



Public Health
England

Protecting and improving the nation's health

HCAI Data Capture System User Manual

Denominators

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. It does this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. PHE is an operationally autonomous executive agency of the Department of Health.

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Document History

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Denominators

This guide provides an overview of the different denominators that are used in the HCAI DCS to calculate rates, where these data are sourced from and processed, and how they differ from those used in the Official Statistics publications on the gov.uk web pages (i.e. Quarterly Epidemiological Commentary, Annual Tables, etc).

Please see Table 1 for the list of different reports and aspects of the system where a rate can be calculated and therefore, a denominator is used.

Table 1. List of reports where rates are calculated

Located	Name	Default
Reports	Counts or Rates of Infection Episode	Count
Reports -> Standard Reports->Annual Summaries	Cases Reported by Quarterly	Count
	Cases Reported by Yearly	Count
	Cases Trust Apportioned Quarterly	Count
	Cases Trust Apportioned Yearly	Count
	Cases CCG Attributed Quarterly	Count
Summary Dashboard	Cases CCG Attributed Yearly	Count
	Summary Chart	Count
Benchmarking Dashboard	Trends Chart	Count
	Benchmarking	Rate

Table 2. Types of denominator

Type	Base Unit	Description
Mid-year population	Clinical Commissioning Group	Data are published annually on the Office for National Statistics website (www.ons.gov.uk).
	Local Authority	Population data by Clinical Commissioning Group is usually published in the autumn/winter of the following year, for example 2014 CCG level mid-year population estimates are expected in November-December 2015.
		Population data by Local Authority is usually published in the summer of the following year, for example 2015 mid-year population estimates are expected in June-July 2016.
		Please see Mid-year population Mid-year Population for more information.

Type	Base Unit	Description
KH03 (occupied overnight beds)	NHS acute Trust	<p>KH03 returns are published by NHS England (http://www.england.nhs.uk/statistics/statistical-work-areas/bed-availability-and-occupancy/bed-data-overnight/) on a quarterly basis, as an average value for a three month period. The reports are usually published within 8 weeks of the quarter-end, i.e. for the April to June 2015 quarter, the data were published in August 2015.</p> <p>Please see KH03 KH03 for more information.</p>
IS bed days + discharges	Independent Sector Provider	<p>These data are submitted by Independent Sector Providers at the end of a given financial year. This is the sum of bed days in a year and the discharges in a year. Please see IS bed days + discharges KH03</p> <p>KH03 returns are published on a quarterly basis as the number of occupied overnight beds on an average day in a three month period. In the Official Statistics publications on the organisms included in the mandatory surveillance of healthcare associated infections on gov.uk, all rates produced by quarter (i.e. in Quarterly Epidemiological Commentary), use the specific quarter in question to get the most accurate results.</p> <p>However, in order for the HCAI DCS to be able to calculate rates over any time period, the denominator data is used slightly differently.</p> <p>Data is downloaded from the NHS England website, as it is for the Official Statistics reports; however, data is then scaled up to the total number of occupied overnight beds for a given financial year. This is then uploaded to the HCAI DCS. Then, in order for the system to calculate a rate for a specific time period, the total occupied overnight beds for the financial year is divided by the number of days in the financial year and then multiplied by the number of days in the time period in question. For example, in order to calculate the number of occupied overnight beds for January 2014 you would follow equations (1) and (2):</p> <p>(1) <i>Number of occupied overnight beds for January 2014</i> =</p> $\left(\frac{\text{Total occupied overnight beds in financial year 2013/14}}{\text{Total number of days in financial year 2013/14}} \right) \times \text{Total number of days in January 2014}$

		<p>(2) <i>Number of occupied overnight beds for January 2014</i> = $\left(\frac{34327781}{365}\right) \times 31 \text{ days}$ =</p> <p>2915510</p> <p>As the data starts off as a financial year as opposed to a quarter, any seasonal differences in bed day values are removed and so the rates will be <u>slightly</u> different.</p> <p>NB. The rates produced by the HCAI DCS should be used as an estimate only, please see the official outputs on the PHE gov.uk pages for the actual infection rates. In addition, if you wish to use rates for your organisation outside of your organisation please contact us at mandatory.surveillance@phe.gov.uk for confirmation that the rates are accurate and suitable to be used for more than an estimate.</p> <p>IS bed days + discharges for more information on how these are calculated.</p>
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Denominator Notes

Mid-year Population

Mid-year population data on the HCAI DCS will be uploaded as full calendar years on an annual basis.

