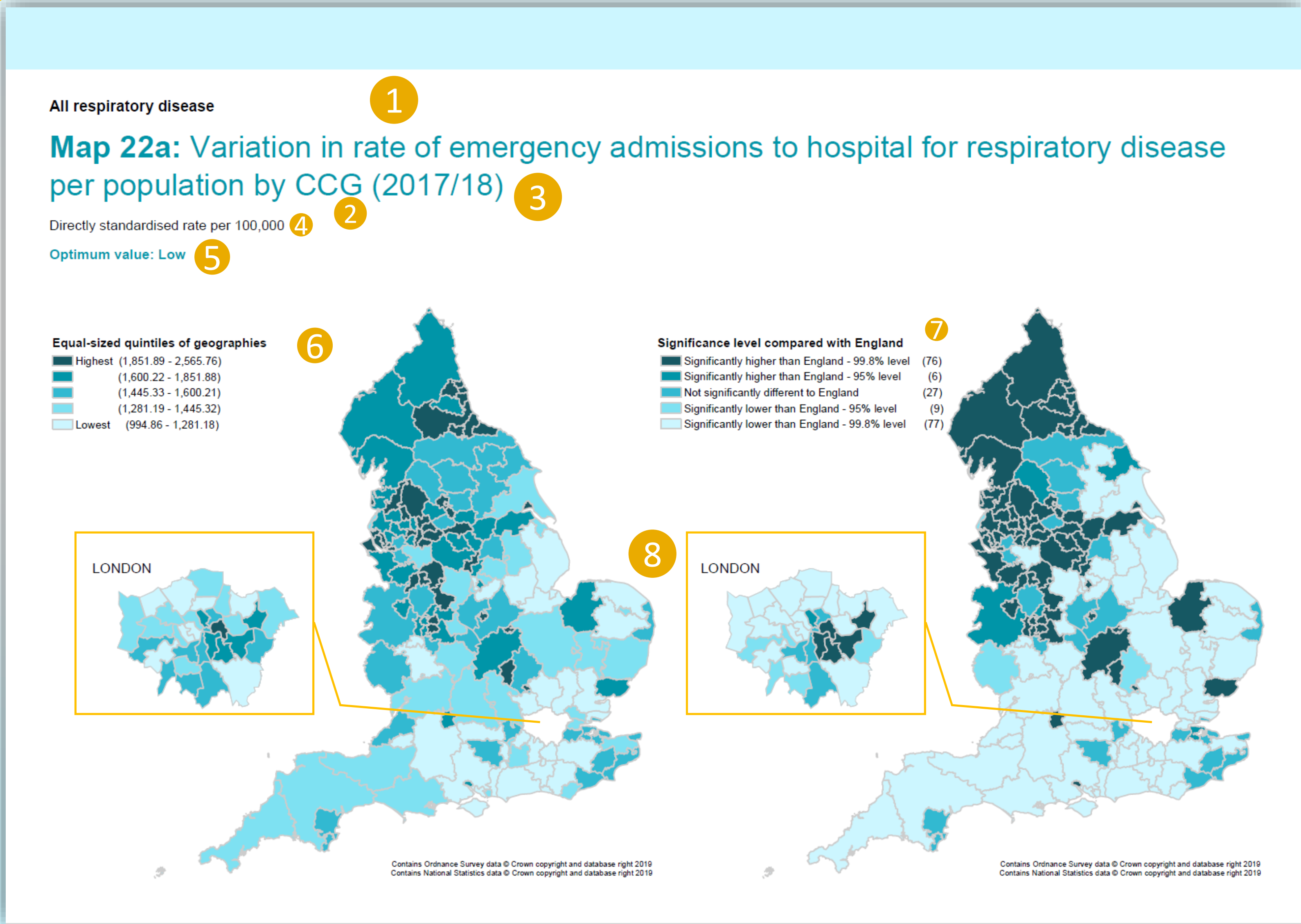
Maps

1. **Type of statistic** (e.g. rate, proportion)
2. **Geographic boundaries**
3. **Year of data presented**
4. **Rate calculated per x number of people**
5. **Optimum values** Low indicates lower values are preferential (high indicates higher values are preferential). Local interpretation maybe required for some indicators.



6. **Equal sized quintiles** The number of areas presented on the map are divided equally between the 5 categories with those with the highest values forming the 'Highest' group etc.

   For example, in 2018 there were 195 CCGs, so 39 CCGs are in each category. Darker areas have the highest values.

7. **Significance level compared with England** The darkest and lightest shading on map shows CCGs whose confidence intervals do not overlap with the England value.

   The second darkest and lightest colours show areas where the England value falls between the CCG's 95% and 99.8% CI.

   The number in brackets indicates the number of CCGs in each category.

8. **London** is presented as a separate zoomed in map for clarity.

