Seven-day Services Indicators: interpretation guidance and frequently asked questions (FAQs)

Purpose of this guidance

This guidance has been produced to aid the understanding and interpretation of the Seven-day Services Indicators. Its purpose is to help non-statisticians to accurately describe the indicators and to avoid some of the common mistakes which could be made when interpreting them.

NHS Digital hopes that this guidance will be of assistance to users interpreting the statistics, including media teams writing press releases or other material about the Seven-day Services Indicators.

The analysts responsible for the statistics and the NHS Digital media team are always happy to offer advice and guidance on the language that can and cannot be used to accurately describe the data, so please do contact us with any queries using the contact details at the end of this document.

What are the Seven-day Services Indicators?

The Seven-day Services Indicators provide information on how we can effectively measure both improvement and variation in care provision across the week. Indicators on the following topics are included:

- Mortality within 30 days of admission by week-part of admission to hospital
- Emergency readmissions within seven days of discharge from hospital by day of discharge
- Length of stay following an emergency admission to hospital by day of admission
What data are used to calculate the Seven-day Services Indicators?

The data used to produce the Seven-day Services Indicators are generated from data that trusts submit to the Secondary Uses Service (SUS). The data are processed by NHS Digital to create Hospital Episode Statistics (HES) data. HES data are used in the calculation of the Seven-day Services emergency readmissions and length of stay indicators.

HES data are linked with death registrations data from the Office for National Statistics for use in the calculation of the Seven-day Services mortality indicator to allow deaths which occurred outside of hospital to be captured.

Why are the indicators now published as management information?

Previously, the Seven-day Services indicators have been published as experimental official statistics. Due to the inherent complexities of the methodology and the range of academic opinion on the construction of the indicators, the resource required to refine the statistics through a Technical Advisory Group process would be prohibitive, and the achievement of a robust outcome would be uncertain. Also, these indicators have been accessed less frequently than other comparable statistics.

Therefore, from the October 2018 publication onwards they are being produced as management information for local use by NHS trusts rather than as experimental official statistics. Management information describes aggregate information collated and used in the normal course of business to inform operational delivery, policy development or the management of organisational performance. This may not be quality assured to the same extent as other official statistics.

Interpretation of the Seven-day Services mortality indicator

What does the indicator measure?

The 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). Corresponding results comparing patients admitted during the transition period (Monday and Friday) to patients admitted midweek are also provided as contextual information. The results are presented as odds ratios.

The indicator has been designed to give individual trusts additional evidence about the care they deliver at different times of the week. If variation exists across the week for a particular trust, it should be examined in more detail to understand the causes.

There may be differences in the characteristics of patients admitted at the weekend compared to midweek, and it is not possible to identify and adjust for all of these. For example, it is difficult to fully adjust for the severity of the condition of the patient because
this information is not recorded in the HES dataset upon which the indicator is based. However, adjustments for various patient characteristics that are captured in hospital data (including the condition the patient is in hospital for, other conditions the patient suffers from, age, sex, deprivation, ethnicity, seasonality, admission source, admission method and prior admission history) are included in the methodology.

What do the odds ratios mean?

Odds ratios which are greater than one indicate an increased likelihood of mortality compared to the reference category (midweek) while odds ratios which are less than one indicate a decreased likelihood of mortality compared to the reference category, holding all other characteristics constant.

An odds ratio of 1.14 means that the odds of mortality within 30 days of admission for patients admitted at the weekend are 14 per cent higher than the odds of mortality within 30 days of admission for patients admitted midweek. This implies that the probability of mortality within 30 days of an admission at the weekend is higher than for midweek admissions, but does not mean that this probability is 14 per cent higher i.e. the probability ratio is not 1.14. If the odds ratio is greater than one, it is an overestimate of the corresponding probability ratio. If the odds ratio is less than one, it is an underestimate of the corresponding probability ratio. The extent of the underestimation or overestimation is greater if the underlying mortality rate is higher. If the underlying mortality rate is low then the odds ratio and the probability ratio are approximately equal.

Confidence intervals are also presented. If the confidence interval for a trust includes the value one then the Seven-day Services mortality indicator does not show a significantly different outcome for mortality within 30 days of admission for patients admitted at the weekend compared to midweek. For example, if the confidence interval for the odds ratio is (0.95 – 1.25) then the mortality indicator does not show a significant weekend effect, but if the confidence interval for the odds ratio is (1.05 – 1.15) then there is a significant difference.

