

# Publication Report



## Hospital Standardised Mortality Ratios

Quarterly HSMR Release

19 May 2015



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## Introduction

Most deaths that occur in hospital are inevitable because of the patient's condition on admission. Some deaths can be prevented, however, by improving care and treatment or by avoiding harm.

Hospital Standardised Mortality Ratios (HSMR) adjust mortality data to take account of some of the factors known to affect the underlying risk of death. They include all acute inpatient and day-case patients admitted to all medical and surgical specialties (excluding obstetrics and psychiatry).

The HSMR calculation includes patients who died within 30 days from hospital admission. This means that the HSMR includes deaths that occurred in the community (deaths that did not happen in a hospital) as well as those occurring in-hospital. These latest statistics reflect completeness of validated hospital returns as at 12 April 2015.

Since December 2009, the Information Services Division (ISD) of NHS National Services Scotland (NSS) has published quarterly HSMRs for all Scottish hospitals participating in the [Scottish Patient Safety Programme \(SPSP\)](#). The SPSP was established with the overall aim of reducing hospital mortality by 15% by 2012. This was then extended to a 20% reduction by December 2015. HSMRs are provided to enable these acute hospitals to monitor their progress on reducing hospital mortality over time.

This report features the latest extension to the time series for the SPSP with observations at Scotland, NHS Board and hospital levels from October-December 2006 (start of the baseline period) through to October-December 2014. This information has already been released to NHS Boards in a management information tool on 30 April 2015.

This report includes additional information and commentary on patterns of mortality over the longer term and by key demographic factors. There is extensive information on the development of the measure, how it has been embedded in Scotland and how it compares to similar information used in other parts of the UK.

A [technical document](#) is available on how the HSMR is calculated and describes the methodology used in more detail.

## Key points

- HSMR at Scotland-level has decreased by 16.1% between October-December 2007 and October-December 2014. Overall hospital mortality at Scotland level had been falling prior to the baseline period.
- Thirty (97%) of the thirty-one hospitals participating in the SPSP have shown a reduction in HSMR since October-December 2007 (end of the baseline period); seventeen of these had a reduction in excess of 15%, with seven showing a reduction in excess of 20%.
- Hospital mortality has fallen for all types of admission; non-elective medical patients consistently account for proportionately the majority 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.

## Interpreting HSMR results

The HSMR value for Scotland for the baseline period is 1. This allows quarterly hospital values to be compared to the baseline period for Scotland.

- **If an HSMR value is less than 1:** 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 1:** This means the number of deaths within 30 days for a hospital is more than predicted.

However, if the number of deaths is more than predicted this does not necessarily mean that these were avoidable deaths (i.e. that they should not have happened), or that they were unexpected, or attributable to failings in the quality of care.

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.

## How HSMR information is used

Safety is a priority ambition for the [Healthcare Quality Strategy for NHS Scotland](#) 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 SPSP and other improvement initiatives. HSMR is the key outcome indicator from the SPSP.

**Health Improvement Scotland (HIS)** reviews the data with ISD to identify potential patterns in the data and to initiate a dialogue with boards where appropriate. Healthcare Improvement Scotland may 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 the statistics to: monitor progress on achieving the aim of reducing hospital mortality by 20% by December 2015 as set out by the SPSP; inform policy decision making; respond to parliamentary and public business. For example, commissioning the [NHS Lanarkshire Rapid Review Assessment](#).

**NHS Boards** use the 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 e.g. through [Preventing Harm Action Plans](#).

A guide for NHS Boards on how to use the HSMR to help improve patient care has been published - [Using the Hospital Standardised Mortality Ratio to help improve patient care](#)

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

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

## Results and Commentary

All data is presented quarterly to show trends, as such some of the detail within the charts may be difficult to view within the report. Therefore, a link to the relevant excel data table has been provided alongside each chart.

### 1. Trends at Scotland Level

#### 1.1 Scotland (Overall)

Chart 1 and Figure 1 show that the HSMR at Scotland-level has decreased by 16.1% between October-December 2007 and October-December 2014, estimated from regression line values. The overall reduction has decreased since the previously reported reduction to July-September 2014 (16.3%).

Possible factors contributing to changes in the HSMR include:

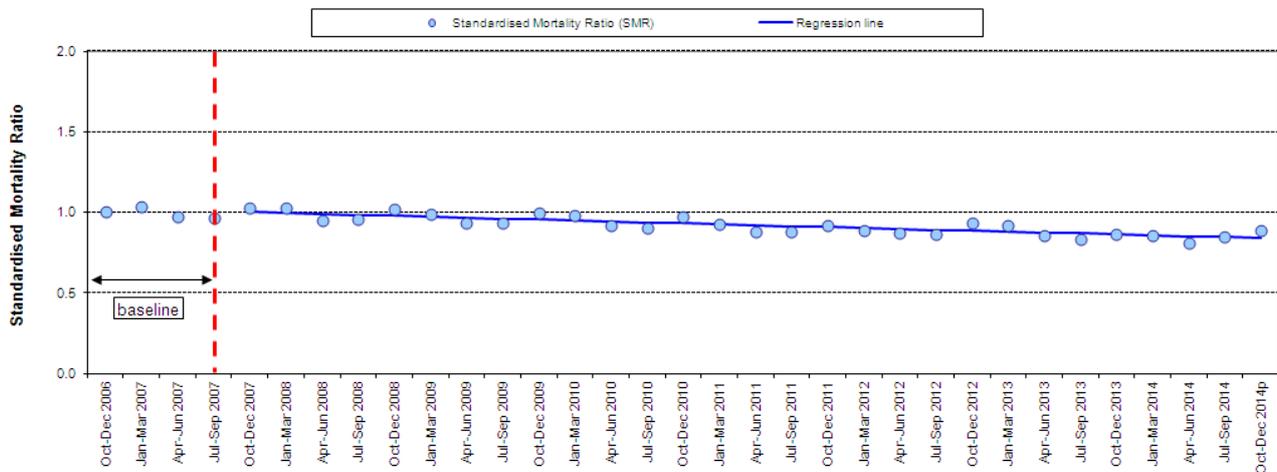
- improvements in the quality of care and treatment;
- reductions in injury or harm to people from healthcare they receive;
- changes in the severity of illnesses in patients admitted to hospital that are not fully corrected for (standardised) by the statistical model used to produce HSMR;
- changes 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).

