating hospitals. The following series of tables and charts are presented.

- Table 1: Observed deaths, predicted deaths, hospital standardised mortality ratio, number of patients and crude mortality rate.
- Figure 1a: Number of observed and predicted deaths in Scotland.
- Figure 1b: Number of observed and predicted deaths for a selected hospital from the list in Table 1.
- Figure 2: Hospital standardised mortality ratio for all hospitals in Scotland, and for a selected hospital from the list in Table 1.
- Figure 3: Crude Mortality Rates (%) for all hospitals in Scotland combined and for hospitals selected from the list in Table 1.

Both Table A1a and Table A1b contain macros and can be viewed using Microsoft EXCEL. Users should ensure that their macro security settings are set to enable this content to be viewed.

Since August 2014 these results have also been published in an interactive dashboard format. A link to the latest available iteration of this is available on the HSMR webpage.

Table 2
For each NHS Board SPSP participant hospital Table 2 shows the current HSMR (July to September 2015) and the overall percentage change since the equivalent quarter in the previous year.

Table A2a
Table A2a provides a series of tables for each NHS Board of Treatment containing the numerator (number of deaths within 30-days of ultimate hospital discharge) and denominator (number of patients) data according to this definition. Charts similar to Chart 9 containing the trend for each NHS Board of treatment plotted against Scotland have also been provided.
Refinements to HSMR Methodology

Since the HSMR statistics were first released in 2009, extensive dialogue with stakeholders identified that there may be features of the HSMR model that could be refined and potentially improved upon. However, opportunity to implement such improvements needed to be balanced against the overall policy strategy, which was the continuation of the measure to end December 2015 to support the current phase of the Scottish Patient Safety Programme.

During 2015/16 ISD undertook to fully review the model methodology. As a result of this review ISD made the following recommendations to update the model methodology following the end of the current phase of the SPSP:

- Re-base the model on a more frequent basis, ensuring that the predicted mortality used within the HSMR calculation is based on more up to date data.
- Update the Charlson Index weightings used to calculate co-morbidity & prior morbidity weightings.
- Update the primary diagnosis groupings using the 140 Clinical Classification System categories as used in the Summary Hospital Mortality Indicator produced by the Health & Social Care Information Centre).
- Add co-morbidities and Scottish Index of Multiple Deprivation to the explanatory variables used for case-mix adjustment.
- Move to using a logistic regression based model instead of a decision tree.

More details of the review work and recommendations are available in the HSMR Review Paper. A Technical Document is also available on how the HSMR is now calculated and describes the methodology used in more detail.

Next Update

The next update, reporting on admissions to 31st December 2015, will be published on Tuesday 17 May 2016.
## Glossary

<table>
<thead>
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<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>HSMR</td>
<td>Hospital Standardised Mortality Ratio</td>
</tr>
<tr>
<td>NRS</td>
<td>National Records for Scotland (formerly General Register Office for Scotland)</td>
</tr>
<tr>
<td>SHMI</td>
<td>The Summary Hospital-level Mortality Indicator (SHMI) is an indicator which reports on mortality at trust level across the NHS in England. It is produced and published quarterly as an official statistic by the Health and Social Care Information Centre (HSCIC).</td>
</tr>
<tr>
<td>SIMD</td>
<td>Deprivation for individuals is estimated from aggregate data derived from the census and other routine sources. These are used to estimate the deprivation of small geographical areas. The Scottish Index of Multiple Deprivation (SIMD) has seven domains (income, employment, education, housing, health, crime, and geographical access, which have been combined into an overall index to pick out area concentrations of multiple deprivation.</td>
</tr>
<tr>
<td>SMR</td>
<td>Scottish Morbidity Record.</td>
</tr>
<tr>
<td>SMR(01)</td>
<td>SMR containing non-obstetric and non-psychiatric inpatient and day case activity.</td>
</tr>
<tr>
<td>SPSP</td>
<td>The Scottish Patient Safety Programme (SPSP) is a national programme that aims to improve the safety and reliability of healthcare and reduce harm, whenever care is delivered. The SPSP is led by Healthcare Improvement Scotland</td>
</tr>
</tbody>
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## List of Tables

