



Summary Hospital-level Mortality Indicator (SHMI)

Deaths associated with hospitalisation,
England, April 2020 – March 2021:
Background quality report

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The SHMI can be used by hospital trusts to compare their mortality outcomes to the national baseline. Regulators (for example, the Care Quality Commission) and commissioning organisations can also use the SHMI to investigate outcomes for trusts. However, it should not be used to directly compare mortality outcomes between trusts, and it is inappropriate to rank trusts according to their SHMI.

Introduction

The Summary Hospital-level Mortality Indicator (SHMI) reports on mortality at trust¹ level across the NHS in England using a standard and transparent methodology. This indicator is produced and published monthly as a National Statistic by NHS Digital.

The SHMI is the ratio between the actual number of patients who die following hospitalisation at the trust and the number that would be expected to die on the basis of average England figures, given the characteristics of the patients treated there.

SHMI values for each trust are published along with bandings indicating whether a trust's SHMI is 'higher than expected', 'as expected' or 'lower than expected'. For any given number of expected deaths, a range of observed deaths is considered to be 'as expected'. If the observed number of deaths falls outside of this range, the trust in question is considered to have a higher or lower SHMI than expected.

The SHMI includes deaths which occurred in hospital or within 30 days of discharge and is calculated using Hospital Episode² Statistics (HES) data linked to Office for National Statistics (ONS) death registrations data. Deaths related to COVID-19 are excluded from the SHMI. The expected number of deaths is calculated from statistical models derived to estimate the risk of mortality based on the characteristics of the patients (including the condition the patient is in hospital for, other underlying conditions the patient suffers from, age, gender, method and month of admission to hospital, and birthweight (for perinatal diagnosis groups only)).

The purpose of the SHMI is to compare mortality outcomes for hospital trusts to the England average at a fixed point in time. The SHMI can be used by hospital trusts to compare their mortality outcomes to this national baseline. Regulators (for example, the Care Quality Commission) and commissioning organisations can also use the SHMI to investigate mortality outcomes for trusts. However, it should not be used to directly compare mortality outcomes between trusts, and it is inappropriate to rank trusts according to their SHMI. To support the interpretation of the SHMI, various contextual indicators are published alongside it.

Trusts may be located at multiple sites and may be responsible for 1 or more hospitals. A breakdown of the data by site of treatment is also published as an experimental statistic³.

This document aims to provide users with an evidence-based assessment of the quality of the SHMI publication outputs. It reports against the 9 European Statistical System (ESS) quality dimensions and principles⁴.

¹ An NHS trust (or provider) is a legal entity which provides services on behalf of the NHS. Trusts may be located at multiple sites and may be responsible for 1 or more hospitals.

² An episode is a single period of care under 1 consultant.

³ Experimental statistics are official statistics which are published in order to involve users and stakeholders in their development and as a means to build in quality at an early stage.

⁴ The original quality dimensions are: relevance, accuracy and reliability, timeliness and punctuality, accessibility and clarity, and coherence and comparability; these are set out in Eurostat Statistical Law. However more recent quality guidance from Eurostat includes some additional quality principles on: output quality trade-offs, user needs and perceptions, performance cost and respondent burden, and confidentiality, transparency and security.

Relevance

Relevance is the degree to which the statistical product meets user needs in both coverage and content.

The SHMI is a complex indicator and there are a range of academic views on various aspects of the methodology. The SHMI is subject to continuous evaluation and the methodology is currently under review.

A SHMI Engagement Group consisting of stakeholders and users of the indicator have been convened to lead this work. They report to the National Medical Director at NHS England, Professor Stephen Powis.

In the initial phase of the review, several tactical improvements to the methodology were recommended as well as some additional breakdowns of the data and presentational improvements. These tactical changes have been implemented from the May 2019 publication onwards, and further details are available in the announcement of methodological changes. A longer term, more fundamental review of the methodology was paused due to the COVID-19 pandemic. In Spring 2021 this work resumed, and users will be kept informed as the next stage of the review progresses.

Link to the announcement of methodological changes:

<http://digital.nhs.uk/pubs/methchanges>

Known methodological issues are detailed in the SHMI methodology development log and kept under review.

Link to the SHMI methodology development log:

<http://digital.nhs.uk/shmi-development>

Coverage

As of the July 2020 publication, COVID-19 activity has been excluded from the SHMI. The SHMI is not designed for this type of pandemic activity and the statistical modelling used to calculate the SHMI may not be as robust if such activity were included.

If any of the episodes within a provider spell⁵ have a COVID-19 diagnosis code, then the spell is excluded from the SHMI.

Additionally, for deaths included in the SHMI, if COVID-19 is recorded anywhere on the death certificate, then the death and the spell it is linked to are excluded from the SHMI. This 2nd exclusion is necessary as the SHMI also includes deaths which occurred outside of hospital within 30 days of discharge.

Activity that is being coded as COVID-19, and therefore excluded, is monitored in the contextual indicator 'Percentage of provider spells with COVID-19 coding' which is part of this publication.

Changes in the number of spells since the start of the COVID-19 pandemic are monitored in the contextual indicator 'Provider spells compared to the pre-pandemic period' which is part of this publication.

⁵ A provider spell is a continuous period of time spent as a patient within a single trust (provider). A spell may consist of 1 or more episodes (a single period of care under 1 consultant).

Further information about the exclusion of COVID-19 activity from the SHMI can be found on the SHMI homepage.

Link to the SHMI homepage:

<http://digital.nhs.uk/SHMI>

The SHMI methodology has been designed for non-specialist acute trusts. Specialist trusts, mental health trusts, community trusts and independent sector providers are excluded from the SHMI because there are important differences in the case-mix of patients treated there compared to non-specialist acute trusts and the SHMI has not been designed for these types of trusts.

When the SHMI was established, one of the principles was that it should include activity for all admitted patients (except day cases, regular attenders and stillbirths). The Clinical Classifications Software (CCS) is a tool for grouping patients into a manageable number of clinically meaningful categories using the International Classification of Diseases (ICD-10) diagnosis codes. The SHMI includes all 260 CCS categories for ICD-10 diagnosis codes (except COVID-19 activity) and this gives a wider coverage compared with some other mortality indicators. For example, the Hospital Standardised Mortality Ratio (HSMR) produced by Dr Foster Intelligence (DFI) includes 56 of the CCS categories, accounting for approximately 80 per cent of deaths occurring in hospital.

Further information regarding the Clinical Classifications Software categories for ICD-10 diagnosis codes can be referenced at:

<https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp>

There are variations between trusts in the recording of same day emergency care. For example, some trusts may submit this activity as part of the Outpatient dataset rather than the Admitted Patient Care (APC) dataset, and so these records will not be included in the SHMI. It is not known which trusts do not include all same day emergency care activity in their APC data submissions.

The SHMI includes all deaths⁶ occurring either in hospital or within 30 days of discharge for all non-specialist acute NHS trusts in England. In addition, all patients who die within 30 days after transfer from a non-specialist acute NHS trust to a community, mental health or specialist trust have their death attributed to the last non-specialist acute NHS trust they were treated in prior to transfer. Deaths occurring outside hospital are included to provide a more complete picture of mortality associated with hospitalisation, compared to looking only at deaths occurring in hospital.