Linear regression is a statistical technique used to fit a straight line through a sequential set of data points. A regression line is routinely fitted to the HSMR trend from the baseline average (October-December 2007) through to the latest HSMR. This technique is used to smooth out seasonal variations in HSMR and to provide a more stable basis on which to monitor long term change. See [How Regression Line is Calculated](#) for further information.

The percentage change is calculated as the difference between the regression line values of October-December 2007 (first after baseline) and October-December 2014. The same technique is used to measure the change in HSMR for each participating hospital ([Table 2](#)).

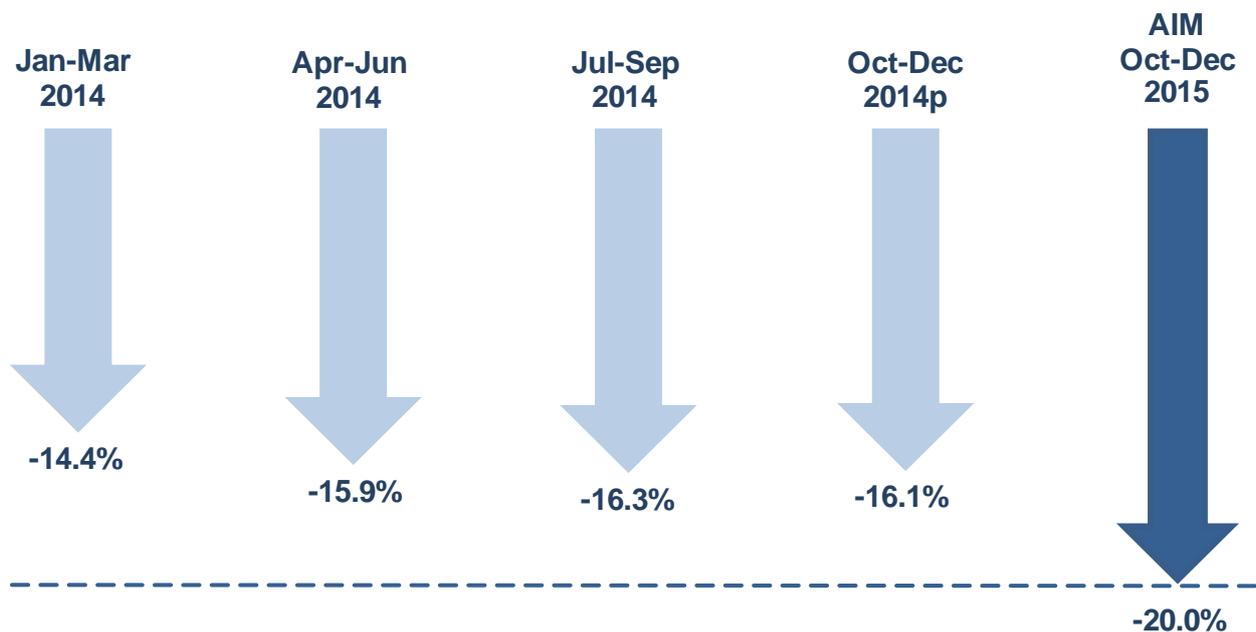
**Chart 1: HSMR for deaths within 30-days of admission (with regression line); Scotland, Oct-Dec 2006 to Oct-Dec 2014p**

The data relating to Chart 1 can be found in [Table A1b](#)



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

**Figure 1: The published decrease in HSMR at Scotland-level between October to December 2007 and the past four quarters**



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.

## 1.2 Scotland Trends – from 2005

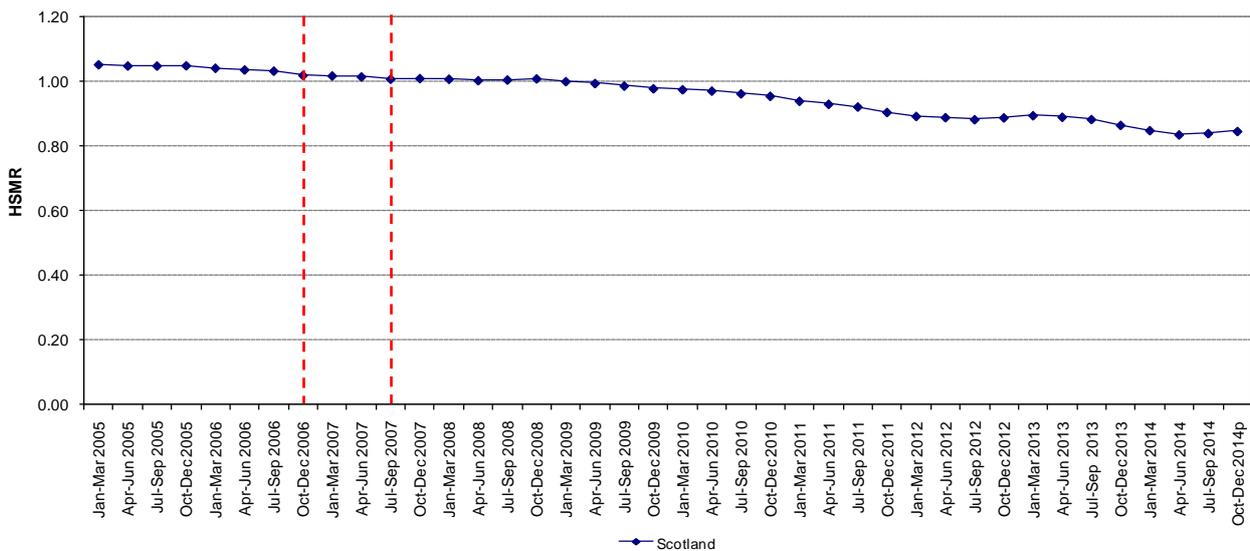
All emphasis to date has focussed on patterns of hospital mortality from the baseline period onwards. As the HSMR measure has become more established, questions have been asked about what was happening to hospital mortality prior to the baseline period. ISD has sourced information retrospectively from administrative sources and calculated HSMRs from January 2005.