This is illustrated in Figure 1 where the odd ratios are represented by the blue bars and the confidence intervals are represented by the vertical lines.

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1 Significant means that the probability that the observed effect is due to chance is less than 5 per cent.
The Seven-day Services mortality indicator cannot be used to directly compare mortality outcomes between trusts and, in particular, it is inappropriate to rank trusts according to their odds ratios.

The comparison is strictly within the same hospital trust and is independent of the overall mortality rate for that trust. For example, a trust with a high odds ratio for mortality at the weekend compared to midweek may have a low overall mortality rate and vice-versa.

An odds ratio which is significantly greater than one should not immediately be interpreted as indicating bad performance.

Instead, it should be viewed as a ‘smoke alarm’ which requires further investigation by the trust.

The methodology used to calculate the odds ratios for a particular trust takes into account the number of patients treated and their characteristics (including the condition the patient is in hospital for, other conditions the patient suffers from, age, sex, deprivation, ethnicity, seasonality, admission source, admission method and prior admission history) and so these factors should not influence the results.

There are many other factors which have the potential to affect a trust’s outcomes including (but not limited to) the quality of the data upon which the indicator is based, other patient
characteristics not listed above, patient behaviour, the provision of services both in and outside of the hospital (including social care), the organisation of services and availability of resources e.g. staff, and quality of care, but this analysis is unable to determine the causes of any observed variation.

It is recommended that trusts with odds ratios which are significantly greater than one should follow this up and use a structure such as the pyramid of investigation for special cause variation\(^2\) to further investigate their odds ratios (see Figure 2), particularly if the odds ratio is significantly greater than one for multiple reporting periods.

More likely explanations are listed towards the bottom of the pyramid, and so it is suggested that these are investigated first.

**Figure 2: Pyramid of investigation for special cause variation**

![Pyramid of investigation for special cause variation](image)

Similarly, an odds ratio which is not significantly different from one or is significantly less than one should not immediately be interpreted as indicating satisfactory or good performance. The Seven-day Services mortality indicator requires careful interpretation and should be used in conjunction with other indicators and information from other sources (e.g. the other Seven-day Services indicators, self-assessment data on the Seven-day Services clinical standards\(^3\), other mortality indicators, patient feedback, staff surveys and other similar material) that together form a holistic view of trust outcomes.

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\(^3\) Further information on the clinical standards and the self-assessment data is available at [https://www.england.nhs.uk/seven-day-hospital-services/](https://www.england.nhs.uk/seven-day-hospital-services/) and [https://improvement.nhs.uk/resources/seven-day-services/](https://improvement.nhs.uk/resources/seven-day-services/).
What does a correlation between the indicator and another variable mean?
A correlation between the indicator and other variables of interest does not imply causation. Even if a correlation suggests that there is a relationship between the indicator and another variable, it does not necessarily imply that one is causing the other. For example, other factors may be influencing both the Seven-day Services mortality indicator and other variables, suggesting a direct relationship where there is none.

What does this indicator tell us about the number of avoidable deaths?
This indicator does not provide a measure of the number of avoidable deaths for a hospital trust. Whether or not a death could have been prevented can only be investigated by a detailed case-note review. This indicator is not a direct measure of quality of care.

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, which is available to download from https://www.england.nhs.uk/publication/national-guidance-on-learning-from-deaths/. 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.

Are all hospital trusts included in the indicator?
Trusts are excluded from the indicator if the number of deaths within 30 days of admission in any of the three week-parts is less than 100, as the indicator would be unreliable in such cases. This means that it is possible for a trust to be included in the results for some reporting periods and not others.

Activity for providers other than NHS trusts (e.g. independent sector providers) is considered to be outside of the scope of this publication, and so these data have been excluded from the analysis.

In light of concerns around whether the statistical models adequately address the differences in case-mix for patients treated in specialist trusts, community trusts and mental health trusts compared to non-specialist acute trusts, only non-specialist acute trusts are included in the indicator.

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4 For this indicator, the week is divided into the following three week-parts: midweek (Tuesday, Wednesday and Thursday), weekend (Saturday and Sunday), and transition (Monday and Friday).
Are all admissions to a hospital trust included in the data?
Any hospital inpatient, whether on an emergency or elective pathway, may deteriorate unexpectedly with a risk of death if the deterioration is not recognised and acted upon promptly. For this reason, both emergency and elective admissions are included in the indicator. Contextual information for mortality within 30 days of emergency admissions only is presented alongside the main indicator.