Trusts which solely provide community or specialist services are excluded from the SHMI. However, integrated acute and community trusts (which provide both acute and community services) are included and some patients will transfer between acute and community care at these trusts.

For integrated acute and community trusts, the SHMI includes the time from the patient's admission until 30 days following discharge from the trust and does not account for any transfer between acute and community settings. This is different from patients who are initially treated at a trust providing only acute services who are then transferred to a community trust. In these cases, the SHMI includes the time from admission to the acute trust until 30 days following transfer from the acute trust only. This difference has led to concerns that not all trusts are being evaluated on a like-for-like basis.

⁶ Deaths related to COVID-19 are excluded from the SHMI.

There is no way of identifying community activity in the HES dataset. Therefore, it is not possible to quantify the number of trusts affected, or the potential impact on these trusts. The number of affected trusts may increase over time as more trusts transition to an integrated model of service provision and the impact will vary depending on the nature of the community services being provided e.g. rehabilitation services compared to palliative care. Trusts which only provide community services in an outpatient setting will be unaffected because only inpatient activity is included in the SHMI.

For trusts where inpatient community activity is provided at a separate site to community activity, the site level breakdown of the data (included from the May 2019 publication onwards) can be used to assess the impact of this issue. However, some trusts will provide both acute and community activity at the same site.

The range of SHMI values is considerably greater at site level than at trust level. There are several factors which contribute to this. These include some sites having particular specialisms and service models (for example, dialysis, maternity and end of life care) and also some inconsistencies in how trusts have defined their 'sites'. For example, a trust could be made up of a hospice providing end of life care and an acute hospital. The trust could have an 'as expected' SHMI overall, with the hospice having a 'higher than expected' SHMI and the acute hospital having a 'lower than expected' SHMI. These known issues will be investigated and addressed, where possible, as part of the ongoing review of the SHMI methodology.

A site type classification is included in the data to assist interpretation and has been derived by linking HES and Care Quality Commission (CQC) reference data. The alignment between codes in the respective reference tables is known to be imperfect, and this remains a work in progress, but is considered to be of sufficient accuracy for inclusion in this breakdown.

Provider spells may consist of 1 or more episodes (a single period of care under 1 consultant). This breakdown uses the site from the 1st episode in the provider spell. A contextual indicator on the percentage of provider spells where the site of treatment for the last episode is different to the 1st is also included as part of the SHMI publication and is designed to aid in the interpretation of the site level data.

There is some overlap between the mental health data captured in HES and in the Mental Health Services Data Set (MHSDS). It has been decided that mental health data should continue to be submitted to both MHSDS and HES. The duplication of this reporting will continue to be reviewed in future updates of the Commissioning Data Sets data standard. However, there is unlikely to be any formal change before 2021-22. If providers are formally requested to stop submitting the data to HES in future this change will cause a decrease in the amount of mental health data being captured in HES. The impact on the mental health diagnosis groups (groups 42 – Organic mental disorders, 43 – Non-organic mental disorders, anxiety, 44 – Other psychoses and 45 – Psychotic disorders, other mental conditions) will be monitored if future changes are made.

Risk adjustment

The statistical models used in the calculation of the SHMI take into account the characteristics of the patients (including the condition the patient is in hospital for, other underlying conditions the patient suffers from, age, gender, method and month of admission to hospital, and for perinatal diagnosis groups only – birthweight).

The SHMI methodology does not make any adjustment for patients who are recorded as receiving palliative care. This is because there is considerable variation between trusts in the coding of palliative care. Following feedback, 2 contextual indicators relating to palliative care coding are published alongside the SHMI:

- The percentage of all finished provider spells coded as receiving palliative care
- The percentage of all deaths reported in the SHMI coded as receiving palliative care

A small number of non-specialist acute trusts have hospices within their organisation. The transfer of patients into these hospices from other non-specialist acute trusts is likely to increase the observed number of deaths for these trusts. Also, there are a small number of non-specialist acute trusts who provide specialist palliative care inpatient services within designated wards. This arrangement will potentially have an effect on the SHMI as well because the statistical models used to estimate the expected number of deaths do not make any adjustment for patients who are recorded as receiving palliative care. More detailed analysis on this issue can be found in the palliative care coding report, which is available to download from NHS Digital's SHMI research and development page.

Link to the palliative care coding report:

<http://digital.nhs.uk/shmi-development>

The SHMI methodology does not make any adjustment for deprivation. This is because adjusting for deprivation might create the impression that a higher death rate for those who are more deprived is acceptable. More detailed analysis can be found in the report on the impact of deprivation on the SHMI, which is available to download from NHS Digital's SHMI research and development page.

Link to the report on the impact of deprivation on the SHMI:

<http://digital.nhs.uk/shmi-development>

2 contextual indicators on deprivation are published alongside the SHMI:

- Provider spells split by deprivation quintile
- Deaths split by deprivation quintile

No adjustment is made for the severity of the condition the patient is in hospital for, as this information is not captured in the HES dataset upon which the SHMI is based. This means that if a trust treats a high (or low) proportion of seriously ill patients with a particular condition compared to other trusts, the statistical models used to estimate the expected number of deaths will not take account of this.

Control limits

The control limits used to categorise trusts as having either a 'higher than expected', 'as expected' or 'lower than expected' SHMI include an adjustment to account for over-dispersion. Over-dispersion is the presence of greater variability in a dataset than would be expected based on a given statistical model. This is a common feature in the analysis of applied data where populations are heterogeneous (different in character). As explained in

Spiegelhalter (2005)⁷, the level of over-dispersion can be characterised by the over-dispersion factor, denoted by ϕ (phi). For this SHMI publication $\phi = 6.19$ which is statistically significant. Ignoring this over-dispersion could lead to a large number of trusts being inappropriately classified as having a 'higher than expected' or 'lower than expected' SHMI. Therefore, the methodology described in Spiegelhalter (2005)⁷ is used to adjust the SHMI control limits for the presence of over-dispersion.

For the 1st publication of the SHMI in October 2011, 2 different sets of control limits and the corresponding bandings were published for this indicator:

- 95 per cent control limits from a random effects model applying a 10 per cent trim for over-dispersion
- 99.8 per cent control limits from an exact Poisson distribution

Following feedback suggesting that the publication of 2 bandings was confusing for users, NHS Digital now only publishes 1 banding corresponding to the control limits which account for over-dispersion, although the 2 sets of control limits will continue to be made available in the underlying data for transparency.

The same methodology is used to calculate the control limits at site level and for some of the individual SHMI diagnosis groups. For reasons of statistical robustness, a SHMI value and control limits are only calculated if the number of provider spells is greater than or equal to 30⁸, the number of observed deaths is greater than 7 and the number of expected deaths is greater than 7.5.