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<tr>
<th>Name</th>
<th>Time period</th>
<th>File &amp; size</th>
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<tr>
<td>Table A1a (Hospital Standardised Mortality Ratios by NHS Board of Treatment; Jan-Mar 2011 to Jul-Sep 2015)</td>
<td>January 2011 – September 2015</td>
<td>Excel [149kb]</td>
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<td>Table A1b (Hospital Standardised Mortality Ratios by Hospital; Jan-Mar 2011 to Jul-Sep 2015)</td>
<td>January 2011 – September 2015</td>
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<td>Table A2a (Crude hospital mortality rates for in-hospital deaths and deaths within 30-days of discharge by NHS Board of Treatment; Jul-Sep 2005 to Jul-Sep 2015)</td>
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<tr>
<td>Table 2 (Percentage Change in Standardised Mortality Ratios (regression line) for hospitals in Scotland between Jul-Sep 2014 and Jul-Sep 2015)</td>
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<td>Table 4 (Impact of the data refresh on the previously published provisional Standardised Mortality Ratios for all hospitals in Scotland; Apr-Jun 2015)</td>
<td>April – June 2015</td>
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<td>Chart4-Chart9 (Crude mortality rates (%) for deaths within 30-days of admission by subgroup; Apr-Jun 2005 to Jan-Mar 2015)</td>
<td>April 2005 - September 2015</td>
<td>Excel [78kb]</td>
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</tbody>
</table>
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Further Information
Further information can be found on the ISD website

NHS Performs
A selection of information from this publication is included in NHS Performs. NHS Performs is a website that brings together a range of information on how hospitals and NHS Boards within NHSScotland are performing.

Rate this publication
Please provide feedback on this publication to help us improve our services.
Appendices

A1 – Background Information

Methods Used to Calculate the HSMR

The HSMR is calculated for all acute inpatient and daycase patients admitted to all specialties (medical and surgical). The calculation takes account of patients who died within 30 days from admission; that is, it includes deaths that occurred in the community (out of hospital deaths) as well as those occurring in-hospital.

The HSMR is calculated as:

\[ \text{HSMR} = \frac{\text{Observed Deaths}}{\text{Predicted Deaths}} \]

To calculate the predicted deaths, a predicted probability of death within 30 days from admission was calculated for each patient based on the patient’s primary diagnosis; specialty (medical or surgical); age; sex; where the patient was admitted from; the number and severity of prior morbidities in the previous (i) 12 months (ii) 5-years; the number and severity of co-morbidities on the admitting episode; the number of emergency admissions in the previous 12 months; whether admitted as an inpatient or day case; type of admission (elective / non-elective); and deprivation quintile.

To calculate the HSMR from the baseline year (re-based in August 2016 to January 2011 to December 2013) the predicted probabilities were calculated using data from January 2011 to December 2013. These probabilities were then applied to the data for January 2014 to the latest quarter. The predicted probabilities were then summed to hospital level in order to produce the predicted number of deaths. See HSMR Technical Document for more detailed information on the methodology.

In order to count the number of patients and deaths within each quarter the patient’s last stay within each quarter was selected. The outcome (whether the patient was alive or dead within 30 days) and the variables used for case-mix adjustment were taken from the first episode of the stay. Patients with admissions in different quarters will be counted in each quarter. If a patient was admitted in one quarter but died in the subsequent quarter, any admissions in this latter quarter were excluded. This ensured that the analysis was patient-based, within quarter, and that deaths were counted only once.