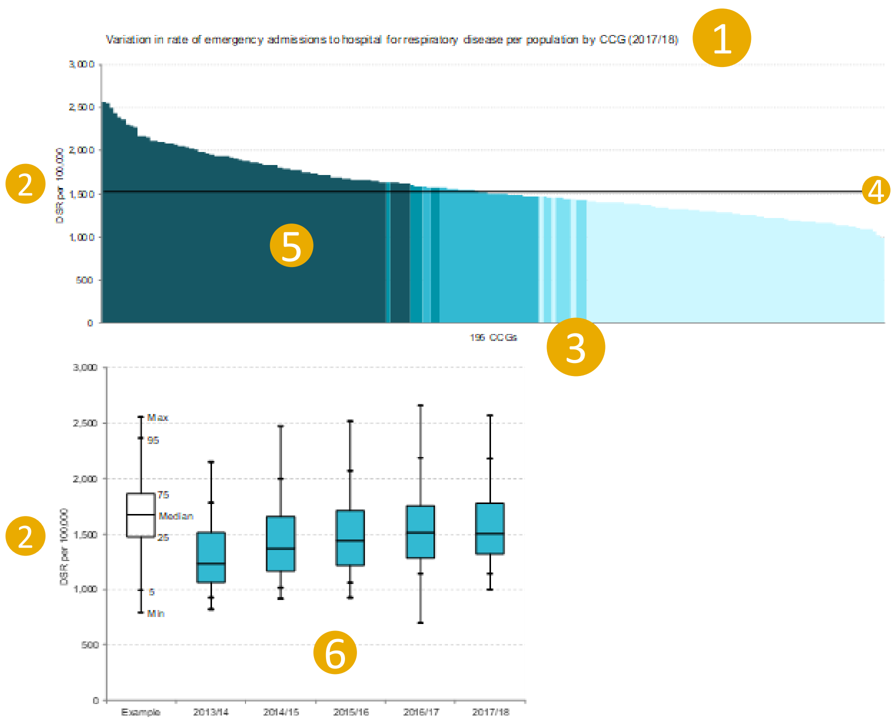
Chart, box plot and table

1. Title shows indicator details including: value type, geography and year .

2. The y-axis plots the value and gives details of the value type e.g. rate / proportion and the unit e.g. per 100,000 population.

3. The x-axis shows the geography and the number of areas on chart.

4. The line shows the England average.



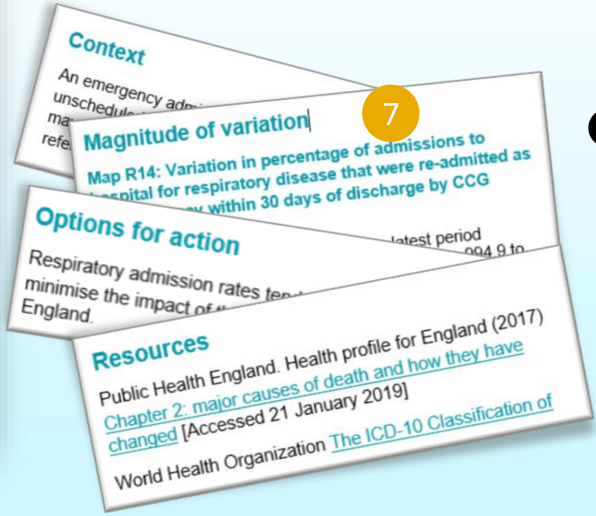
	Example	2013/14	2014/15	2015/16	2016/17	2017/18	
Max-Min (Range)		1325.7	1553.5	1590.2	1960.2	1570.9	No significant change
95th-5th percentile		858.1	974.4	1008.7	1044.1	1039.9	WIDENING Significant
75th-25th percentile		454.2	493.9	496.6	474.3	457.9	No significant change
Median		1232.7	1376.6	1439.9	1511.4	1506.4	INCREASING Significant

5. Each bar represents an area (e.g. a CCG). The height of the bar is relative to the value for that area. Collectively, the bars show the spread of values across England.

The colour of the bar represents how significant the area's value is in relation to England based on the area's confidence interval. Areas utilise the same colours and categories as the maps.

Areas that are significantly higher than England at a 99.8% or 95% level are shown as darker bars whereas those with lower significance to England, at a 99.8% or 95% level, are lighter. The colour in the middle represents areas that are not significantly different from England.

Where the significance bar chart shows little variation across the CCGs, the equal interval map colours have been used.



6. For each indicator, data is presented visually in a time series of box and whisker plots. The box plots show the distribution of data.

The line inside each box shows the median (the mid-point, so if the 195 CCGs were sorted in order of value, the value halfway between the CCGs in the 97th and 98th position would give the median). The bottom and top of the teal box represents the values which 25% and 75% of the areas fall below. 50% of the areas have a value within this range.

The whiskers mark the values at which 5% and 95% of areas fall below. The median and maximum values are also shown.

The time series allows us to see how the median has changed over time, but also whether the gap between the extreme values has changed.

The table accompanying the box and whisker plots shows whether there has been any statistically significant change in the median, or in the degree of variation over time.

7. **Sections in the chapter**

Context – provides an overview of why the indicator is of public health interest

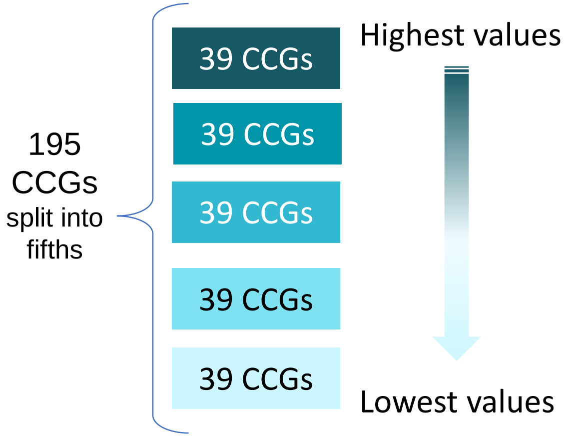
Magnitude of variation – provides commentary in relation to the chart, box plot and table

