Publication Report

Hospital Standardised Mortality Ratios

Quarterly HSMR Release

28 May 2013

An Official Statistics Publication for Scotland

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Introduction

In 2011, 53,661 deaths in Scotland were recorded by the National Records of Scotland; the majority (about 60%) occurred in hospital although the exact proportion varied across hospitals.

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.

In 2009, the Scottish Patient Safety Programme (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. Since December 2009, Information Services Division (ISD) has produced quarterly hospital standardised mortality ratios (HSMR) for all Scottish hospitals participating in the SPSP. HSMRs are provided to enable these acute hospitals to monitor their progress on reducing hospital mortality over time.

In May 2010, the Scottish Government published the Healthcare Quality Strategy for NHS Scotland with its three quality ambitions. The HSMR is included within a suite of 12 national quality outcome measures that were developed to monitor progress on achieving the ambitions.

The Scottish HSMR utilises the routine linkage of data obtained from hospital discharge summaries to death registrations from NRS. The HSMR is calculated for all acute inpatient and day case patients admitted to all specialties (medical and surgical, excluding obstetrics and psychiatry). The calculation takes account of patients who died within 30 days from hospital admission. This means that the HSMR includes deaths that occurred in the community (out of hospital deaths) as well as those occurring in-hospital. However, the Scottish HSMR is not a measure of all in-hospital mortality because it does not include patients that die in-hospital after 30-days from admission. Additional information is provided at Scotland level to show trends in all in-hospital mortality and deaths within 30-days of ultimate hospital discharge.

As outlined above, the Scottish HSMR is calculated by obtaining routinely collected deaths data. These crude mortality data are then adjusted to take account of some of the factors known to affect the underlying risk of death. Development of the case-mix adjustment methodology for Scotland began in early 2008. Although the method used in England at that time by Dr Foster informed the Scottish process, the models are different and reflect differences in the source data. See History of HSMR in Scotland for further information on how the Scottish model was developed. Scottish HSMRs are therefore not directly comparable to those produced for English hospitals. See International Comparisons for more information on the differences between the Scottish and English approaches.

This report provides access to the same information contained within the management information tool provided to NHS boards on 3rd May 2013. It 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 2012. It then 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.

Key points

- The Scottish Patient Safety Programme (SPSP) was established with the overall aim of reducing hospital mortality by 15% by December 2012. This was then extended to a 20% reduction by December 2015.
- HSMRs are calculated when crude mortality data are adjusted to take account of some of the factors known to affect the underlying risk of death.
- HSMR at Scotland-level has decreased by 11.8% between October-December 2007 and October-December 2012
- Rolling annual HSMR's show that there was a sustained reduction in hospital mortality between 2009 and 2011; the level thereafter has remained relatively constant.
- Hospital mortality has fallen for all types of admission; non-elective medical patients consistently account for 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.
- Twenty eight (90%) of the thirty one hospitals participating in the SPSP have shown a reduction in HSMR since October-December 2007 (end of the baseline period); eight of those had a reduction in excess of 15%.
- Overall hospital mortality at Scotland level had been falling prior to the baseline period.
- HSMRs in Scotland are not directly comparable to similar measures adopted elsewhere in the United Kingdom.
- A high or higher than expected HSMR should be a trigger for further investigation, as in isolation it cannot be taken to imply a poorly performing hospital or poor quality of care.
- The future development of HSMR in Scotland shall be driven by the extended aim of a 20% reduction by December 2015 and implementation of the Quality Strategy – Quality Measures Framework.

Results and Commentary

These latest statistics have been derived from the Linked SMR01 Database and reflect completeness of validated hospital returns as at 30th March 2013.

Current Trends (Oct-Dec 2006 to Oct-Dec 2012)

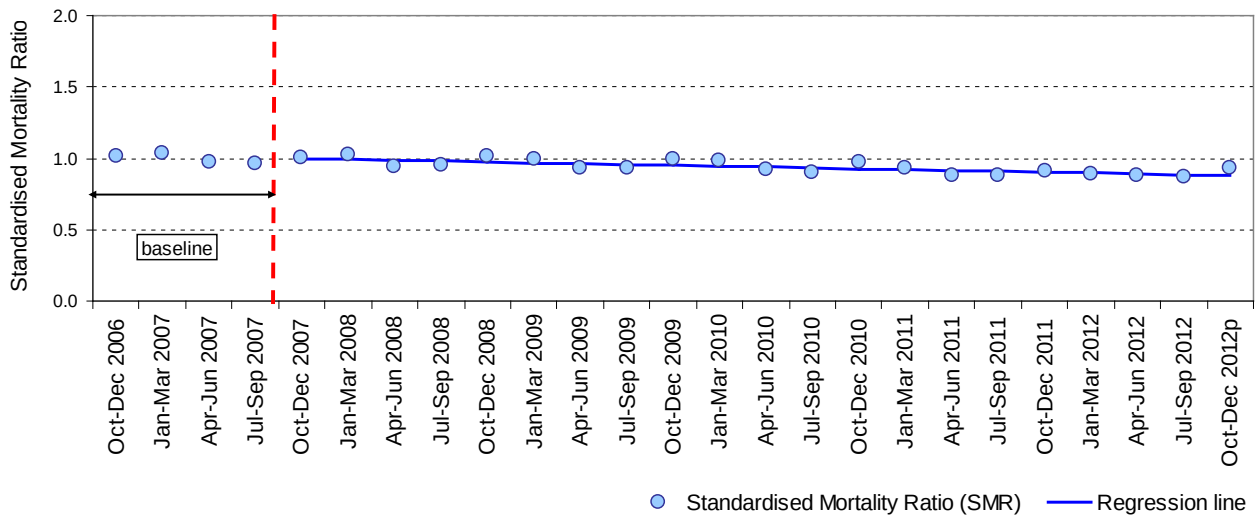
Scotland (Overall)

Chart 1 and **Table 1** show that the HSMR at Scotland-level has decreased by 11.8% between October-December 2007 and October-December 2012 using regression line values.

Possible factors contributing to changes on 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 (reference technical note); 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 (reference data quality / clinical coding section).

In the time period since the end of baseline year (October 2006 – September 2007), the number of patients admitted to hospital has remained fairly constant. There appears to have been a slow decline in the number of actual deaths, more evident from 2010 onwards, and the number of 'predicted' deaths (according to the statistical model) has increased. There is therefore a suggestion that in recent quarters more severely ill patients are being admitted to hospital. This would be consistent with a move to patient pathways where the balance of care is being shifted from hospital to the community for less ill patients.

Chart 1: Standardised Mortality Ratios for deaths within 30-days of admission (with regression line); Scotland, Oct-Dec 2006 to Oct-Dec 2012p



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

These statistics are updated on a quarterly basis and reflect the HSMR for each quarter independently. 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 through to the latest HSMR. This technique is used to smooth out clear seasonal variations in HSMR and to provide a more stable basis on which to monitor long term change. The percentage change is measured against the difference between the regression line values of October-December 2007 (first after baseline) and October-December 2012. The same technique is used to measure the change in HSMR for each participating hospital (Table 2).

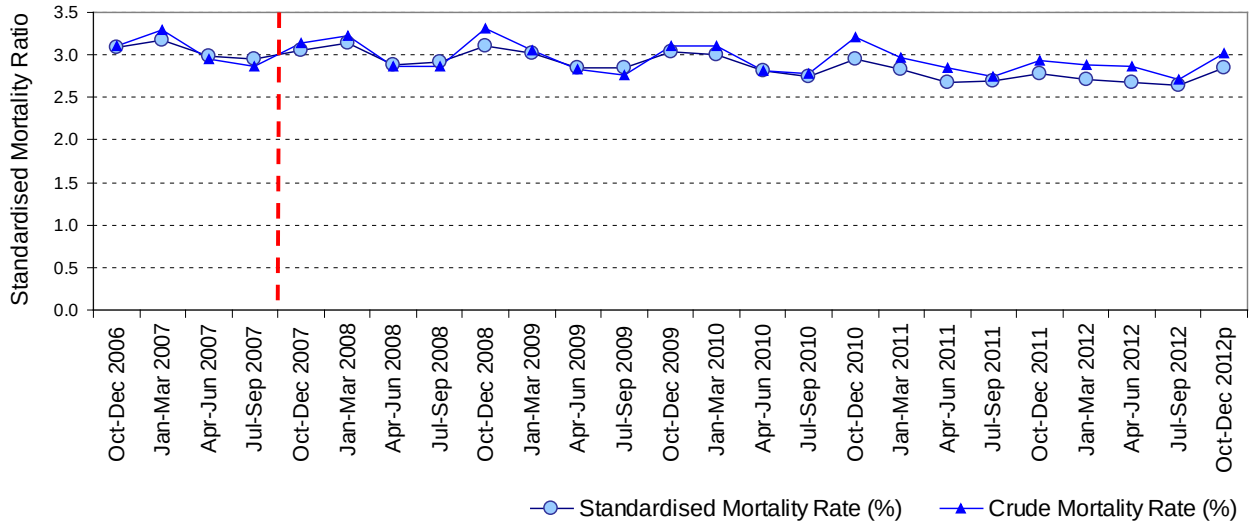
The overall reduction has slowed since the previously reported reduction to July-September 2012 (12.4%) and reflects the impact of the increase in HSMR from 0.87 during July-September 2012 to 0.93 for October-December 2012. This pattern is consistent with previous years; Table 1 demonstrates that in each year both crude mortality rates and HSMR are consistently higher during October to December compared to July to September.

Table 1: Number of observed and predicted deaths, crude mortality rates (%) and standardised mortality ratios for deaths within 30-days of admission; Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]

Quarter	Observed Deaths	Predicted Deaths	Standardised Mortality Ratio	Patients	Crude Mortality (%)
Oct-Dec 2006	6,792	6,711	1.01	219,199	3.1
Jan-Mar 2007	7,249	6,979	1.04	220,545	3.3
Apr-Jun 2007	6,431	6,570	0.98	218,330	2.9
Jul-Sep 2007	6,186	6,398	0.97	215,257	2.9
Oct-Dec 2007	6,910	6,888	1.00	219,982	3.1
Jan-Mar 2008	7,224	7,030	1.03	223,418	3.2
Apr-Jun 2008	6,450	6,829	0.94	224,705	2.9
Jul-Sep 2008	6,369	6,660	0.96	221,995	2.9
Oct-Dec 2008	7,470	7,324	1.02	226,113	3.3
Jan-Mar 2009	7,059	7,132	0.99	231,718	3.0
Apr-Jun 2009	6,391	6,833	0.94	226,426	2.8
Jul-Sep 2009	6,192	6,655	0.93	224,336	2.8
Oct-Dec 2009	7,078	7,125	0.99	227,346	3.1
Jan-Mar 2010	7,048	7,163	0.98	227,074	3.1
Apr-Jun 2010	6,381	6,936	0.92	226,406	2.8
Jul-Sep 2010	6,245	6,941	0.90	224,449	2.8
Oct-Dec 2010	7,057	7,281	0.97	219,705	3.2
Jan-Mar 2011	6,763	7,281	0.93	227,761	3.0
Apr-Jun 2011	6,317	7,195	0.88	222,444	2.8
Jul-Sep 2011	6,180	7,025	0.88	224,979	2.7
Oct-Dec 2011	6,685	7,335	0.91	227,205	2.9
Jan-Mar 2012	6,733	7,599	0.89	234,264	2.9
Apr-Jun 2012	6,531	7,456	0.88	228,065	2.9
Jul-Sep 2012	6,108	7,047	0.87	225,081	2.7
Oct-Dec 2012[p]	6,773	7,245	0.93	223,977	3.0

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

Chart 2: Standardised and crude mortality rates (%) for deaths within 30-days of admission; Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]



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

In order to compare the trajectories of HSMR against crude mortality in **Chart 2**, the HSMR has been expressed as a percentage (%). To do this, the Scotland level mortality for the period October 2006 to September 2007 (the baseline year) was calculated by taking the overall sum of observed deaths over the four quarters and dividing the result by the sum of the patient numbers for each quarter. This constant value is then weighted for each quarter by multiplying it against each individual quarterly HSMR.

