Hospital Standardised Mortality Ratio

January 2021 to December 2021

A National Statistics release for Scotland

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Introduction

This report by Public Health Scotland (PHS) presents Hospital Standardised Mortality Ratios (HSMR) at Scotland, NHS Board and hospital levels for the latest 12 month period. It includes additional information and commentary on patterns of mortality by key demographic factors. There is extensive information on the development of the measure and how it compares to similar information used in other parts of the UK.

The mix of patients seen varies between hospitals, and the mortality rate may be higher or lower at a hospital for many reasons; the patients seen, for example, may be more seriously ill than average. HSMRs therefore take account of some of the factors known to affect the risk of death, so that comparisons between individual hospitals and Scotland are made on a comparable basis.

Quarterly HSMR publications have been released since 2009, with periodic reviews of the methodology. The most recent changes were made in August 2019, ensuring that the methodology continues to be robust and that comparisons which are made against the national average continue to be appropriate and relevant for each point in time. As a result, **HSMRs published from August 2019 onwards cannot be compared to prior releases using a different methodology.**

This release provides HSMRs for the period January 2021 to December 2021, using validated hospital SMR01 returns as at 11 April 2022. This information has previously been released to NHS Boards as management information. Additional information and commentary on patterns of mortality by key demographic factors is included for the period January 2017 to December 2021 so that changes over time can be evaluated. There is also extensive information on the development of the measure and how it compares to similar information used in other parts of the UK.
COVID-19

Since the start of the COVID-19 outbreak, Public Health Scotland (PHS) has been working closely with the Scottish Government and health and care colleagues to support the surveillance and monitoring of COVID-19 amongst the population. There is a large amount of data being regularly published regarding COVID-19 (for example, PHS weekly reports, including wider impacts analysis; Coronavirus in Scotland – Scottish Government and Deaths involving coronavirus in Scotland – National Records of Scotland).

The HSMR methodology has been updated to ensure the diagnosis ICD-10 codes for COVID-19, U07.1 to U07.7, are included in the model. For more information please refer to the HSMR COVID-19 Methodology Update paper.

During the pandemic, hospitals have had to adjust their normal ways of working to react to this healthcare emergency. As a result, there will be changes in the volume of activity in some of the groups used to calculate the HSMRs, for example less elective admissions. Any changes in crude mortality trends and HSMRs should be considered in this context.
Hospital Standardised Mortality Ratios

Hospital Standardised Mortality Ratios adjust death data, also known as mortality data, to take account of some of the factors known to affect the underlying risk of death. The adjusted mortality at individual hospitals can then be compared to the Scottish average. This approach provides a better starting point for investigating hospital mortality than crude mortality rates, which do not provide a fair comparison: the mix of patients admitted to different hospitals likely have a different underlying risk of death. Note that a mix of patients is called a case mix in this report.

We calculate HSMRs using information from acute inpatient and day case patients admitted to all medical and surgical specialties in NHSScotland apart from obstetrics and psychiatry. Our calculation takes account of patients who died within 30 days of hospital admission. This means that HSMR values also include some deaths that occurred outside hospital, and excludes deaths that occurred in hospital more than 30 days after admission.

How are HSMR values calculated?

To calculate HSMR values, we first find the risk of death for particular patient groups across Scotland during a three-year baseline period. These groups were chosen based on factors known to influence the chance of death, and include age, sex, diagnosis, type of admission, and number and severity of illness.

Then, we apply the calculated risk of death to the corresponding patient groups seen in each hospital in a one-year reporting period. A prediction is then made for the number of deaths that would have occurred in each hospital if the Scottish average risk of death for those groups had applied.

We then compare this predicted figure with the actual observed number of deaths that did occur within the hospital to give the standardised ratio:

\[ \text{HSMR} = \frac{\text{Observed Deaths}}{\text{Predicted Deaths}} \]
**How are HSMR values interpreted?**

We calculate HSMR values for a one-year period, and they can be interpreted as follows:

- An HSMR value of exactly 1 means that the number of patients who died within 30 days of admission was equal to the number of predicted deaths. In other words, the risk of death matched the Scottish average risk for the patient groups that were seen. The HSMR value for Scotland is therefore always 1.00.