There are a number of caveats to be considered and addressed in relation to whether the HSMR is a good indicator of quality. For example, the statistical model used to produce the HSMR does not take account of palliative care, and so changes over time in palliative care services could be expected to impact on the HSMR. In addition, the current model looks at deaths within 30 days of admission to hospital, which means that in-hospital deaths are not captured if the patient is in hospital for more than 30 days.
Inter-Uk Comparisons: England and Wales

There is more than one measure routinely produced and used in England and Wales for the measurement of hospital mortality – HSMR and SHMI.

HSMR – England and Wales

What is now commonly referred to as HSMR indicator, was developed by Imperial College and is now routinely produced by Dr Foster Intelligence for England and Wales. This was a first for the UK in terms of national coverage and the development of the Scottish model was largely informed by the work done in England for this indicator.

For England and Wales there is a far greater emphasis, in the published HSMR data, on comparisons between a trust's HSMR and the national average than there is in Scotland. The Scottish approach is to focus on individual hospital trends and the aim of achieving a 20% reduction by 2015. In Scotland mortality for each hospital is standardised to a fixed baseline period and individual patient risks therefore remain constant over time. In England the SHMI model is re-calibrated every quarter so comparisons that are made against the average are appropriate and relevant for each point in time.

As a result, no direct comparison can be made between HSMRs for England and Scotland.

Summary Hospital-level Mortality Indicator (SHMI)

More recently other alternatives have become available, most notably the Summary Hospital-level Mortality Indicator (SHMI) (Department of Health / NHS Information Centre).

The SHMI was developed in collaboration with the Department of Health and overseen by an expert reference group. Its development followed publication of the first Francis report into Mid Staffordshire Hospital which included a recommendation for an NHS-owned and produced summary hospital mortality indicator.

Like the HSMR in Scotland, the SHMI is updated and published quarterly and is based on a statistical model developed from the national hospital dataset (equivalent to the SMR01 in Scotland), which calculates for each hospital how many deaths would be expected to occur if they were like the national average at that point in time.

The model takes into account a number of factors such as differences in age, sex, diagnosis, type of admission and other diseases (co-morbidity). This figure is then compared with the number of deaths that did occur in the hospital and the SHMI is the ratio between the two. SHMI acknowledges that there are unaccounted for factors affecting mortality in hospitals and recognition that there is random variation in the number of deaths as we do in Scotland. Chart 8 showed the crude mortality in Scotland over time according to the same definition as SHMI.

England and Wales SHMI and HSMR comparison

There are three key differences between the SHMI and the Dr Foster HSMR used in England and Wales

- The proportion of in-hospital deaths included in the index – this is all deaths in the SHMI but only 80% in the HSMR
- The inclusion of deaths outside acute hospitals in the SHMI but not in the HSMR
- The factors adjusted for vary between the two indicators
Comparison with Scotland

Regardless of the method, one message holds true for both the Scottish and English / Welsh approaches. That is, a high or higher than expected HSMR/SHMI should be a trigger for further investigation as on its own it cannot be taken to imply a poorly performing hospital or poor quality of care nor can it rule out quality issues or high levels of avoidable mortality.

A measure of uncertainty is calculated for the SHMI and the NHS Information Centre calculates statistical bands to help decide when the SHMI for any trust exceeds expected limits. There is a scientific debate about how best to calculate these bands, so two different methods have been used.

In Scotland, we do not calibrate our model each quarter and publish the data with statistical bands around a national average. We do however, as part of our governance process, look at point in time comparisons against the national average using statistical methods in combination with a more subjective review of patterns in the trends backed-up by Statistical Process Control (run-chart) methodologies. See section on Quarterly Process for more information.

As there remains a subjective element to the assessment of when a communication should be triggered, work in Scotland is focused on developing a whole-system suite of indicators that includes HSMR underpinned by a set of statistical /subjective rules and formal multi-agency governance arrangements involving ISD, HIS and Scottish Government.

One important difference between the SHMI and other publicly available measures of hospital mortality in England is the inclusion of deaths within 30 days of discharge wherever they occur, not just in the hospital. There are other differences such as the proportion of all in hospital deaths included, and factors taken into account in the statistical model.