A small number of trusts carry out all activity at a single site. In such cases, the SHMI value will be the same in both the site level and trust level data. However, the SHMI banding ('higher than expected', 'as expected' or 'lower than expected') may be different. The reason for this difference is a result of the greater variability in the data at site level (as described above), which in turn affects the calculation of the control limits used to define the SHMI banding. As the control limits at site and trust level may therefore not be the same, this leads to the same SHMI value potentially having a different categorisation at trust and site level. For single site trusts where the trust level SHMI banding is "higher than expected" but the site level SHMI banding is "as expected" it is advised that trusts still investigate the reasons for the "higher than expected" trust banding. The trust level banding should take precedence in this situation.

From the May 2019 publication onwards, SHMI values, SHMI bandings and control limits are published for the following diagnosis groups:

- Group 2 – septicaemia (except in labour), shock
- Group 15 – cancer of bronchus, lung
- Group 30 – secondary malignancies
- Group 37 – fluid and electrolyte disorders

⁷ Spiegelhalter D. (2005). Funnel plots for comparing institutional performance. *Statistics in Medicine*. 24:1185-1202.

⁸ This achieves consistency with the approach used by Patient Reported Outcome Measures (PROMs) where data are only presented when there are 30 or more modelled records for a particular procedure and measure mix.

- Group 57 – acute myocardial infarction
- Group 73 – pneumonia (excluding TB/STD)
- Group 74 – acute bronchitis
- Group 96 – gastrointestinal haemorrhage
- Group 101 – urinary tract infections
- Group 120 – fracture of neck of femur (hip)

These groups have been chosen because they have high numbers of deaths and statistical models that are considered to have sufficiently explained the expected variation in outcomes due to the case-mix adjustment. They are the same diagnosis groups for which NHS Digital generates variable life-adjusted display (VLAD) charts which are provided to trusts via the SHMI Extract Service.

Accuracy and reliability

Accuracy and reliability relate to the proximity between an estimate and the unknown true value.

Data sources

The SHMI is calculated using data from 2 administrative sources:

- NHS Digital Hospital Episode Statistics (HES) data
- Office for National Statistics (ONS) death registrations data

Administrative data are data collected primarily for administrative reasons (e.g. for registration, record-keeping and other operational purposes) where their use in the calculation of statistical outputs is secondary.

HES is a data warehouse containing details of all NHS funded admissions, outpatient appointments and A&E attendances at English hospitals. Healthcare providers collect administrative and clinical information locally to support the care of the patient and store this in their Patient Administration System (PAS). These data are submitted to the Secondary Uses Service (SUS) to enable providers to be paid for the care they deliver. The data are then processed by NHS Digital to create HES data. HES extracts are taken from the SUS data warehouse on a monthly basis, at pre-arranged dates during the year. HES represents a series of fixed positions aligned to extracted data, while SUS is continuously updated whenever data are submitted.

HES is a unique data source, whose strength lies in the richness of detail at patient level. HES data includes specific information about the patient (such as age and gender), clinical information (such as diagnoses), administrative information (such as dates and methods of admission and discharge) and geographical information (such as where the patient was treated and the area in which they live).

Link to further information on HES data:

<http://digital.nhs.uk/hes>

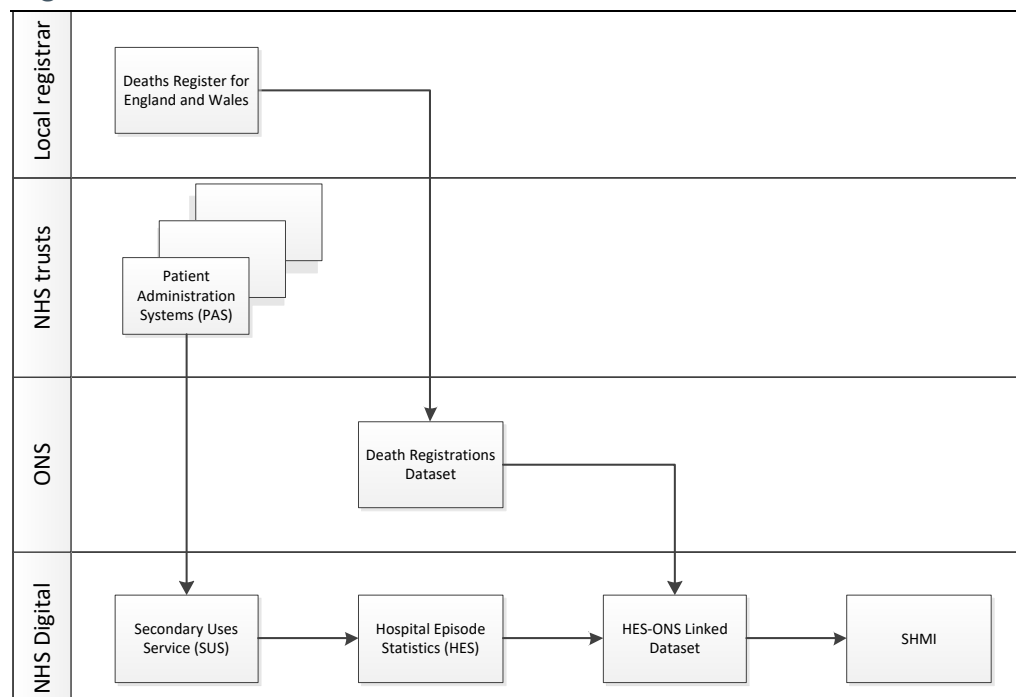
Deaths in England must be registered with the local registrar within 5 days of the date of death (there are a number of exceptions e.g. if the death is referred to a coroner). Details of death registrations are sent electronically to ONS from register offices to create the death registrations dataset. The death registrations dataset includes information on the date of death, date of registration of the death, place and cause of death. However, only the date of death is used in the calculation of the SHMI.

Link to further information on ONS death registrations data:

<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/methodologies/mortalitystatisticsinenglandandwalesqmi>

HES data are linked to the ONS death registrations data to enable deaths which occur outside of hospital to be captured. This linked dataset is used to calculate the SHMI. The data flows described above are illustrated in Figure 1.

Figure 1: SHMI data flows



Quality assurance of HES data

The accuracy of HES data is the responsibility of the providers who submit the data to SUS. These data are required to be accurate to enable providers to be correctly paid for the care they deliver. However, following data submission several levels of quality assurance are routinely carried out prior to the data being used in the calculation of the SHMI.

The data submitted to SUS must adhere to the Commissioning Data Sets (CDS) data standard and providers submit data to SUS using an xml schema, meaning that the data must comply with certain validation rules before they can be submitted. NHS Digital leads on schema changes and consults with data submitters about proposed changes. Further data quality checks are then carried out, and each month NHS Digital makes data quality dashboards available to providers to show the completeness and validity of their data submissions to SUS (including a dashboard showing site of treatment completion rates in order to identify where site level data quality issues may exist) in order to help facilitate improvements. This helps to highlight any issues so that corrections can be made to the data as part of the next submission.

Link to further information on submitting data to SUS and SUS data quality:

<http://digital.nhs.uk/sus/>

<https://digital.nhs.uk/services/secondary-uses-service-sus/sus-data-quality-reporting>

Information on the patient's primary diagnosis (the condition that they are in hospital for) and any secondary diagnoses are coded using the 10th revision of the World Health Organization's International Classification of Diseases (ICD-10), which is an internationally recognised classification.