In order to counter the impact of the seasonal variation, Chart 2 displays rolling annual HSMR for January-March 2005 to October-December 2014. This shows that mortality has been reducing prior to the baseline period (the parallel dotted red lines represent the bounds of the baseline period). Following a sustained reduction in HSMR between 2009 and 2011, the level remained relatively constant until mid-2013, with subsequent data showing a further reduction in hospital mortality.

Each point represents the sum of observed deaths for that quarter plus the three preceding quarters divided by the sum of predicted deaths over the same four quarters.

**Chart 2: Rolling (quarterly) annual HSMR for deaths within 30-days of admission; Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 2 can be found in Table [Chart2-Chart7](#)

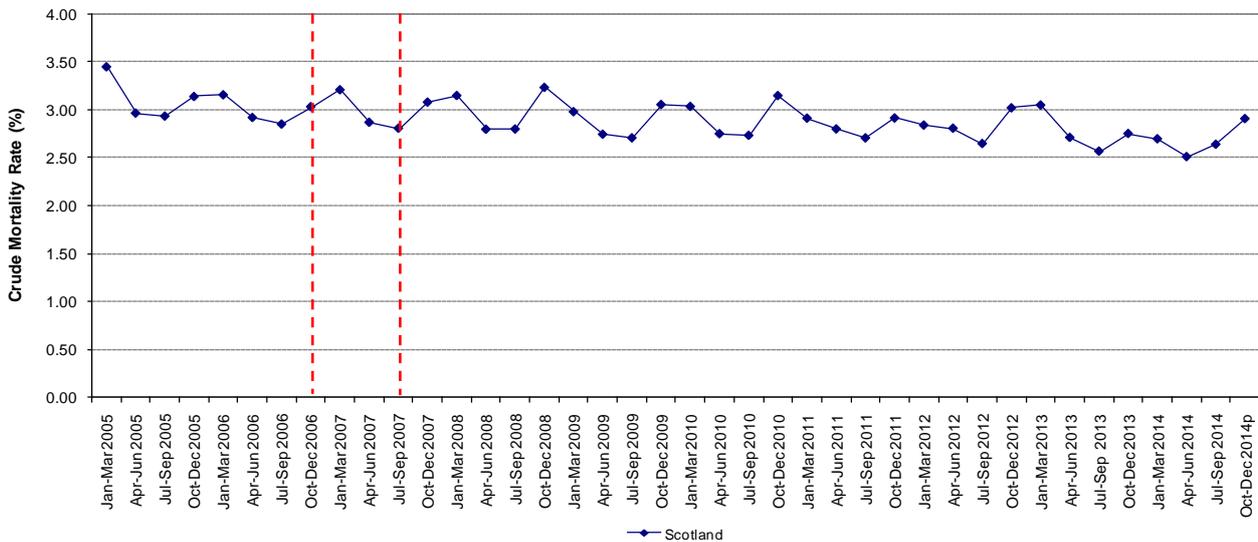


p - Provisional (see Appendix A1 - Data Quality and Timeliness)

Similarly, Chart 3 shows that overall crude hospital mortality (%) at Scotland level from January-March 2005 to October-December 2014 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 3: Overall crude mortality rates (%) for deaths within 30-days of admission; Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 3 can be found in Table [Chart2-Chart7](#)



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

## 2. Scotland (Sub-groups)

### 2.1 Scotland - by type of admission

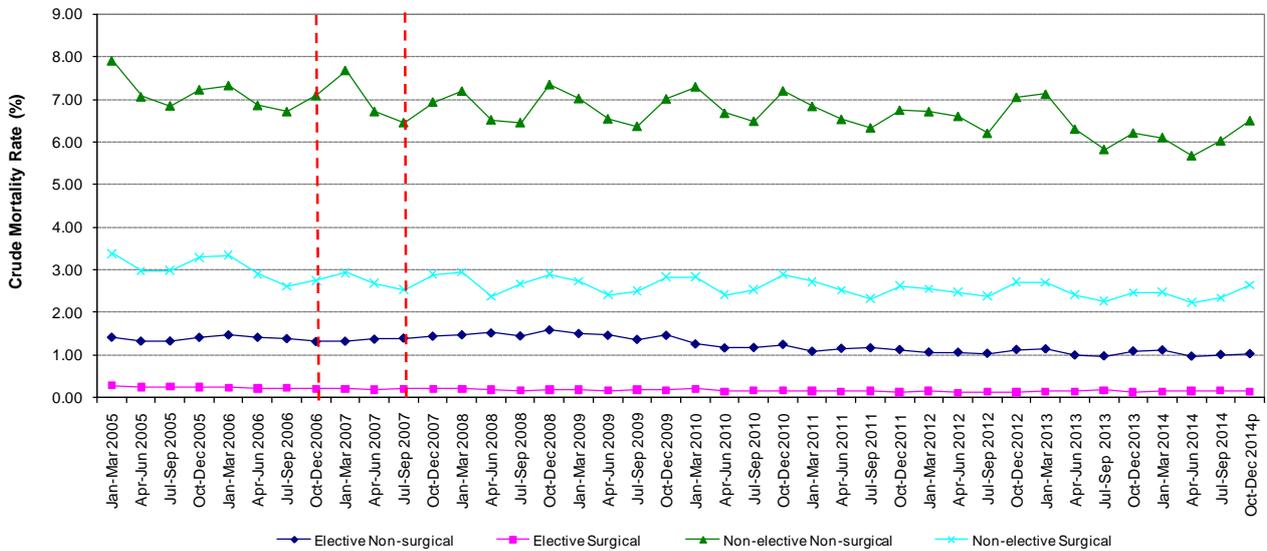
HSMR is by definition an overall indicator that encapsulates mortality outcomes against overall hospital activity. It is possible to examine trends in the same 30-day mortality outcome for some of the underlying factors.

