The Hospital Standardised Mortality Ratio in Scotland:

Recommendations from a Short Life Working Group

June 2014
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1. Introduction

This paper sets out recommendations on the Hospital Standardised Mortality Ratio (HSMR) in Scotland. These recommendations were produced by a Short Life Working Group (SLWG) which was commissioned and led by Healthcare Improvement Scotland, with involvement of Scottish Government, Public Health & Intelligence, and a number of NHS boards. These organisations are committed to improving the quality and safety of patient care in Scotland, and recognise the important role of measurement in driving such improvement.

The primary target audience for this paper is comprised of staff from these organisations with an interest in the measurement of the quality and safety of healthcare. The recommendations can, in addition, be expected to be of interest to other organisations/individuals, and are therefore in the public domain. After stating the recommendations, the paper provides a brief description of work that has been carried out in Scotland to date on HSMR, and there is also a summary of some key messages in this field from the international literature. Additional rationale supporting each recommendation is then provided.

Most deaths following admission to hospital are inevitable, because of the patients’ conditions when they are admitted. However, some deaths can be prevented by improving care and treatment or by reducing healthcare related harm. Death is a ‘hard’ outcome which is recorded accurately, and hospital mortality statistics have been used for more than one hundred years as a helpful lens through which to view systems of care. It is therefore important that the health service makes good use of hospital mortality statistics (alongside data on other aspects of healthcare) to help get a better understanding of how patient care is delivered. Used wisely, such data can help to identify aspects of care that can be improved, to make care better for patients and their families.

The HSMR is one such measure (or metric). Many countries are now using the HSMR (or an equivalent) as a tool to help monitor hospital mortality and identify opportunities for improving patient care, and HSMR has been used in Scotland for a number of years to stimulate improvements in clinical care. Nonetheless, the way that the HSMR is produced, presented and used is not straightforward. If not understood properly, or if used inappropriately, the HSMR could even be counterproductive - for example if used to make unfair snapshot judgements about the quality of care. The reason that the SLWG was established was the widespread recognition that, despite the significant progress made in Scotland to date in the use of mortality statistics, there are further opportunities to improve various aspects of the approach regarding the HSMR.

When considering summary hospital mortality data in his review of hospital trusts in England, Sir Bruce Keogh\(^1\) highlighted the following three specific problems that require action:
• The complexity of the data and the difficulties this presents for professionals, patients and the public who want to understand and use it;
• The shortage of key skills in data analysis and interpretation available to trusts, boards and management teams; and
• Consistency of metrics and information to be used to monitor quality on an ongoing basis.

These issues are reflected in the recommendations in this paper, which are presented under the following four headings:

A. Suite of metrics on quality and safety
B. Use and presentation of HSMR
C. Operational improvement support
D. Statistical model used to produce HSMR

Although numbered, the recommendations are not listed in any order of importance or operational value. Each recommendation specifies a suggested timescale and identifies the organisation(s) responsible for its delivery. The first recommendation focuses on the fundamentally important issue of ensuring that summary hospital mortality data (such as HSMR) are not considered in isolation – but instead are viewed in the context of a broader suite of metrics about quality and safety. While the subsequent recommendations focus specifically on HSMR, it is expected that many of these will be of direct relevance to the ways in which other measures of quality and safety are produced, presented, and used.

That is, the overall approach recommended consists of:

1. Ensuring data on hospital mortality are used as part of a wider suite of metrics on the quality and safety of clinical care, with less emphasis placed on HSMR in isolation.
2. In parallel with this, improving aspects of the methodology regarding HSMR in the short and medium term – in order to maximise the utility of HSMR until a broader suite of metrics is in place, and also to contribute to preparations for how such a suite of metrics will be presented and used.

Considerable progress has been made in recent years, both in Scotland and internationally, on measuring the quality and safety of healthcare. The SLWG based its recommendations on the published literature, experience of using the HSMR in Scotland, and the expert opinion of members of the group. Taken together, the recommendations reflect an evolution of the approach taken in Scotland to date, rather than a more dramatic change in approach. In preparing its recommendations, the SLWG focused on if and how summary hospital mortality statistics (such as HSMR) can contribute to making care better for patients.
2. Summary of recommendations

A. Suite of metrics on quality and safety

1. A suite of metrics on quality and safety (including data on hospital mortality) should be defined for use by NHS boards locally and at national level. Healthcare Improvement Scotland should lead a ‘90-day process’ to define a suite of metrics, seeking input from others including NHS boards, Public Health & Intelligence, and Scottish Government. Organisation responsible: Healthcare Improvement Scotland. Timescale: by September 2014.