Link to further information on ICD-10 codes:

<https://icd.who.int/browse10/2016/en>

An external auditor, acting on behalf of the Department of Health and Social Care, audits the data submitted to SUS to ensure that organisations are being paid correctly for the care they deliver. Although the most recent audit shows that there is variation between trusts in the accuracy of clinical coding, the use of diagnosis groupings in the calculation of the SHMI means that it is more robust to minor errors in clinical coding and the accuracy of clinical coding in the HES data is therefore considered sufficient for the purpose of calculating the SHMI. Additionally, a contextual indicator on the percentage of provider spells with an invalid primary diagnosis code is published alongside the SHMI. The audit also highlights the consistent under-recording of comorbidities, and contextual indicators on mean depth of coding⁹ are also published alongside the SHMI.

Link to the results of the latest external audit report:

<https://www.gov.uk/government/publications/payment-by-results-the-quality-of-clinical-coding-in-the-nhs>

HES extracts are taken from the SUS data warehouse on a monthly basis, at pre-arranged dates during the year. Further validation and data cleaning are then carried out before additional data items are derived and the data are made available to users.

The HES Data Quality team discuss data quality issues with the information leads in organisations who have submitted the data, and data quality notes are updated with each HES publication. These specify known data quality issues which need to be considered when analysing the data e.g. shortfalls in the data for particular organisations and problems with particular data fields. Details of specific data quality issues affecting this publication are listed in the 'Data quality issues affecting this publication' section of this report.

Link to HES data quality notes and data cleaning rules:

<https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics/the-processing-cycle-and-hes-data-quality>

Provisional HES data are published on a monthly basis approximately 2 months after the end of the reporting period. Finalised HES data are published on an annual basis around 6 months after the end of the reporting period. A combination of finalised and provisional HES data is used in the calculation of the SHMI to ensure that the indicator is as timely as possible. Provisional HES extracts are taken from the SUS data warehouse on a monthly basis, at pre-arranged dates during the year. Each extract is cumulative and contains data submitted by trusts for the financial year so far, i.e. the month 1 extract will contain only data submitted with an activity date in April, but the month 5 extract will contain data with an activity date from April to August.

Provisional data may be incomplete or contain errors which have not yet been corrected, and counts produced from provisional data are likely to be lower than those generated for the same period using the finalised dataset. This shortfall is likely to be most pronounced in the latest month of the provisional dataset, and for this reason activity for the latest month is not used in the calculation of the SHMI e.g. when using the month 5 extract, only activity in the period April to July is used.

Further analysis on the scale of the differences between the provisional and finalised HES data can be found in the data quality section of the final year publication. Similarly, information on data completeness compared to previous provisional extracts is provided as part of the provisional monthly publications.

⁹ Depth of coding is defined as the number of secondary diagnosis codes for each finished provider spell in the SHMI dataset.

Link to finalised and provisional HES publications:
<https://digital.nhs.uk/hes>

Quality assurance of death registrations data

Routine data validation checks are carried out by the registrar when a death is registered. Further checks (e.g. to identify duplicate records and to check for consistency between dates of birth, death and registration) are carried out when the data are received by ONS and suspect records are referred back to register offices. Full details of the quality assurance process are available on the ONS website.

Link to the Mortality Statistics Quality and Methodology Information:
<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/methodologies/mortalitystatisticsinenglandandwalesqmi>

Provisional death registrations statistics are published on a monthly basis by ONS approximately 4 weeks after the end of the reporting period. ONS also publish provisional weekly death registration statistics approximately 11 days after the end of the reporting period. Finalised death registrations data are published on an annual basis around 6 months after the end of the reporting period. Provisional ONS death registrations data are sent to NHS Digital on a weekly basis so that up-to-date information is available for linkage with the HES dataset. The provisional data are refreshed with the annual death registrations dataset when this becomes available.

The provisional data have not been subject to the full quality assurance process and so may not contain all deaths which were registered, or which occurred during the reporting period. In England, deaths must be registered within 5 days of the date of death. However, there are a number of situations when the registration of a death will be delayed e.g. if the death is referred to a coroner for investigation. Comparing the monthly and annual death registrations data for the calendar year 2009 showed a difference of less than 1 per cent in the counts of deaths registered between the 2 datasets, suggesting that the coverage and quality of the provisional monthly data are high.

Further details of this analysis are available in the HES-ONS linked mortality data guide:
<https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/linked-hes-ons-mortality-data>

Changes have been made to the processes for the certification and registration of deaths as part of the Coronavirus Act 2020. Further information on the impact of these changes on the quality of mortality data is available on the ONS website.

Link to the ONS analysis on the quality of mortality data during the coronavirus pandemic:
<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/qualityofmortalitydataduringthecoronaviruspandemicenglandandwales/2020>

Accuracy and reliability of the data linkage

HES data are linked with ONS death registrations data to enable those deaths which occurred outside of hospital to be captured. This is an established data linkage which is routinely carried out by NHS Digital. Matching is performed by comparing patient identifiable fields, such as date of birth, sex, NHS number and/or postcode, which are present in both the HES and death registrations datasets. Some deaths in the ONS death registrations dataset cannot be matched to records in HES e.g. because the individual has not attended

hospital. Although all deaths in England must be registered, some deaths in the HES dataset cannot be linked to records in the death registrations dataset e.g. due to a delay in the registration of the death (because of an ongoing coroner's inquest) or because of missing or inaccurately recorded patient identifiers meaning that the records could not be linked. Based on previous analysis using death registrations data from 2011, approximately 2 per cent of deaths recorded in HES cannot be linked to a record in the ONS death registrations dataset. These records are included in the final HES-ONS linked dataset along with HES records which have been successfully linked to a record in the death registrations dataset.

Further details of this analysis, along with further information on the data linkage methodology are available in the HES-ONS linked mortality data guide:

<https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/linked-hes-ons-mortality-data>

When creating the HES-ONS linked dataset, deaths occurring in hospital are identified as those where the discharge method is 'Died'. Stillbirths are identified in HES as records where the discharge method is 'Stillbirth' and so these records are not identified as deaths occurring in hospital in the HES-ONS linked dataset. For this reason, stillbirths are excluded from the calculation of the SHMI.

On rare occasions patients may appear to have activity in HES after the date of death in the HES-ONS linked dataset. This is called 'subsequent activity' and is a data quality issue related to either a patient being incorrectly coded in the HES dataset, (e.g. an outpatient appointment recorded as attended after the date of death), or incorrectly submitted patient identifiers resulting in incorrect linkage between HES and ONS death registrations data.

Analysis using the SHMI dataset for discharges in the period January 2011 – December 2013 shows that approximately 0.16 per cent of records are flagged with subsequent activity. Around 0.05 per cent of in hospital deaths in the dataset are not processed as an event of death, because there is a later record in the dataset which the death record is linked to. This problem is not specific to any particular trust or diagnosis group and so the overall impact on the SHMI at trust level is negligible. This issue was discussed at the July 2014 meeting of the SHMI Technical Working Group, where it was agreed that no further action was required due to the negligible impact of subsequent activity on the SHMI.