- If an HSMR value for a hospital is less than 1: the number of deaths within 30 days of admission for this hospital was fewer than predicted.

- If an HSMR value for a hospital is greater than 1: the number of deaths within 30 days of admission for this hospital was more than predicted.

If the number of deaths was more than predicted, it does not necessarily mean that there were avoidable deaths, which should not have happened, or that any were unexpected or were attributable to failings in the quality of care. HSMR values are only a starting point, and Health Improvement Scotland and NHS Boards use them as a guide for areas requiring further investigation.

**Can HSMR values be compared with previous years?**

HSMR quarterly releases from August 2019 onwards are not comparable to earlier releases due to changes in the methodology. These changes were designed to refine the model, and were made in response to a review following the end of the Scottish Patient Safety Programme’s aim of reducing hospital mortality by December 2018. See section on Refinements to HSMR methodology for more information.

HSMRs are also less appropriate than crude mortality rates for examining changes through time. Trends in HSMR are impacted by variations in case mix and coding practices, and do not allow a meaningful comparison between different time periods. They can be used only to compare each hospital to the Scottish average in a single time period.
How is HSMR information used?

Safety is a priority ambition for the Healthcare Quality Strategy for NHSScotland. A lower hospital mortality should reflect work in individual hospitals to review mortality, and reflect reductions in serious adverse events and infections under the Scottish Patient Safety Programme and other improvement initiatives.

Healthcare Improvement Scotland reviews the data, alongside other indicators, with Public Health Scotland to identify potential areas for further exploration. Healthcare Improvement Scotland offer advice/support to NHS Boards, on request, about using hospital mortality data to help learn about and improve the quality of patient care.

The Scottish Government use these statistics to monitor hospital mortality, inform policy decision making, and respond to parliamentary and public business. One example of this was in the commissioning of the NHS Lanarkshire Rapid Review Assessment.

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

In addition, a guide for NHS Boards has been developed ‘Using the Hospital Standardised Mortality Ratio to help improve patient care’. To help local users better understand their data, and to encourage a sense of ownership of the information, an infrastructure has been put in place in partnership between PHS and Healthcare Improvement Scotland, offering:

• sub-group analysis
• audit of specific cases
• our assistance in interpretation of the national statistics and local intelligence
Main points

• For the period January 2021 to December 2021 no hospitals had a significantly higher standardised mortality ratio than the national average.

• For the period January 2021 to December 2021 one hospital had a significantly lower standardised mortality ratio than the national average: Western General Hospital (0.75).

• Unadjusted hospital mortality remained relatively stable at between 2.6% and 3.3% from January 2017 to March 2020. During this period, the relatively small variation shows clear seasonal patterns with increases in mortality during the winter months. Since April 2020 to December 2021, unadjusted hospital mortality has increased reaching 5.4% during the first wave of the Covid-19 pandemic (April - June 2020) and 4.4% during the second wave (October 2020 - March 2021).

• Non-elective admissions consistently account for the largest proportion of deaths within 30-days of admission.

• Patients from the least deprived areas of Scotland consistently have lower levels of crude 30-day mortality than patients from more deprived areas.

• Around three quarters of deaths within 30-days of admission take place in hospital while the remaining deaths take place in the community.

• The next update, reporting on admissions to 31 March 2022, will be published on Tuesday 09 August 2022.
1 HSMR results and commentary

A funnel plot is a type of ‘Statistical Process Control’ chart that helps to show data at a particular point in time. Funnel plots in this report allow comparisons between each hospital and the average for Scotland for a particular period. Please refer to the Funnel Plots appendix for further information on interpretation.

Chart 1 shows the funnel plot for the latest 12-month period. This chart shows that there were no hospitals above the upper control limit, which is three standard deviations above the Scottish average. There was one hospital below the lower control limit, which is three standard deviations below the Scottish average: Western General Hospital (0.75).

**Chart 1: HSMR for deaths within 30-days of admission, January 2021 to December 2021**

The data relating to this chart can be found in Table 1. Provisional
2 Crude mortality trends

This section presents crude mortality rates for deaths within 30 days of admission, which can be used to show trends through time. Since crude mortality rates do not account for differences in case mix, they are less appropriate for comparing individual hospitals to Scotland. This section therefore does not make such comparisons, but does show overall results for Scotland before an examination of some of the factors that affect the underlying risk of death.