Rates by financial year calculated in the Official Statistics publications on the gov.uk web pages have historically used the mid-year population data (published by calendar year) that was considered to be the most relevant, and the easiest for our users wishing to calculate their own rates locally, for example, when calculating a financial year rate for 2013/14, we have used the population data published for calendar year 2013.

However, due to the dynamic nature of on-demand reporting (i.e. user can often modify the date ranges and frequency of a report) the HCAI DCS, will by default use the most appropriate denominator for the time period, meaning that for a rate for financial year 2013/14, the equivalent of 9 months (April-December, inclusive) of population data from 2013 and 3 months (January-March, inclusive) of population data for 2014 will be used as the population denominator.

Population data by Local Authority is used just for Local Authorities, while population data by CCG is used for both CCGs but also to scale up from the health geography base unit to sub-national groups (e.g. Area Team, NHS regions).

KH03

KH03 returns are published on a quarterly basis as the number of occupied overnight beds on an average day in a three month period. In the Official Statistics publications on the organisms included in the mandatory surveillance of healthcare associated infections on gov.uk, all rates produced by quarter (i.e. in Quarterly Epidemiological Commentary), use the specific quarter in question to get the most accurate results.

However, in order for the HCAI DCS to be able to calculate rates over any time period, the denominator data is used slightly differently.

Data is downloaded from the NHS England website, as it is for the Official Statistics reports; however, data is then scaled up to the total number of occupied overnight beds for a given financial year. This is then uploaded to the HCAI DCS. Then, in order for the system to calculate a rate for a specific time period, the total occupied overnight beds for the financial year is divided by the number of days in the financial year and then multiplied by the number of days in the time period in question. For example, in order to calculate the number of occupied overnight beds for January 2014 you would follow equations (1) and (2):

(1) *Number of occupied overnight beds for January 2014 =*

$$\left(\frac{\text{Total occupied overnight beds in financial year 2013/14}}{\text{Total number of days in financial year 2013/14}} \right) \times \text{Total number of days in January 2014}$$

(2) *Number of occupied overnight beds for January 2014 =* $\left(\frac{34327781}{365} \right) \times 31 \text{ days}$
 $= 2915510$

As the data starts off as a financial year as opposed to a quarter, any seasonal differences in bed day values are removed and so the rates will be slightly different.

NB. The rates produced by the HCAI DCS should be used as an estimate only, please see the official outputs on the PHE gov.uk pages for the actual infection rates. In addition, if you wish to use rates for your organisation outside of your organisation please contact us at mandatory.surveillance@phe.gov.uk for confirmation that the rates are accurate and suitable to be used for more than an estimate.

IS bed days + discharges

Bed days + discharges account for the number of different days a patient was in the hospital. A day case will count as 1, while a one-night stay will count as 2.

In order to calculate this, Independent Sector Providers need to calculate two things:

- (a) the total number of patients in a hospital bed at midnight (bed days) between, and
- (b) the total number of discharges

The total number of bed days, for FY 2014/15 for example, is the sum of the number of occupants in a bed at midnight during the whole financial year, from those in a bed at midnight

at the end of the day of 1st April 2014 to those in bed at midnight at the end of the day of 31st March 2015.

The total number of discharges, for FY 2014/15 for example, is the total number of patients with a discharge date between 1st April 2014 and 31st March 2015, inclusive.

NB: The IS bed days + discharge denominator data are only available at Independent Sector Healthcare Provider level; therefore, rates for the Independent Sector cannot be calculated at site level. In addition, as Independent Sector Healthcare Providers can have sites over multiple health geographies, it is not possible to scale up Independent Sector Healthcare Providers to sub-national groups through the reporting route. This means that rates using 'ID bed days + discharges' can only be calculated at Provider- and National-levels.