B. Use and presentation of HSMR

2. HSMR should continue to be used in Scotland as an indicator (or flag), to highlight areas where further consideration may be required to understand and improve systems of care. HSMR should not be used as a sole basis to make judgements (positive or negative) about the quality or safety of patient care, as it is not a direct or absolute measure of quality or safety. Organisations responsible: NHS boards, Scottish Government, Healthcare Improvement Scotland, Public Health & Intelligence. Timescale: from July 2014.

3. Official HSMR statistics should continue to be published in ways that allow variation in the data over time to be monitored, and also enable comparison of the variation in these data between each hospital and the Scottish average. Organisation responsible: Public Health & Intelligence. Timescale: from August 2014.

4. HSMR data should also be presented in additional ways, to further support NHS boards to understand and improve systems of care. The utility of these presentations should be assessed in conjunction with NHS boards (see recommendation 6c). This includes (not exclusively):

4a. presenting time-series HSMR data monthly (rather than quarterly)

4b. presenting time-series HSMR data using Statistical Process Control charts (for example I chart, X-bar chart), run charts, and CUSUM charts

4c. presenting time-series unadjusted (crude) mortality data using Statistical Process Control charts (for example P chart), run charts, and CUSUM charts

4d. adjusting time-series HSMR data to take account of any seasonal variation, and

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* The ways in which such a suite of metrics would complement the Scottish Government’s hospital scorecard are described in section 5.
4e. presenting comparative HSMR data (using a funnel plot) covering periods of 6 and 12 months (rather than quarterly). **Organisations responsible:** Public Health & Intelligence, Healthcare Improvement Scotland. **Timescale:** from August 2014.

5. Any charts (for example, time series data, comparisons of data for individual hospitals with the Scottish average) that are used as a basis for initiating a dialogue with an NHS board about a high and/or increasing HSMR should be placed in the public domain. **Organisations responsible:** Public Health & Intelligence and Healthcare Improvement Scotland. **Timescale:** from August 2014.

C. Operational improvement support

6. To improve the understanding and use of HSMR:

6a. the HSMR Guide for NHS boards\(^2\) (originally produced in 2011) should be updated. **Organisation responsible:** Healthcare Improvement Scotland. **Timescale:** July 2014

6b. the updated guide should be actively promoted with non-executive board members, managerial staff, and clinical staff – as part of a programme to provide training and support opportunities for NHS boards. **Organisation responsible:** Healthcare Improvement Scotland. **Timescale:** from September 2014, and

6c. feedback should be sought from NHS boards on the ongoing use of the various methods used to present HSMR to determine what charts should be regularly produced. **Organisations responsible:** Public Health & Intelligence, Healthcare Improvement Scotland. **Timescale:** September 2014.

7. A standardised approach for reviewing and learning from hospital-related deaths should be designed. **Organisations responsible:** Public Health & Intelligence, Healthcare Improvement Scotland and Scottish Government. **Timescale:** October 2014.

8. A dialogue should continue to be held with any NHS board where one of its hospitals is identified as having a relatively high and/or increasing HSMR. **Organisation responsible:** Healthcare Improvement Scotland. **Timescale:** from July 2014.

9. The Standard Operating Procedure for having this dialogue with NHS boards should evolve and be updated. **Organisation responsible:** Healthcare Improvement Scotland. **Timescale:** by July 2014.
10. An approach for producing more immediate mortality alerts to NHS boards for some specific diagnostic groups or procedures should be tested. **Organisations responsible: Healthcare Improvement Scotland and Public Health & Intelligence. Timescale: by December 2014.**

**D. Statistical model used to produce HSMR**

11. The statistical model used to produce the HSMR should be critically reviewed and refined. **Organisation responsible: Public Health & Intelligence. Timescale: to be completed so updated model is used on data for the period January 2016 onwards** (to coincide with the end of the present phase of the acute adult Scottish Patient Safety Programme, for which the current model will be used on data covering the period up until December 2015).

12. As part of the review of the statistical model, a learning event should be held involving others working in this field (including from outside Scotland), in order to contribute to and learn from the experience internationally. This should consider available models and how they are best used. **Organisations responsible: Public Health & Intelligence and Healthcare Improvement Scotland. Timescale: May 2015.**

13. Also as part of this review and development work, the source information used to calculate the Scottish HSMR should be processed using an independent statistical model in order to compare results. **Organisation responsible: Public Health & Intelligence. Timescale: by May 2015.**

14. Research should be commissioned to help understand:

14a. the observed differences in HSMR between different categories of hospital (small general, large district general, large teaching)

14b. what factors are underlying the decrease in HSMR at a Scotland level, and

14c. what is causing the variable changes in predicted mortality in different hospitals and what implications there may be for ensuring data consistency.