How are deaths attributed to trusts?
For the calculation of the Seven-day Services mortality indicator, a death is counted if the patient died within 30 days of admission. This means that it is possible for one death to be included multiple times in the indicator if there are multiple admissions for the same patient. For example, if a patient is admitted to trust A on 1 January, and then admitted to trust B on 20 January and dies on 23 January then a death is counted for both of these admissions.

What does the marginal national odds ratio measure?
The marginal national odds ratio gives an indication of the overall difference in 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 across England.

The marginal national results do not include trusts where the number of deaths in any of the three week-parts is less than 100, or data for specialist trusts, community trusts and mental health trusts.

What does the over-dispersed z-score measure?
The over-dispersed z-score represents the number of over-dispersed standard deviations the trust level odds ratio is from the marginal national value. This means that if the over-dispersed z-score lies outside of the range -1.96 to 1.96 then the trust level odds ratio is significantly different from the marginal national odds ratio.

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). The calculation of the over-dispersed z-score and the confidence intervals for the odds ratios includes adjustments to take account of over-dispersion where it is present.

For publications released prior to October 2018, data for specialist trusts, community trusts and mental health trusts were included in the marginal national results if the number of deaths within 30 days of admission was greater than or equal to 100 for each of the three week-parts, although individual results for these trusts were not presented. Further information on this methodological change is available at http://digital.nhs.uk/pubs/methchanges.
How is the Seven-day Services mortality indicator different from the Summary Hospital-level Mortality Indicator (SHMI)?

The SHMI is an indicator which reports on mortality at trust level across the NHS in England using a standard and transparent methodology. It is produced and published quarterly as a National Statistic\(^6\) 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.

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 two indicators, the methodologies used to calculate them are different. In particular, the adjustments made for various patient characteristics differ between the two indicators.

Further information on the SHMI is available at http://digital.nhs.uk/shmi.

Interpretation of the Seven-day Services emergency readmissions indicator

What does the indicator measure?

The indicator compares the odds of an emergency readmission within seven days for patients discharged on a particular day of the week to the odds of an emergency readmission within seven days for patients discharged on a Wednesday. The results are presented as odds ratios.

The indicator has been designed to give individual trusts additional evidence about the care they deliver at different times of the week. If variation exists across the week for a particular trust, it should be examined in more detail to understand the causes.

Adjustments for various patient characteristics (including the condition the patient is in hospital for, other conditions the patient suffers from, age, sex, deprivation and ethnicity) are included in the methodology.

What do the odds ratios mean?

Odds ratios which are greater than one indicate an increased likelihood of an emergency readmission within seven days of discharge compared to a Wednesday while odds ratios

\(^6\) National Statistics status means that official statistics meet the highest standards of trustworthiness, quality and public value. Further information is available at https://www.statisticsauthority.gov.uk/code-of-practice/.
which are less than one indicate a decreased likelihood of an emergency readmission within seven days of discharge compared to a Wednesday, holding all other characteristics constant.

An odds ratio of 1.14 means that the odds of an emergency readmission within seven days for discharges on a particular day of the week are 14 per cent higher than the odds of an emergency readmission within seven days for discharges on a Wednesday. This implies that the probability of an emergency readmission within seven days of discharge for that day of the week is higher than for discharges on a Wednesday, but does not mean that this probability is 14 per cent higher i.e. the probability ratio is not 1.14. If the odds ratio is greater than one, it is an overestimate of the corresponding probability ratio. If the odds ratio is less than one, it is an underestimate of the corresponding probability ratio. The extent of the underestimation or overestimation is greater if the underlying emergency readmission rate is higher. If the underlying emergency readmission rate is low then the odds ratio and the probability ratio are approximately equal.

Confidence intervals are also presented. If the confidence interval for a trust includes the value one then the Seven-day Services emergency readmissions indicator does not show a significantly different outcome for emergency readmissions within seven days for patients discharged on a particular day compared to a Wednesday. For example, if the confidence interval for the odds ratio is (0.90 – 1.10) then the indicator does not show a significant effect, but if the confidence interval for the odds ratio is (1.05 – 1.15) then there is a significant difference. For a visual representation of this, see Figure 1.