Chart 2 clearly shows that crude and standardised mortality rates at Scotland level begin to diverge from the period October to December 2010 onwards. It is worth noting that NHS boards first accessed these statistics in December 2009. During 2010 established governance arrangements, communications and HSMR learning networks started to mature.

The divergence of crude and standardised mortality rates implies a change in the case-mix of the patient population. The emergence of consistently higher crude rates compared to standardised rates suggests that from October 2010, patients admitted to hospital are much sicker than those admitted previously. This will be true to an extent as the Healthcare Quality Strategy and the Adult Health & Social Care Integration Bill promote a shift in the balance of care, enhancing preventative and anticipatory approaches and the avoidance of unnecessary hospital admissions. There will also be an impact of improvements to the accuracy of clinical coding brought about by the widespread local dissemination of measures such as HSMR and as a result of the recent Scottish audit of coding accuracy on SMR01. Further information on this audit is available in the Clinical Coding section.

There are various factors that could be contributing to the observed decrease on the HSMR and there is anecdotal evidence to suggest that improvement in the quality/safety of patient care is at least one of the factors at play.

However, the balance of contributions to the reducing HSMR from improved quality of care, changes in case-mix 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

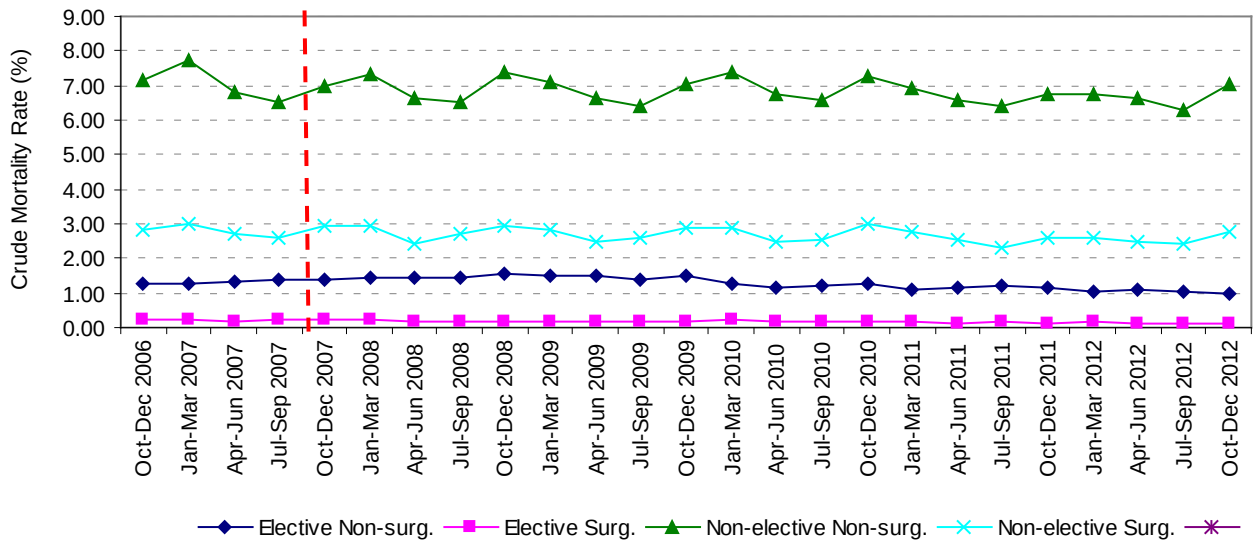
utilise this measure. See Future of HSMR for further information on how the measure might evolve over time. In the meantime, other outcome measures relating to quality of care and associated with the Scottish Patient Safety Programme (e.g. healthcare acquired infections, ventilator associated pneumonia) add weight to the proposal that improved quality of care is contributing to a significant degree.

Scotland (Sub-groups)

The Hospital Standardised Mortality Ratio 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.

Type of Admission

Chart 3: Crude mortality rates (%) for deaths within 30-days of admission by type of admission; Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]



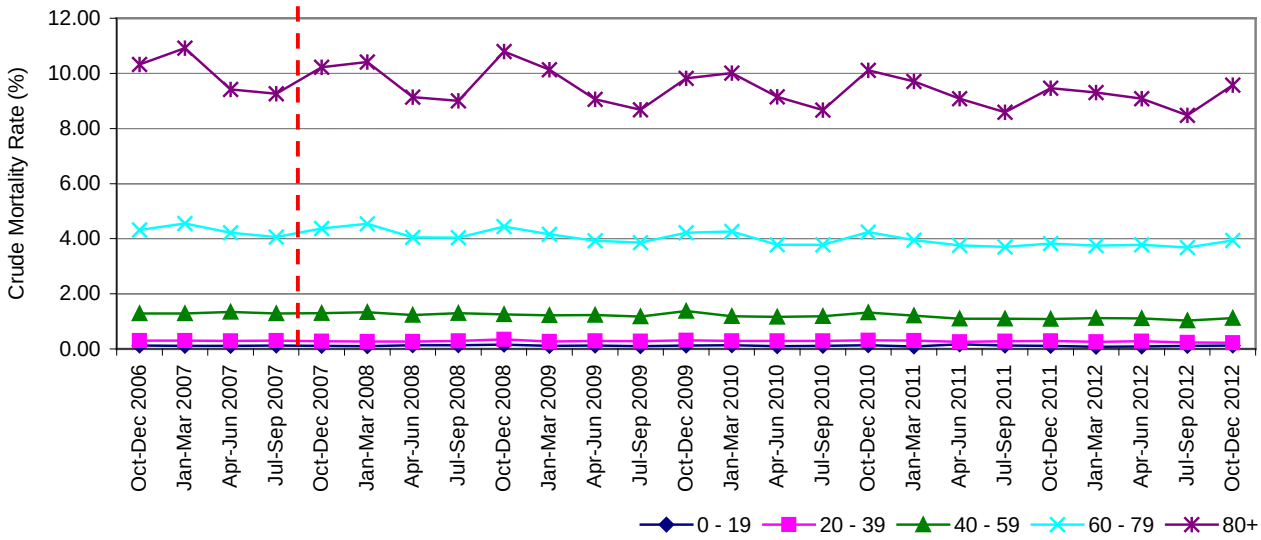
p - Provisional (see Appendix A1 - Data Quality and Timeliness)

Chart 3 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 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 a downward trend in mortality.

Age-Group

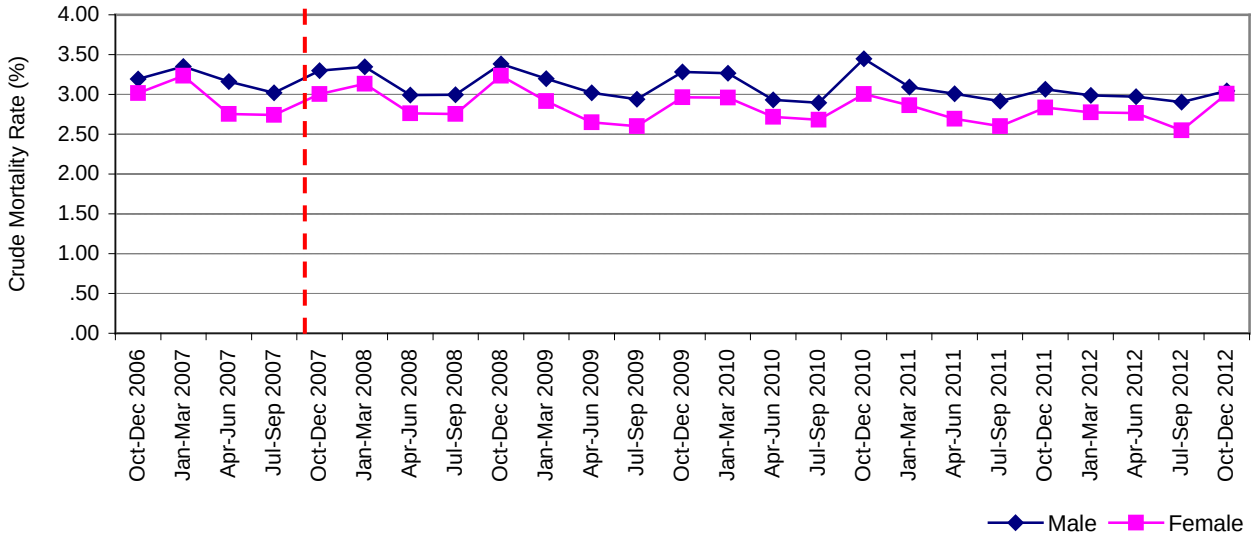
Chart 4: Crude Mortality Rates for deaths within 30-days of admission by age group; Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]



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

Sex

Chart 5: Crude Mortality Rates for deaths within 30-days of admission by sex; Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]

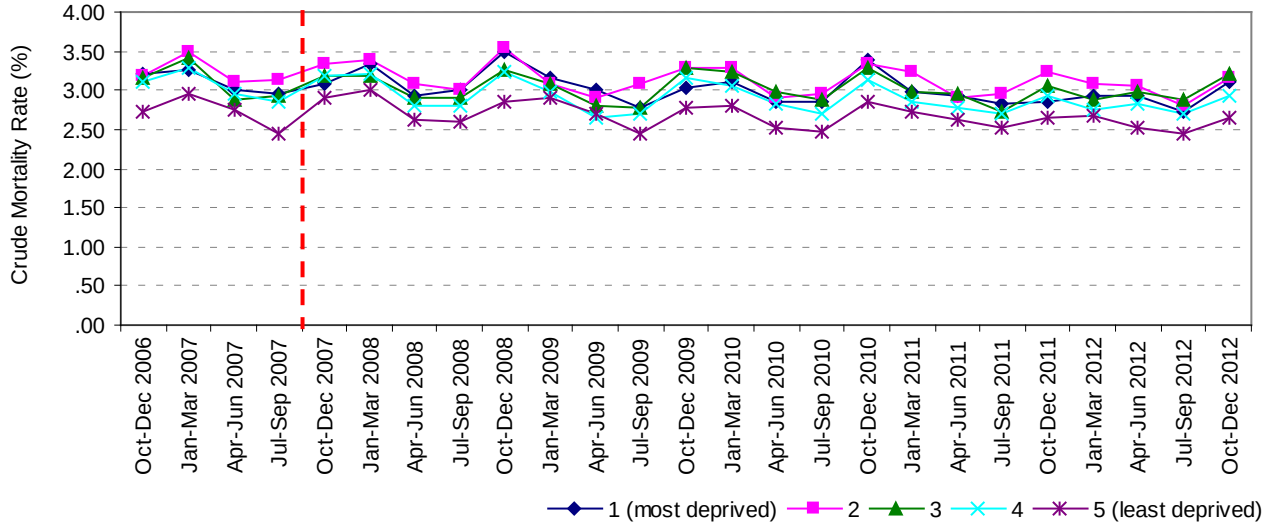


p - Provisional (see Appendix A1 - Data Quality and Timeliness)

Chart 4 and **Chart 5** shows that mortality within 30-days of admission increases with age and that mortality rates had been consistently higher for males throughout the time period. The difference between the mortality for males and females had remained relatively constant throughout the entire period, but has converged in the latest quarter.