Link to the SHMI Technical Working Group proceedings:

<http://digital.nhs.uk/shmi-development>

Additional quality assurance checks carried out following the calculation of the SHMI

As part of the preparation of the SHMI publication, further quality assurance checks are routinely carried out. For example, the number of finished provider spells for each trust is compared to the number in the previous reporting period and any large changes which are not already documented in the HES data quality notes are investigated further with the HES Data Quality team. The HES data quality notes are also reviewed and details of any data quality issues impacting on the SHMI publication are highlighted in the 'Data quality issues affecting this publication' section below.

On a quarterly basis (for the February, May, August and November publications), trusts are provided with the opportunity to review their SHMI data prior to its publication for the purpose of quality assurance via NHS Digital's Clinical Indicator Preview tool. Each preview period

allows 5 working days for trusts to carry out this quality assurance and to raise any issues or questions directly with the SHMI team. It is important that there is clinical engagement and clinical governance of information that is routinely captured about care provided, and senior clinicians in all NHS organisations are expected to participate fully in this process. As part of this, medical directors (or other senior clinicians) are asked to sign-off the SHMI for their trust. Sign-off represents that processes are in place to assure clinical data quality at a high level. If a trust raises data quality concerns during the preview period, the impact of the issue is investigated, and this is then documented in this report where necessary.

Data quality issues affecting this publication

This publication uses provisional data for the financial year 2021-22 (month 2 extract) and 2020-21 (month 13 extract) and finalised HES data for earlier financial years.

Fewer spells

Please note that there has been a fall in the number of spells for some trusts due to COVID-19 impacting on activity from March 2020 onwards and this appears to be an accurate reflection of hospital activity rather than a case of missing data. Further information is available in the contextual indicator 'Provider spells compared to the pre-pandemic period' which is part of this publication.

Shortfall in records

There is a shortfall in the number of records for North Cumbria Integrated Care NHS Foundation Trust (trust code RNN), meaning that values for this trust are based on incomplete data and should therefore be interpreted with caution.

An issue with HES reference data has resulted in some records for Guy's and St Thomas' NHS Foundation Trust (trust code RJ1) being flagged as invalid. This has led to a shortfall in spells, meaning that values for this trust are based on incomplete data and should therefore be interpreted with caution.

Incorrect classification of day cases and regular day attenders

Day cases and regular day attenders are excluded from the SHMI. However, some day cases for University College London Hospitals NHS Foundation Trust (trust code RRV) have been incorrectly classified as ordinary admissions meaning that they have been included in the SHMI. Maidstone and Tunbridge Wells NHS Trust (trust code RWF) has submitted a number of records with a patient classification of 'day case' or 'regular day attender' and an intended management value of 'patient to stay in hospital for at least one night'. This mismatch has resulted in the patient classification being updated to 'ordinary admission' by the HES data cleaning rules. This may have resulted in the number of ordinary admissions being overstated. The trust has been contacted to clarify what the correct patient classification is for these records. Values for these trusts should therefore be interpreted with caution.

Discrepancy between dates of discharge and episode end

A very small number of discharge episodes for patients who have died in hospital have been submitted with different values in the date of discharge (DISDATE) and episode end date (EPIEND) date fields. This discrepancy has resulted in these episodes being reclassified as non-discharge episodes by the HES data cleaning rules, meaning that these episodes have not been included in the finished provider spells dataset used in the calculation of the SHMI. Further details are provided in the HES data quality notes. As the number of affected records is very small, this is likely to have a small impact on the results for the 4 trusts affected by this issue, which are: Barking, Havering and Redbridge University Hospitals NHS Trust (trust code RF4), Lancashire Teaching Hospitals NHS Foundation Trust (trust code RXN), Mid and South Essex NHS Foundation Trust (trust code RAJ) and Somerset NHS Foundation Trust (trust code RH5).

Stillbirths not recorded correctly

There may be several trusts that are unable to record stillbirths with a discharge method of 'Baby was stillborn' in their Patient Administration System (PAS) and are instead coding these records with a discharge method of 'Died'. This means that such records will be included in the calculation of the SHMI where they should have been excluded. The impact on the overall SHMI is small but the impact on individual SHMI diagnosis groups (groups 116 - Congenital anomalies, 117 - Short gestation and slow fetal growth, 118 - Birth related conditions, 119 - Other perinatal conditions and 141 - Livebirths) is likely to be greater for affected trusts and so results for these diagnosis groups should be interpreted with caution.

Link to HES data quality notes and data cleaning rules:

<https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/hospital-episode-statistics/the-processing-cycle-and-hes-data-quality>

Calculation of the expected number of deaths

The expected number of deaths is calculated from 142 logistic regression models (corresponding to 142 diagnosis groups) derived to estimate the risk of mortality based on the characteristics of the patients (including the condition the patient is in hospital for, other underlying conditions the patient suffers from, age, gender, method and month of admission to hospital and birthweight (for the perinatal diagnosis groups)). The statistical models are constructed using 36 months of data from trusts throughout England. The final 12 months of this period are used to calculate the SHMI for each individual trust.

The NOCHECK and RIDGING=ABSOLUTE model-fitting options in the SAS Enterprise Guide software are applied to ensure that all of the statistical models converge.

- The NOCHECK option suppresses checking for infinite parameters.
- The RIDGING=ABSOLUTE option adjusts the ridging technique used by SAS to improve the log-likelihood function.

Link to further information on the model-fitting options available in SAS:

http://support.sas.com/documentation/cdl/en/statug/68162/HTML/default/viewer.htm#statug_logistic_syntax22.htm

The success of the case-mix adjustment in predicting the outcome (died or survived) is evaluated using the c statistic for each logistic regression model. The c statistic is the probability of estimating a lower risk of death for a randomly selected patient who survived compared to a randomly selected patient who died and takes values in the range 0.5-1.0. Models are typically considered to have a reasonable predictive ability if the c statistic is 0.7 or higher.

The c statistics for each of the 142 SHMI diagnosis groups are published along with other model fit statistics as part of each SHMI publication. The data can be found in the 'SHMI model fit statistics' file in the 'SHMI statistical model data' folder of the 'SHMI data files' download for each publication. Details of the 142 SHMI diagnosis groups can be referenced in Appendix A of the SHMI methodology specification document.

Link to the SHMI publication:

<https://digital.nhs.uk/data-and-information/publications/statistical/shmi>

The c statistic for the 142 models ranges from 0.617 to 0.967 with an average of 0.825 and a standard deviation of 0.078. The inter-quartile range is 0.107 with the lower and upper quartiles as 0.778 and 0.885 respectively. Table 1 provides further information on the distribution of the c statistics for the 142 SHMI diagnosis groups.

Table 1: Distribution of the c statistic for the statistical models for the 142 SHMI diagnosis groups, April 2018 – March 2021

c statistic	Number of SHMI diagnosis groups
$0.5 \leq c < 0.6$	0
$0.6 \leq c < 0.7$	11
$0.7 \leq c < 0.8$	38
$0.8 \leq c < 0.9$	68
$0.9 \leq c \leq 1.0$	25

Source: NHS Digital

The following SHMI diagnosis groups have a c statistic which is less than 0.7 (the c statistic for each diagnosis group is given in brackets).