The Seven-day Services emergency readmissions indicator cannot be used to directly compare outcomes between trusts and, in particular, it is inappropriate to rank trusts according to their odds ratios.

The comparison is strictly within the same hospital trust and is independent of the overall emergency readmission rate for that trust. For example, a trust with a high odds ratio for emergency readmissions following discharge on a Saturday compared to discharge on a Wednesday may have a low overall emergency readmission rate and vice-versa.

An odds ratio which is greater than one should not immediately be interpreted as indicating bad performance.

Instead, it should be viewed as a 'smoke alarm' which requires further investigation by the trust.

The methodology used to calculate the odds ratios for a particular trust takes into account the number of patients treated and their characteristics (including the condition the patient is in hospital for, other conditions the patient suffers from, age, sex, deprivation and ethnicity) and so these factors should not influence the results.
There are many other factors which have the potential to affect a trust’s outcomes including (but not limited to) the quality of the data upon which the indicator is based, other patient characteristics not listed above, patient behaviour, the provision of services both in and outside of the hospital (including social care), the organisation of services and availability of resources e.g. staff, and quality of care, but this analysis is unable to determine the causes of any observed variation.

It is recommended that trusts with odds ratios which are significantly greater than one should follow this up and use a structure such as the pyramid of investigation for special cause variation to further investigate their odds ratios (see Figure 2), particularly if the odds ratio is significantly greater than one for multiple reporting periods.

Similarly, an odds ratio which is not significantly different from one or is significantly less than one should not immediately be interpreted as indicating satisfactory or good performance. The Seven-day Services emergency readmissions indicator requires careful interpretation and should be used in conjunction with other indicators and information from other sources (e.g. the other Seven-day Services indicators, self-assessment data on the Seven-day Services clinical standards, other emergency readmissions indicators, patient feedback, staff surveys and other similar material) that together form a holistic view of trust outcomes.

**What does a correlation between the indicator and another variable mean?**

A correlation between the indicator and other variables of interest does not imply causation. Even if a correlation suggests that there is a relationship between the indicator and another variable, it does not necessarily imply that one is causing the other. For example, other factors may be influencing both the Seven-day Services emergency readmissions indicator and other variables, suggesting a direct relationship where there is none.

**What does this indicator tell us about the number of avoidable emergency readmissions?**

This indicator does not provide a measure of the number of avoidable emergency readmissions for a hospital trust. Whether or not a readmission could have been prevented can only be investigated by a detailed case-note review. This indicator is not a direct measure of quality of care.

Due to the way in which readmissions are identified, it is likely that some emergency readmissions are unrelated to the original stay in hospital.

**Are all hospital trusts included in the indicator?**

Trusts are excluded from the indicator if the number of emergency readmissions within seven days for any day of discharge is less than 100, as the indicator would be unreliable in
such cases. This means that it is possible for a trust to be included in the results for some reporting periods and not others.

Activity for providers other than NHS trusts (e.g. independent sector providers) is considered to be outside of the scope of this publication, and so these data have been excluded from the analysis.

In light of concerns around whether the statistical models adequately address the differences in case-mix for patients treated in specialist trusts, community trusts and mental health trusts compared to non-specialist acute trusts, only non-specialist acute trusts are included in the indicator.

**Are all discharges included in the data?**

Discharges with both emergency and non-emergency admission methods are included in the indicator. Contextual information which includes only discharges where the patient was admitted in an emergency is presented alongside the main indicator.

Stillbirths and patients who are discharged as dead are excluded, as a readmission is not possible.

**How are emergency readmissions attributed to trusts?**

Emergency readmissions are attributed to the trust from which the patient was last discharged. For example, if a patient is discharged from trust A on 1 January, and then admitted to trust B as an emergency on 3 January and discharged on 4 January, the emergency readmission at trust B is attributed to trust A.

**What does the marginal national odds ratio measure?**

The marginal national odds ratio gives an indication of the overall difference in the odds of an emergency readmission within seven days for patients discharged on a particular day to the odds of an emergency readmission within seven days for patients discharged on a Wednesday.