Option for action – gives suggestions for best practice

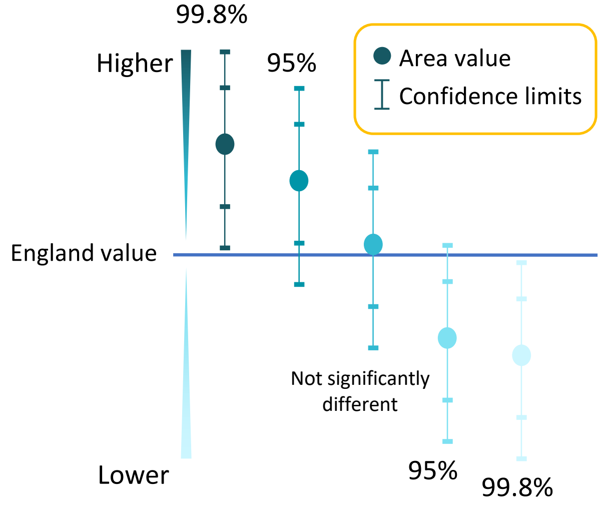
Resources – gives links to useful documents

How were the categories calculated?

Equal-sized quintiles



Significance to England



Confidence intervals give an estimated range in which the true CCG value lies.

Where the CCG's confidence interval does not overlap with the England value, the CCG is classed as being *significantly higher or lower than England at a 99.8% level*.

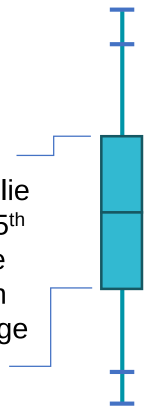
If the England value lies between the 99.8% and 95% CI, this value is classed as being *significantly higher or lower than England at a 95% level*.

Where the England value is between the upper and lower 95% CI, the CCG is classed as *not being significantly different from England*.

Box & whisker plot

Whiskers
Show the extreme values in the dataset.

Box
50% of the data values lie between the 25th and 75th percentile. The distance between these is known as the inter-quartile range (IQR).



Maximum The value of the area with the highest value.

95th percentile 95% of areas have values below this.

75th percentile 75% of areas have values below this.

Median (50th percentile) The median is the middle value of an ordered dataset. Half of the observations are below it and half above.

25th percentile 25% of areas have values below this.

5th percentile 5% of areas have a value below this.

Minimum The value of the area with the lowest value.

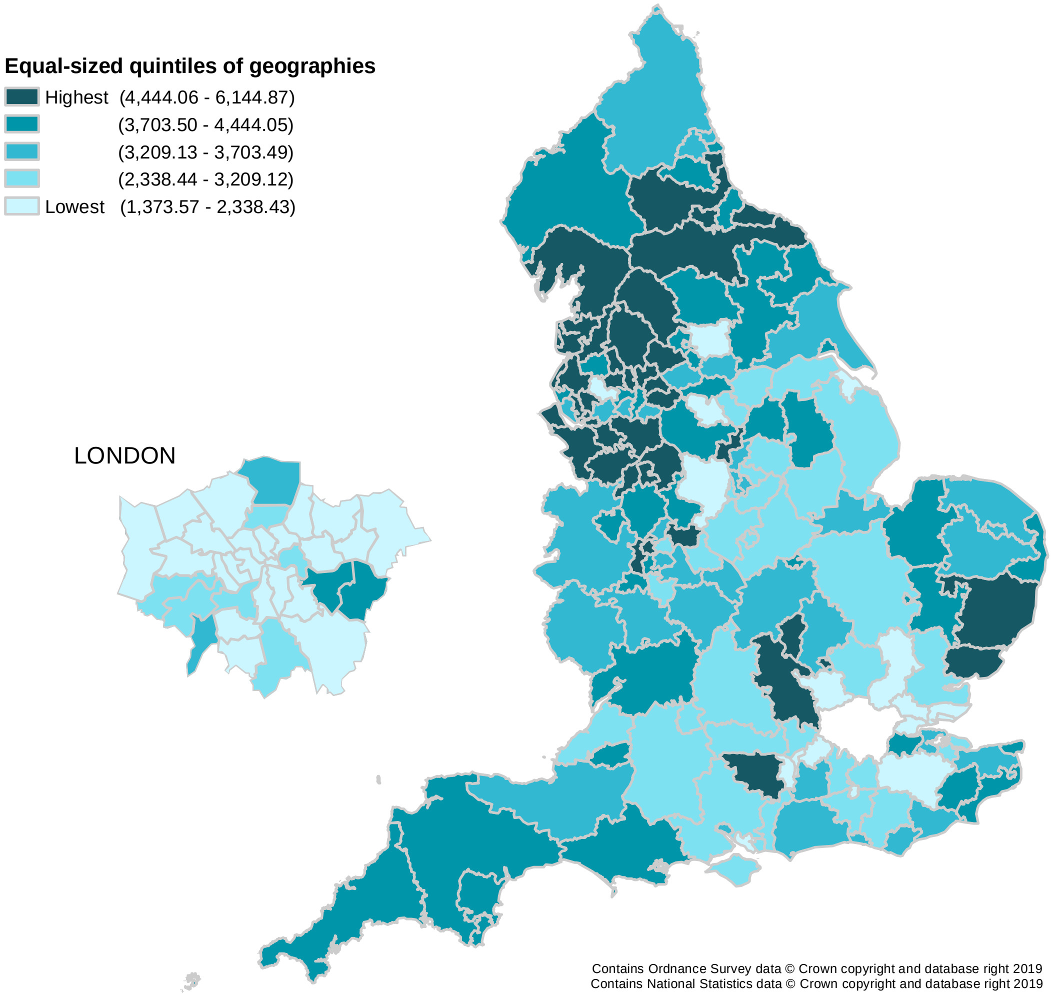
Box plot percentile	CCG rank position (195 CCGs in 2018)
Max	195
95%	Mid value between values of CCGs in ranks 185 and 186
75%	Mid value between values of CCGs in ranks 146 and 147
50% - Median	Mid value between values of CCGs in ranks 97 and 98
25%	Mid value between values of CCGs in ranks 48 and 49
5%	Mid value between values of CCGs in ranks 9 and 10
Min	1