In Scotland, the HSMR has focussed only on deaths within 30-days of admission (but includes deaths in the community). It differs therefore from both SHMI and Dr Fosters HSMR in that respect alone. Also the adjustment factored into the different models varies, although they are very similar in many respects.

Table 3 shows a summary of some of the key comparisons between the English and Scottish approaches.
### Table 3: Key comparisons between the favoured methods for hospital mortality indicators in Scotland and England.

<table>
<thead>
<tr>
<th></th>
<th>Scotland (HSMR)</th>
<th>England and Wales Summary Hospital-level Mortality Indicator (SHMI)</th>
<th>England and Wales Dr Foster (HSMR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td>One patient observation per spell (referred to in Scotland as a continuous inpatient stay) attributed to the admission hospital of the last spell of care prior to death.</td>
<td>One patient observation per spell attributed to the last acute trust prior to death.</td>
<td>One patient observation per spell attributed to each acute trust involved in care. Only patients with a diagnosis that falls within 56 diagnosis groups are included (~80% of all activity)</td>
</tr>
<tr>
<td><strong>Deaths</strong></td>
<td>Deaths within 30 days of admission to an acute hospital (wherever they occur)</td>
<td>All deaths occurring in hospital</td>
<td>All inpatient and day case deaths in hospital</td>
</tr>
<tr>
<td></td>
<td>In-hospital deaths occurring beyond 30-days are excluded.</td>
<td>And deaths within 30 days of discharge from acute hospital (wherever they occur)</td>
<td></td>
</tr>
<tr>
<td><strong>Adjustments</strong></td>
<td>Primary diagnosis (Scottish groupings x26) / Specialty (medical or surgical) / age / sex / admitted from / number and severity of prior morbidities in the previous (i) 12 months (ii) 5-years / number and severity of co-morbidities on admitting episode / number of emergency admissions in the previous 12 months / inpatient or day case / type of admission (elective / non-elective)/ deprivation</td>
<td>Age/ sex/ admission type/ CCS group (diagnosis) / comorbidity (modified Charlson score)</td>
<td>Age/ sex/ admission type/ CCS group (diagnosis) / comorbidity (modified Charlson score)/ deprivation/ previous emergency admissions / palliative care (specialty code 315; ICD10 code Z515/source of admission)</td>
</tr>
</tbody>
</table>

- **Patients**: One patient observation per spell for each spell, referred to as a continuous inpatient stay in Scotland. It includes the last spell of care prior to death.
- **Deaths**: Deaths within 30 days of admission to an acute hospital, including in-hospital deaths occurring beyond 30 days.
- **Adjustments**: Includes primary diagnosis, specialty, age, sex, admission type, number of morbidities, number of emergency admissions, and type of admission.
A2 - Quarterly Process

Since the first release of quarterly HSMR statistics to NHS Boards across Scotland in December 2009, a pattern of analysis and reporting coupled with cross agency governance procedures has been established.

There are three key stages to this quarterly process which include other indicators of quality.

Stage One: HSMR Management Information Tool

The initial production of the HSMR Management Information Tool involves the systematic review of the data by representatives from ISD and HIS. The purpose of the review is to identify potential patterns in the data and to initiate a dialogue with NHS Boards where appropriate. As the emphasis remains on local ownership of the data, a guidance document has been prepared jointly by Healthcare Improvement Scotland, the Information Services Division, Scottish Patient Safety Programme, and the Quality Improvement Hub.

By releasing information via the management tool first, NHS Boards have an opportunity to gain a greater understanding of some of the implications of the fairly complex adjustments that were applied in the model and to reconcile this with their own local data and intelligence.

Stage Two: Official Statistics Publication of HSMR for Scotland

The first Official Statistics release of the information was in June 2010, when a set of abbreviated summary tables were published on a dedicated website and linked to the main ISD site. The timing of the publication has been altered to better synchronise with the availability of death data from National Records of Scotland and to optimise the timeliness of reporting. See the section on Timeliness for further information.