Scottish Index of Multiple Deprivation

Chart 6: Crude Mortality Rates for deaths within 30-days of admission by deprivation (SIMD); Scotland, Oct-Dec 2006 to Oct-Dec 2012 [p]



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

The Scottish Index of Multiple Deprivation (SIMD) presents a picture of multiple deprivation across Scotland. The Scottish Government has used this method to track multiple deprivation since the development of the first Index of Multiple Deprivation in 2004. It is based on the six domains of employment, income, health, education, access and crime.

Each individual patient's postcode is recorded on their SMR01 record and this is used to map to a specific data-zone. The data-zone is the key small-area statistical geography currently used in Scotland. The data-zone geography covers the whole of Scotland and nests within local authority boundaries. Data-zones are groups of 2001 Census output areas and have populations of between 500 and 1,000 household residents. Where possible, they have been made to respect physical boundaries and natural communities. They have a regular shape and, as far as possible, contain households with similar social characteristics.

Each of the five categories presented here represent 20% of all of Scotland's data-zones. A '1' is assigned to patients who live in one of the most deprived data-zones in Scotland and a '5' is assigned to those who live in one of the least deprived data-zones in Scotland.

Inequalities in healthcare and health outcomes are revealed when data are stratified by a socio-economic factor such as SIMD. In the case of HSMR, **Chart 6** shows that patients from the least deprived areas of Scotland consistently have lower levels of 30-day mortality than patients from more deprived areas. At the opposite end of the spectrum however, patients from the most deprived areas of Scotland rarely have the highest levels of 30-day hospital mortality in any of the time periods presented.

Hospital and NHS Board Trends

Crude Rates and Hospital Standardised Mortality Ratios

The HSMR value for Scotland for the baseline year is 1. This allows quarterly hospital values to be compared to the baseline year 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 less 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 (HSMR is more than 1) this does not necessarily mean that these were avoidable deaths (i.e. that they should not have happened at all), or that they were unexpected, or attributable to failings in the quality of care.

In the spirit of the Scottish Patient Safety Programme, 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. Given that NHS users of the statistics have raised concerns about the use of the current model for the purposes of making direct hospital comparisons or identifying outliers, ISD will continue to present the information in a way that focuses on individual hospitals progress over time. 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.

Please refer to the section on Future of HSMR for further information on how ISD propose to work with stakeholders on the refinement of this measure.

The latest NHS Scotland data for quarters ending December 2006 to December 2012, and comparable information by NHS Board of treatment and Hospital are given in **Table A1a** and **Table A1b** respectively.

The data in **Table A1a** contains a 'drop-down' selection option for NHS Scotland 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

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** - Crude Mortality Rates and Hospital Standardised Mortality Ratios for all hospitals in Scotland combined and for hospitals selected from the list in Table 1 plotted against the median value.
- **Figure 5** – 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.

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 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 to December 2006).

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 to 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 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 to December 2006).

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

Percentage Change

Table 2 shows the current HSMR (October to December 2012) for each NHS Board SPSP participant hospital, and the overall percentage change since October to December 2007 according to regression line values.

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

- **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.

A negative prefix against the percentage change suggests that there has been a reduction in HSMR since the baseline period according to regression line values. Twenty eight of the hospitals participating in the SPSP have shown a reduction in HSMR since the end of the baseline period.

Eight hospitals had shown a reduction in excess of 15% by December 2012, with three of those showing a reduction in excess of 20%:

- NHS Ayrshire and Arran's Crosshouse Hospital (31.3%),
- NHS Greater Glasgow and Clyde's Southern General Hospital (20.3%)
- NHS Highland's Raigmore Hospital (20.5%).

The reductions for Crosshouse Hospital and the Southern General Hospital are based on greater than predicted initial levels of mortality (1.28 and 1.10 respectively for October to December 2007). The reduction for Raigmore Hospital was based on a lower than predicted initial level of mortality (0.80 for October to December 2007).

Only three hospitals in Scotland exhibit a positive change over time.

Western Isles Hospital (+4.5%) is a small hospital treating less than 1,000 patients per quarter on average from a mainly rural population. The smaller than average patient numbers will affect the overall trend which will be less stable than the trends exhibited by Scotland's larger hospitals.

Stracathro Hospital in Tayside and the Golden Jubilee National Hospital provide 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 transplantation surgery at the Golden Jubilee National Hospital in 2008 and Stracathro hospital treats a disproportionately aged patient population as compared to Scotland, a sizeable proportion of which have suffered strokes.

Longer-term Trends (Oct-Dec 2002 to Oct-Dec 2012)

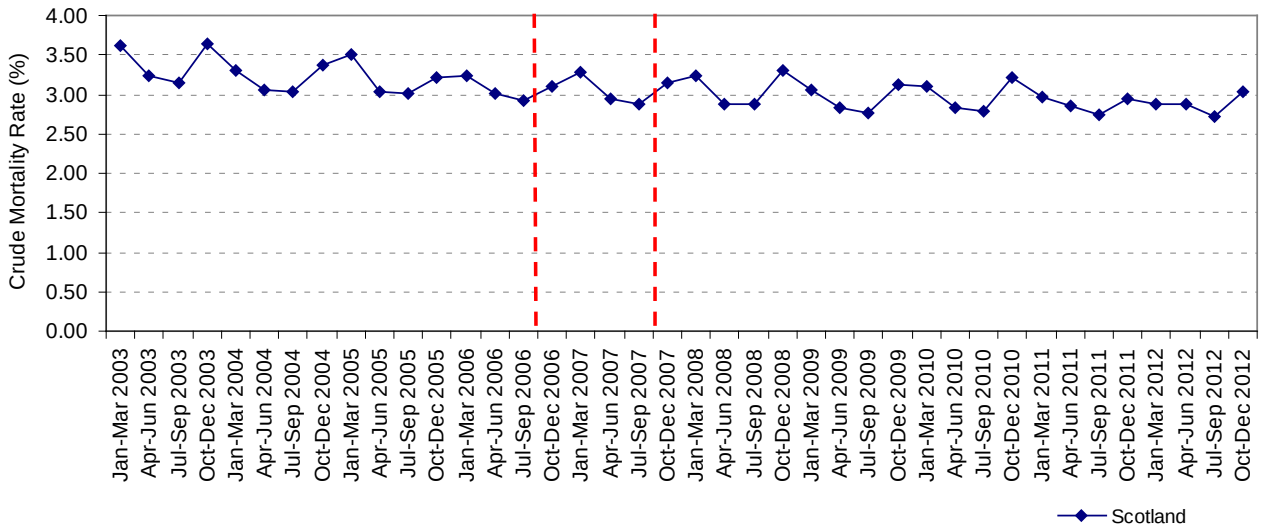
All emphasis to date has focussed on patterns of hospital mortality from the base-line period onwards. As the measure has become established questions have been asked about what was happening to hospital mortality prior to the baseline period. As the information is sourced retrospectively from routine sources, and the database includes hospital activity linked to death registrations back to the early 1980's, there is no reason why this cannot be looked at.

Scotland (Overall)

Chart 7a shows that overall crude hospital mortality (%) at Scotland level from January to March 2003 to October to December 2012 according to the existing definition of deaths within 30-days of admission had been falling prior to the baseline period. The seasonal

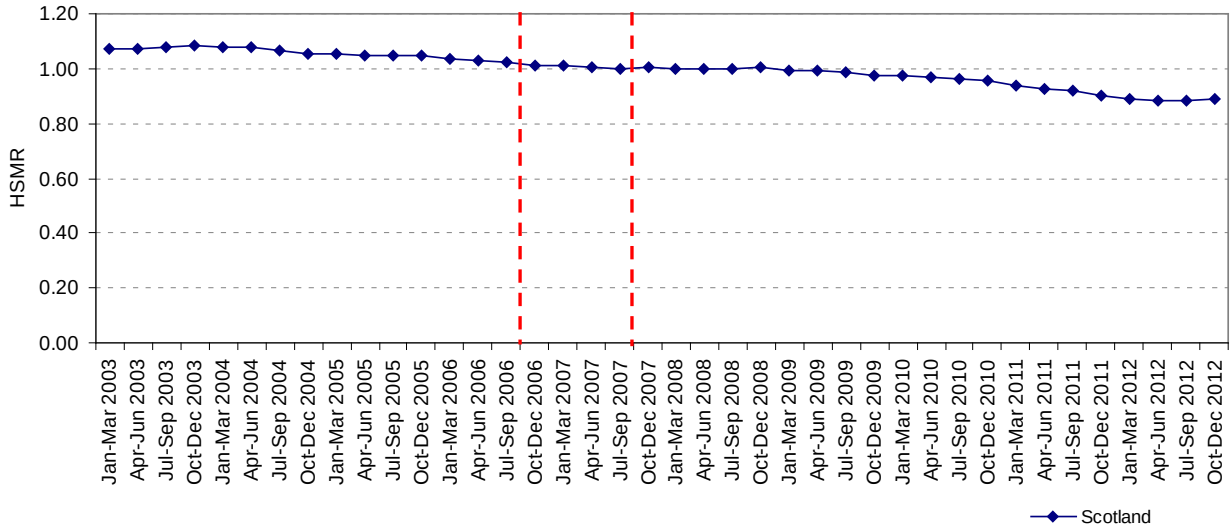
pattern previously highlighted is again exhibited in this chart and the parallel dotted red lines represent the bounds of the baseline period.

Chart 7a: Overall crude mortality rates (%) for deaths within 30-days of admission; Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

Chart 7b: Rolling (quarterly) annual HSMR for deaths within 30-days of admission; Scotland, year ending Jan-Mar 2003 to Oct-Dec 2012 [p]



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

In order to counter the impact of the seasonal variation, Chart 7b displays rolling annual HSMR for the years ending January to March 2003 to October to December 2012. Following a sustained reduction in HSMR between 2009 and 2011, the level has remained relatively constant during the most recent four quarters of 2012.