**Organisations responsible: Public Health & Intelligence and Healthcare Improvement Scotland. Timescale: by December 2014.**
3. Background

The majority of deaths that occur in hospital are inevitable because of the patients’ conditions on admission. However, some deaths can be prevented by improving care and treatment or by reducing healthcare related harm. A high-level aim of the Scottish Patient Safety Programme, established in 2008, was to reduce hospital mortality by 15% by December 2012. This aim was subsequently extended to a 20% reduction by December 2015. In order to monitor progress in relation to this aim, the Information Services Division (now called Public Health & Intelligence) was asked to develop the HSMR for Scottish hospitals. Since December 2009, Public Health & Intelligence has published, quarterly, HSMRs for all acute hospitals participating in the Scottish Patient Safety Programme. The Scottish HSMR uses the routine linkage of data obtained from hospital discharge summaries to death registrations, the latter held by the National Records of Scotland (www.nrscotland.gov.uk/). The HSMR is a measurement tool where crude mortality data are adjusted to take account of some of the factors known to affect the underlying risk of death. The HSMR is calculated as the ratio of the actual number of deaths within 30 days of admission to hospital (irrespective of place of death) to the predicted number of deaths:

\[ \text{HSMR} = \frac{\text{observed deaths}}{\text{predicted deaths}}. \]

Healthcare Improvement Scotland and Public Health & Intelligence systematically review the latest HSMR figures each quarter. While the HSMR was designed primarily to be used to monitor progress in reducing hospital mortality in relation to the aim of the Scottish Patient Safety Programme, Healthcare Improvement Scotland also conducts a dialogue with an NHS board if one of its hospitals is identified as having a markedly high HSMR (ie greater than three standard deviations above the Scottish average for a specific quarter). The purpose of this dialogue is to ensure that the NHS board in question is aware of these data, and to seek confirmation that the data are being taken seriously and, where necessary, are being acted upon. Specifically, does the NHS board understand what factor(s) are causing the variation in the data (eg potentially relating to how the source information is captured, characteristics of the patients being cared for at the hospital, or the quality of clinical care)? Latterly, this engagement process includes the provision of additional data or analyses to support further investigation locally, and also the offer of advice in using the HSMR (eg, via a supportive site visit or teleconference). In 2011, Healthcare Improvement Scotland produced a guide for NHS boards on using the HSMR.

More recently, and at the request of the Scottish Government, Healthcare Improvement Scotland led a rapid review of the quality and safety of acute care in one NHS board. This review was prompted by a persistently high HSMR in one hospital, and noteworthy HSMRs in two others.
Other countries have also developed HSMRs and equivalent metrics. For example, in England there is:

1. an HSMR developed by Dr Foster (which shares the same principles and acronym with the Scottish measure, but uses slightly different data and a different statistical model)
2. a Summary Hospital-Level Mortality Indicator (produced by the Health and Social Care Information Centre), and
3. a Risk Adjusted Mortality Index (produced by CHKS, part of the Capita Group).

In addition, in England the Care Quality Commission runs a mortality outliers programme, in which it has a dialogue with hospital trusts identified as having relatively high mortality. Furthermore, in 2013, Professor Sir Bruce Keogh (NHS Medical Director for England) led a review of the quality of care and treatment provided by 14 hospital trusts that were persistent outliers on mortality indicators.

Since the Scottish HSMR was first published in 2009, a considerable body of experience in this field has been gained internationally, augmenting the practical experience garnered in Scotland during this time. There was widespread recognition that, despite the significant progress made in Scotland to date in the use of mortality statistics, there are opportunities to improve various aspects of the approach regarding the HSMR. For this reason a short life working group (SLWG), commissioned and led by Healthcare Improvement Scotland, was established in 2013 to advise on future work in Scotland in relation to the HSMR (the membership is included on page 22). This paper presents the group’s recommendations.