The publication has been expanded to include more substantial commentary and context, including a look at stratified patterns of mortality at Scotland level and longer-term trends. There is also more commentary on the evolution of the measure in Scotland; where it came from, where we are now and where we are headed. We also take a more comprehensive look at how the Scottish HSMR compares to similar measures in other parts of the UK.

Stage Three: Hospital Scorecard

The Hospital Scorecard is a management information product commissioned by the Scottish Government’s Directorate for Health Workforce & Performance. The scorecard incorporates HSMR with a series of other indicators, some of which are already routinely published. The other indicators are readmissions, length of stay, hospital acquired infection rates, A&E waiting times and patient experience. The purpose of the scorecard is to provide an overview with different indicators synchronised to a common point in time. A major benefit of using a scorecard approach is that it addresses concerns raised about governance processes based on the review of HSMR alone.

A summary of the processes and key dates for the latest quarterly cycle is shown in the table below.
### Month Processes and Key Dates

#### January
- Source database refreshed (12 January 2016)
- Analytical work begins, involving
  - Extraction of quarterly patient observations with outcome
  - Mapping of predictions from baseline model
  - Calculation of observed & predicted deaths at Hospital-level calculated by aggregating outcomes and predictions
  - Import to reporting template
  - Internal QA and data scrutiny (data completeness)
- Review meeting with Healthcare Improvement Scotland (28 January 2016)
- Management Information Tool made available to NHS Boards (29 January 2016)

#### February
- Official statistics report production cycle commences
- Scottish Government and NHS Boards receive standard pre-release access (9 Feb 2016)
- ISD briefs Scottish Government on content of report (10 Feb 2016)
- Report published on ISD website at 09:30 on Tuesday 16th February 2016

#### March
- Hospital Scorecard (containing HSMR and suite of additional indicators) released to Scottish Government’s Directorate for Health Workforce & Performance and Healthcare Improvement Scotland (date tbc)
- Scottish Government and HIS briefed by ISD on analytical data issues and interpretation of the scorecard
- Scorecard presented to Scottish Government Health & Social Care Management Meeting (date tbc)

Throughout the quarterly cycle, interaction with NHS Boards is of paramount importance. There has been dialogue with the majority of NHS Boards since HSMRs were first released. This has been through a number of routes, including SPSP learning sessions, the QI Hub, or through the formal escalation process.
A3 - Data Quality and Timeliness

HSMR is being used extensively across Scotland as one of a number of indicators of quality and safety. The credibility of the HSMR is dependent on robust data quality, particularly around the accuracy and consistency of the recording of main diagnosis.

Source Data

The HSMR measure is derived from the routine returns that hospitals submit to the Information Services Division for their non-obstetric and non-psychiatric inpatient and day case activity (known as the SMR01 dataset). ISD have well established mechanisms to work with providers to ensure the quality of the SMR01 records is maintained and where necessary enhanced.

The data is submitted to ISD on a monthly basis and are retrospectively linked together at patient-level. The hospital patient-profiles are then linked to the NRS death records on a monthly basis. During interaction with NHS Boards ISD has found that widespread use of the HSMR has drawn the focus of attention to the quality of data and clinical coding.

Data Quality Assurance

In May 2012, ISD published the findings of their most recent quality assurance assessment which was undertaken during 2010-11 to ensure that SMR01 (General / Acute Inpatient and Day Case) data items are being recorded consistently and to a high standard throughout NHS Scotland. The report shows that:

- main condition (used as a fundamental part of the HSMR calculation) is being recorded with an accuracy rate of 88%;
- however, not all of the hospitals participating in the SPSP were included in the sample, and the sample included hospitals not participating in the SPSP
- findings suggest that common conditions, such as Heart Disease, Chronic Obstructive Pulmonary Diseases and alcohol-related conditions are routinely recorded at levels above 95%
- recommendations and system improvements identified by the report have been implemented by NHS Boards
- ISD Clinical Coding Tutors routinely advise NHS Boards on coding issues

Timeliness

The majority of hospital admission data will be complete for the latest quarter, however it should still be considered provisional on the basis that the source data are dynamic and additional hospital returns will come in and be reflected in future calculations of the HSMR for that quarter.