Chart 4 shows the mortality trend according to the four very broad and recognisable 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 proportionately the majority of deaths within 30-days of admission and that elective surgical admissions have the least. Across all four categories of patients there is evidence of an overall downward trend in mortality which has been falling prior to the baseline period.

**Chart 4: Crude mortality rates (%) for deaths within 30-days of admission by type of admission; Scotland Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 4 can be found in Table [Chart2-Chart7](#)



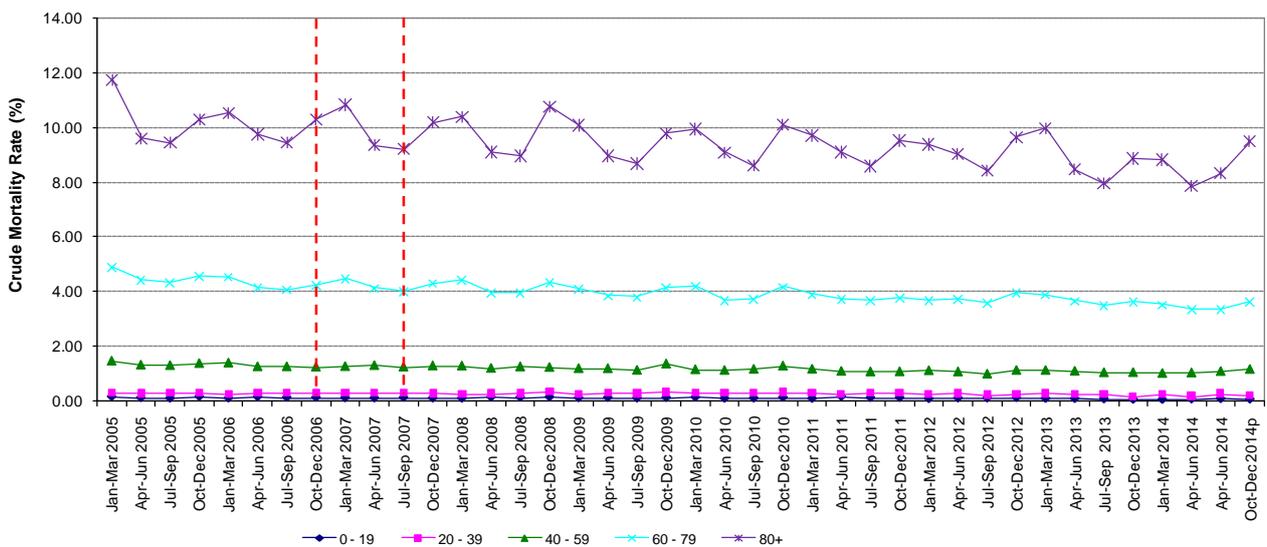
p - Provisional (see Appendix A1 - Data Quality and Timeliness)

## 2.2 Scotland - by age-group

Chart 5 shows that mortality within 30-days of admission increases with age,

**Chart 5: Crude mortality rates (%) for deaths within 30-days of admission by age group; Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 5 can be found in Table [Chart2-Chart7](#)



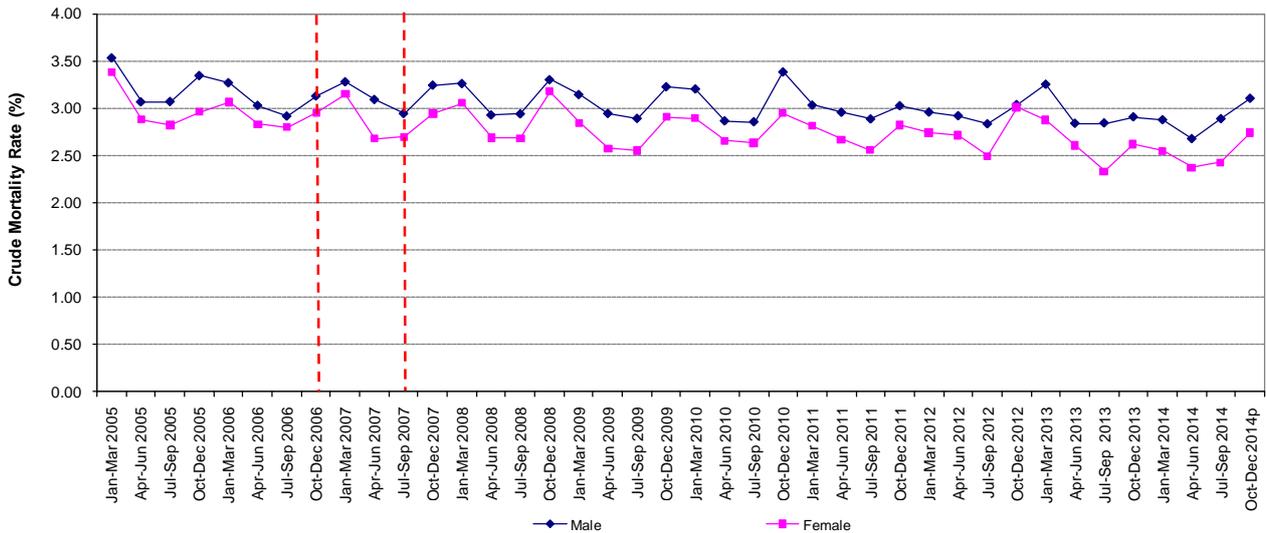
p - Provisional (see Appendix A1 - Data Quality and Timeliness)

### 2.3 Scotland - by gender

Chart 6 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 6: Crude mortality rates (%) for deaths within 30-days of admission by sex; Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 6 can be found in Table [Chart2-Chart7](#)