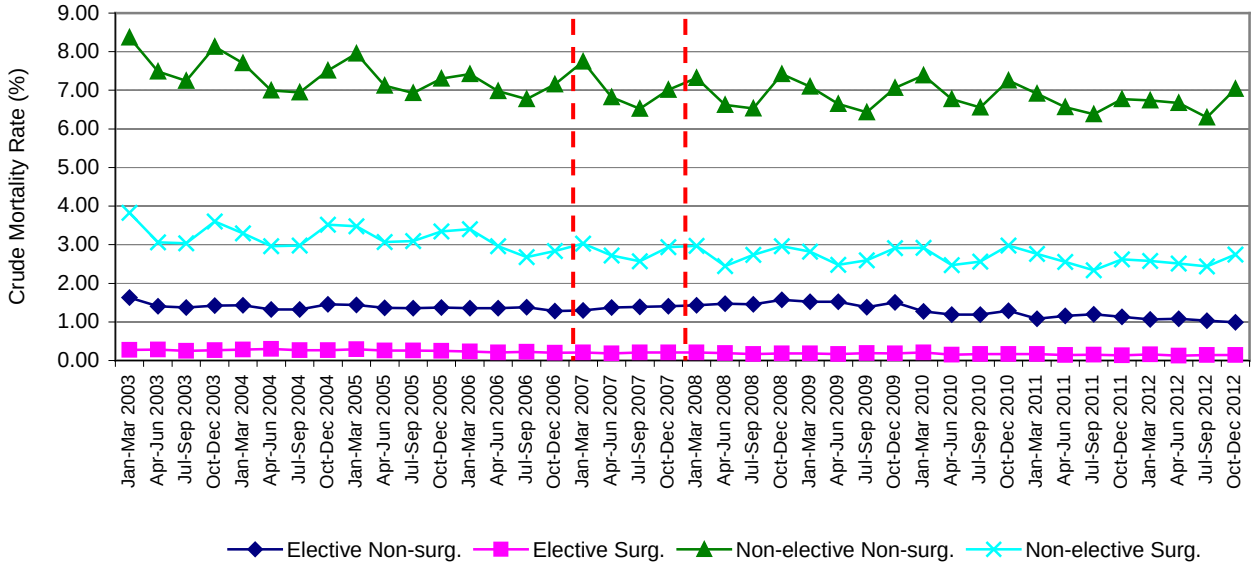
Each point represents the sum of observed death for that quarter plus the three preceding quarters divided by the sum of predicted deaths over the same four quarters.

Scotland (Sub-groups)

The following charts also show that overall crude mortality had been falling prior to the baseline period for the various subgroups already examined above.

Type of Admission

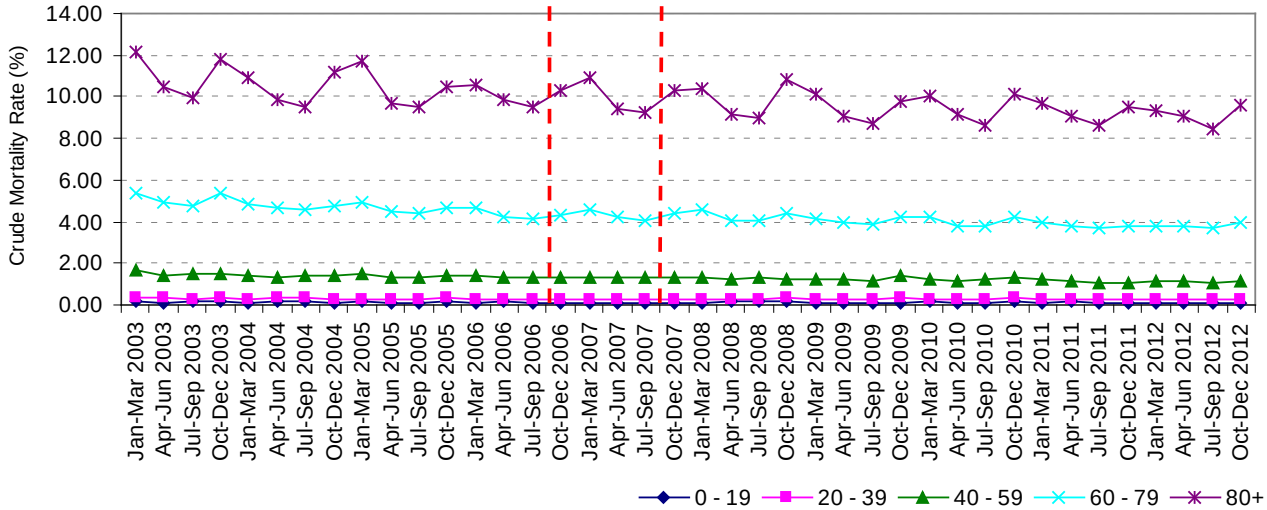
Chart 8: Crude mortality rates (%) for deaths within 30-days of admission by type of admission; Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

Age-group

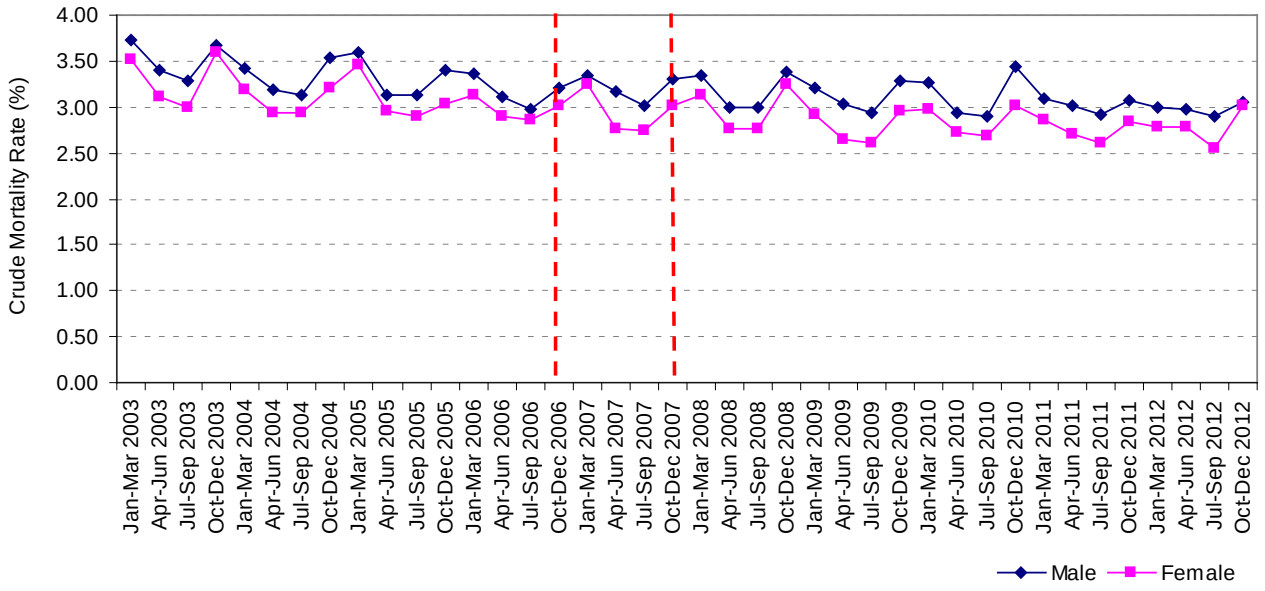
Chart 9: Crude mortality rates (%) for deaths within 30-days of admission by age group; Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

Sex

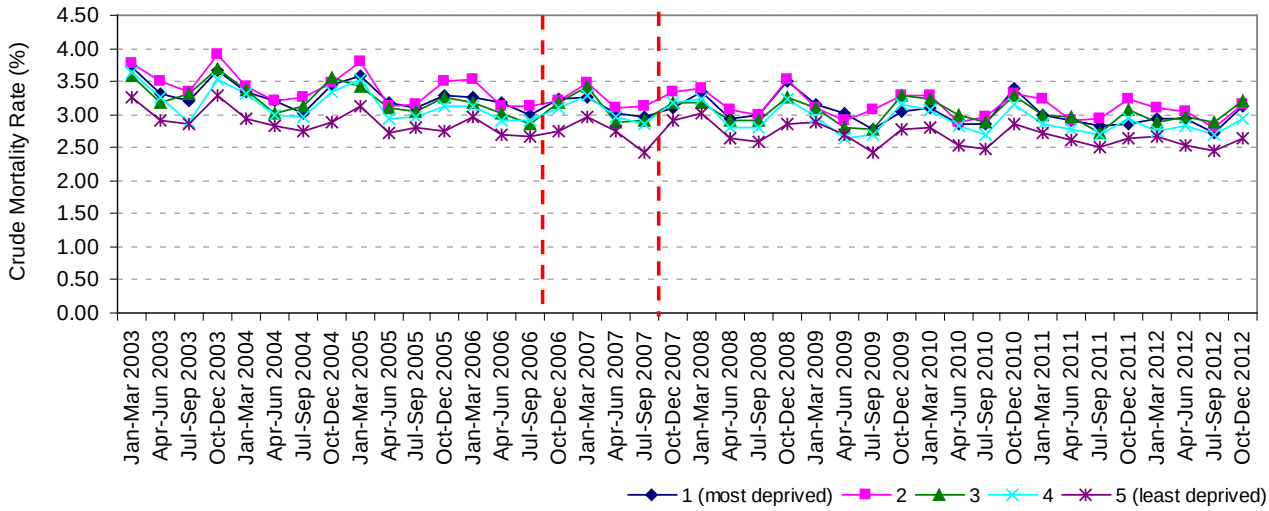
Chart 10: Crude mortality rates (%) for deaths within 30-days of admission by sex; Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

Scottish Index of Multiple Deprivation

Chart 11: Crude mortality rates (%) for deaths within 30-days of admission by deprivation (SIMD); Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

International Comparisons

Inter-UK Comparisons

There is more than one measure routinely produced and used in England for the measurement of hospital mortality. What is now commonly referred to as HSMR (Hospital Standardised Mortality Ratio) is the indicator developed by Imperial College and which is now routinely produced by Dr Foster Intelligence. 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. See section on History of HSMR in Scotland for more information.

More recently other alternatives have come on-line, most notably the Summary Hospital-level Mortality Indicator (SHMI) (Department of Health / NHS Information Centre) and the Risk Adjusted Mortality Index (RAMI) produced by CHKS Ltd.

There are three key differences between the SHMI and the Dr Foster HSMR:

- 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

The NHS Information Centre is an organisation with a remit broadly similar to that of Information Services Division in Scotland. 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 our own 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 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.

There is a far greater emphasis, in the published 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. This further emphasises why no direct comparison can be made between HSMRs for England and Scotland.

Like Scotland there is the same acknowledgement that there are unaccounted for factors affecting mortality in hospitals and recognition that there is random variation in the number of deaths. 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. 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 our partner organisation Healthcare Improvement Scotland.