Denominator Time Period

Denominator Data has been uploaded to the HCAI DCS in one-year blocks. This corresponds to calendar year for mid-year population data and financial year for both KH03 occupied overnight beds and IS bed days + discharges.

In most of the reports listed in Table 1, you have the ability to select the 'Denominator Period' that you would like to use to calculate the rates in the report that you are running. The default value for the 'Denominator Period' will be set to 'Most Applicable'; this allows the system to determine what the most relevant time period for the denominator is.

For example, if running a report to calculate the rate of **Trust apportioned** *C. difficile* infection for financial years 2011/12 to 2012/13, inclusive, by quarter, the system will assess the 'Period From' and 'Period To' dates that you have selected for the report and will then best match the denominator period, in this instance it will use **KH03 data** for financial year 2011/12 to calculate the first four quarters' rates (i.e. April-June 2011, July-September 2011, October-December 2011 and January-March 2012) and then KH03 data for financial year 2012/13 to calculate the last four quarters' rates (i.e. April-June 2012, July-September 2012, October-December 2012 and January-March 2013).

Alternatively, you can select any of the time periods that are listed in the drop-down menu for the 'Denominator Period' report parameter. If you select a single time period as the denominator but are asking for infection rates which cover a different period than the selected denominator period, all of the time periods will have rates calculated using the selected time period.

For example, if you run a report of rates for MSSA bacteraemia per 100,000 population, covering 2012 and 2013 and select the 'Denominator Period' as "01-01-2012 to 31-12-2012" then both the rates for 2012 and 2013 will be calculated using a 2012 denominator.

We recommend the leaving the report set to 'Most Applicable' value for the 'Denominator Period' if you are unsure what to use.

NB. Denominator values used on the system have to be extracted from different sources and then processed before they can be uploaded to the HCAI DCS. In addition, different denominators are published/provided to PHE directly at different times during the year. If you want to determine what the most recent denominator time period is for the denominator type

that you have selected, please look at the drop-down for 'Denominator Period'. All time periods available for specific denominators will be presented in this drop-down list.

Appropriate denominator usage

There are multiple different denominator types, and not all of them are relevant or appropriate for use in calculating a specific rate. The default denominator value is dependent on the organisation type that you selected earlier. For NHS Trusts the only denominator value available will be 'KH03 occupied overnight beds (per 100,000)'. For CCGs, Local Authorities and Directors of Public Health the only denominator value available will be 'Mid-year population (per 100,000)'; however, it is worth noting that for Local Authorities (either as counts or rates), the number of infections per Local Authority is calculated using the residents pathway through the attribution process – this is different to the CCG tracing algorithm (please see Local Authority Mapping User Guide and CCG Attribution User Guide for more information on the how cases are attributed to Local Authorities and Clinical Commissioning Groups, respectively). For Independent Sector Healthcare Providers the only denominator available will be 'IS bed days + discharges (per 100,000)'.

For NHS Trusts, CCGs, Local Authorities, Directors of Public Health and Independent Sector Healthcare Providers no other denominator type option is provided as the rates can only be calculated using these denominator types. This is because these organisations are considered to be the base-level organisational units that the sub-national and national groups are made up from.

For sub-national and national groups, the number of infections/bacteraemias are aggregated up through one of two routes:-

- The reporting route – where the base unit is an NHS Trust and the infection/bacteraemia count for a sub-national group is aggregated by summing the total for all NHS Trusts and/or Independent Sector Healthcare Providers that fall into in a particular geographical area.
- The commissioning route – where the base unit is a CCG and the infection/bacteraemia count for a sub-national group is aggregated by summing the total for all CCGs within a particular geographical area.

For example, NHS Regions will have their total number of infections/bacteraemias calculated by summing the total number of infections/bacteraemias for all CCGs that fall within their region, while the total number of infections/bacteraemias for a PHE Centre will be calculated by summing up the total number of infections/bacteraemias for all NHS Trusts that fall within their geographical area.