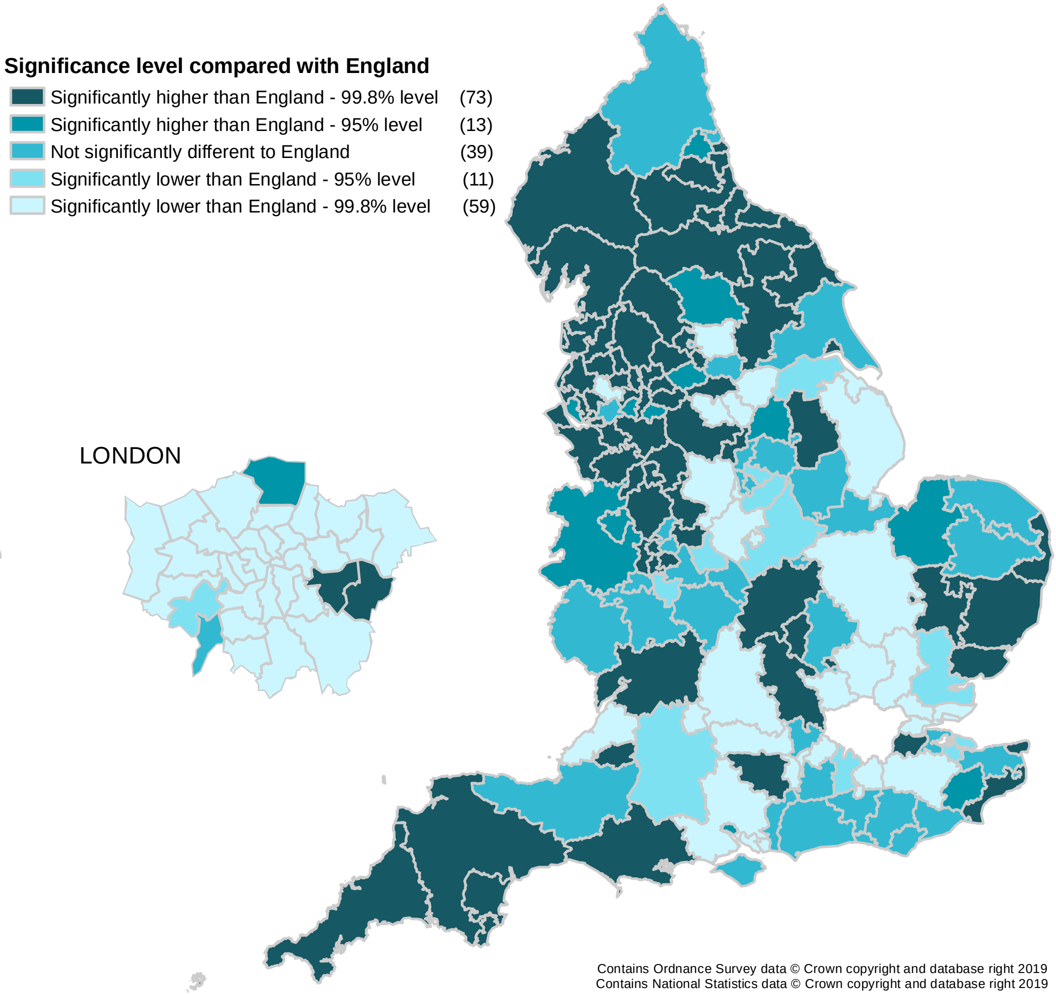
Bronchiolitis – Hospital admissions

Map 20a: Variation in rate of emergency admissions to hospital for bronchiolitis in children aged under 2 years per population by CCG (2015/16-2017/18)