- Group 42 – organic mental disorders (0.617)
- Group 51 – coma, stupor and brain damage (0.692)
- Group 64 – cardiac arrest and ventricular fibrillation (0.647)
- Group 65 – congestive heart failure, nonhypertensive (0.646)
- Group 66 – acute cerebrovascular disease (0.688)
- Group 75 – chronic obstructive pulmonary disease and bronchiectasis (0.670)
- Group 77 – aspiration pneumonitis, food/vomitus (0.669)
- Group 79 – respiratory failure, insufficiency, arrest (adult) (0.684)
- Group 93 – liver disease, alcohol-related (0.653)

- Group 99 – acute and unspecified renal failure (0.697)
- Group 124 – intracranial injury (0.699)

All records in diagnosis group 5 (HIV infection) have been anonymised within SUS because HIV is a legally restricted diagnosis code. This means that the age and the gender have been removed for these records, contributing to a poor model fit for this diagnosis group (c statistic 0.721).

From the May 2019 publication onwards, an adjustment for birthweight has been included in the logistic regression models for 6 diagnosis groups, improving their c statistics compared to previous publications. These diagnosis groups are:

- Group 115 – cardiac and circulatory congenital anomalies
- Group 116 – digestive congenital anomalies, genitourinary congenital anomalies, nervous system congenital anomalies, other congenital anomalies
- Group 117 – short gestation, low birth weight, fetal growth retardation
- Group 118 – intrauterine hypoxia and birth asphyxia, respiratory distress syndrome, hemolytic jaundice and perinatal jaundice, birth trauma
- Group 119 – other perinatal conditions
- Group 141 – livebirths

For the remaining diagnosis groups with c statistics which are less than 0.7, NHS Digital will investigate whether improvements can be made to the model fit as part of the longer-term development of the indicator. Further information is available in the SHMI methodology development log.

Link to the SHMI methodology development log:
<http://digital.nhs.uk/shmi-development>

Timeliness and punctuality

Timeliness refers to the time gap between publication and the reporting period. Punctuality refers to the gap between planned and actual publication dates.

From its 1st publication in October 2011 until May 2019, the SHMI was published on a quarterly basis. From the May 2019 publication onwards, the SHMI has been published on a monthly basis, with the statistical models used to derive the expected number of deaths also rebased on a monthly basis in line with the publication.

Each publication includes discharges in a rolling 12-month period. The SHMI is published just over 4 months after the end of the reporting period. This time lag is due to the timescales for the availability of the HES and ONS data upon which the SHMI is based. The calculation of the SHMI requires HES and death registrations data for the month after the end of the reporting period to allow all deaths which occurred within 30 days of discharge to be captured.

Details of the reporting period and ONS data extract used in the calculation of each SHMI publication are available in the SHMI publication timetable. Details of the HES extracts which have been used in the calculation of the SHMI, along with the corresponding SUS submission deadlines, are available in the HES SHMI data guidance document.

Link to the SHMI publication timetable and HES SHMI data guidance document:
<http://digital.nhs.uk/SHMI>

Planned publication dates are announced on NHS Digital's publication calendar. This publication was released on the pre-announced publication date. The next edition of this publication is due to be released on Thursday 09 September 2021. A timetable for future SHMI publications is available to download from the link provided above.

Link to the NHS Digital data homepage
<https://digital.nhs.uk/data>

Accessibility and clarity

Accessibility is the ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the metadata, illustrations and accompanying advice.

The SHMI is available in the public domain from the following sources:

- NHS Digital website: <https://digital.nhs.uk/data-and-information/publications/statistical/shmi>
- NHS.uk website: <http://www.nhs.uk/Scorecard/Pages/IndicatorFacts.aspx?MetricId=96>
- data.gov.uk website: https://data.gov.uk/dataset/summary_hospital-level_mortality_indicator_shmi

The monthly publication of the SHMI includes:

- Interactive data visualisation
- One page summary of the publication
- SHMI data at trust level
- SHMI data at site of treatment level
- SHMI data broken down by trust and diagnosis group
- SHMI contextual indicators
- SHMI model parameter statistics
- SHMI model fit statistics
- Indicator methodology specifications
- Background quality report

Data files are provided in machine readable (csv) and Excel format, and data definitions are provided for the machine readable versions.

The following supporting information is available to download from the SHMI homepage:

- Interpretation guidance
- Frequently asked questions (FAQs)
- Guidance for trusts
- Publication timetable
- Users and uses statement
- Detailed information on the HES data used in the calculation of the SHMI
- Indicator methodology specifications
- Methodology development log

- Ad-hoc reports and analysis

A SHMI data extract service is available to trusts that complete an application process and have obtained the relevant approvals. Trusts that have registered for this service receive an extract of the record-level data which has been used to calculate their SHMI and accompanying contextual indicators following the monthly publication of the SHMI in order to allow them to carry out quality assurance and further analysis and investigations into their SHMI. Trusts are only provided with access to their own SHMI data. Further information and an application form are available to download from the SHMI homepage.

Link to the SHMI homepage:

<http://digital.nhs.uk/SHMI>

Other requests for access to the record-level data which are used in the calculation of the SHMI should be directed to NHS Digital's Data Access Request Service (DARS).

Link to the Data Access Request Service:

<http://digital.nhs.uk/dars>

Coherence and comparability

Coherence is the degree to which data that are derived from different sources or methods, but refer to the same topic, are similar. Comparability is the degree to which data can be compared over time and domain.

Coherence

There are several tools available to organisations in England to monitor mortality associated with hospitalisation. There are some differences between the SHMI and other mortality indicators.

Two of the main tools which are currently used by NHS trusts in addition to the SHMI are:

- Hospital Standardised Mortality Ratio (HSMR) which is developed and produced by Dr Foster Intelligence (DFI).
- Risk Adjusted Mortality Indicator (RAMI) which is developed and produced by CHKS.

HSMR

The main differences between the SHMI and the HSMR are:

- The HSMR is reported as a standardised ratio with a baseline of 100, while the SHMI has a baseline of 1.
- The SHMI includes deaths occurring in hospital and deaths occurring outside of hospital within 30 days of discharge, whereas the HSMR only includes deaths occurring in hospital.
- The SHMI includes deaths from all 260 Clinical Classifications Software (CCS) groups (except COVID-19 activity), while the HSMR includes deaths from 56 CCS groups which account for around 80 per cent of in hospital deaths.
- The case-mix adjustment variables differ between the SHMI and the HSMR. For example, the HSMR includes an adjustment for palliative care whereas the SHMI does not.
- The final model selection method varies between the SHMI and the HSMR.

Further details of the methodology used to calculate the HSMR are available from DFI:

Link to the DFI website:
<http://www.drfooster.com/>

RAMI

The main differences between the SHMI and the RAMI are:

- The RAMI is reported as a standardised ratio with a baseline of 100, while the SHMI has a baseline of 1.