NB: the default denominator type presented by the HCAI DCS will be 'Mid-year population (per 100,000)' regardless of the default aggregation route. If you choose to calculate rates for PHE Centre or PHE Region using the 'Mid-year population (per 100,000)' denominator (the default type presented), there will be a mismatch in the way that the numerator and denominator are aggregated from their base units. In this instance, in order to make sure that the way in which the numerator and denominator are calculated match (i.e. via the reporting route), you may wish to use the drop-down menu to select 'KH03 occupied overnight beds (per 100,000)'.

Please also note, that this denominator is a proxy for NHS Trust population, and is best used when calculating rates of Trust apportioned or Trust assigned cases of bacteraemia/infections.

Please see Table 3 for the recommended 'Denominator Type' for each 'Organisation Type'.

In addition, for all sub-national/national groups, there are alternative denominators available in the drop-down menu. However, if you use 'KH03 occupied overnight beds (per 100,000)' for any of the organisation types on the commissioning pathway, this will again cause a mismatch between the aggregation routes for the numerator and denominator. Calculating rates using this combination is therefore not recommended and should be interpreted with caution.

Denominator values for Independent Sector Healthcare Provider Sites are not currently collected; IS bed days + discharges are provided at Provider-level and National-level only. Therefore, please note, that while you can start to set the parameter values for Independent Sector Healthcare Provider Sites and rates, there are actually no Denominators available for this Organisation Type and so the report cannot actually be run as a rate for this organisation type.

Furthermore, even though other denominator options may be available for sub-national organisations, these are for use with NHS data and the only rate for Independent Sector Healthcare cases that is sensible to calculate is one by 'Mid-year Population'.

Table 3. Most appropriate 'Denominator Type' by 'Organisation Type'

Organisation Type	Most appropriate Denominator Type	Notes
NHS Trust	KH03 occupied overnight beds (per 100,000)	Only denominator type available
Public Health England Centre	KH03 occupied overnight beds (per 100,000)	Infection episodes are aggregated up to sub-national group level through the reporting route, so occupied overnight beds are the denominator type that matches numerator aggregation. Alternative denominators are available but please note the mismatch between aggregation of infection episodes and denominators.
Public Health England Region	KH03 occupied overnight beds (per 100,000)	Infection episodes are aggregated up to sub-national group level through the reporting route, so occupied overnight beds are the denominator type that matches numerator aggregation.

Organisation Type	Most appropriate Denominator Type	Notes
		Alternative denominators are available but please note the mismatch between
		aggregation of infection episodes and denominators.
Public Health England (National)	KH03 occupied overnight beds (per 100,000) or Mid-year population (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.
PHE Field Epidemiology (National)	KH03 occupied overnight beds (per 100,000) or Mid-year population (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.
Clinical Commissioning Group	Mid-year population (per 100,000).	Denominator based on the population of the CCG catchment area. The DCS does not currently support a registered patient denominator.
NHS England Area Team	Mid-year population (per 100,000).	Infection episodes are aggregated up to sub-national group level through the commissioning route, so mid-year population is the most appropriate denominator type. Alternative denominators are available but please note the mismatch between aggregation of infection episodes and denominators.
NHS England Commissioning Board Region	Mid-year population (per 100,000).	Infection episodes are aggregated up to sub-national group level through the commissioning route, so mid-year population is the most appropriate denominator type. Alternative denominators are available but please not the mismatch between aggregation of infection episodes and denominators.
NHS England (National)	Mid-year population (per 100,000) or KH03 occupied overnight beds (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.

Organisation Type	Most appropriate Denominator Type	Notes
Independent Sector Healthcare Provider	IS bed days + discharges (per 100,000).	Only denominator type available
Independent Sector Healthcare Provider Site	N/A	No denominator available
Renal Unit	N/A	No denominator available
Director of Public Health	Mid-year population (per 100,000).	Only denominator type available
Local Authority	Mid-year population (per 100,000).	Only denominator type available
Department of Health	Mid-year population (per 100,000) or KH03 occupied overnight beds (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.
Care Quality Commission	Mid-year population (per 100,000) or KH03 occupied overnight beds (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.
Trust Development Authority	Mid-year population (per 100,000) or KH03 occupied overnight beds (per 100,000).	All infection episodes are aggregated to national-level. Thus, either denominator is appropriate.