Death registrations from NRS are linked to hospital admissions in Scotland on a monthly basis. This has enabled the HSMR time series to be extended to include admissions up to 12 January 2016 in this release.

A new patient management system (TrakCare PMS) has been implemented in five NHS Boards:

- NHS Ayrshire & Arran
- NHS Borders
- NHS Grampian
- NHS Greater Glasgow & Clyde
NHS Lanarkshire

The system has also been implemented in NHS Highland, and although implementation is now complete there are still issues impacting on the submission of SMR returns. We therefore estimate that the HSMR for NHS Highland hospitals for quarter July – September 2015 is based on approximately 65% completeness. This is an overall estimate for NHS Highland, as such there may be some hospitals within the board with higher levels of completeness and conversely with lower levels of completeness for quarter July – September 2015.

ISD continues to work with PMS Consortium Boards on national outputs to ensure they meet national definitional and processing requirements.

All hospitals have HSMRs calculated for the most recent quarters based on their current levels of data completeness. With the exception of NHS Highland (65%), NHS Dumfries & Galloway (78%) and NHS Orkney (89%) all NHS Board HSMRs are based on completeness levels above 90% for July to September 2015.

HSMRs should therefore be interpreted within the context of changes over time to the denominator patient numbers. ISD continues to work with NHS Boards to assist in the resolution of any data submission issues.


**Refreshing Previously Provisional Data**

The previous report, published on 17\textsuperscript{th} November 2015, presented provisional data for April – June 2015 along with data completeness estimates for those hospitals undergoing PMS implementation. The data for that quarter has now been refreshed to reflect additional returns that have subsequently been submitted for that quarter. The impact of those further submissions suggests that, previous completeness estimation was appropriate, and at Scotland level the data were approximately 98% complete. The overall Scottish HSMR for April – June 2015 has decreased slightly from 0.86 to 0.85 (rounded to 2 decimal places).

*Table 4* shows the impact of the refresh on the individual hospital level HSMRs. Completeness levels in the latest period for those NHS Boards undergoing PMS implementation is generally now consistent with levels observed for other NHS Boards.

In NHS Highland, the HSMR was based on approximately 76% completeness. The refresh of HSMRs for their reported hospitals during April – June 2015 has brought about an increase in the previously reported level of HSMR for three NHS Highland hospitals; Caithness General Hospital (1.11 to 1.17), Lorn & Islands Hospital (1.00 to 1.04) and Raigmore Hospital (0.78 to 0.83). Completeness for this period is now estimated at 95%.

In NHS Orkney, the HSMR was based on approximately 93% completeness. However, the refresh of HSMR for their hospital during April to June 2015 has brought about a small reduction in the previously reported level of HSMR from 0.79 to 0.76. Completeness for this period is now estimated at 100%.

The updated analysis suggests that completeness for the majority of all remaining hospitals during April – June 2015 is now in excess of 95%, with the refresh causing no sizable changes to the previous level of the HSMR.
# A4 – Publication Metadata (including revisions details)