Scotland – overall

Chart 2 shows the overall crude hospital mortality percentage at Scotland level. The value was generally around 3%, with seasonal increases over the winter months. However, April to June 2020 saw a substantial increase above the historical average due to the impact of COVID-19. The crude mortality rate did then reduce, but has since remained elevated. Two factors have influenced this increase: deaths from COVID-19, and a reduction in overall patient numbers where those that did attend were the more seriously ill patients.

Chart 2: Overall crude mortality rates (%) for deaths within 30-days of admission, Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 2. Table 2 also provides crude mortality charts for each NHS Board and hospital. p Provisional
Scotland – by type of admission

Chart 3 shows the mortality trend for the two types of admission: elective and non-elective. Non-elective patients consistently account for the largest proportion of deaths.

Chart 3: Crude mortality rates (%) for deaths within 30-days of admission by type of admission, Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 2. Provisional
Scotland – by specialty

Chart 4 shows the mortality trend according to seven distinct specialty groups. We classify specialty group according to the specialty of the consultant/GP/healthcare professional who was in charge of the patient episode. It shows that patients under the Community specialty have the highest rate of crude mortality within 30 days of admission, followed by Medical. Those recorded under Dental, Paediatrics, and Women & Newborn specialties consistently have the lowest rate.

Chart 4: Crude mortality rates (%) for deaths within 30-days of admission by specialty group, Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 2. Provisional
Scotland – by age

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

**Chart 5: Crude mortality rates (%) for deaths within 30-days of admission by age group, Scotland, Jan-Mar 2017 to Oct-Dec 2021**

The data relating to this chart can be found in Table 2. Provisional
Scotland – by sex

Chart 6 shows that mortality rates have consistently been higher for males throughout the time period. The difference between the mortality for males and females has also remained relatively constant.

Chart 6: Crude mortality rates (%) for deaths within 30-days of admission by sex, Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 2.
Scotland – by Scottish Index of Multiple Deprivation

The Scottish Index of Multiple Deprivation classifies small areas in Scotland based on their deprivation level using data on employment, income, health, education, access and crime.

Chart 7 shows that patients from the least deprived areas of Scotland consistently have lower levels of 30-day mortality than patients from more deprived areas.

Chart 7: Crude mortality rates (%) for deaths within 30-days of admission by deprivation, Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 2. Provisional
Scotland – by place of death

Chart 8 shows the proportion of deaths within 30 days of admission by place of death. Around a quarter of these deaths generally occur in the community with the remaining three quarters taking place in hospital.

Chart 8: Proportion of deaths within 30-days of admission by place of death, Scotland, Jan-Mar 2017 to Oct-Dec 2021 p

The data relating to this chart can be found in Table 2. p Provisional
3 Alternative crude mortality measures

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

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

Chart 9: Crude mortality rates (%) for deaths within 30-days of ultimate hospital discharge (includes all in-hospital mortality), Scotland, Jan-Mar 2017 to Oct-Dec 2021

The data relating to this chart can be found in Table 3. Table 3 also provides charts for mortality within 30 days of discharge for each NHS Board. Provisional

For the latest quarter (October to December 2021) there were 7,609 deaths within 30-days of admission to hospital in Scotland, and 8,584 deaths within 30-days of ultimate hospital discharge (including all in-hospital deaths). While the longer time period does mean more deaths are included in the second definition, both trends are
generally similar. Although seasonal variation does exist, crude mortality remained relatively constant until the impact of COVID-19 in 2020. Since peaking at 6.1% in April to June 2020, crude mortality within 30 days of discharge has remained elevated.

**Population-based mortality**

Mortality rates can also be examined by comparing the total number of deaths with the population in a given time period and area. This approach provides an overall picture of the mortality in the population. Crude population mortality rates for Scotland are given in this section using the total number of deaths in each quarter and mid-year population estimates.

Chart 10 shows the trend in overall population mortality for Scotland between January 2017 and December 2021. Values have remained relatively stable over the last five years, with some seasonal variation, before increasing in April to June 2020 due to the impact of the COVID-19 pandemic.