Crude rate per 100,000

Optimum value: Low

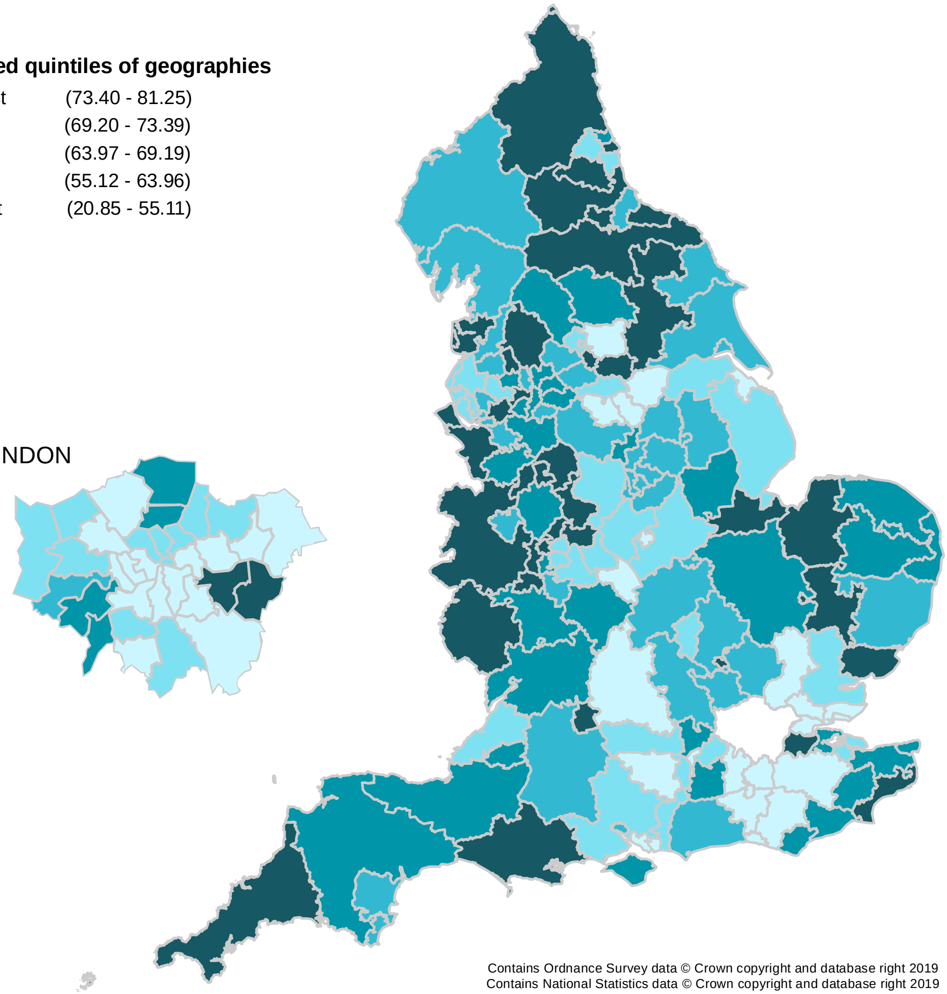


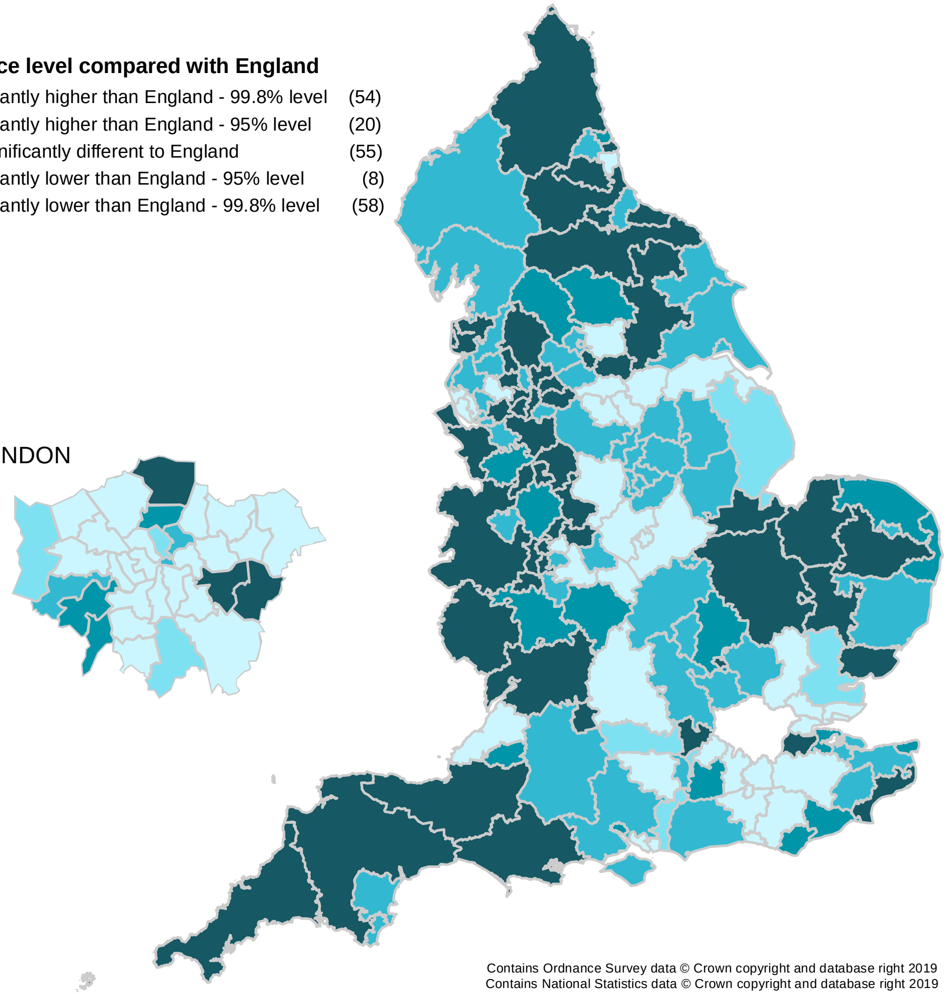


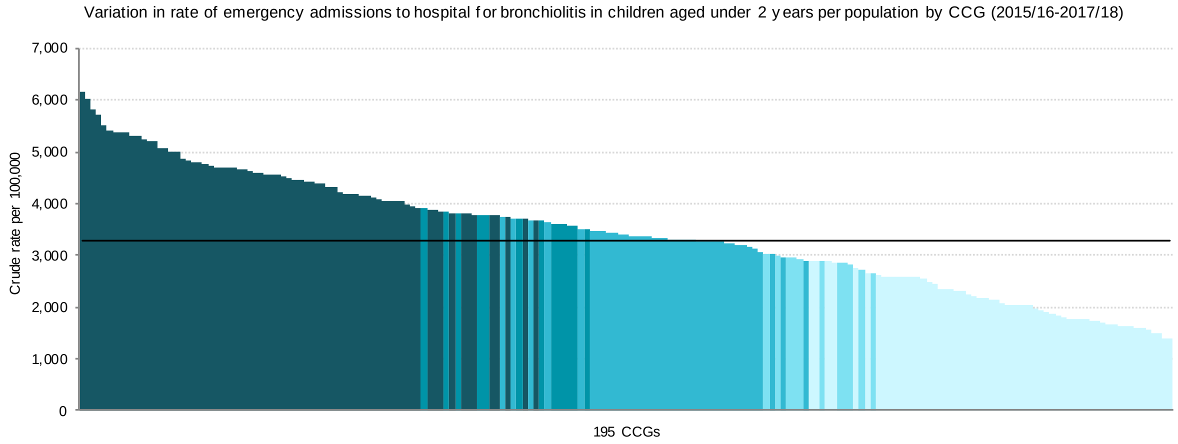
Bronchiolitis – Hospital admissions

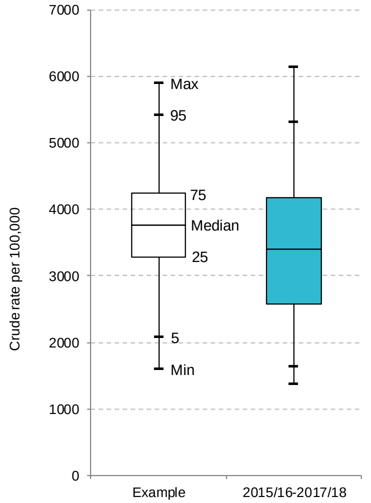
Map 20b: Variation in percentage of zero and one day emergency admissions to hospital for bronchiolitis in children aged under 2 years by CCG (2015/16-2017/18)

Optimum value: Requires local interpretation









Max-Min (Range)		4771.3
95th-5th percentile		3665.8
75th-25th percentile		1595.8
Median		3400.3

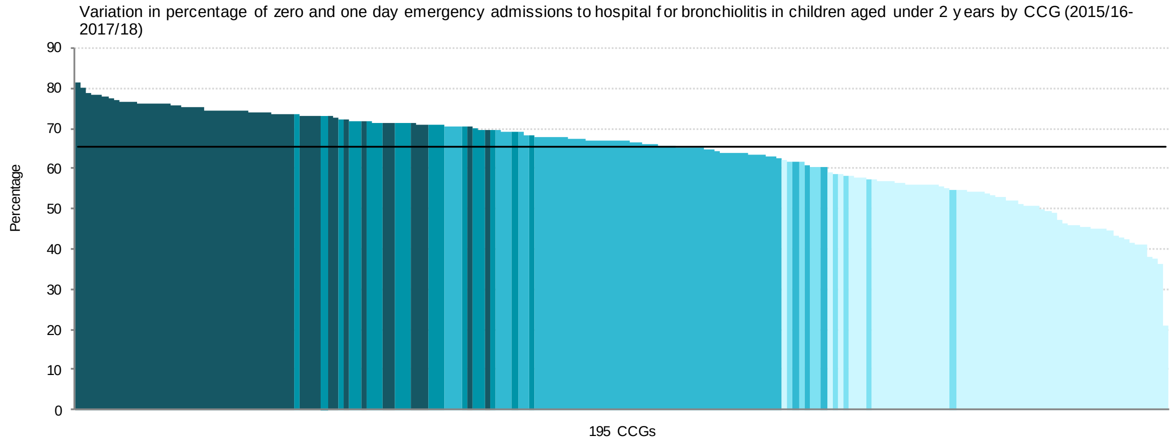
Context

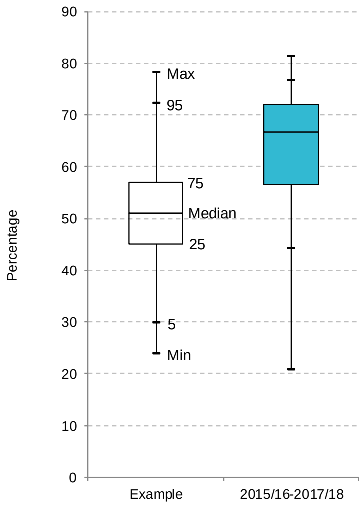
Bronchiolitis is a viral respiratory infection of the lower airways, predominantly affecting infants under the age of 1 year but occasionally infants up to the age of 2 years. In industrialised countries, 1-3% of all infants are admitted to hospital as a result of bronchiolitis.[1] Human respiratory syncytial virus (RSV) is the most common cause of bronchiolitis in infants, and RSV is the single most common cause of hospital admissions in infancy.[2] Globally RSV is the most common cause of childhood acute and severe lower respiratory tract infections and a cause of substantial mortality.[3]

The majority of children with bronchiolitis do not require admission to hospital. Indications for hospital admission include the need for feeding therapy and/or supplemental oxygen therapy. Prolonged hospital admission of young children disrupts family life, and affects the well-being of the child and their family, including the financial impact of time off work.

A family's capacity to care for a recovering infant at home may influence a clinician's decision whether to discharge a child with bronchiolitis. For selected patients, brief admission to short-stay observation units (sometimes in combination with home oxygen therapy) can be a safe means to reduce the burden to families and services of prolonged hospitalization.[4]

The seasonal epidemic nature of bronchiolitis, with most cases in England occurring in the winter, also means that unnecessarily prolonged inpatient stays place demands upon healthcare resources at a time of year when services are already stretched to their limits.