The SLWG based its recommendations on the published literature (particularly research since Scotland developed its own HSMR), experience of using the HSMR in Scotland during this time (including the rapid review referred to above), and the expert opinion of members of the group. In preparing its recommendations, the working group focused on if and how summary hospital mortality statistics such as HSMR can add public value, and contribute to making care better for patients.
4. International literature

HSMR (and equivalent metrics) remains a controversial measure. Some have argued that it should be abandoned altogether\(^9,10\). Others, including developers of the statistical models, reject this view and highlight the value of HSMR, but are careful to note its limitations\(^11,12\). There is now a clear consensus internationally, which the SLWG endorses, that the HSMR in itself is not an absolute and direct measure of the quality or safety of care\(^13-16\). Indeed, The Health Foundation’s recent report, The Measurement and Monitoring of Safety, states that ‘A single measure of safety is a fantasy’, and the SLWG recognises that hospital mortality data do have an important role to play as an indicator, and should be used in this capacity as part of a wider suite of measures.

The HSMR is calculated by dividing the actual number of deaths observed by the number of deaths predicted by a statistical model. Changes to either the number of observed or predicted deaths will therefore influence the overall HSMR. Increases in predicted mortality (which would reduce HSMR) have sometimes been attributed to improved accuracy of data or information recording\(^17\), and there have even been accusations of deliberate gaming of data\(^18\).

In addition, while the statistical models used to produce HSMRs are designed to take account of the characteristics of patients admitted to different hospitals (known as case-mix), their ability to do so is inevitably limited. For this reason, some approaches have excluded from analyses specialist hospitals, very small hospitals, or hospitals with known poor data quality\(^19\).

There is evidence from Massachusetts\(^14\) and England\(^1,4\) that a hospital’s status on a mortality indicator may be affected by the choice of metric or statistical model used. For example, the two different mortality measures used to identify which hospital trusts to focus on for the Keogh review generated two different lists of trusts, as a result of the differing statistical methodology. A single model is used to produce HSMRs for Scottish hospitals, and it cannot be ruled out that a different statistical model would give different results, and result in different actions.

In addition, what appear to be relatively small changes in the source data can affect the HSMR sufficiently to move a hospital from being within the normal range to being a statistical outlier\(^3,13\).

The use of hospital-wide mortality data as an indicator has certain inevitable limitations. By definition, hospital-wide mortality data may conceal important variations in mortality within a hospital\(^16\). When considering hospital-wide data, high mortality in one area (such as cardiology) may be masked by low mortality in another (such as orthopaedics). Case note review suggests that around 7% of deaths in hospital are potentially avoidable\(^20,21\), and these occur mainly in those with limited life expectancy. Mortality measured at hospital level may therefore be neither specific nor sensitive for drawing attention to quality of care issues. In addition, while mortality is clearly a key outcome that needs to be monitored, it is only one of a number of
important clinical outcomes – and indeed it is a direct outcome for only a relatively small percentage of all admissions.

Given this brief summary of some key findings from the literature, what are the implications for a continued role for HSMR in monitoring and improving the quality and safety of care in Scotland? The key to this is to understand both the strengths and limitations of HSMR, and to avoid over interpretation of the data. As Professor Sir Bruce Keogh stated, ‘However tempting it may be, it is clinically meaningless and academically reckless, to use such statistical measures to quantify actual numbers of avoidable deaths’. There is a risk that the apparent precision of such mortality metrics (for example calculated to two decimal places) leads to the conclusion that this is an accurate and absolute measurement of clinical care, and that variation (between hospitals, or over time) necessarily reflect something that is statistically or clinically significant when this will not always be the case.

There are significant challenges with how indicators, including summary hospital mortality statistics, are presented, interpreted, and used – in addition to how they are calculated in the first place.

Particular attention needs to be paid to the use of HSMR as an aim of improvement programmes, and caution should be exercised in attributing changes in HSMR to improvements in care generally or to specific interventions. Most hospitals have scope to improve the recording and coding of the source information that is used to produce the HSMR. This is desirable for its own sake and indeed improving the completeness and accuracy of hospital discharge summaries will enhance communication about a person’s condition and care between hospital-based staff and their colleagues based in the community.

It is certainly possible that improving the completeness and accuracy of the source information will increase predicted mortality, and in doing so reduce HSMR – without there being improved quality of care. Following from this, there is a risk of ‘the point with targets is you get what you ask for, not what you want’. This risk is less likely if a range of measures are used.