**Chart 10: Population death rates (crude rates per 1,000 people), Scotland, Jan-Mar 2017 to Oct-Dec 2021 p**

The data relating to this chart can be found in Table 3. Table 3 also provides population-based mortality charts for each NHS Board area. p Provisional
Hospital and NHS Board level

HSMR data are provided by PHS to allow an individual hospital to monitor its mortality in comparison to the national average. The process is not designed to compare hospitals or different time periods. Trends in crude mortality are provided to allow individual hospitals to monitor variation over time.

- **NHS Fife**: in order to reflect current service configuration, an HSMR is not reported on separately for Queen Margaret Hospital as this site does not include any acute wards.

- **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. In addition, Queen Elizabeth University Hospital activity includes that of the New Victoria and West Glasgow hospitals. These changes have been applied to all time points retrospectively back to the initial reporting period.

Individual hospital level data for any combined sites are available on request.
Refinements to HSMR methodology

Since the HSMR statistics were first released in 2009, the model methodology has been periodically reviewed to ensure that it continues to be robust and that comparisons against the national average continue to be appropriate and relevant for each point in time.

Any improvements had to be balanced against the overall policy strategy and purpose of the HSMR which, from 2016, was to monitor progress towards the Scottish Patient Safety Programme (SPSP) aim of reducing mortality by a further 10% by end December 2018. The end of this phase of the SPSP provided the opportunity to review the model methodology and subsequently update/refine it. A previous significant review also took place in 2015/16.

The main changes made to the HSMR methodology from August 2019 were:

• Moving to a dynamic three-year baseline period, advanced by three months with each reporting period, ensuring the Scottish HSMR is always representative of current outcomes and reflective of changing case-mix and provision of services.

• Moving to a one-year reporting period – rather than three months – when drawing comparisons against the national average, smoothing out seasonal variation and reducing variation for smaller hospitals.

• Using less aggregated specialty groupings to improve performance of the model and allow more in-depth analysis.

More details of the review work and recommendations are available in the HSMR Review Paper. A Technical Document is also available that describes the current HSMR methodology in more detail. Interpretation Guidance and Frequently Asked Questions documents answer questions on the differences between the previous and current methodologies.
Glossary

**HSMR**
Hospital Standardised Mortality Ratio

**NRS**
National Records for Scotland (formerly General Register Office for Scotland)

**SHMI**
The Summary Hospital-level Mortality Indicator (SHMI) is an indicator which reports on mortality at trust level across the NHS in England. It is produced and published quarterly as an official statistic by the Health and Social Care Information Centre (HSCIC).

**SIMD**
Deprivation for individuals is estimated from aggregate data derived from the census and other routine sources. These are used to estimate the deprivation of small geographical areas. The Scottish Index of Multiple Deprivation (SIMD) has seven domains (income, employment, education, housing, health, crime, and geographical access), which have been combined into an overall index to pick out area concentrations of multiple deprivation.

**SMR**
Scottish Morbidity Record

**SMR(01)**
SMR containing non-obstetric and non-psychiatric inpatient and daycase activity.

**SPSP**
The Scottish Patient Safety Programme (SPSP) is a national programme that aims to improve the safety and reliability of healthcare and reduce harm, whenever care is delivered. The SPSP is led by Healthcare Improvement Scotland.
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Further information

Further Information can be found on the PHS website.
For more information on HSMR see the HSMR section of our website. The code used to produce this publication can be accessed in this GitHub repository.

The next release of this publication, reporting on admissions to 31 March 2022, will be published on Tuesday 09 August 2022.

Data files

The latest NHSScotland data from Jan-Mar 2017 to Oct-Dec 2021 and comparable information by NHS Board of treatment and hospital are given in the Excel files that accompany this publication. Please note the following:

Table 1 – HSMR
Table 1 presents hospital-level HSMR on a funnel plot for each rolling 12 month period, allowing comparisons to be made between each hospital and the average for Scotland for that particular period.

Table 2 – Overall 30-day crude mortality demographics for NHSScotland
The data within Table 2 provides overall crude mortality rates by hospital, and crude mortality demographics for NHSScotland. The following series of tables and charts are presented for the latest five-year period:
• Overall crude mortality rates (%) for deaths within 30 days of admission, including by type of admission, age group, specialty group, sex and deprivation.