	Example	2015/16-2017/18
Max-Min (Range)		60.4
95th-5th percentile		32.4
75th-25th percentile		15.4
Median		66.7

Magnitude of variation

Map 20a: Variation in rate of emergency admissions to hospital for bronchiolitis in children aged under 2 years per population by CCG (2015/16-2017/18)

The maps and column chart display the latest period (2015/16 to 2017/18), during which CCG values ranged from 1373.6 to 6144.9 per 100,000 population, which is a 4.5-fold difference between CCGs. The England value for 2015/16 to 2017/18 was 3281.6 per 100,000 population.

Map 20b: Variation in percentage of zero and one day emergency admissions to hospital for bronchiolitis in children aged under 2 years by CCG (2015/16-2017/18)

The maps and column chart display the latest period (2015/16 to 2017/18), during which CCG values ranged from 20.9% to 81.3%, which is a 3.9-fold difference between CCGs. The England value for 2015/16 to 2017/18 was 65.4%.

Variations in admissions for children with bronchiolitis may reflect epidemiological factors including:

- socio-economic deprivation
- being born prematurely
- maternal tobacco smoking during pregnancy
- household tobacco-smoking status[5]

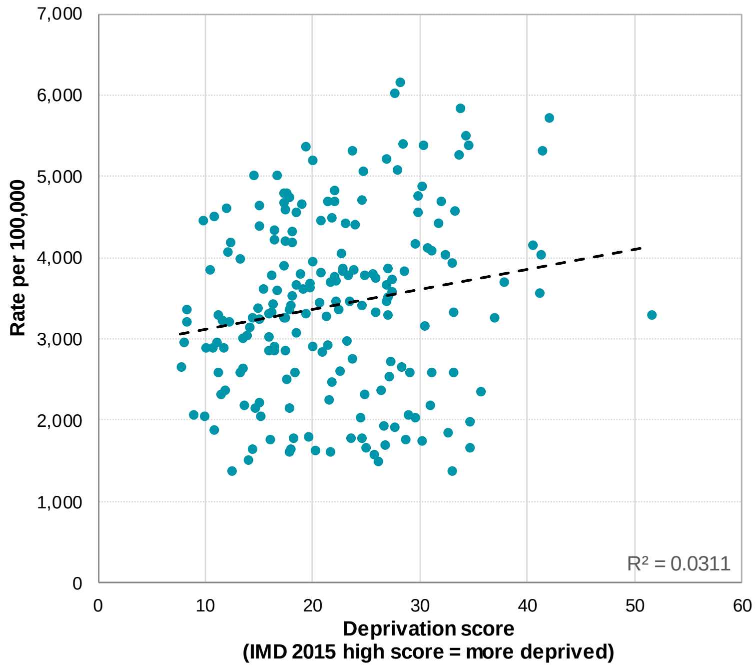
There is a complex interaction between risk factors such as prematurity, smoking or housing quality, and socio-economic deprivation (which is an independent risk factor for bronchiolitis as well as for all of the other associations listed above).

Despite this, among CCGs in England there is no correlation between the rate of admissions for bronchiolitis and socioeconomic deprivation (see Figure 20.1). Therefore, the degree of variation observed cannot be attributed purely to variation in socio-economic deprivation.

Admission rate and duration of admission is partly a function of patient factors such as severity of illness; however, hospital admissions for bronchiolitis have risen sevenfold in England over the past fifty years, but with no obvious increase in markers of disease severity such as mortality or admission to intensive care.[6] This suggests that this is not the sole reason for the variation seen, and could also be related to local differences in healthcare factors such as:

- the management and assessment of children with bronchiolitis in the emergency department
- thresholds for admission and discharge from hospital
- quality of primary, community and social care support available to families during the infant's recovery period

Figure 20.1: **Rate of emergency admissions for bronchiolitis in children aged under 2 years and deprivation, by CCG (2015/16-2017/18)**



Hospital admission rates should not be assessed in isolation. Areas which have higher admission rates are likely to have a higher proportion of short stay (zero or one day admissions), and vice versa, because a cautious approach to admission criteria setting is likely to result in greater numbers of admissions of less severely affected infants, who will be less likely to require a prolonged admission. This correlation is borne out by our data (see Figure 20.2).

Therapies for bronchiolitis are mainly supportive, involving:

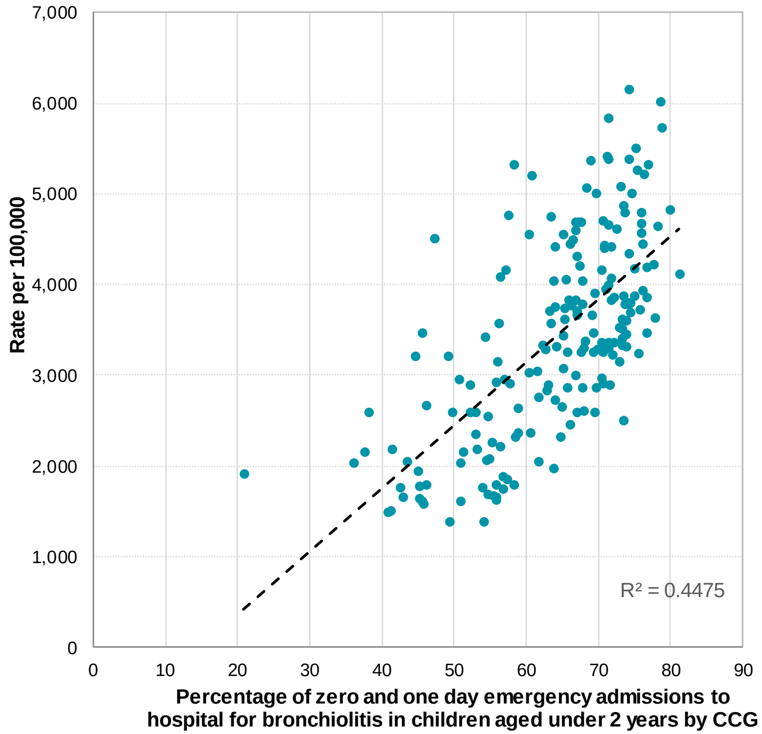
- nasogastric tube feeding
- supplemental oxygen
- in severe cases, mechanical ventilator support