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

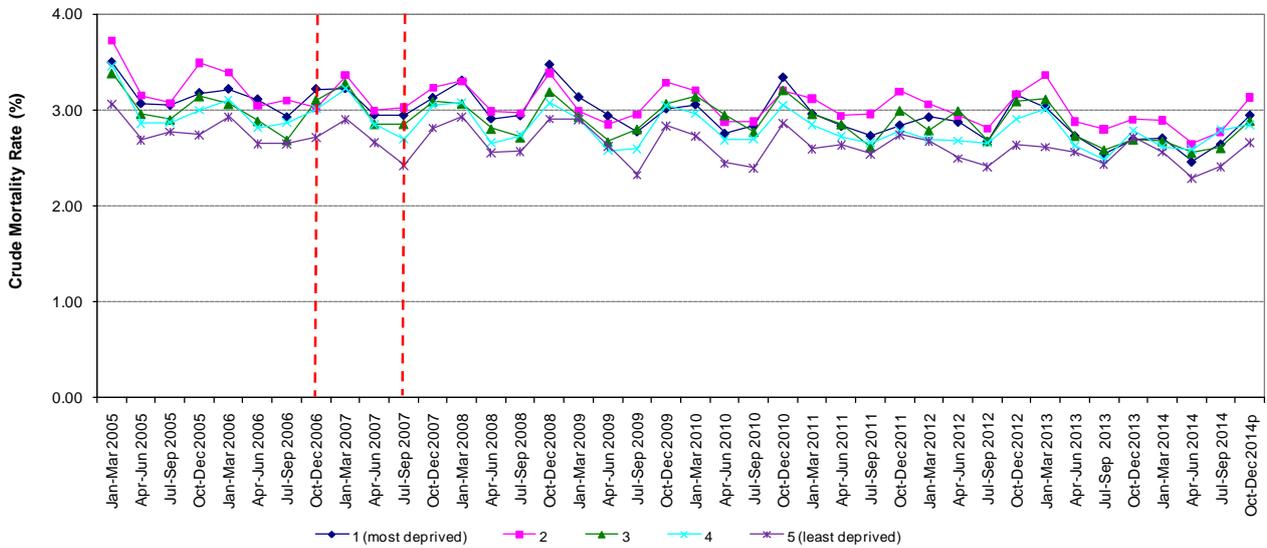
### 2.4 Scotland - by Scottish Index of Multiple Deprivation

The Scottish Index of Multiple Deprivation (SIMD) 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 7 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 7: Crude mortality rates (%) for deaths within 30-days of admission by deprivation (SIMD 2012); Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 7 can be found in Table [Chart2-Chart7](#)



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

### 3. 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 or identify outliers and 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
- The initial level of HSMR, it may be reasonable to assume that those 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.

#### 3.1 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 (October-December 2006). 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 (October-December 2006).
- **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. These changes have been applied to all time points retrospectively back to the initial reporting period (October-December 2006).

Individual hospital level data for these combined sites are available on request.

### 3.2 Percentage Change

Seventeen hospitals had shown a reduction in excess of 15% by September 2014, with seven of those showing a reduction in excess of 20%:

- NHS Ayrshire & Arran’s Crosshouse Hospital (35.1%) 
- NHS Fife (22.8%) 
- NHS Lanarkshire’s Wishaw General Hospital (21.7%) 
- NHS Tayside’s Ninewells Hospital (21.5%) 
- NHS Forth Valley (20.1%) 
- NHS Greater Glasgow and Clyde’s Southern General Hospital (21.3%) 
- NHS Orkney’s Balfour Hospital (22.2%) 

Please note that the percentage reduction seen for the following hospitals is based on greater than predicted initial levels of mortality:

- NHS Ayrshire and Arran’s Crosshouse Hospital (1.32 for October-December 2007).
- NHS Fife (1.11 for October-December 2007).
- NHS Lanarkshire’s Wishaw General Hospital (1.13 for October to December 2007).
- NHS Forth Valley (1.23 for October-December 2007).
- NHS Greater Glasgow and Clyde’s Southern General Hospital (1.15 for October-December 2007).
- NHS Orkney’s Balfour Hospital (1.83 for October-December 2007).

Only one hospital in Scotland exhibited an increasing trend in HSMR over time, namely the Golden Jubilee National Hospital. Golden Jubilee National Hospital provides specialist services with a case-mix of patients that differs substantially from the majority of other hospitals in Scotland. Although the model adjusts for case-mix, there could be characteristics inherent in the patient population that are not typical of other Scottish

hospitals. For instance there was a shift to heart and lung surgery at the Golden Jubilee National Hospital in 2008.

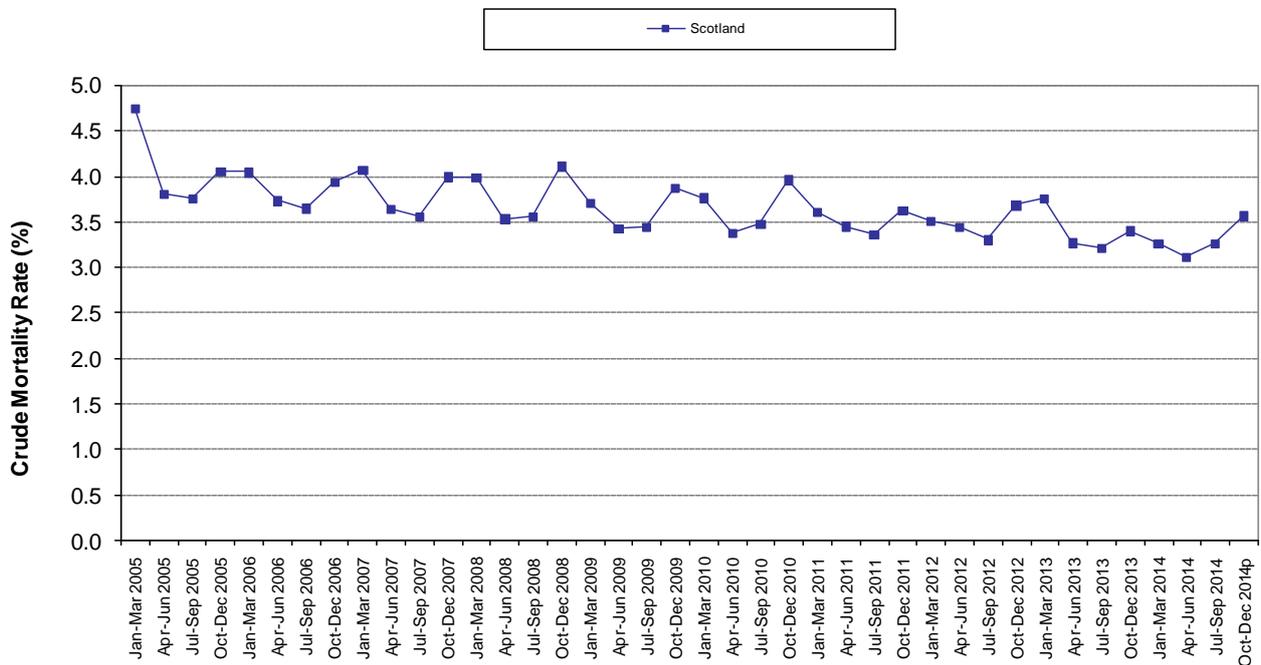
#### 4. In-patient mortality and deaths within 30-days of discharge