• Proportion of deaths (%) within 30-days of admission by place of death

Table 3 – Crude mortality from discharge, and population based mortality rates
The data within Table 3 contains a ‘drop-down’ selection option for NHSScotland and any of the NHS Boards. The following series of tables and charts are presented:

• Crude mortality rates (%) within 30-days of ultimate hospital discharge (including all in-hospital deaths)

• Crude population mortality rates per 1,000 people.

These results have also been published in an interactive dashboard format. A link to the latest dashboard is available on the HSMR webpage.

Open data

Data from this publication is available to download from the Scottish Health and Social Care Open Data Portal.

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Appendices

Appendix 1 – Background information

Methods used to calculate the HSMR

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

The HSMR is calculated as: \( \text{HSMR} = \frac{\text{Observed Deaths}}{\text{Predicted Deaths}} \)

To calculate the predicted deaths, a predicted probability of death within 30 days from admission was calculated for each patient based on the patient's primary diagnosis; specialty group; age; sex; where the patient was admitted from; the number and severity of prior morbidities in the previous (i) 12 months (ii) 5-years; the number and severity of co-morbidities on the admitting episode; the number of emergency admissions in the previous 12 months; whether admitted as an inpatient or day case; type of admission (elective / non-elective); and deprivation quintile. To calculate the HSMR the predicted probabilities are calculated using data from the latest rolling three year base period (this is advanced by three months with each reporting period). These probabilities are then applied to the data for the final 12 month period of the base period. The predicted probabilities are summed to hospital level in order to produce the predicted number of deaths. See HSMR Technical Document for more detailed information on the methodology.

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

**Funnel plots**

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

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

There are three lines in the funnel plots in this report.
The first line in dark blue is the average for Scotland. Plotted on either side of the average are two sets of curved lines called control limits (red). The red control limits are plotted at three standard deviations from the average. Orange warning limits have also been plotted on the charts presented here, at two standard deviations from the average. In the example below data points presented as circles represent hospitals. The limits are wider at the left hand side of the graph because the data points plotted here represent smaller hospitals which are made up of fewer observations and subject to greater variability. This means that smaller hospitals will appear towards the left hand side of the graph and larger hospitals towards the right.

**Overdispersion**

An overdispersion factor has been applied to the funnel plot limits to reduce the effect of possibly false outliers. This is discussed in more detail in the Scottish HSMR Technical Document.

**How to interpret a funnel plot**

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

**Inter-UK comparisons: England and Wales**

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

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

For England and Wales there is an emphasis on comparisons made between a trust’s HSMR and the national average. This is also similar to the current Scottish approach, although trends in unadjusted mortality still form a significant part of our publication report and commentary.

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

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

Like the HSMR in Scotland, the SHMI is updated and published quarterly and is based on a statistical model developed from the national hospital dataset (equivalent to the SMR01 in Scotland), which calculates for each hospital how many deaths would be expected to occur if they were like the national average at that point in time. The model takes into account a number of factors such as differences in age, sex, diagnosis, type of admission and other diseases (co-morbidity). This figure is then compared with the number of deaths that did occur in the hospital and the SHMI is the ratio between the two. SHMI acknowledges that there are unaccounted for factors affecting mortality in hospitals and recognition that there is random variation in the number of deaths as we do in Scotland. Chart 8 showed the crude mortality in Scotland over time according to the same definition as SHMI.

In England the SHMI model is re-calibrated every quarter so comparisons that are made against the average are appropriate and relevant for each point in time. As of August 2019, Scotland moved to a similar approach of re-calibrating every quarter using a rolling three year base period.
However, the two approaches still differ significantly and therefore, no direct comparison can be made between HSMRs for England and Scotland.

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

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

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

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

In Scotland, we also calibrate our model each quarter and, 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 unadjusted mortality trends backed-up by Statistical Process Control (control chart) methodologies. See section on Quarterly process for more information.

As there remains a subjective element to the assessment of when a communication should be triggered, work in Scotland is focused on developing a whole-system suite of indicators that includes HSMR underpinned by a set of statistical /subjective rules and formal multi-agency governance arrangements involving PHS, 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 focused only on deaths within 30-days of admission (but includes deaths in the community). It differs therefore from both SHMI and Dr Fosters HSMR in that respect alone. Also the adjustment factored into the different models varies, although they are very similar in many respects.