The marginal national results do not include trusts where the number of emergency readmissions within seven days for any day of discharge is less than 100, or data for specialist trusts, community trusts and mental health trusts.⁷

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⁷ For publications released prior to October 2018, data for specialist trusts, community trusts and mental health trusts were included in the marginal national results if the number of emergency readmissions within seven days of discharge was greater than or equal to 100 for each day of discharge, although individual results for these trusts were not presented. Further information on this methodological change is available at [http://digital.nhs.uk/pubs/methchanges](http://digital.nhs.uk/pubs/methchanges).
What does the over-dispersed z-score measure?
The over-dispersed z-score represents the number of over-dispersed standard deviations the trust level odds ratio is from the marginal national value. This means that if the over-dispersed z-score lies outside of the range -1.96 to 1.96 then the trust level odds ratio is significantly different from the marginal national odds ratio.

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). The calculation of the over-dispersed z-score and the confidence intervals for the odds ratios includes adjustments to take account of over-dispersion where it is present.

How is the Seven-day Services emergency readmissions indicator different from other indicators on emergency readmissions?

NHS Digital publish emergency readmissions indicators as part of the NHS Outcomes Framework, the Clinical Commissioning Group Outcomes Indicator Set and the Compendium of Population Health. These indicators, which cover emergency readmissions within 30 days (28 days for the Compendium of Population Health indicator), are presented as indirectly standardised rates and allow for comparisons between the various geographies and health organisations (e.g. local authorities, clinical commissioning groups, hospital trusts) and the national figure. These indicators also exclude hospital admissions for certain diagnoses, including cancer, obstetrics and mental health

The Seven-day Services emergency readmissions indicator has been designed to give trusts additional evidence about the care they deliver at different times of the week. The results are presented as odds ratios and the comparison is strictly within the same hospital trust and is independent of the overall emergency readmission rate for that trust. The shorter readmission period of seven days is used as, in some cases, a readmission within a short period following discharge from hospital would be considered indicative of the patient being discharged before they were fit or be due to lack of availability of rehabilitation and support services when a patient was discharged home following hospital treatment.

Further information about these indicators is available at https://digital.nhs.uk/data-and-information.

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8 Mental health admissions are only excluded from the Compendium of Population Health indicator.

9 The decision to look at readmissions within seven days of discharge is based on evidence in the following reports: http://www.rand.org/content/dam/rand/pubs/technical_reports/2012/RAND_TR1198.pdf and http://www.hsj.co.uk/Journals/2/Files/2011/6/15/Sg2_Service%20Kit_Reducing%2030-Day%20Readmissions.pdf.
Interpretation of the Seven-day Services length of stay indicator

What does the indicator measure?

The indicator presents the median\(^{10}\) length of stay by day of admission to hospital. The number of admissions with a length of stay of 0, 1, 2, 3 and 4 or more days is also provided for contextual information.

It has been designed to give individual trusts additional contextual information about the care they deliver at different times of the week. If variation exists across the week for a particular trust, it should be examined in more detail to understand the causes.

Does the methodology include adjustments for patient characteristics?

At this time, no adjustments for patient characteristics have been applied to this indicator. Therefore, comparisons between results for different trusts or between trusts and the national level results are not appropriate. It is not possible to determine whether variations in length of stay for admissions on different days of the week are due to differences in quality of care and/or service provision, or due to differences in the characteristics of the patients admitted.

What does a correlation between the indicator and another variable mean?

A correlation between the indicator and other variables of interest does not imply causation. Even if a correlation suggests that there is a relationship between the indicator and another variable, it does not necessarily imply that one is causing the other. For example, other factors may be influencing both the Seven-day Services length of stay indicator and other variables, suggesting a direct relationship where there is none.

Are all admissions included?

The length of stay can only be calculated once the patient has been discharged. Only discharges where the patient was admitted in an emergency are included in this indicator. Cases where the length of stay is negative are also excluded, as this means that the admission date is after the discharge date, indicating a data quality error.

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\(^{10}\) The median represents the middle value when all values for length of stay are placed in ascending order. If the number of values is even then there is no single middle value and the median is then calculated as the arithmetic mean of the two middle values.
Are all hospital trusts included in the indicator?
Activity for providers other than NHS trusts (e.g. independent sector providers) is considered to be outside of the scope of this publication, and so these data have been excluded from the analysis.

More information and contact details
The latest edition of the Seven-day Services publication is available to download from NHS Digital’s publication repository.

➢ Seven-day Services publication page

For media queries please contact our press office at media@nhsdigital.nhs.net or phone 0300 303 3888.

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