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 their remains a subjective element to the assessment of when a communication should be triggered, ISD choose not to publish a statistical comparative analysis in isolation. Work in Scotland is leaning more towards 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. **Chart 12** shows the crude mortality in Scotland over time according to the same definition as SHMI. For the latest quarter (October to December 2012) there were 6,773 deaths within 30-days of admission to hospital in Scotland, and 8,452 deaths within 30-days of ultimate hospital discharge (including all in-hospital deaths).

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.

Regardless of the method, one message holds true for both the Scottish and English 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. Likewise, a low or lower than expected HSMR/SHMI cannot rule out quality issues or high levels of avoidable mortality.

Table 3: Key comparisons between the favoured methods for hospital mortality indicators in Scotland and England.

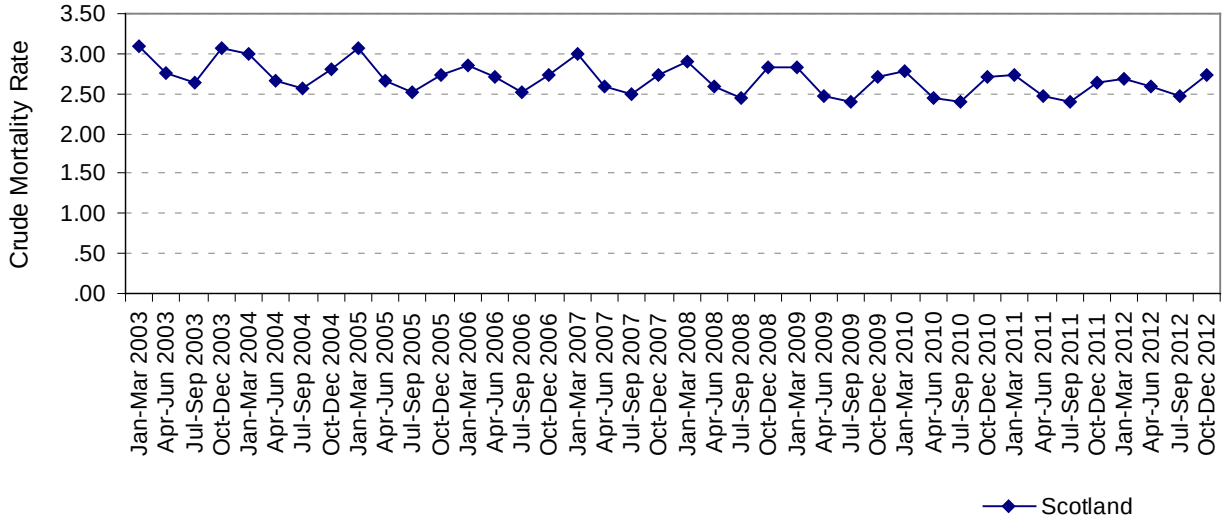
	Scotland (HSMR)	England and Wales Summary Hospital-level Mortality Indicator (SHMI)	England and Wales Dr Foster (HSMR)
Patients	One patient observation per spell (referred to in Scotland as a continuous inpatient stay) attributed to the admission hospital of the last spell of care prior to death.	One 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)
Deaths	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
Adjustments	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)

In-patient mortality and deaths within 30-days of discharge

In England, the Summary Hospital-level Mortality Indicator (SHMI) looks at all in-patient mortality and deaths within 30-days of discharge. As explained in the section History of HSMR in Scotland, preference in Scotland was to associate the outcome with decisions made at the point of admission. The Scottish HSMR is not a measure of all in-hospital mortality because it does not include patients that die in-hospital more than 30-days from admission. However, the approach adopted by SHMI has been applied to Scottish data, to address questions about how the Scottish trend would look according to a methodology

more similar to England. The main issue centres on the fact that there are deaths that occur in-hospital that are not attributed in the Scottish dataset.

Chart 12: Crude mortality rates (%) for deaths within 30-days of ultimate hospital discharge (includes all in-hospital mortality);
Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

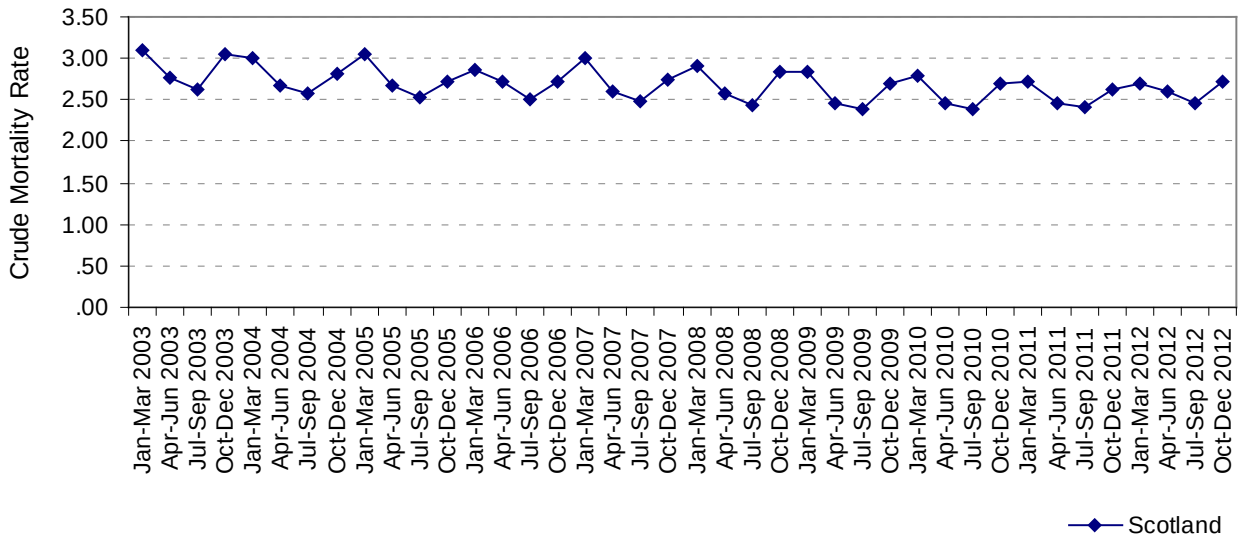
Chart 12 shows the trend in mortality at Scotland level according to a definition similar to the SHMI in England. The mortality rates are inevitably higher than the admission-based method, reflecting the longer opportunity for follow-up. The trend is however consistent with the admission based mortality patterns, and show that although exhibiting seasonal variation, hospital mortality has fallen over the past ten years.

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

Population-based Mortality

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 National Records for Scotland, at Scotland level and by NHS Board of residence.

Chart 13: Underlying Population Death Rates (crude rates per 1000 population); Scotland, Jan-Mar 2003 to Oct-Dec 2012 [p]



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

Chart 13 shows the trend in overall population mortality for Scotland between January to March 2003 and October to December 2012. The series, although exhibiting seasonal characteristics, still demonstrates a downward trend in overall mortality.

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

Future of HSMR

The HSMR has been in circulation for some time now in Scotland and throughout this report we mention a number of factors that are fundamental to achieving a balanced interpretation of the statistics. We recognise and acknowledge the concerns of our stakeholders in relation to the interpretation of these statistics and how HSMR plays into formal governance arrangements.

Since the statistics were first released, the landscape has changed and there have been important developments that will influence how we take HSMR reporting in Scotland forward. Most notably, this includes:

- The extended aim of a 20% reduction in HSMR by December 2015
- Implementation of the Quality Strategy - Quality Measures Framework

We have learned much from our extensive dialogue with stakeholders throughout the past three years and there may be features of the 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. Clearly, we do not wish to confuse users with variations of HSMR. The current model will therefore continue to be used for the next release. A clinical reference group has formed and is being brought together periodically over the coming year to advise on the utility of the current model and advise on the appropriateness and implications of analytical

revisions. Results from this dialogue will be considered by ISD and will be taken to 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:

- 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.

The Quality Strategy is about three things:

- Putting people at the heart of the NHS
- Providing the best possible care and making the right thing easier to do for every person every time.
- Making measurable improvement in the aspects of quality of care that patients, their families and carers and those providing healthcare services see as really important

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 this Quality Strategy. Further information on the Healthcare Quality Strategy can be found here.

Your Opinion

Much of our effort to date has focussed on dialogue with internal NHS stakeholders, to establish confidence in the measure and trust in the governance process. This publication aims to inform a wider audience, including patients and their carers, about what brings us to this point. This report is as much about the processes and governance arrangements that underpin hospital mortality reporting in Scotland as it is about the actual data and trends.

Researchers may be interested in ISD's Electronic Data Research and Innovation Service (eDRIS). This is a new service designed to provide a single point of contact and to assist researchers in study design, approvals and data access in a secure environment. It includes what was previously referred to as (Medical) Record Linkage and is ISD's contribution to the Scottish Informatics Programme (SHIP).

ISD Scotland publishes a wide variety of health-related data including a range of alternative information on mortality. National Records for Scotland also publishes extensive information on the patterns of population mortality for Scotland.

If you have difficulty finding the information you are looking for or have any comments on how we present our information, we'd like to hear from you. Please contact us (details below) for more information at any time.

Next Update

The next update, reporting on admissions to 31st March 2013, will be made available on the ISD website on Tuesday 27th August 2013.

Glossary

HSMR	Hospital Standardised Mortality Ratio
NRS	National Records for Scotland
SPSP	Scottish Patient Safety Programme
SHMI	Summary Hospital-level Mortality Indicator

List of Tables

Name	Time period	File & size
Table A1a (Hospital Standardised Mortality Ratios by NHS Board of Treatment; Oct-Dec 2006 to Oct-Dec 2012)	October 2006 - December 2012	Excel [117kb]
Table A1b (Hospital Standardised Mortality Ratios by Hospital; Oct-Dec 2006 to Oct-Dec 2012)	October 2006 - December 2012	Excel [246kb]
Table A2a (Crude hospital mortality rates for in-hospital deaths and deaths within 30-days of discharge by NHS Board of Treatment; Oct-Dec 2002 to Oct-Dec 2012)	January 2003 - December 2012	Excel [187kb]
Chart A1 (Overall population crude mortality rates by NHS Board; Oct-Dec 2002 to Oct-Dec 2012)	January 2003 - December 2012	Excel [394kb]
Table 2 (Percentage Change in Standardised Mortality Ratios (regression line) for hospitals in Scotland between Oct-Dec 2007 and Oct-Dec 2012)	October 2007 – December 2012	Excel [22kb]
Table 4 (Impact of the data refresh on the previously published provisional Standardised Mortality Ratios for all hospitals in Scotland; Jul-Sep 2012)	July – September 2012	Excel [22kb]
chart3-chart6 (Crude mortality rates (%) for deaths within 30-days of admission by subgroup; Oct-Dec 2006 to Oct-Dec 2012)	January 2003 - December 2012	Excel [110kb]
chart7-chart11 (Crude mortality rates (%) for deaths within 30-days of admission by subgroup; Jan-Mar 2003 to Oct-Dec 2012)	January 2003 - December 2012	Excel [82kb]

Contact

Richard Dobbie
Principal Information Analyst
Richard.Dobbie@nhs.net
0131 275 7732

Alan Finlayson
Service Manager
Alan.Finlayson@nhs.net
0131 275 6271

Michael Webster
Senior Information Analyst
Michael.Webster@nhs.net
0131 275 6881

Further Information

Further information can be found on the ISD website

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A1 – Background Information

Data Quality and Timeliness

Source Data

The measure is derived from the routine returns that hospitals submit to the Information Services Division in relation to their non-obstetric and non-psychiatric inpatient and day case activity (SMR01). The hospital data are submitted to ISD on a monthly basis and are retrospectively linked together at patient-level. The hospital patient-profiles are further linked to the National Records of Scotland (formerly General Register Office for Scotland) deaths records, again on a monthly basis.