The table below shows a summary of some of the key comparisons between the English and Scottish approaches.

### Key comparisons between the favoured methods for hospital mortality indicators in Scotland and England.

<table>
<thead>
<tr>
<th>Patients</th>
<th>Scotland (HSMR)</th>
<th>England and Wales Summary Hospital-level Mortality Indicator (SHMI)</th>
<th>England and Wales Dr Foster (HSMR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One patient observation per spell attributed to the last acute trust prior to death.</td>
<td>One patient observation per spell attributed to the last acute trust prior to death.</td>
<td>One patient observation per spell attributed to each acute trust involved in care. Only patients with a diagnosis that falls within 56 diagnosis groups are included (~80% of all activity)</td>
</tr>
<tr>
<td>Deaths</td>
<td>Deaths within 30 days of admission to an acute hospital (wherever they occur); In-hospital deaths occurring beyond 30-days are excluded.</td>
<td>All deaths occurring in hospital; and deaths within 30 days of discharge from acute hospital (wherever they occur)</td>
<td>All inpatient and day case deaths in hospital</td>
</tr>
<tr>
<td>Scotland (HSMR)</td>
<td>England and Wales Summary Hospital-level Mortality Indicator (SHMI)</td>
<td>England and Wales Dr Foster (HSMR)</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Adjustments</strong></td>
<td>CCS group (primary diagnosis) / Specialty (medical or surgical) / age / sex / admitted from / number and severity of prior morbidities in the previous (i) 12 months (ii) 5-years / number and severity of co-morbidities on admitting episode / number of emergency admissions in the previous 12 months / inpatient or day case / type of admission (elective / non-elective) / deprivation</td>
<td>Age/ sex/ admission type/ CCS group (diagnosis) / comorbidity (modified Charlson score) / deprivation / previous emergency admissions / palliative care (specialty code 315; ICD10 code Z515/source of admission)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2 – Quarterly process

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

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

**Stage One: HSMR Management Information Tool**

The HSMR Management Information Tool is produced and shared with the NHS Boards first. This allows NHS Boards the opportunity to gain a greater understanding of some of the implications of the fairly complex adjustments that were applied in the model and to reconcile this with their own local data and intelligence.

**Stage Two: Official Statistics publication of HSMR for Scotland**

The first Official Statistics release of the information was a set of abbreviated summary tables in June 2010. The publication has since been expanded to include more substantial commentary and context, including stratified patterns of mortality at Scotland level and longer-term trends.

**Stage Three: Hospital Intelligence Dashboard**

The Hospital Intelligence Dashboard is a management information product commissioned by the Scottish Government. The dashboard incorporates HSMR with a series of other indicators: readmissions, length of stay, hospital acquired infection rates, A&E waiting times and patient experience. A major benefit of this dashboard is that it allows an overview of patient care so that governance processes can be based on more information than HSMR alone.

Throughout the quarterly cycle, interaction with NHS Boards is of paramount importance. There has been dialogue with the majority of NHS Boards since HSMRs were first released. This has been through a number of routes, including SPSP learning sessions, and the QI Hub.
A summary of the processes and key dates for the latest quarterly cycle is in the table below.

<table>
<thead>
<tr>
<th>Month</th>
<th>Process and Key Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>Source database refreshed (11 April 2022); Analytical work begins, involving extraction of patient observations with outcome, mapping of predictions from baseline model, calculation of observed &amp; predicted deaths at Hospital-level calculated by aggregating outcomes and predictions, import to reporting template, internal QA and data scrutiny (data completeness); Management Information Tool made available to NHS Boards (29 April 2022)</td>
</tr>
<tr>
<td>May</td>
<td>Official statistics report production cycle commences; Scottish Government and NHS Boards receive standard pre-release access (03 May 2022); PHS briefs Scottish Government on content of report (04 May 2022); Report published on PHS website at 09:30 on Tuesday 10 May 2022.</td>
</tr>
<tr>
<td>June</td>
<td>Hospital Intelligence Dashboard released to Scottish Government’s Directorate for Health Performance and Delivery; Scottish Government and HIS briefed by PHS on analytical data issues and interpretation of the dashboard; dashboard presented to Scottish Government Health &amp; Social Care Management Meeting.</td>
</tr>
</tbody>
</table>
Appendix 3 – Data quality and timeliness