Chart 8 shows the trend in mortality at Scotland level according to a definition similar to the Summary Hospital-level Mortality Indicator (SHMI) 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 (October-December 2014) there were 6,641 deaths within 30-days of admission to hospital in Scotland, and 8,156 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 8: Crude mortality rates (%) for deaths within 30-days of ultimate hospital discharge (includes all in-hospital mortality); Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 8 can be found in [Table A2a](#)



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

[Table A2a](#) provides a chart similar to Chart 8 containing the trend for each NHS Board of treatment plotted against Scotland.

## 5. Population-based Mortality

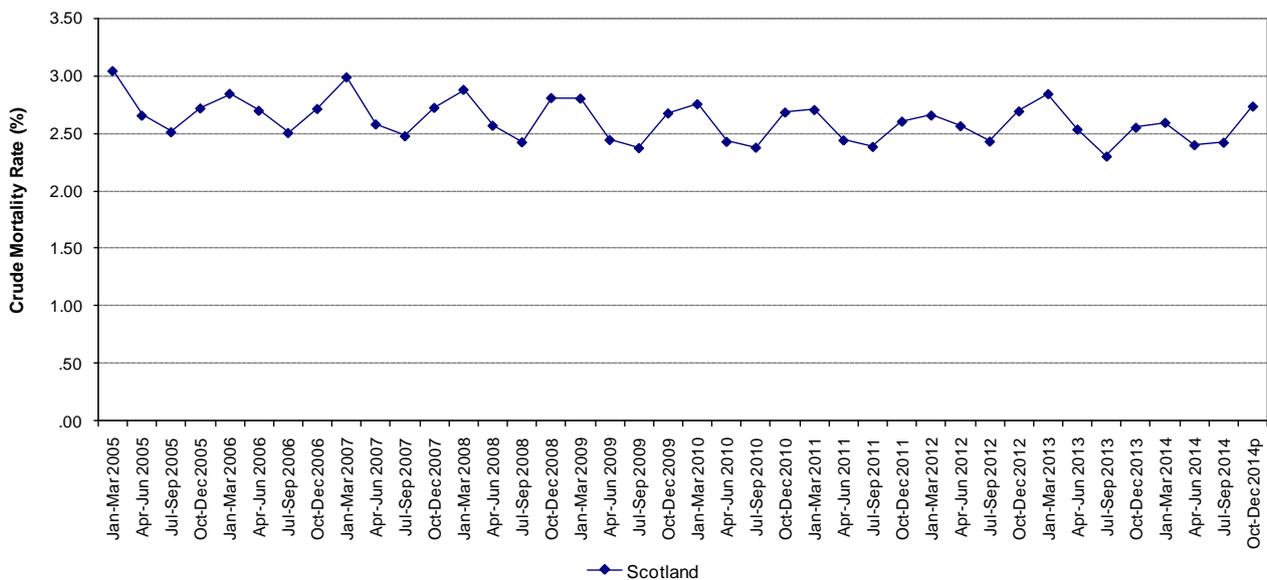
HSMR shows the ratio of observed to expected deaths. It is therefore possible for an HSMR to fall but for death rates to increase. For this reason HSMRs should be considered alongside crude death rates as crude rates are useful for getting an overall picture of the number of deaths relative to the population.

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 (NRS) at Scotland level and by NHS Board of residence.

Chart 9 shows the trend in overall population mortality for Scotland between January-March 2005 and October-December 2014. The series, although exhibiting seasonal characteristics, still demonstrates a downward trend in overall mortality.

**Chart 9: Underlying Population Death Rates (crude rates per 1000 population); Scotland, Jan-Mar 2005 to Oct-Dec 2014p**

The data relating to Chart 9 can be found in [ChartA1](#)



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 December 2006 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: Hospital standardised mortality ratio with regression line for all hospitals in Scotland, and for a selected hospital from the list in Table 1.
- Figure 4: Standardised and 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, available on the [HSMR webpage](#).

### Table 2

For each NHS Board SPSP participant hospital [Table 2](#) shows the current HSMR (October-December 2014) and the overall percentage change since October-December 2007 according to regression line values.

### 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 8 containing the trend for each NHS Board of treatment plotted against Scotland have also been provided.

## Future of HSMR

ISD has had extensive dialogue with stakeholders, and discussions have identified that there may be features of the HSMR model that could be refined and potentially improved upon in future.

Opportunity to implement such improvements will need to be balanced against the overall policy strategy, which is the continuation of the measure to 2015. The current model will therefore continue to be used for the next release.

A clinical reference group has been formed to advise on the utility of the current model and the appropriateness and implications of analytical revisions. Results from this dialogue will be considered by ISD and policy colleagues at Scottish Government for agreement on the strategy for the continuation of the quarterly reporting cycle. The implications of any change will then be communicated throughout our stakeholder community.

Some of the questions that the advisory group will be asked to consider include the following.

- Need for calibration of the model every quarter (i.e. are we satisfied of the robustness of using increasingly historical coefficients particularly when point in time comparative analysis is used as part of the governance process).
- Appropriateness of existing diagnostic groups.
- Appropriateness of indexing the record at point of admission (particularly in relation to selecting main diagnosis on records that are potentially sourced from short-stay admissions units).
- Latest situation with regards coding of palliative care and the secondary diagnoses for co-morbidities.
- Embedding the entire Hospital Scorecard into the escalation process.