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<th>Metadata Indicator</th>
<th>Description</th>
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<tr>
<td>Publication title</td>
<td>Hospital Standardised Mortality Ratios</td>
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<tr>
<td>Description</td>
<td>Quarterly release of HSMR trends at Scotland, NHS Board and Hospital levels between Jan-Mar 2011 and Jul-Sep 2015. Also includes analyses of crude mortality trends over the longer term between Apr-Jun 2005 and Jul-Sep 2015.</td>
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<td>Quality Indicators</td>
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<tr>
<td>Data source(s)</td>
<td>SMR01 / NRS Death Registrations – Linked Database</td>
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<tr>
<td>Date that data are acquired</td>
<td>12th January 2016</td>
</tr>
<tr>
<td>Release date</td>
<td>Tuesday 16th February 2016</td>
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<tr>
<td>Frequency</td>
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<tr>
<td>Timeframe of data and timeliness</td>
<td>Quarterly reporting periods from Apr-Jun 2005 to Jul-Sep 2015 (one-quarter reporting lag)</td>
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<tr>
<td>Continuity of data</td>
<td>SMR01 has recorded data in current form since April 2007</td>
</tr>
<tr>
<td>Revisions statement</td>
<td>The publication contains a refresh of previously reported data to reflect additional source data that has been received since last publication.</td>
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<td>Revisions relevant to this publication</td>
<td>Data at hospital level that was previously reported as provisional for quarter Apr-Jun 2015 is explicitly compared with the refreshed values for that quarter in this release.</td>
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<td>Concepts and definitions</td>
<td>Contains sections on Data Source, Methodology and Development</td>
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<tr>
<td>Relevance and key uses of the statistics</td>
<td>Quality improvement and assurance.</td>
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<td>Accuracy</td>
<td>Quality assured by NHS Boards (management information version of reports) and ISD</td>
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<td>Completeness</td>
<td>Approximately 96% for the latest quarter.</td>
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<tr>
<td>Comparability</td>
<td>Contains section on inter-UK comparisons, data not directly comparable with similar measures used in England.</td>
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<tr>
<td>Accessibility</td>
<td>It is the policy of ISD Scotland to make its web sites and products accessible according to published guidelines.</td>
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<tr>
<td>Coherence and clarity</td>
<td>Measures to enhance coherence and clarity within this report include: explanatory chart/table notes, minimal use of abbreviations/abbreviations explained in text, comprehensive notes on background and methodology.</td>
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<tr>
<td>Value type and unit of measurement</td>
<td>Ratio of observed over predicted deaths (HSMR)</td>
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<td></td>
<td>Crude and Standardised Mortality (expressed as percentage of patients that die within 30-days of admission)</td>
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<td>Disclosure</td>
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<td>Official Statistics designation</td>
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<tr>
<td>UK Statistics Authority Assessment</td>
<td>Assessment report published (ref no. 249). Confirmed as National Statistics April 2014</td>
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<td>Next published</td>
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A5 – Early Access details (including Pre-Release Access)

Pre-Release Access
Under terms of the "Pre-Release Access to Official Statistics (Scotland) Order 2008", ISD are obliged to publish information on those receiving Pre-Release Access ("Pre-Release Access" refers to statistics in their final form prior to publication). The standard maximum Pre-Release Access is five working days. Shown below are details of those receiving standard Pre-Release Access.

Standard Pre-Release Access:
Scottish Government Health Department
NHS Board Chief Executives
NHS Board Communication leads

Early Access for Management Information
These statistics will also have been made available to those who needed access to ‘management information’, ie as part of the delivery of health and care:

<table>
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<tr>
<th>NHS Health Board</th>
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</thead>
<tbody>
<tr>
<td>Ayrshire &amp; Arran</td>
<td>Clinical Improvement Manager</td>
</tr>
<tr>
<td>Borders</td>
<td>Director of Nursing</td>
</tr>
<tr>
<td></td>
<td>Patient Safety Programme Manager</td>
</tr>
<tr>
<td>D&amp;G</td>
<td>Nurse Director and Director for Patient Safety</td>
</tr>
<tr>
<td>Dumfries &amp; Galloway</td>
<td>Patient Safety &amp; Improvement Manager</td>
</tr>
<tr>
<td>Fife</td>
<td>Patient Safety Programme Manager</td>
</tr>
<tr>
<td>Forth Valley</td>
<td>Director of Nursing</td>
</tr>
<tr>
<td></td>
<td>Head of Clinical Governance</td>
</tr>
<tr>
<td>Golden Jubilee</td>
<td>Clinical Governance Manager</td>
</tr>
<tr>
<td></td>
<td>Director of Nursing &amp; Clinical Services</td>
</tr>
<tr>
<td>Grampian</td>
<td>Nurse Director</td>
</tr>
<tr>
<td></td>
<td>SPSP Programme Manager</td>
</tr>
<tr>
<td>Greater Glasgow &amp; Clyde</td>
<td>Head of Clinical Governance</td>
</tr>
<tr>
<td>Highland</td>
<td>Head of Quality</td>
</tr>
<tr>
<td></td>
<td>Health Intelligence Specialist</td>
</tr>
<tr>
<td>HIS</td>
<td>Executive Clinical Director</td>
</tr>
<tr>
<td></td>
<td>Consultant in Public Health Medicine</td>
</tr>
<tr>
<td></td>
<td>2x Health Improvement Advisors</td>
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<tr>
<td>Lanarkshire</td>
<td>Head of Clinical Governance and Risk Management</td>
</tr>
<tr>
<td></td>
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</tr>
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<td>Lothian</td>
<td>Consultant in Public Health</td>
</tr>
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<td></td>
<td>SPSP Programme Manager</td>
</tr>
<tr>
<td>NHS Ayrshire and Arran</td>
<td>Assistant Director (Healthcare Quality, Governance and Standards)</td>
</tr>
<tr>
<td></td>
<td>Associate Medical Director</td>
</tr>
<tr>
<td>NHS Lothian</td>
<td>Associate Medical Director</td>
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<tr>
<td>Region</td>
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</tr>
<tr>
<td>Orkney</td>
<td>Clinical Governance &amp; Risk Management Lead</td>
</tr>
<tr>
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<td>Director of Pharmacy</td>
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<td>Programme Manager - 18 Weeks / SPSP</td>
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<tr>
<td></td>
<td>Senior Planning &amp; Information Officer</td>
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<tr>
<td>Tayside</td>
<td>Patient Safety Co-ordinator</td>
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<td></td>
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<tr>
<td>Western Isles</td>
<td>Nurse Director &amp; Director of Patient Safety</td>
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</table>

**Early Access for Quality Assurance**

These statistics will also have been made available to those who needed access to help quality assure the publication: n/a.
A6 – ISD and Official Statistics

About ISD
Scotland has some of the best health service data in the world combining high quality, consistency, national coverage and the ability to link data to allow patient based analysis and follow up.

Information Services Division (ISD) is a business operating unit of NHS National Services Scotland and has been in existence for over 40 years. We are an essential support service to NHSScotland and the Scottish Government and others, responsive to the needs of NHSScotland as the delivery of health and social care evolves.

Purpose: To deliver effective national and specialist intelligence services to improve the health and wellbeing of people in Scotland.

Mission: Better Information, Better Decisions, Better Health

Vision: To be a valued partner in improving health and wellbeing in Scotland by providing a world class intelligence service.

Official Statistics
Information Services Division (ISD) is the principal and authoritative source of statistics on health and care services in Scotland. ISD is designated by legislation as a producer of ‘Official Statistics’. Our official statistics publications are produced to a high professional standard and comply with the Code of Practice for Official Statistics. The Code of Practice is produced and monitored by the UK Statistics Authority which is independent of Government. Under the Code of Practice, the format, content and timing of statistics publications are the responsibility of professional staff working within ISD.

ISD’s statistical publications are currently classified as one of the following:

- National Statistics (ie assessed by the UK Statistics Authority as complying with the Code of Practice)
- National Statistics (ie legacy, still to be assessed by the UK Statistics Authority)
- Official Statistics (ie still to be assessed by the UK Statistics Authority)
- other (not Official Statistics)

Further information on ISD’s statistics, including compliance with the Code of Practice for Official Statistics, and on the UK Statistics Authority, is available on the ISD website.

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics. Designation can be broadly interpreted to mean that the statistics:

- meet identified user needs;
- are well explained and readily accessible;
- are produced according to sound methods, and
- are managed impartially and objectively in the public interest.

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.