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

Source data

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

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

Data quality assurance

In August 2016, PHS published the findings of their most recent quality assurance assessment which was undertaken during 2014-15 to ensure that SMR01 (General / Acute Inpatient and Day Case) data items are being recorded consistently and to a high standard throughout NHS Scotland. The report shows that:

• main condition (used as a fundamental part of the HSMR calculation) is being recorded with an accuracy rate of 89%;

• however, not all of the hospitals participating in the SPSP were included in the sample, and the sample included hospitals not participating in the SPSP;
Recommendations include an improved and increased recording of conditions identified as acute or background conditions affecting the management of the patient.

Timeliness

The majority of hospital admission data will be complete for the latest quarter, however it should still be considered provisional on the basis that the source data are dynamic and additional hospital returns will come in and be reflected in future calculations of the HSMR for that quarter. Death registrations from NRS are linked to hospital admissions in Scotland on a monthly basis. This has enabled admissions up to December 2021 to be included in this release.

PHS continues to work with health boards on national outputs to ensure they meet national definitional and processing requirements.

All hospitals have HSMRs calculated for the most recent quarters based on their current levels of data completeness. All NHS Board HSMRs are based on completeness levels of 95% and above for October to December 2021 with the exception of Shetland (69%). PHS are aware of a delayed backlog of cases from Galloway Community Hospital in the previous reporting period.

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

More information about SMR completeness is available on our website.

Refreshing previously provisional data

The previous report, published on February 2022, presented provisional data up to July to September 2021 along with data completeness estimates for those hospitals undergoing PMS implementation. The data for that period has now been refreshed to reflect additional returns that have subsequently been submitted for that time period. The impact of those further submissions suggests that previous completeness estimation was appropriate, and at Scotland level the data were approximately 99% complete.
Appendix 4 – Publication metadata

Publication title

Hospital Standardised Mortality Ratios

Description

Release of HSMR at Scotland, NHS Board and Hospital levels for the period January 2021 to December 2021. Also includes analyses of crude mortality trends over the longer term from January to March 2017 to October to December 2021.

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

11 April 2022

Release date

10 May 2022

Frequency

Quarterly
Timeframe of data and timeliness

Hospital Standardised Mortality Ratios (HSMR) for the latest 12 month period January 2021 to December 2021. Quarterly crude mortality trends from January to March 2017 to October to December 2021 (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 crude mortality data to reflect additional source data that has been received since last publication.

Revisions relevant to this publication

This release of HSMR uses an updated methodology; it is not comparable to previous releases using the old methodology.

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 PHS.

Completeness

Approximately 98% 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 PHS to make its websites 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 the text, comprehensive notes on background and methodology.

Value type and unit of measurement

Ratio of observed over predicted deaths (HSMR); crude mortality (expressed as percentage of patients that die within 30-days of admission)

Disclosure

The PHS protocol on statistical disclosure is followed.

Official Statistics designation

National Statistic

UK Statistics Authority Assessment


Last published

08 February 2022

Next published

09 August 2022

Date of first publication

June 2010
Help email

phs.QualityIndicators@phs.scot

Date form completed

22 April 2022
Appendix 5 – Early access details

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

Standard pre-release access:
Scottish Government Health Department
NHS Board Chief Executives
NHS Board Communication leads

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

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

**Early access for quality assurance**

These statistics will also have been made available to those who needed access to help quality assure the publication.
Appendix 6 – PHS and Official Statistics

About Public Health Scotland (PHS)
PHS is a knowledge-based and intelligence driven organisation with a critical reliance on data and information to enable it to be an independent voice for the public’s health, leading collaboratively and effectively across the Scottish public health system, accountable at local and national levels, and providing leadership and focus for achieving better health and wellbeing outcomes for the population. Our statistics comply with the Code of Practice for Statistics in terms of trustworthiness, high quality and public value. This also means that we keep data secure at all stages, through collection, processing, analysis and output production, and adhere to the ‘five safes’.