In summary, while all statistical models are necessarily incomplete, some may be useful – and the key issue is how HSMR is used. It is unwise to ignore HSMR, and also unwise to place too much emphasis on the metric in isolation – given it is not a direct and absolute measure of quality or safety. Mortality statistics, such as HSMR, are best used as part of a wider suite of measures. HSMR should be used as an indicator or flag that draws attention to areas where further consideration is required – rather than to form a judgement. This is reflected in the following recommendations, which aim to put HSMR in a wider context, while also addressing some issues that relate to such metrics more broadly and to the Scottish HSMR specifically. The view of the working group is that, while it is important to better understand the Scottish HSMR, the ultimate aim of work in this area is not the design of a perfect statistical model. Instead, the aim is to improve how such mortality data are used alongside other metrics to drive improvements in patient safety and care.
5. Rationale for recommendations

A. Suite of metrics on quality and safety

1. A suite of metrics on quality and safety (including data on hospital mortality) should be defined for use by NHS boards locally and at national level. Healthcare Improvement Scotland should lead a ‘90-day process’ to define a suite of metrics, seeking input from others including NHS boards, Public Health & Intelligence, and Scottish Government. **Organisation responsible: Healthcare Improvement Scotland.** **Timescale: by September 2014.**

The SLWG considers that summary hospital-level mortality statistics (such as HSMR) have an important role to play in monitoring and improving the quality of healthcare, yet it is concerned about the emphasis currently placed on HSMR in relative isolation. As stated by The Health Foundation in its 2013 report, The Measurement and Monitoring of Safety, ‘A single measure of safety is a fantasy’ – and attempting to use a single measure to capture the quality and safety of care is misguided. Potential unintended consequences of such an approach include undermining public confidence and staff morale by causing unnecessary alarm and, on the other hand, jeopardising the safety of care by providing false reassurance. While the SLWG recognises that it is important to continue to consider HSMR data for Scottish hospitals, its view is that the current position needs to evolve rapidly into an approach whereby data on hospital mortality are considered and used as part of a wider suite of metrics and intelligence (eg also including data on patient experience, staffing levels, clinical effectiveness). The SLWG acknowledges that Public Health & Intelligence already produces a hospital scorecard for the Scottish Government, and the suite of metrics the SLWG recommends is defined should complement (rather than replace) this scorecard. Specifically, the proposed suite of metrics will cover hospital- and community-based services (the scorecard only includes data about hospitals). Also, unlike the scorecard, this suite of metrics will not be constrained by what data are currently available at national level. Once a suite of metrics on quality and safety has been defined, further work will be required to produce the data in practice, and also to determine how these data will be presented for and used by different organisations.

Healthcare Improvement Scotland has a range of methods for rapid evidence and practice reviews, and will undertake a ‘90-day process’ based on the Institute for Healthcare Improvement (IHI) 90-day process ([www.ihi.org/about/Documents/IHI%20Innovation%20Summary.pdf](http://www.ihi.org/about/Documents/IHI%20Innovation%20Summary.pdf)). This in turn was based on Proctor & Gamble’s Innovation Method, designed to provide a reliable and efficient way to research innovative ideas, assess their potential for advancing quality improvement, and bring them to action.
B. Use and presentation of HSMR

2. HSMR should continue to be used in Scotland as an indicator (or flag), to highlight areas where further consideration may be required to understand and improve systems of care. HSMR should not be used as a sole basis to make judgements (positive or negative) about the quality or safety of patient care, as it is not a direct or absolute measure of quality or safety. Organisations responsible: NHS boards, Scottish Government, Healthcare Improvement Scotland, Public Health & Intelligence. Timescale: from July 2014.

HSMR is of potential interest to a number of parties, including NHS boards, Scottish Government, Healthcare Improvement Scotland, Public Health & Intelligence, the general public, and the media. It is important that there is a good shared understanding among those interested in HSMR about what the metric can and cannot be used for. In particular, it should be acknowledged that HSMR should not be used as a sole basis for drawing conclusions that the quality or safety of care in a particular hospital is poor, or indeed, good. For example, no definitive assurance that the quality of care is satisfactory can be drawn from an HSMR value that is within or below the expected range. There is a historical pattern that some hospitals, and some types of hospitals, have lower HSMR values for reasons which are not yet known. The rapid review in one NHS board, carried out in 2013\(^3\), found that concerns about quality and safety were not confined to the hospital with a persistently high HSMR. As Shahian (2010)\(^{14}\) and Jha (2005)\(^{16}\) have demonstrated, measurement at hospital level may obscure important issues in particular patient groups. Not all patient harm will be apparent in hospital-level mortality statistics. This includes excess mortality in uncommon diagnostic groups which may not influence the hospital result. HSMR cannot be used to calculate lives lost or saved. This can only be done by case note review\(^8,9,13\).