The credibility of the HSMR is dependent on robust data quality, particularly around the accuracy and consistency of the recording of main diagnosis. The SMR01 linked database contains in excess of 35 million patient records and ISD have well established mechanisms to work with providers to ensure the quality of the SMR01 records is maintained and where necessary enhanced. HSMR is being used extensively across Scotland as one of a number of indicators of quality and safety. During interaction with boards ISD has found that widespread use of the HSMR has drawn the focus of attention to the quality of data and clinical coding.

SMR01 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 ISD's Data Quality Assurance (DQA) team is responsible for evaluating and ensuring that the Scottish Morbidity Record (SMR) datasets are accurate, consistent and comparable across time and between sources. Evaluation of quality of data in any information system involves a comparison of data against an agreed set of standards. The audit was conducted retrospectively in order to support the credibility of ISD's national patient based data. The report shows that:

- Main Condition (used as a fundamental part of the HSMR calculation) is being recorded with an accuracy rate of 88%.
- Thirteen of the 24 hospitals assessed did not achieve the recommended minimum 90% standard for accuracy rate of Main Condition.
- Findings suggest that if the final discharge letter had been available, and fully utilised, at the time of coding then the accuracy rate of Main Condition would have improved from 88% to 94% (which exceeds the recommended minimum standard accuracy rate of 90%).

Clinical Coding

When the HSMR is released to boards it is accompanied with the following reminder to data providers about how ICD-10 codes should be assigned to national returns by the local clinical coders.

In order to mitigate the potential risk of bias being introduced to the measure as a result of inconsistent local interpretation of the definitions a link to the data dictionary is always provided.

It states that:

The main condition is the condition, diagnosed at the end of the episode of health care, primarily responsible for the patient's need for treatment or investigation. If there is more than one such condition, the one held most responsible for the greatest use of resources should be selected. If no diagnosis was made, the main symptom, abnormal finding, or problem should be selected as the main condition.

Patients may have more than one SMR01 episode within a hospital admission. Each episode should be coded to reflect the situation at the end of that episode (as per definition, above). Coders should not return to a previous episode and amend the codes according to findings/tests performed in a subsequent episode. Diagnosis (or symptoms/findings) should be recorded in the episode in which they were ascertained.

We now know that increasingly, patients are admitted to an assessment unit (or equivalent) before being transferred to more appropriate accommodation for further tests and treatment. It is not unusual for a symptom to be coded as the main condition in the first episode with a definitive diagnosis established later in the patient's stay in hospital (ie subsequent or final episode). Modern systems mean that the first episode may be recorded before the patient has been discharged from hospital.

The following excerpt from the 'Methods' section describes the selection criteria adopted during the HSMR analytical phase.
"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."

ISD are developing an analytical process that will mitigate the potential for underestimating risk that may arise from the current method of selecting the diagnosis from the first episode. Please see section on 'future of HSMR'.

Common Categories

A number of mappings have been applied retrospectively to certain fields within the source records (SMR01). This has been carried out in order to form broader categories, more appropriate for stable statistical modelling and analyses. In the case of the Charlson Index, the mapping represents an internationally accepted definition.

Descriptions of how these mappings have been applied are presented in Tables 5-8 below.

Table 5 describes how each of the individual ICD-10 clinical codes has been assigned to one of the twenty-six groupings used for the main diagnosis adjustment in the Scottish HSMR.

Table 6 lists the ICD-10 codes that have been assigned to each of the seventeen Charlson Index categories used for the prior-morbidity adjustment in the Scottish HSMR.

Further information on the International Classification of Diseases including access to an online reference manual (ICD-10) is available on the World Health Organisation (WHO) website.

Table 7 describes how each of the individual specialty codes has been assigned to a surgical / non-surgical variable.

Table 8 describes how each of the type of admission codes has been assigned to an elective / non-elective variable.

Timeliness

To address concerns over the timeliness of the data, death registrations from National Records of Scotland (NRS) are now 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 31st December 2012 in this release. The majority of hospital admission data will be complete for that 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.

Refreshing Previously Provisional Data

A new patient management system (TrakCare PMS) has been implemented in 4 NHS Boards; NHS Borders, NHS Grampian, NHS Lanarkshire and NHS Ayrshire & Arran. The system is being implemented in a phased approach in NHS Greater Glasgow & Clyde. The implementation programme has impacted on the submission of SMR returns, affecting the level of data-completeness on which the HSMR is based. 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. Although diminishing, there remains a degree of data deficit; 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.

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

The previous report, published on 26th February 2013, presented provisional data for July to September 2012 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 95% complete. The overall HSMR for Scotland has not changed as a result of the refresh and remains 0.87.

Table 4 shows the impact of the refresh on the individual hospital level HSMRs and, as expected, the data deficit was greater in those boards undergoing PMS implementation. In Greater Glasgow and Clyde, the HSMR for Royal Alexandra Hospital and Vale of Leven was based on approximately 60% completeness, with the reported HSMR increasing from 0.96 to 1.07. Although the level of completeness for Inverclyde Royal Hospital was approximately 96% previously, the HSMR has increased from 0.74 to 0.86 due to the subsequent return of a relatively small number of additional cases. In NHS Grampian, the HSMR for Aberdeen Royal Infirmary was previously based on a completeness level of 89%. The impact of the refresh has resulted in a reduction in the HSMR from 0.75 to 0.68.

Of the NHS boards not affected by PMS implementation only Fife Acute and Raigmore Hospital in NHS Highland had HSMR's provisionally reported on the basis of completeness

levels below 95% (89% and 93% respectively). The impact of the refresh for Fife Acute caused a reduction in HSMR from 0.97 to 0.92 and for Raigmore Hospital a reduction from 0.69 to 0.66.

The updated analysis suggests that completeness for all remaining hospitals during July to September 2012 was previously already in excess of 95%, with the refresh causing no sizable changes to the previous level of the HSMR.

This quarter, for October to December 2012 we estimate the following levels of data completeness for all sites within the five boards currently undergoing PMS implementation:-

NHS Ayrshire & Arran
- Ayr Hospital (95%-100%)
- Crosshouse Hospital (95%-100%)

NHS Borders
- Borders General Hospital (95%-100%)

NHS Grampian
- Aberdeen Royal Infirmary (90%-95%)
- Dr Gray's Hospital (95%-100%)

NHS Greater Glasgow & Clyde
- Inverclyde Royal Hospital (95%-100%)
- Royal Alexandra/Vale of Leven (80%-85%)
- Southern General Hospital (95%-100%)
- Victoria Infirmary (95%-100%)

Not currently implementing TrakCare
- Western Infirmary/Gartnavel General (95%-100%)
- Glasgow Royal Infirmary / Stobhill (95%-100%)

NHS Lanarkshire
- Hairmyres Hospital (95%-100%)
- Monklands District General Hospital (90%-95%)
- Wishaw General Hospital (95%-100%)

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:

HSMR = Observed Deaths / 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 March 2012. The predicted probabilities were then summed to hospital level in order to produce the predicted number of deaths.

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. See the section on Future of HSMR for further information.

Quarterly Process

Since the first release of quarterly HSMR statistics to NHS Boards across Scotland in December 2009, an established pattern of analysis and reporting coupled with cross agency governance procedures has matured. There are three key phases to the Quarterly Process, which contains HSMR at its heart but now includes the wider context of other indicators of quality.

1. HSMR Management Information Tool
2. Official Statistics Publication of HSMR for Scotland (this report)
3. The Hospital Scorecard

A key component of the initial production of the HSMR, now established as routine, involves the systematic review of the data by representatives from Information Services Division and Healthcare Improvement Scotland. The purpose of the review is to identify potential patterns in the data and to initiate a dialogue with 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.

The first release of HSMR to boards in December 2009 was considered management information, not followed by publication of the statistics. This afforded time for boards 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. 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. Since then, the format of release to boards has mirrored that of the management information tool, i.e. the same series of tables and charts for Scotland and each individual participating hospital. The timing of the release was 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 remained relatively unchanged until now. This report has been much 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.

These reports have been assessed by the UK Statistics Authority for accreditation as National Statistics. ISD are responding to a number of the requirements and recommendations in this latest report and expect to hear the final outcome of the assessment in the summer of this year.

The Hospital Scorecard is a product commissioned by the Scottish Government's Directorate for Health Workforce & Performance and is now established as a routine part of the quarterly HSMR cycle. The scorecard is a management information product that incorporates HSMR with a series of other indicators, some of which are already routinely published. The other indicators cover 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.

Throughout the quarterly cycle, interaction with boards is key and openly encouraged. Dialogue with the majority of NHS boards has been extensive since HSMRs were first released. This is in the form of much bespoke dialogue or more formally via the SPSP learning sessions or Quality HUB, or through the formal escalation process described above.

To help users within the NHS better understand their data, and to encourage their sense of ownership of the information a supportive 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

A summary of the processes and key-date for the latest quarterly cycle is provided below:

Month	Processes and Key Dates
April	· Source database refreshed **(9th April 2013)** · Analytical work begins, involving o Extraction of quarterly patient observations with outcome o Mapping of predictions from baseline model o Calculation of observed & predicted deaths at Hospital-level calculated by aggregating

	outcomes and predictions o Import to reporting template o Internal QA and data scrutiny (data completeness)
May	· Review meeting with Healthcare Improvement Scotland **(1st May 2013)** · Update management information website · Management Information Tool made available to NHS Boards **(3rd May 2013)** · Official statistics report production cycle commences · Scottish Government receive extend pre-release access **(16th May 2013)** · NHS Boards receive standard pre-release access **(21st May 2013)** · ISD briefs Scottish Government on content of report **(21st May 2013)** · Report published on ISD website at 09:30 on **Tuesday 28th May 2013**
June	· 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)**

History of HSMR in Scotland

Background

The Scottish Patient Safety Programme (SPSP) initially set an aim to reduce hospital mortality by 15%, by December 2012. To monitor this, ISD were formally asked by the Chief Medical Officer for Scotland in early March 2008 to commence development of a case mix adjusted model for hospital standardised mortality ratios.

The SPSP held a patient safety learning session in May 2008 where progress was presented to senior NHS leaders. Following this learning session ISD set up a clinical group to get both clinical and statistical advice on the methods used to develop this work and clinical advice on whether the emerging model was relevant. This group was made up of four senior clinicians, a professor of medical statistics, chair of a clinical governance committee and ISD.