Despite evidence-based national guidance[7], there are differences in the use of these treatments, particularly the criteria for starting and stopping supplemental oxygen, as well as variation in the clinical criteria for discharge for children with bronchiolitis.[8] Differences in discharge could also reflect:

- general discharge processes for all children in the local department, hospital or provider unit
- level of support available in the local community, including early supported discharge services

The level of support available locally from the extended family, community health and social services may account for some of the variation observed. Distance from home to healthcare is also an important factor, and this may explain relatively higher rates of admission for bronchiolitis, and higher proportion of zero and one day admission, among CCGs which have a predominantly rural population.

Figure 20.2: **Rate of emergency admissions for bronchiolitis and percentage of zero and one day admissions in children aged under 2 years, by CCG (2015/16-2017/18)**



Options for action

Local clinicians, in particular emergency department practitioners and paediatricians, need to apply:

- evidence-based guidance for the assessment of children with respiratory illness
- clear admission criteria for children presenting with bronchiolitis, based on national evidence-based guidelines supplemented by frequent reviews of the most recent literature

To identify factors responsible for variations in the duration of admission for bronchiolitis in the local population, commissioners and providers need to investigate differences in:

- clinical management of bronchiolitis
- wider hospital processes and patient flows

Shorter duration of hospital stay for bronchiolitis (reflected here as a higher proportion of zero or one day admissions) may increase the likelihood of readmission. Commissioners and providers should investigate this through clinical audit of local readmission rates.

Introduction of a clinical care pathway has been shown to reduce variation in treatment of bronchiolitis, and significantly reduce duration of admission.[9]

Commissioners need to ensure that vulnerable children and families have access to adequate community-based support regarding recovery after discharge.

Clinicians, supported by commissioners, need to ensure that all at-risk children (such as those with pre-existing lung disease or significant congenital heart disease) receive seasonal prophylaxis with monthly injections of monoclonal antibody against RSV in accordance with Public Health England guidance (see “Resources”). Mechanisms are required not only to deliver treatment to those who present themselves to healthcare services, but to identify and contact pro-actively the families of at-risk children to ensure the children are protected.

Resources

National Institute for Health and Care Excellence (2015) Bronchiolitis in children: diagnosis and management (NICE guideline [NG9]) [Accessed 31 July 2019]

Public Health England (2015) Immunisations against infectious diseases Respiratory syncytial virus; the green book, chapter 27a [Accessed 31 July 2019]

Public Health England Respiratory Syncytial Virus (RSV): guidance, data and analysis [Accessed 31 July 2019]

[1] Leader S and Kohlhase K (2002) Respiratory syncytial virus-coded pediatric hospitalizations, 1997 to 1999 Pediatric Infectious Disease Journal 21:629–632 [Accessed 31 July 2019]
[2] Deshpande S and Northern V (2003) The clinical and health economic burden of respiratory syncytial virus disease among children under 2 years of age in a defined geographical area Archives of Diseases in Childhood 88:1065-1069 doi: 10.1136/adc.88.12.1065 [Accessed 31 July 2019]
[3] Nair H, Nokes D, Gessner B and others (2010) Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis Lancet 375:1545–1555 doi: 10.1016/S0140-6736(10)60206-1 [Accessed 31 July 2019]
[4] Sandweiss D, Mundorff M, Hill T and others (2013) Decreasing Hospital Length of Stay for Bronchiolitis by Using an Observation Unit and Home Oxygen Therapy JAMA Pediatr 167(5):422-428 doi:10.1001/jamapediatrics.2013.1435 [Accessed 31 July 2019]
[5] Semple M, Taylor-Robinson D, Lane S and Smyth R (2011) Household Tobacco Smoke and Admission Weight Predict Severe Bronchiolitis in Infants Independent of Deprivation: Prospective Cohort Study PLoS ONE 6(7):e22425 doi:10.1371/journal.pone.0022425 [Accessed 31 July 2019]
[6] Green C, Yeates D, Goldacre A and others (2016) Admission to hospital for bronchiolitis in England: trends over five decades, geographical variation and association with perinatal characteristics and subsequent asthma Arch Dis Child 101:140-146 doi:10.1136/archdischild-2015-308723 [Accessed 31 July 2019]
[7] National Institute for Health and Care Excellence (2015) Bronchiolitis in children: diagnosis and management (NICE guideline [NG9]) [Accessed 31 July 2019]
[8] Cunningham S, Rodriguez A, Adams T and others (2015) Oxygen saturation targets in infants with bronchiolitis (BIDS): a double-blind, randomised, equivalence trial Lancet 386:1041-8 doi: 10.1016/S0140-6736(15)00163-4 [Accessed 1 August 2019]
[9] Walker C, Danby S and Turner S (2011) Impact of a bronchiolitis clinical care pathway on treatment and hospital stay European Journal of Paediatrics 171:827-832 doi: 10.1007/s00431-011-1653-9 [Accessed 1 August 2019]