3. Official HSMR statistics should continue to be published in ways that allow variation in the data over time to be monitored, and also enable comparison of the variation in these data between each hospital and the Scottish average. Organisation responsible: Public Health & Intelligence. Timescale: from August 2014.

There is an established set of data published by Public Health & Intelligence which shows the HSMR value for each hospital and for Scotland from 2007. This also includes data on the actual and predicted number of deaths. The data are presented as tables and over time with trend line from 2007. The different hospitals can be compared from tables, but not graphically.

The pros and cons of making comparisons between the HSMR for an individual hospital and the Scottish average were set out in the HSMR guide for NHS boards, published in 2011. This remains a complex issue, and it is important to acknowledge that there were different views in this regard amongst the SLWG. The SLWG is in agreement that there are a number of factors that could contribute to variation.
observed between the HSMR for an individual hospital and the national average, of which the quality of patient care is only one. Other notable factors include systematic differences in how the source information used to calculate the HSMR is captured, and differences in the characteristics of the patients admitted (case-mix). Comparisons between an individual hospital’s HSMR and the Scottish average undoubtedly need to be made with caution, and some question whether such comparisons should be made at all given the significant caveats. It should be noted that the concept of the HSMR was first developed specifically to enable such comparisons. It can also be argued that it would be neglectful for the health service in Scotland not to look at how the HSMRs for individual hospitals compare with the Scottish average. This is because any variation observed could potentially draw attention to areas that, at the very least, are worthy of further consideration. If a problem with clinical care in a hospital went unrecognised, and it could have been identified by analysing HSMR data, then the public could rightly ask why this information was not acted upon. On balance, it is recommended that such comparisons should be made (as they are in other countries, including England), but only to serve as an invitation to look at specific areas more closely, and they should not be used as a basis for making judgements about the relative quality and safety of care. Using the HSMR to produce a meaningful league table of hospitals would be impossible, given the intrinsic limitations of case mix adjustment and the existence of random variation. It is for this reason that funnel plots are the preferred method for presenting comparative data.

4. HSMR data should also be presented in additional ways, to further support NHS boards to understand and improve systems of care. The usefulness of these presentations should be assessed in conjunction with NHS boards (see recommendation 6c). This includes (not exclusively):

4a. presenting time-series HSMR data monthly (rather than quarterly)

4b. presenting time-series HSMR data using Statistical Process Control charts (for example I chart, X-bar chart), run charts, and CUSUM charts

4c. presenting time-series unadjusted (crude) mortality data using Statistical Process Control charts (for example P chart), run charts, and CUSUM charts

4d. adjusting time-series HSMR data to take account of any seasonal variation, and

4e. presenting comparative HSMR data (using a funnel plot) covering periods of 6 and 12 months (rather than quarterly).


While time-series HSMR figures are currently published and presented quarterly, the SLWG has advised that for improvement purposes, data should be presented
monthly using additional techniques, for example Statistical Process Control charts. These are widely used in Scotland as part of the Scottish Patient Safety Programme and have a number of potential advantages. In particular, they allow the differentiation of random and non-random variation, and offer the opportunity to adjust for any seasonal effects.

The charts are well understood by those closely involved with the Scottish Patient Safety Programme, but the best way of presenting them to Executive and Non-executive board members and managers will need to be explored.

Using similar techniques to present the numbers of observed and predicted deaths is also important in helping to understand the factors affecting the HSMR value. For example, the reduction in HSMR seen in the North West of England reflected an increase in the number of predicted deaths that was entirely attributable to improved recording and coding of the source information.¹⁷

It has also been suggested that CUSUM charts should be used to identify possible changes in mortality at an early stage²⁷-²⁹, and there are examples of such charts being used in Scotland (eg Scottish Arthroplasty Project). CUSUM charts are being used extensively in England by Dr. Foster Intelligence, and their usefulness will be investigated by Public Health & Intelligence and Healthcare Improvement Scotland.

5. Any charts (for example, time series data, comparisons of data for individual hospitals with the Scottish average) that are used as a basis for initiating a dialogue with an NHS board about a high and/or increasing HSMR should be placed in the public domain. Organisations responsible: Public Health & Intelligence and Healthcare Improvement Scotland. Timescale: from August 2014.

“Transparency should be complete, timely and unequivocal. All data on quality and safety, whether assembled by government, organisations, or professional societies, should be shared in timely fashion with all parties who want it, including, in accessible form, with the public.”³⁰ The SLWG noted that the main chart used to date to initiate a dialogue with an NHS board about HSMR (the funnel plot) is not currently placed in the public domain. Following from the issues raised for recommendation 3, there are valid concerns about how such data/comparisons, when published, might be misinterpreted or used inappropriately – but this is even more likely if the data are published with no way to distinguish the random variation of values from non-random variation.