- The SHMI includes deaths occurring in hospital and deaths occurring outside of hospital within 30 days of discharge, whereas the RAMI only includes deaths occurring in hospital.
- The SHMI includes more activity compared to the RAMI. For example, zero length of stay emergencies and spells containing the palliative care diagnosis code (Z51.5) are excluded from the RAMI.
- The case-mix adjustment variables differ between the SHMI and the RAMI.

Further details of the methodology used to calculate the RAMI are available from CHKS:

Link to the CHKS website:

<http://www.chks.co.uk/>

Seven-day Services

NHS Digital's Seven-day Services publication includes an indicator on the topic of mortality associated with hospitalisation. This indicator compares the odds of mortality within 30 days of admission for patients admitted at the weekend to the odds of mortality within 30 days of admission for patients admitted midweek (Tuesday, Wednesday and Thursday). The SHMI can be used to compare a trust's mortality outcomes to the national baseline, whereas the purpose of the Seven-day Services mortality indicator is to compare outcomes for patients admitted to a particular trust at the weekend with outcomes for patients admitted midweek at the same trust. The comparison is strictly within the same trust and is independent of the overall mortality rate for that trust.

Due to the distinct purposes of the 2 indicators, the methodologies used to calculate them are different. In particular, the adjustments made for various patient characteristics differ between the 2 indicators.

From April 2020, the Department of Health and Social Care is no longer commissioning NHS Digital to produce the Seven-day Services indicators. Therefore, no further publications in this series are planned.

Link to historical NHS Digital's Seven-day Services publications:

<https://digital.nhs.uk/data-and-information/publications/statistical/seven-day-services>

Other mortality indicators

Other indicators on the topic of mortality can be found on the Clinical Indicators section of the website. These include:

- Mortality indicators for specific conditions or procedures e.g. mortality within 30 days of hospital admission for stroke, deaths from venous thromboembolism (VTE) related events within 90 days post discharge from hospital.
- Mortality indicators for different geographical and demographic breakdowns e.g. Clinical Commissioning Group (CCG) level indicators, indicators broken down by deprivation decile.
- Indicators which are wider in scope than mortality associated with hospitalisation e.g. potential years of life lost (PYLL) from causes considered amenable to healthcare.

Link to other mortality indicators published by NHS Digital:
<https://digital.nhs.uk/data-and-information/clinical-indicators>

Analysis on deaths within 30, 60 and 90 days of admission or procedure calculated using HES-ONS linked data (which is the same dataset as that used in the calculation of the SHMI) was made available as a monthly topic of interest alongside the April 2014 – August 2014 provisional monthly HES Admitted Patient Care (APC) data.

Link to monthly topic of interest on the HES-ONS linked dataset:
<http://content.digital.nhs.uk/pubs/hesapr14aug14>

In March 2017, the National Quality Board introduced new guidance for NHS trusts on how they should learn from the deaths of people in their care. As part of this, trusts are required to publish information on the total number of inpatient deaths and the number that were subject to case record review. Of those deaths reviewed, trusts are also required to provide an estimate of the number that were judged more likely than not to have been due to problems in care. This data is not collected centrally, and data should not be compared between trusts due to differences in the case record review methodologies.

Link to National Quality Board guidance on learning from deaths:
<https://www.england.nhs.uk/publication/national-guidance-on-learning-from-deaths/>

The national Maternal, Newborn and Infant Clinical Outcome Review Programme (MNI-CORP) is a national programme of work conducting surveillance and investigating the causes of maternal deaths, stillbirths and infant deaths. It is carried out by the Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK (MBRRACE-UK) collaboration.

Link to further information on the MBRRACE-UK collaboration:
<https://www.npeu.ox.ac.uk/mbrance-uk>

Comparability

The SHMI is not designed to measure changes in mortality over time. Instead, its purpose is to compare trust level mortality outcomes to the England average at a fixed point in time.

The statistical models used in the calculation of the SHMI are rebased monthly, at every publication. This means that the England average figures which drive the expected figures are updated every month. Any improvements or otherwise to a SHMI for a trust compared to the previous publication will be relative to the England average at the point of publication. Therefore, if the overall England average has improved and the performance of a trust has also improved around the same scale, their SHMI would show little, if any, change.

The SHMI can be used to compare a trust's mortality outcomes to the national baseline. However, it should not be used to directly compare mortality outcomes between trusts, and it is inappropriate to rank trusts according to their SHMI.

As of the July 2020 publication, COVID-19 activity has been excluded from the SHMI. The SHMI is not designed for this type of pandemic activity and the statistical modelling used to calculate the SHMI may not be as robust if such activity were included.

Excluding COVID-19 activity means that, as far as possible, the SHMI will remain consistent with previous publications. However, there may be significant changes in the volumes in activity in some of the SHMI diagnosis groups as a result of the COVID-19 pandemic (e.g. reductions in elective admissions). NHS Digital will carefully monitor this as more data

becomes available for the time periods affected by the pandemic and will regularly review the exclusions and their appropriateness as well as the SHMI values, applying appropriate caveats where necessary.

Please note that there has been a fall in the number of spells for some trusts due to COVID-19 impacting on activity from March 2020 onwards and this appears to be an accurate reflection of hospital activity rather than a case of missing data. Further information is available in the contextual indicator 'Provider spells compared to the pre-pandemic period' which is part of this publication.

From the March 2020 publication onwards, the deprivation contextual indicators have been calculated using the 2019 version of the Index of Multiple Deprivation (IMD) meaning that the results are not comparable with previous releases of these indicators (which used the 2015 version).

The following methodological changes were implemented from the May 2019 publication onwards, as part of the ongoing SHMI review:

- Changes to some diagnosis groups
- Inclusion of an adjustment for seasonality
- Inclusion of an adjustment for birthweight (perinatal diagnosis groups only)
- Updates to disclosure control methodology
- Using the 2015 version of the IMD in the calculation of the deprivation contextual indicators.

This means that the results for this publication are not directly comparable with the results from publications released prior to May 2019. In addition, a breakdown of the data by site of treatment has been introduced, along with SHMI bandings and control limits for some diagnosis groups. Further details, including an assessment of the impact of the changes, are available in the announcement of methodological changes.

Link to the announcement of methodological changes:

<http://digital.nhs.uk/pubs/methchanges>

The SHMI and accompanying contextual indicators are published to reflect organisational structures at the time of publication processing. Therefore, combined data are published for trusts that have merged. Details of organisational changes affecting previous SHMI publications are provided in the SHMI frequently asked questions document.

Link to the SHMI frequently asked questions:

<http://digital.nhs.uk/SHMI>

For trusts that have merged, if 2 sites share the same name and 1st 4 characters of the postcode, they are deemed to be the same physical site and a site level mapping table is created on this basis. The site level mappings used in the preparation of this publication are listed in Table 2 below. A known limitation to this method is that if the name of the site has changed then this mapping cannot be carried out.