A Quality Alliance has been formed, and will monitor progress towards the ambitions of the Quality Strategy on a regular basis with reference to a small set of high-level Quality Outcome Measures. The Hospital Standardised Mortality Ratios published here form one element of a suite of 12 national Quality Outcome Measures proposed in the Quality Strategy.

## Further information

ISD Scotland publishes a wide variety of health data including a range of alternative information on mortality: [www.isdscotland.org/Health-Topics/Deaths/](http://www.isdscotland.org/Health-Topics/Deaths/).

The National Records of Scotland also publishes information on patterns of population mortality for Scotland: [www.nrscotland.gov.uk/statistics-and-data](http://www.nrscotland.gov.uk/statistics-and-data).

## Researchers

Researchers may be interested in ISD's [Electronic Data Research and Innovation Service \(eDRIS\)](#). This service provides a single point of contact and to assist researchers in study design, approvals and data access in a secure environment.

## Next Update

The next update, reporting on admissions to 31 March 2015, will be published on Tuesday 18 August 2015.

## Glossary

HSMR	Hospital Standardised Mortality Ratio
NRS	National Records for Scotland (formerly General Register Office for Scotland)
SHMI	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).
SIMD	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.
SMR	Scottish Morbidity Record.
SMR(01)	SMR containing non-obstetric and non-psychiatric inpatient and day case activity.
SPSP	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

## List of Tables

Name	Time period	File & size
<a href="#">Table A1a (Hospital Standardised Mortality Ratios by NHS Board of Treatment; Oct-Dec 2006 to Oct-Dec 2014)</a>	October 2006 - December 2014	Excel [143kb]
<a href="#">Table A1b (Hospital Standardised Mortality Ratios by Hospital; Oct-Dec 2006 to Oct-Dec 2014)</a>	October 2006 - December 2014	Excel [309kb]
<a href="#">Table A2a (Crude hospital mortality rates for in-hospital deaths and deaths within 30-days of discharge by NHS Board of Treatment; Jan-Mar 2005 to Oct-Dec 2014)</a>	January 2005 - December 2014	Excel [240kb]
<a href="#">Chart A1 (Overall population crude mortality rates by NHS Board; Jan-Mar 2005 to Oct-Dec 2014)</a>	January 2005 - December 2014	Excel [179kb]
<a href="#">Table 2 (Percentage Change in Standardised Mortality Ratios (regression line) for hospitals in Scotland between Oct-Dec 2007 and Oct-Dec 2014)</a>	October 2007 – December 2014	Excel [14kb]
<a href="#">Table 4 (Impact of the data refresh on the previously published provisional Standardised Mortality Ratios for all hospitals in Scotland; Jul-Sep 2014)</a>	July - September 2014	Excel [13kb]
<a href="#">chart2-chart7 (Crude mortality rates (%) for deaths within 30-days of admission by subgroup; Jan-Mar 2005 to Oct-Dec 2014)</a>	January 2005 - December 2014	Excel [78kb]

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## Appendix

### A1 – Background Information

#### Methods Used to Calculate the HSMR

The HSMR is calculated for all acute inpatient and day-case 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:

$$\text{HSMR} = \text{Observed Deaths} / \text{Predicted Deaths}$$

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 of emergency admissions in the previous 12 months; and whether admitted as an inpatient or day case and type of admission (elective / non-elective).

To calculate the HSMR from the baseline year (October 2006 to September 2007) the predicted probabilities were calculated using data from October 2006 to September 2007. These probabilities were then applied to the data for October 2007 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. Further work currently underway also aims to assess whether the measure would be more robust if it is based on the final diagnosis attributed to each patient rather than the first, and whether a degree of re-categorisation of diagnosis might be more appropriate.

## 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.

One aspect of the review work ongoing in Scotland at the moment around HSMR is the robustness of making point in time comparisons on a historically calibrated model.

As there remains a subjective element to the assessment of when a communication should be triggered, we do not publish a statistical comparative analysis in isolation. 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.**

	<b>Scotland (HSMR)</b>	<b>England and Wales Summary Hospital-level Mortality Indicator (SHMI)</b>	<b>England and Wales Dr Foster (HSMR)</b>
<b>Patients</b>	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.	One patient observation per spell attributed to the last acute trust prior to death.	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)
<b>Deaths</b>	Deaths within 30 days of admission to an acute hospital (wherever they occur)  In-hospital deaths occurring beyond 30-days are excluded.	All deaths occurring in hospital  And deaths within 30 days of discharge from acute hospital (wherever they occur)	All inpatient and day case deaths in hospital
<b>Adjustments</b>	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 of emergency admissions in the previous 12 months / inpatient or day case / type of admission (elective / non-elective)	Age/ sex/ admission type/ CCS group (diagnosis) / comorbidity (modified Charlson score)	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)

## 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
<b>April</b>	<ul style="list-style-type: none"> <li>• Source database refreshed (12 April 2015)</li> <li>• Analytical work begins, involving               <ul style="list-style-type: none"> <li>○ Extraction of quarterly patient observations with outcome</li> <li>○ Mapping of predictions from baseline model</li> <li>○ Calculation of observed &amp; predicted deaths at Hospital-level calculated by aggregating outcomes and predictions</li> <li>○ Import to reporting template</li> <li>○ Internal QA and data scrutiny (data completeness)</li> </ul> </li> <li>• Review meeting with Healthcare Improvement Scotland (29 April 2015)</li> <li>• Management Information Tool made available to NHS Boards (30 April 2015)</li> </ul>
<b>May</b>	<ul style="list-style-type: none"> <li>• Official statistics report production cycle commences</li> <li>• Scottish Government and NHS Boards receive standard pre-release access (12 May 2015)</li> <li>• ISD briefs Scottish Government on content of report (13 May 2015)</li> <li>• Report published on ISD website at 09:30 on Tuesday 19 May 2015</li> </ul>
<b>June</b>	<ul style="list-style-type: none"> <li>• Hospital Scorecard (containing HSMR and suite of additional indicators) released to Scottish Government's Directorate for Health Workforce &amp; Performance and Healthcare Improvement Scotland (date tbc)</li> <li>• Scottish Government and HIS briefed by ISD on analytical data issues and interpretation of the scorecard</li> <li>• Scorecard presented to Scottish Government Health &amp; Social Care Management Meeting (date tbc)</li> </ul>

Throughout the quarterly cycle, interaction with NHS Boards is key. 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.