Any concerns do not constitute a valid reason to withhold the public release of such data, and instead proactive steps should be taken to seek to support appropriate interpretation and use.
C. Operational improvement support

6. To improve the understanding and use of HSMR:

6a. the HSMR Guide for NHS boards\(^2\) (originally produced in 2011) should be updated. **Organisation responsible: Healthcare Improvement Scotland. Timescale: July 2014**

6b. the updated guide should be actively promoted with non-executive board members, managerial staff, and clinical staff – as part of a programme to provide training and support opportunities for NHS boards. **Organisation responsible: Healthcare Improvement Scotland. Timescale: from September 2014, and**

6c. feedback should be sought from NHS boards on the ongoing use of the various methods used to present HSMR, to determine what charts should be regularly produced. **Organisations responsible: Public Health & Intelligence and Healthcare Improvement Scotland. Timescale: September 2014.**

There is a need to promote greater understanding of both the strengths and limits of HSMR within NHS boards. Feedback from NHS boards indicates that this lack of clear understanding is currently impeding best use of HSMR to stimulate improvement in patient care. To take account of more recent developments in this field, the HSMR Guide for NHS boards\(^2\), produced in 2011, now needs to be updated.

The updated guide also needs to be actively promoted, for example by face-to-face discussions with non-executive board members, senior managerial staff, and senior clinical staff. The guide and related training and support need to be aligned with other national initiatives, such as the Scottish Patient Safety Programme. Training should also be relevant to the other key measures of quality and safety.

7. A standardised approach for reviewing and learning from hospital-related deaths should be designed. **Organisations responsible: Public Health & Intelligence, Healthcare Improvement Scotland and Scottish Government. Timescale: October 2014.**

NHS boards are seeking a standardised or nationally coordinated methodology for reviewing and learning from hospital-related deaths. This work should build on existing expertise within Healthcare Improvement Scotland (including Scottish Patient Safety Programme) and Public Health & Intelligence (including Scottish Audit of Surgical Mortality), and should be in conjunction with the Academy of Royal Medical Colleges. The development of a standardised tool or methodology for Scotland should be informed by work in this area elsewhere.
8. A dialogue should continue to be held with any NHS board where one of its hospitals is identified as having a relatively high and/or increasing HSMR. **Organisation responsible: Healthcare Improvement Scotland. Timescale: from July 2014.**

and


Healthcare Improvement Scotland currently initiates a dialogue with an NHS board if one of its hospitals is identified as having a markedly high HSMR (specifically, greater than 3 standard deviations higher than the Scottish average for a particular quarter).

A broader suite of information (for example non-random variation on HSMR over time) should be used when considering whether such an interaction should be initiated, and the dialogue would also benefit from having a face-to-face component rather than being as paper based. Recent national reports and reviews1, 8, 30 have highlighted the need to be more open and transparent about what methodology and analyses are used when engaging with the service about increasing or high mortality. When a hospital is identified as having a relatively high or increasing HSMR, then an initial step is to ascertain how complete the data set is, as the rapid review mentioned earlier identified this as being an influential factor3. The procedure for engaging with an NHS board about high or increasing HSMR should be designed to ensure that the data can be interpreted meaningfully, drawing on local knowledge, while also ensuring that the data are taken seriously and acted upon as appropriate. Only if significant concerns arise through the process is there a route to escalate this further (for example to involve Scottish Government). It is also important to capture and understand factors underlying a low or decreasing HSMR, as there might be learning opportunities that can be shared with other NHS boards.

10. An approach for producing more immediate mortality alerts to NHS boards for some specific diagnostic groups or procedures should be tested. **Organisations responsible: Healthcare Improvement Scotland and Public Health & Intelligence. Timescale: by December 2014.**

The SLWG recognised the need to provide a timelier and focused stimulus to NHS boards to examine potential areas for further consideration. Such an approach might be more useful than providing subgroup analyses for the diagnostic groupings currently used for the Scottish HSMR statistical model. There is an opportunity to learn from ongoing work in this area by Dr Foster (www.drfosterintelligence.co.uk/) and Imperial College (www3.imperial.ac.uk/).
D. Statistical model used to produce HSMR

11. The statistical model used to produce the HSMR should be critically reviewed and refined. **Organisation responsible: Public Health & Intelligence.**

   **Timescale:** to be completed so updated model is used on data for the period January 2016 onwards (to coincide with the end of the present phase of the acute adult Scottish Patient Safety Programme, for which the current model will be used on data covering the period up until December 2015).