ISD had already started to develop case-mix adjustment for the Surgical Profiles Project. The method of case-mix adjustment resembled that used in England and developed by Professor Brian Jarman, however, modifications were made to which variables should be adjusted for where it was felt these were more appropriate for Scottish data. The final

model was presented to a second patient safety learning session in January 2009 where the methods, HSMR and results of the validation were presented.

Methods

Scottish hospitals record and submit all inpatient and day case discharges on an SMR01 return. These SMR01 patient records are then linked by the ISD linkage team to National Records of Scotland (NRS) deaths data. This linked data was used for all admissions, including medical and surgical specialties. SMR01 data does not include psychiatric or obstetric specialties, and the clinical group agreed to their complete exclusion from the Scottish model.

Originally analysis was carried out on hospital activity data for one year. This was changed to two years in order to try to capture a larger range of diagnoses for patients. Data from September 2005 to August 2007 was used. This was the most complete data at the time of analysis.

The HSMR methodology used for English hospitals at that time looked at in-hospital mortality only as the outcome variable. See section on International Comparisons for more information. The linkage of SMR01/NRS data allowed Scotland to look at all mortality, including deaths occurring in the community following hospital discharge, and not just in-hospital mortality. The outcome measured, however, was mortality within 30 days from admission. A binary variable was used (0=alive within 30 days, 1=dead within 30 days). As a quality indicator, the clinical advisory group felt it was more appropriate to associate an outcome measure to the patient's initial contact with inpatient or day case hospital services.

The Jarman method was used as a guide to evaluate which variables to adjust mortality for. However, changes were made from the variables used in England: Age, sex, deprivation quintile, type of admission, previous emergency admissions, primary diagnosis, diagnosis subgroup, co-morbidities, palliative care, month of admission (for respiratory diagnoses) and financial year.

The following explanatory variables were used by ISD to try to explain the outcome for Scotland:

- Age
- Sex
- Scottish Index of Multiple Deprivation (Ordered categorical variable: 1 to 5)
- Type of admission (Elective, Emergency / Transfer)
- Inpatient / Day case
- Where a patient was admitted from (Institution, Private residence, Temporary, Transfer from other NHS provider, Transfer from same provider and Other)
- Previous emergency admissions
- Primary diagnosis
- Prior-morbidities in the previous 1 and 5 years
- Specialty (Surgical / non-surgical)

At that time in Scotland, 6% of all deaths followed a day case admission. Therefore, rather than just excluding the day cases or assuming the death was zero a binary variable for inpatient / day case was included in the analysis.

The number of emergency admissions each patient had in the 12 months prior to their most recent admission was also calculated. This figure did not include the most recent (current) admission (separate adjustment for index type of admission). The frequency of this variable

was: 82% of patients had no emergency admissions in the previous year, 9% had 1 admission, 4% had 2 admissions, 2% had 3 admissions, 1% had 4 admissions and 2% had 5 or more emergency admissions in the previous year.

The clinical group agreed that for HSMR, a broad surgical / non-surgical adjustment should be included and this remains the first key variable in the statistical model.

Primary Diagnosis

For the Scotland HSMR the clinical group agreed to include all diagnoses. To identify primary diagnosis, classified by ICD10, the 56 clinical classification groups from Dr Foster were mapped using the main condition in SMR01 data. These groupings were found to account for around 83% of diagnoses that preceded a death in Scotland.

To allow Scotland to include all diagnoses in the analysis, the clinical group agreed that a smaller number of primary diagnosis groupings should be developed for Scotland to incorporate all diagnoses from the 56 clinical classification groups from Dr Foster and the remaining diagnoses found to precede a death in Scotland. These groupings were to be based on medical intelligence and crude mortality rates. Twenty six groups emerged, made up of a series of system categories (e.g. CVS, Malignancy, Neurological) subdivided according to the level of crude mortality (e.g. Malignancy 1 is the lowest mortality rate in the malignancy groupings and Malignancy 3 is the highest). Other than where the mortality rates were low and medical intelligence alone had to be used, there should be no overlap in mortality between groupings within a single system category. Allocation to clinical groupings was particularly difficult when patient numbers were small, and mortality rates became zero. At that point "medical intelligence" was the only basis on which to allocate a category.

Table A – Primary diagnosis groups: 30 day mortality following admission (range of mortality rates for individual diagnoses)

Primary diagnosis group	30 day mortality rate (%)	Primary diagnosis group	30 day mortality rate (%)
Cerebrovascular1	12.4 (8.3 – 13.8)	Malignancy3	16.6 (14.7 – 30.3)
Cerebrovascular2	24.3 (19.3 – 40.1)	Metabolic	3.2 (0.9 – 8.7)
CVS1	2.3 (1.3 – 7.2)	Miscellaneous1	1.0 (0 – 2.83)
CVS2	11.0 (8.2 – 13.5)	Miscellaneous2	5.6 (3.7 – 18.2)
CVS3	15.9 (13.7 – 31.3)	Mortality	93.0 (92.9 – 100.0)
CVS4	68.0 (62.5 – 70.8)	Neurological1	1.1 (0.6 – 2.9)
Gastrointestinal1	1.4 (0.7 – 4.1)	Neurological2	4.5 (2.5 – 17.4)
Gastrointestinal2	6.5 (5.0 – 15.7)	Renal	17.8 (8.3 – 22.2)
Gastrointestinal3	13.4 (10.1 – 23.4)	Respiratory1	2.5 (0.7 – 4.3)
Haematology	2.7 (1.5 – 6.1)	Respiratory2	6.6 (3.2 – 9.0)
Low risk	0.2 (0 – 0.6)	Respiratory3	26.1 (8.9 – 47.8)
Malignancy1	3.9 (1.5 – 7.4)	Trauma1	1.2 (0.7 – 3.0)
Malignancy2	11.4 (8.1 – 14.2)	Trauma2	6.3 (3.1 – 16.7)

These primary diagnosis grouping remain in the current analysis as a nominal categorical variable. Although the chosen modelling technique can group them up further if they have similar mortality levels and given other factors in the model.

Prior Morbidity

To identify co-morbidities Dr Foster used the Charlson Index. The Charlson paper (J Chron Dis Vol. 40, No. 5, pp. 373-383, 1987) provides information on developing a score based on severity of condition and the number of different conditions the patients has. There are 17 co-morbidity groupings that have been assigned a weight based on severity of condition. An Australian version of the Charlson index was developed in 2004 using ICD10 codes (Journal of Clinical Epidemiology 57 (2004) 1288-1294). Table B shows the 17 co-morbidity groups and their assigned weight.

Table B – Co-morbidity grouping from revised Australian index

Condition	Weight (1=least severe, 6=most severe)
Acute myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebral vascular accident	1
Dementia	1
Pulmonary disease	1
Connective tissue disorder	1
Peptic ulcer	1
Liver disease	1
Diabetes	1
Diabetes complications	2
Paraplegia	2
Renal disease	2
Cancer	2
Metastatic cancer	3
Severe liver disease	3
HIV	6

The English hospital episode statistics (HES) data (similar to SMR01 in Scotland) has 14 diagnosis fields. The first diagnosis is the primary diagnosis and the remaining 13 fields are secondary/subsidiary diagnoses. Dr Foster calculated the ICD10 version of the Charlson index using all 14 diagnosis codes from the first episode in the spell (we refer to a spell as a continuous inpatient stay in Scotland) or from the second episode in the spell if the primary diagnosis in the first episode is within a range of sign and symptom codes. The recording of the other conditions was not complete across England. They also included the primary diagnosis (the first diagnosis) when calculating the Charlson score. Dr Foster combine co-morbidity scores of 6 or more (which are not common) and fit it as a categorical variable with seven levels (0, 1, 2, 3, 4, 5 and 6+).

In SMR01 data there are 6 diagnosis fields, the main condition and 5 other conditions. The recording of the other conditions was not complete across Scotland and ISD were advised to screen back through previous SMR01 records (main diagnosis) to establish a prior-morbidity weighting, according to the Charlson index, as a proxy for co-morbidity. This score was calculated separately looking back 1 and 5 years from the patient's most recent admission but the score did not include the most recent admission. (The most recent admission is used to establish one of the twenty six primary diagnosis groupings).

For example, if a patient had a previous main condition of acute myocardial infarction (weight=1) and a further episode coded with diabetes complications as the main condition (weight=2), their prior-morbidity score would be 3. This would hold true if both conditions

occurred within 1 or 5 years of the index admission. Each of the 17 conditions could only be counted once within the screening period (1 or 5 years).

For prior-morbidities in the previous year: 79% of patients had no prior-morbidities, 7% had 1, 12% had 2 and 2% had 3 or more. For prior-morbidities in the previous 5 years: 71% of patients had no prior-morbidities, 11% had 1, 15% had 2 and 3% had 3 or more. These variables were both used as continuous variables to allow the analysis to decide which groups were most associated with mortality.

Palliative Care

Dr Foster included palliative care into their most recent model for England using the specialty of palliative medicine. The specialty / significant facility of palliative medicine recorded on SMR01 would not capture all palliative cases. There was no information on the cancer registry, also linked to SMR01 records, for palliative cancer and although ISD had started collecting hospice data they were very incomplete. Therefore the clinical advisory group recommended that a palliative care adjustment should not be attempted.

Level of Analysis (Patient-Based)

Dr Foster analysed HES data at spell level (stay). The explanatory variables are taken from the first episode in the spell and the outcome is taken from the last episode in the spell. The outcome is in-hospital mortality derived from the hard-coded method of discharge variable.

If a patient was seen in more than one hospital within a spell there is a question about which hospital the mortality is counted against. Dr Foster count the death against the first hospital in the stay if the primary diagnosis at the first hospital is one of the ones of interest. The rationale is that they saw the patient first and therefore probably had more influence over the outcome and it was to some extent their decision or within their control whether to transfer them somewhere else. When they look at post-operative outcomes, however (or if the primary diagnosis at the first hospital is not of interest), and the procedure was done at the second hospital and the patient then died, then the death for that procedure would be counted against the second hospital, not the first (as the first didn’t do the procedure of interest).

SMR01 data are episode based. A patient can have more that one episode within a continuous inpatient stay, where there is a change in consultant or facility for example. A continuous inpatient stay (CIS) is defined as all SMR01 records referring to the same continuous spell of inpatient treatment (whether or not this involves transfer between hospitals or even between NHS Boards). CISs are built up by examining the intervals between successive linked records for a given patient. Thus for each interval a decision is made as to whether the records constitute part of a continuous stay according to defined rules. Apart from the length of the interval between two records, decisions hinge on whether the type of discharge of the first record and type of admission on the second record is a transfer. A patient could have more than one stay within the time period, but as the stays for each person are linked any analysis can be at either patient or stay level. At patient level, only one of the patient’s stays would be selected and included in the analysis. At stay level, every stay would be included in the same way as Dr Foster does. In the two years of activity analysed 62% of patients had 1 stay, 20% had 2 stays, 8% had 3 stays, 4% had 4 stays and 6% had 5 or more stays within the two years.