## 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 31 December 2014 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 October-December 2014 is based on approximately 79% 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 October-December 2014.

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

All hospitals have HSMR's calculated for the most recent quarters based on their current levels of data completeness. In addition to NHS Highland the following NHS Boards HSMR is based on completeness levels below 90% for October to December 2014:

- NHS Orkney (~87%)

HSMR's 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.

For more information about SMR completeness: [www.isdscotland.org/Products-and-Services/Hospital-Records-Data-Monitoring/SMR-Completeness/](http://www.isdscotland.org/Products-and-Services/Hospital-Records-Data-Monitoring/SMR-Completeness/)

### Refreshing Previously Provisional Data

The previous report, published on 17<sup>th</sup> February 2015, presented provisional data for July-September 2014 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 92% complete. The overall Scottish HSMR for July-September 2014 has not changed significantly as a result of the refresh, remaining at 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 Fife, the HSMR was based on approximately 68% completeness. The refresh of HSMR's for their reported hospitals during July-September 2014 has slightly changed the reported level of HSMR with the reported HSMR for Fife Acute Hospital rising from 0.75 to 0.83.

In NHS Highland, the HSMR was based on approximately 60% completeness. The refresh of HSMR's for their reported hospitals during July-September 2014 has slightly changed the reported level of HSMR with the reported HSMR for Belford Hospital reducing from 1.14 to 1.02, and the reported HSMR for Raigmore Hospital reducing from 0.95 to 0.85.

In NHS Shetland, the HSMR was based on approximately 81% completeness. The refresh of HSMR's for their reported hospitals during July-September 2014 has brought about an

increase in the previously reported level of HSMR for Gilbert Bain Hospital (from 0.77 to 0.81).

The updated analysis suggests that completeness for the majority of all remaining hospitals during July-September 2014 is now in excess of 95%, with the refresh causing no sizable changes to the previous level of the HSMR.

## A2 – Publication Metadata (including revisions details)

Metadata Indicator	Description
Publication title	Hospital Standardised Mortality Ratios
Description	Quarterly release of HSMR trends at Scotland, NHS Board and Hospital levels between Oct-Dec 2006 and Oct-Dec 2014. Also includes analyses of crude mortality trends over the longer term between Jan-Mar 2005 and Oct-Dec 2014.
Theme	Health and Social Care, Mortality
Topic	Quality Indicators
Format	Web Publication
Data source(s)	SMR01 / NRS Death Registrations – Linked Database
Date that data are acquired	12 <sup>th</sup> April 2015
Release date	Tuesday 19 <sup>th</sup> May 2015
Frequency	Quarterly
Timeframe of data and timeliness	Quarterly reporting periods from Jan-Mar 2005 to Oct-Dec 2014 (one-quarter reporting lag)
Continuity of data	SMR01 has recorded data in current form since April 2007
Revisions statement	The publication contains a refresh of previously reported data to reflect additional source data that has been received since last publication.
Revisions relevant to this publication	Data at hospital level that was previously reported as provisional for quarter Jul-Sep 2014 is explicitly compared with the refreshed values for that quarter in this release.
Concepts and definitions	Contains sections on Data Source, Methodology and Development
Relevance and key uses of the statistics	Quality improvement and assurance.
Accuracy	Quality assured by NHS Boards (management information version of reports) and ISD
Completeness	Approximately 96% for the latest quarter.
Comparability	Contains section on inter-UK comparisons, data not directly comparable with similar measures used in England.
Accessibility	It is the policy of ISD Scotland to make its web sites and products accessible according to <a href="#">published guidelines</a> .
Coherence and clarity	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.
Value type and unit of measurement	Ratio of observed over predicted deaths (HSMR) Crude and Standardised Mortality (expressed as percentage of patients that die within 30-days of admission)
Disclosure	The <a href="#">ISD protocol on Statistical Disclosure Protocol</a> is followed.
Official Statistics designation	Official Statistic
UK Statistics Authority Assessment	Assessment report published (ref no. 249). Confirmed as National Statistics April 2014
Last published	Tuesday 17 <sup>th</sup> February 2015
Next published	Tuesday 18 <sup>th</sup> August 2015
Date of first publication	June 2010

Help email	<a href="mailto:robyn.munro@nhs.net">robyn.munro@nhs.net</a>
Date form completed	1 <sup>st</sup> May 2015

### A3 – 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:

NHS Health Board	Standard Pre-Release Access
Ayrshire & Arran	Clinical Improvement Manager
Borders	Director of Nursing Patient Safety Programme Manager
D&G	Nurse Director and Director for Patient Safety
Dumfries & Galloway	Patient Safety & Improvement Manager
Fife	Patient Safety Programme Manager
Forth Valley	Director of Nursing Head of Clinical Governance
Golden Jubilee	Clinical Governance Manager Director of Nursing & Clinical Services
Grampian	Nurse Director SPSP Programme Manager
Greater Glasgow & Clyde	Head of Clinical Governance
Highland	Head of Quality Health Intelligence Specialist
HIS	Executive Clinical Director Consultant in Public Health Medicine 2x Health Improvement Advisors
Lanarkshire	Head of Clinical Governance and Risk Management Patient Safety Manager 2x Quality Facilitators
Lothian	Consultant in Public Health SPSP Programme Manager
NHS Ayrshire and Arran	Assistant Director (Healthcare Quality, Governance and Standards) Associate Medical Director
NHS Lothian	Associate Medical Director

Orkney	Clinical Governance & Risk Management Lead
Shetland	Director of Pharmacy Programme Manager - 18 Weeks / SPSP Senior Planning & Information Officer
Tayside	Patient Safety Co-ordinator Patient Safety Development Manager
Western Isles	Nurse Director & Director of Patient Safety SPSP Programme Manager

## A4 – 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.