Table 2: Site level mappings used in the preparation of the SHMI publication, April 2020 – March 2021

Old site code	New site code	Site name
RGQ03	RDE83	ALDEBURGH HOSPITAL
RC110	RC979	BEDFORD HOSPITAL SOUTH WING
RGQ78	RDE78	BLUEBIRD LODGE
RBAC3	RH5F3	BRIDGWATER HOSPITAL
RXH05	E0N1P	BRIGHTON GENERAL HOSPITAL
RQ8L0	RDEP3	BROOMFIELD HOSPITAL
RDZ05	R0D03	CHRISTCHURCH HOSPITAL
RBAC2	RH5G3	DENE BARTON COMMUNITY UNIT
RGQ05	RDE05	FELIXSTOWE HOSPITAL
RR105	RRK98	GOOD HOPE HOSPITAL
RR101	RRK97	HEARTLANDS HOSPITAL
RXH17	X8T7H	HOVE POLYCLINIC
RXH10	Q0W5X	HURSTWOOD PARK CENTRE
RDZ01	R0D11	MACMILLAN UNIT
RBA11	RH5A8	MUSGROVE PARK HOSPITAL
RXH09	N6J7V	PRINCESS ROYAL HOSPITAL
RXH06	G0W1C	ROYAL ALEXANDRA CHILDREN'S HOSPITAL
RXH01	E0A3H	ROYAL SUSSEX COUNTY HOSPITAL
RR109	RRK99	SOLIHULL HOSPITAL
RXH07	X5M8P	SUSSEX EYE HOSPITAL

Source: NHS Digital

New guidance on the clinical coding of patients with sepsis came into effect from 1 April 2017. This resulted in an increase in the number of patients with a primary diagnosis of sepsis and a decrease in the number of patients with a primary diagnosis of pneumonia, urinary tract infection and other localised infections. The improved guidance means that the clinical coding more accurately reflects the patient's condition but also means that the results for some diagnosis groups are not directly comparable to those for previous publications.

SUS+ has replaced SUS with a more efficient and flexible system. This has resulted in some changes to the way that sensitive records are dealt with, meaning that there may be an increase in the number of records without identifiers such as NHS number and date of birth. This will have a limited impact on the SHMI publication.

Link to further information on SUS+:

<http://digital.nhs.uk/sus/replacement>

Comparison with other countries

The SHMI reports on mortality for all non-specialist acute trusts in England only.

- Public Health Scotland publishes the Hospital Standardised Mortality Ratio (HSMR) (the methodology used to calculate the Scottish HSMR is not the same as that used by DFI to calculate the English HSMR):

Link to the Scottish HSMR data:

<http://www.isdscotland.org/Health-Topics/Quality-Indicators/HSMR/>

- The Welsh Government does not currently publish any indicators on mortality associated with hospitalisation.
- The Department of Health in Northern Ireland does not currently publish any indicators on mortality associated with hospitalisation.

Some of the main differences between the SHMI and Public Health Scotland's HSMR are:

- The SHMI includes deaths occurring in hospital and deaths occurring outside of hospital within 30 days of discharge, whereas the Scottish HSMR includes deaths occurring within 30 days of admission.
- The SHMI includes inpatient activity from all specialties, whereas the Scottish HSMR excludes the obstetrics and psychiatry specialties.
- The variables used in the statistical model to calculate the expected number of deaths differ between the SHMI and the Scottish HSMR.
- The SHMI excludes COVID-19 activity whereas this is included in the Scottish HSMR.

Link to the Scottish HSMR COVID-19 methodology update:

https://www.isdscotland.org/Health-Topics/Quality-Indicators/HSMR/Methodology/_docs/HSMR-covid19-methodology-update.pdf

Trade-offs between output quality components

Trade-offs are the extent to which different aspects of quality are balanced against each other.

The Department of Health and Social Care commissioned NHS Digital to produce and publish the SHMI following the recommendations from the National Review of the HSMR (this work considered the English HSMR, not the HSMR used in Scotland). As part of the review the Department of Health and Social Care also commissioned independent statistical modelling work, which was carried out by the School of Health and Related Research (SchARR) at the University of Sheffield.

The statistical models used to estimate the expected number of deaths for the SHMI are built using fewer risk adjustment variables than the variables proposed by the Steering Group for the National Review of the HSMR in their report. Using more risk adjustment variables may improve the predictive power of the models. However, the proposed risk adjustment variables were highly correlated. Using only primary diagnosis, age, Charlson comorbidity index, method of admission to hospital and gender provided a simple and stable model which was recommended by the SchARR in their 'An evaluation of the Summary Hospital Mortality Index' report.

Link to the reports: 'An evaluation of the Summary Hospital Mortality Index' and 'National review of the hospital standardised mortality ratio':

<http://digital.nhs.uk/SHMI>

Some proposed risk adjustment variables are not of sufficient data quality to be included in the final model. For example, the SHMI methodology does not include an adjustment for patients who are recorded as receiving palliative care. This is because there is considerable variation between trusts in the coding of palliative care. Details of further analysis on this issue can be referenced in the palliative care coding report, which is available to download from NHS Digital's SHMI research and development page.

Link to the palliative care coding report:

<http://digital.nhs.uk/shmi-development>

A combination of finalised and provisional data is used in the calculation of the SHMI to ensure that the indicator is as timely as possible.

Assessment of user needs and perceptions

The SHMI users and uses statement describes in detail:

- The different SHMI resources available
- The users of the SHMI resources
- The different ways in which the resources are used
- How we assess and respond to user needs

Link to the SHMI users and uses statement:

<http://digital.nhs.uk/SHMI>

Feedback from users about the proposals being considered as part of the ongoing SHMI review has recently been requested, and this will be used to inform the next stages of the review.

Performance, cost and respondent burden

This section describes the effectiveness, efficiency and economy of the statistical output.

The source of this data is through administrative systems in secondary care and administrative data on death registrations; there is no respondent burden.

Confidentiality, transparency and security

This section describes the procedures and policies used to ensure sound confidentiality, security and transparent practices.

Confidentiality

The SHMI publication is subject to a standard NHS Digital risk assessment prior to issue. Disclosure control has been implemented where necessary in accordance with the protocols associated with the underlying data sources. Further details of the risk assessment are available in NHS Digital's Disclosure Control Procedure. Where disclosure control is deemed necessary, the methodology used is described in the corresponding indicator methodology specification document.

Link to NHS Digital's Disclosure Control Procedure

<https://digital.nhs.uk/data-and-information/find-data-and-publications/statement-of-administrative-sources/a-z-of-nhs-digital-official-and-national-statistics-publications#user-documents>

Link to guidance on how NHS Digital looks after information:

<https://digital.nhs.uk/data-and-information/looking-after-information>

Link to the SHMI and contextual indicator methodology specifications:

<http://digital.nhs.uk/SHMI>

Transparency

Detailed methodology specification documents are available on the NHS Digital website. Users are invited to provide feedback and comments. All feedback and comments will be reviewed and, where appropriate, changes made to the methodology.

Known methodological issues are detailed in the SHMI methodology development log and are kept under review.

Link to the SHMI methodology development log:

<http://digital.nhs.uk/shmi-development>

Other supporting documentation is also published on the SHMI homepage.

Link to the SHMI homepage:

<http://digital.nhs.uk/SHMI>

Security

The Code of Practice for Statistics is followed regarding security and release of information prior to publication.

Link to the Code of Practice for Statistics:

<https://code.statisticsauthority.gov.uk/>