If the analysis was to be at stay level this would mean that patients and deaths would be double counted. Since Dr Foster used in-hospital mortality as their outcome, and this was sourced from the method of discharge variable, they did not encounter the issue of double counting deaths.

There were concerns from the clinical group on the issue of patients being double counted. From the 38% of patients with more than one stay 21% of these patients would have their death double counted. The clinical group decided that from a statistical view stays should not be considered independent and therefore only one stay should be included. From a clinical view the most recent stay was deemed to be the most appropriate selection. Therefore the analysis would be at patient level indexing on the patient's last stay in the period. This meant only one death could be counted for each patient. Therefore, the outcome variable was calculated for each patient using the admission date of the first episode of the last stay and the date of death. For the explanatory variable the age, sex, deprivation, type of admission, inpatient / day case, admitted from and the primary diagnosis are taken from the first episode of the patient's last stay. If the patient is seen in more than one hospital within a stay the outcome is counted against only the first hospital in the stay.

Decision Trees

Decision trees (sometimes called classification trees) were used to find out which explanatory variables best explain hospital mortality and hence which variables should be used for the case mix adjustment of mortality indicators going forward. Statistical Package for the Social Sciences (SPSS) was used to produce the decision trees.

The decision tree method was used so the final model could be easily presented to users with a non-statistical background. It was felt that the results from traditional statistical methods such as logistic regression would be less easily explained to non-statisticians. ISD had used decision trees previously for the Scottish Hip Fracture project. Logistic regression was however used as part of the validation work to enhance the validity of the model developed from the decision trees.

Traditional statistical prediction methods (for example, regression or discriminant analysis) involve fitting a model to data assumed to follow a specified probability distribution, evaluating fit, and estimating parameters that are later used in a prediction equation. Decision tree models take a different approach. They successively partition a data set based on the relationships between independent variables and a dependent (outcome) variable. When successful, the resulting tree indicates which independent variables are most strongly related to the dependent variable. It also displays subgroups (terminal nodes) that may have concentrations of cases with desired characteristics.

The variables used in the decision tree are:

Outcome:

- Mortality (0=Alive within 30 days, 1=Died within 30 days)

Independent variables:

- Age (Continuous)
- Sex (Binary variable: 1=Male, 2=Female)
- Scottish Index of Multiple Deprivation (Ordered categorical variable: 1 to 5)
- Type of admission (Binary variable: 1=Elective, 2=Emergency / Transfer)
- Inpatient / Day case (Binary variable)
- Admitted from (Nominal categorical variable: 1=Institution, 2=Private residence, 3=Temporary, 4=Transfer from other NHS provider, 5=Transfer from same provider and 6=Other)
- Previous emergency admissions (Continuous)

- Primary diagnosis (Nominal categorical variable)
- Prior-morbidity (Continuous)
- Specialty (Nominal categorical variable)

The CHAID (Chi-squared Automatic Interaction Detection) method was used. This method allows continuous explanatory variables to be used and also allows the explanatory variables to be split into more than two groups if appropriate. The CHAID method examines the relationship between categorical independent variables and a categorical dependent variable.

The explanatory variables initially included in the analysis as continuous variables (age, previous emergency admissions and prior-morbidity scores) were ultimately grouped into categories by the software (then treated as ordered categorical variables). This allowed the categories to be formed based on the patients with the biggest difference in mortality rather than just using standard groups.

CHAID first examines the cross-tabulation tables between each of the independent variables and the outcome and tests for significance using a chi-square independence test. If more than one of these relationships is statistically significant, CHAID will select the independent variable that is most significant (smallest p value). If an independent variable has more than two categories, CHAID compares them and collapses together those categories that show no difference in the outcome. It does this successively joining the pair of categories showing the least significant difference. This category merging process stops when all remaining categories differ at the specified testing level.

There are some criteria options that can be selected before running the decision tree. The number of levels to the tree and the minimum number of cases can be selected. Significance levels for splitting nodes and merging categories can be selected. 5% significance levels were used (this is the default) and the minimum number of cases allowed in each terminal node was set to 100 patients.

Figure A – Decision tree.

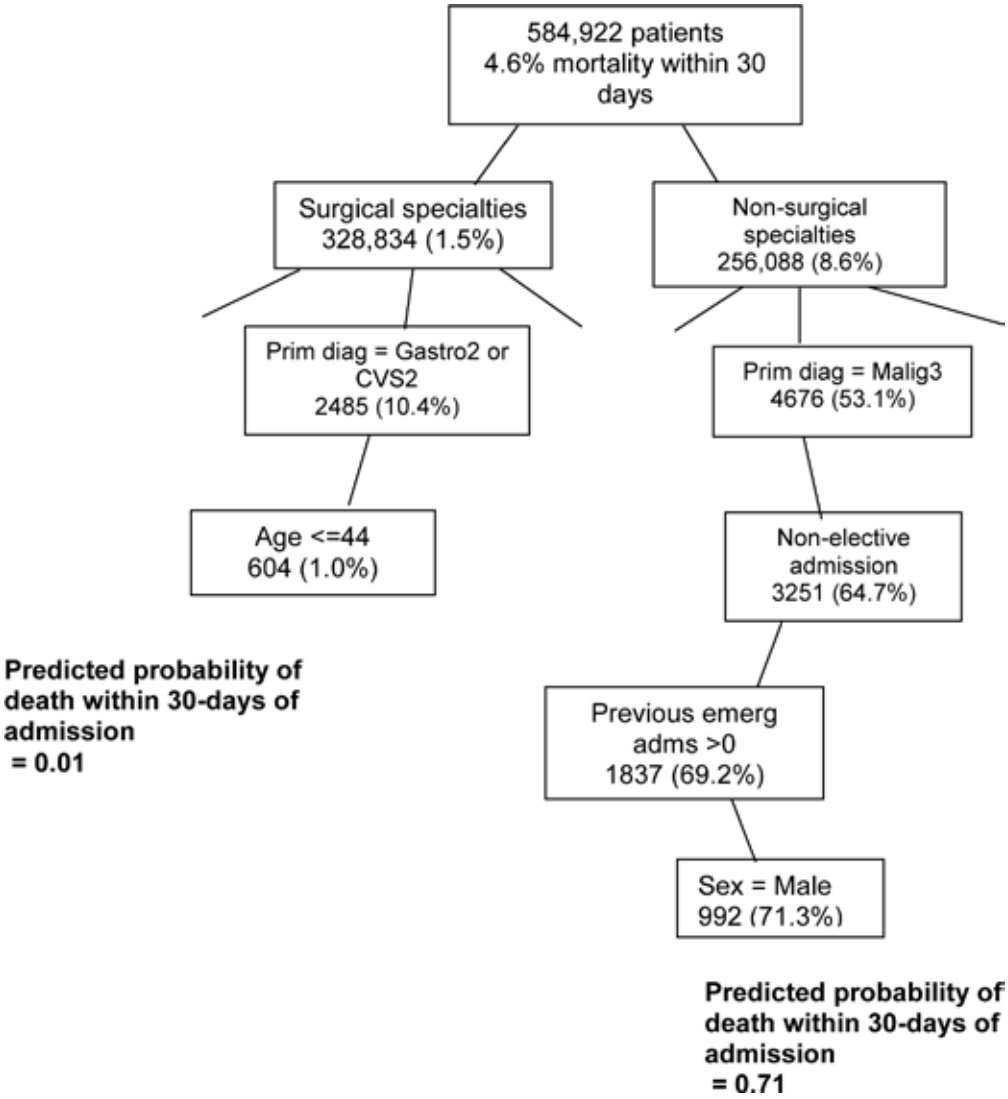

Figure A shows a very small part of the decision tree but demonstrates how the data can be partitioned. The tree is very large so it is not possible to display the whole tree. The analysis started with 584,922 patients – 4.6% of them died within 30 days. The analysis forced the surgical / non-surgical split into the tree. For surgical specialties the most important explanatory variables in explaining the outcome was primary diagnosis. The tree grouped the 26 primary diagnosis categories into 10 groups based on the difference in mortality. For patients with primary diagnosis ‘Gastrointestinal2’ or ‘CVS2’ the next important variable in explaining the outcome was age.

Each pathway on the tree is assigned a predicted probability of death within 30 days of admission. For patients in surgical specialities, with primary diagnosis of ‘Gastrointestinal2’ or ‘CVS2’ and age 44 or less the predicted probability is 0.01.

The probabilities for the nodes that emerge can then be summed to calculate an expected number of deaths and thus allow a Standardised Mortality Ratio to be calculated at hospital, NHS Board and Scotland levels.

Validation

At the outset of the analytical phase, the decision tree software split the entire two years worth of data into two random samples (50% each). One was used to develop the model and the other was used to validate the emerging models.

For any prognostic model there are two aspects of performance to assess, the discrimination and the calibration.

Discrimination

To assess whether the model differentiates between the two outcome groups, alive within 30 days and died within 30 days, Receiver Operating Characteristic (ROC) curves were used. The area under the curve (AUC) statistic was 0.946. (An AUC value of 1.00 represents a perfect discrimination between the two outcome groups and a value of 0.5 represents worthless discrimination.)

Calibration

If the model estimates the risk of death as ‘X’%, to assess if ‘X’% of such individuals actually die the Hosmer-Lemeshow goodness of fit test was used for the model using the first sample. The result of this test was non-significant. A finding of non-significance means the model adequately estimates the risk of dying within 30 days.

Logistic regression was also used to produce a model and the mortality rates were plotted on a funnel chart with the mortality rates from the decision tree. The rates were very similar.

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 2012. Also includes analyses of crude mortality trends over the longer term between Jan-Mar 2003 and Oct-Dec 2012.
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	Tuesday 9th April 2013
Release date	Tuesday 28th May 2013
Frequency	Quarterly
Timeframe of data and timeliness	Quarterly reporting periods from Oct-Dec 2002 to Oct-Dec 2012 (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 2012 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 95% 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 published guidelines.
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 ISD protocol on Statistical Disclosure Protocol is followed.
Official Statistics designation	Official Statistic
UK Statistics Authority Assessment	Assessment report published (ref no. 249).
Last published	Tuesday 26th February 2013
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Date of first publication	June 2010

Help email	richard.dobbie@nhs.net
Date form completed	Wednesday 8th May 2013

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 and, separately, those receiving extended Pre-Release Access.

Standard Pre-Release Access:

Scottish Government Health Department
NHS Board Chief Executives
NHS Board Communication leads

Extended Pre-Release Access

Extended Pre-Release Access of 8 working days is given to a small number of named individuals in the Scottish Government Health Department (Analytical Services Division). This Pre-Release Access is for the sole purpose of enabling that department to gain an understanding of the statistics prior to briefing others in Scottish Government (during the period of standard Pre-Release Access).

Scottish Government Health Department (Analytical Services Division)

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

Early Access for Quality Assurance

These statistics will also have been made available to those who needed access to help quality assure the publication:

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.

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- National Statistics (i.e. assessed by the UK Statistics Authority as complying with the Code of Practice)
- National Statistics (i.e. legacy, still to be assessed by the UK Statistics Authority)
- Official Statistics (i.e. still to be assessed by the UK Statistics Authority)
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