   It is clear from the literature\(^{31}\) that different statistical models yield different results – and it is critically important to have a better understanding about how the Scottish HSMR needs to be redeveloped.

   When the Summary Hospital-Level Mortality Indicator for English hospitals was developed, the details of the statistical model (together with the underlying rationale) were published\(^{32}\), and the Dr Foster model is also published\(^ {4,19}\) – and this approach should also be taken as part of the review of the statistical model used to produce the Scottish HSMR (ideally publication in a peer reviewed journal). In addition, the baseline used to calculate the Scottish HSMR should now be reset as it is a number of years old (data for 2006–2007), and consideration should be given as to whether the baseline should be reset on an annual basis. The working group acknowledges that the current model will be used to produce the Scottish HSMR for data covering the period until December 2015. Therefore, it is essential that the review of the model is completed so that an updated model is in place following this.

12. As part of the review of the statistical model, a learning event should be held involving others working in this field (including from outside Scotland), in order to contribute to and learn from the experience internationally. This should consider available models and how they are best used. **Organisations responsible:** Public Health & Intelligence and Healthcare Improvement Scotland.

   **Timescale:** May 2015.

   It is clear from the literature that there is a significant body of expertise internationally that needs to be considered when reviewing the statistical model used to produce the Scottish HSMR. It is important that Scotland seeks to work with others active in this area, including Dr Foster (www.drfosterintelligence.co.uk/), the Advancing Quality Alliance (www.advancingqualityalliance.nhs.uk/), Imperial College (www3.imperial.ac.uk/), and the Health & Social Care Information Centre (www.hscic.gov.uk/). In addition, it is important that work in this field in Scotland is contributing to the body of expertise internationally.
13. Also as part of this review and development work, the source information used to calculate the Scottish HSMR should be processed using an independent statistical model in order to compare results. **Organisation responsible: Public Health & Intelligence. Timescale: by May 2015.**

Using an independent statistical model, for example one of the English models, to process the source information from Scottish hospitals will make an important contribution to better understanding the strengths of the Scottish HSMR model, together with potential areas for further development.

14. Research should be commissioned to help understand:

14a. the observed differences in HSMR between different categories of hospital (small general, large district general, large teaching)

14b. what factors are underlying the decrease in HSMR at a Scotland level, and

14c. what is causing the variable changes in predicted mortality in different hospitals and what implications there may be for ensuring data consistency.

**Organisations responsible: Public Health & Intelligence and Healthcare Improvement Scotland. Timescale: by December 2014.**

A consistent feature of experience to date in Scotland has been that the HSMR of the ‘teaching hospitals’ (as defined by the ‘Blue Book’ - [www.isdscotland.org/Health-Topics/Finance/Costs/File-Listings-2013.asp](http://www.isdscotland.org/Health-Topics/Finance/Costs/File-Listings-2013.asp)) is less than the ‘large general hospitals’ while the ‘general hospitals’ show more marked variation. The reason for the difference between the teaching hospitals and the large general hospitals is not understood and is potentially important. If it is the result of anomalies in the way the model works then these need to be understood – but if it represents real differences in quality or safety of care then action is required to ensure consistency across Scotland. Processing the Scottish source data through an independent model would contribute to work in this area, as would examining whether differences on HSMR (or equivalent metrics) between categories of hospital are observed in other countries.

The level of HSMR has been reducing nationally and in many Scottish hospitals, and similar patterns are seen in other countries. However, it remains unclear exactly what combination of factors are contributing to the observed reduction in HSMR. It is important to get a better understanding of what these factors are, both at the Scottish level (as one of the national clinical outcome indicators, HSMR is monitored at national level) and individual hospital level (for example to support local improvement work). The decrease in HSMR observed at the Scottish level appears to be driven by an increase in the number of predicted deaths, whereas the number of observed deaths has remained fairly constant.

Further work will include seeking to understand whether this increase in the number of predicted deaths reflects a sicker cohort of patients being admitted, improvements to the recording/coding of the source data, or other factors.
6. References


7. **Membership of HSMR Short-Life Working Group**

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The Healthcare Environment Inspectorate, the Scottish Health Council, the Scottish Health Technologies Group and the Scottish Intercollegiate Guidelines Network (SIGN) are part of our organisation.

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