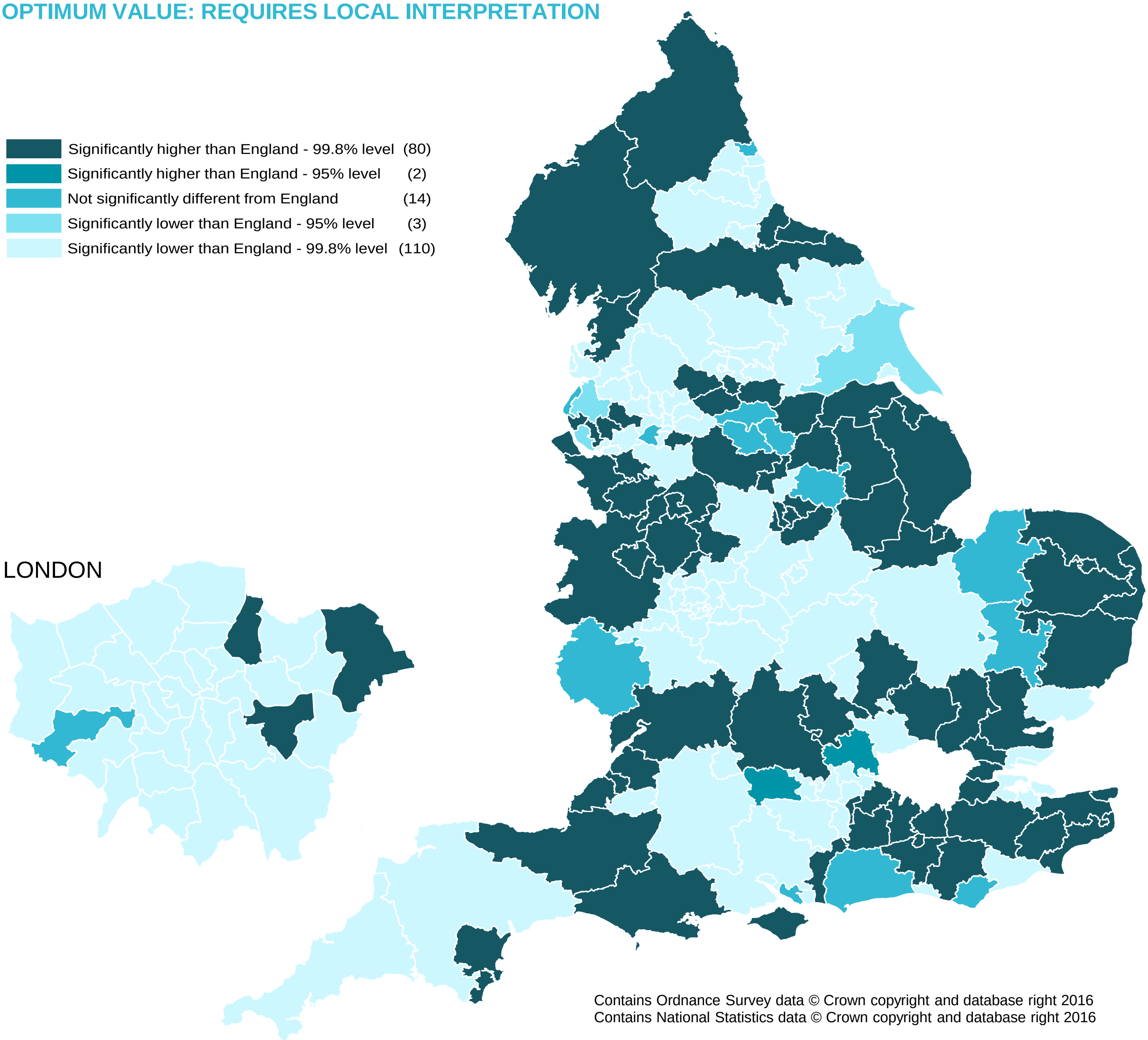
IMAGING SERVICES

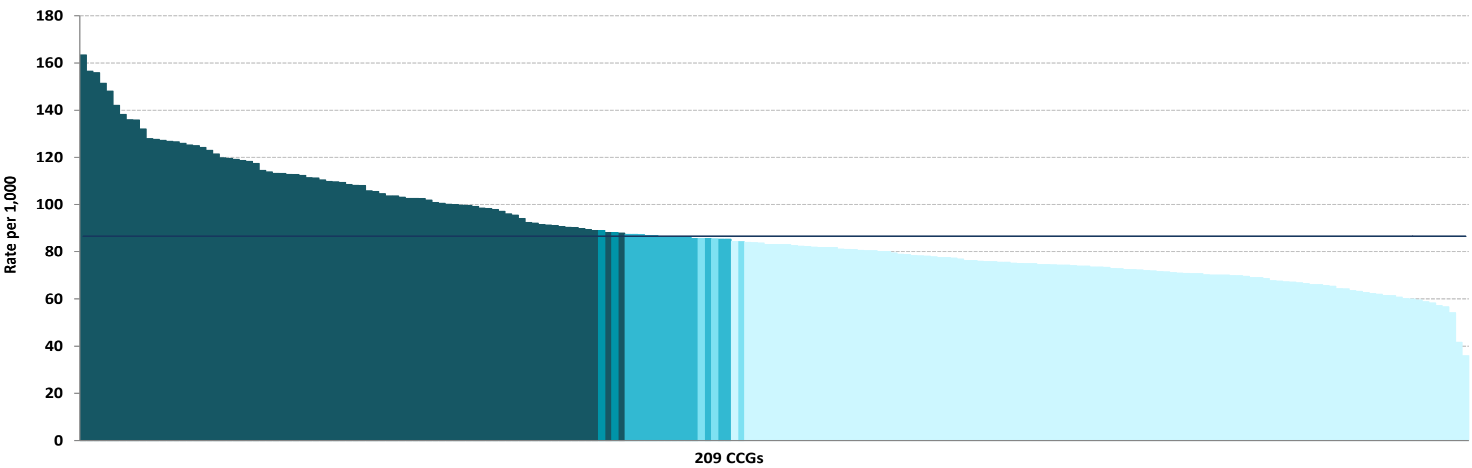
MAP 1: Rate of computed axial tomography (CT) activity per weighted population by CCG

Adjusted for age, sex and 'need', 2015/16

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION





Context

Computed axial tomography (a CT scan) is an X-ray technique using a scanner that takes a series of pictures across the body allowing a radiologist to view the images in a two- or three-dimensional form.[1]

Computed axial tomography is used:

- to diagnose disease, trauma or abnormality
- to plan and guide therapeutic interventions
- to monitor response to treatment

Computed axial tomography is often the conclusive diagnostic test.

Apart from being used as an imaging modality in its own right, CT can also be used to complement and supplement information obtained from magnetic resonance imaging (MRI) and other imaging modalities such as ultrasound.

Magnitude of variation

The map and column chart display the most recent annual period (2015/16), during which CCG values ranged from 33.9 to 163.4 per 1,000 weighted population, which is a 4.6-fold difference between CCGs. The England value for 2015/16 was 86.6 per 1,000 weighted population. Although not strictly comparable, the Organisation for Economic Co-Operation and Development (OECD)[2] data shows that in 2013 CT activity ranged from 31.7 per 1,000 inhabitants in Finland to 494.6 per 1,000 inhabitants in Estonia.

The boxplot shows the distribution of CCG values for the period 2013/14 to 2015/16 by quarter.

In contrast to the maximum to minimum range narrowing significantly, both the 95th to 5th percentile gap and of the 75th to 25th percentile gap widened significantly. So whilst there was a contraction of the most extreme values, values in the central part of the distribution moved away from the median.

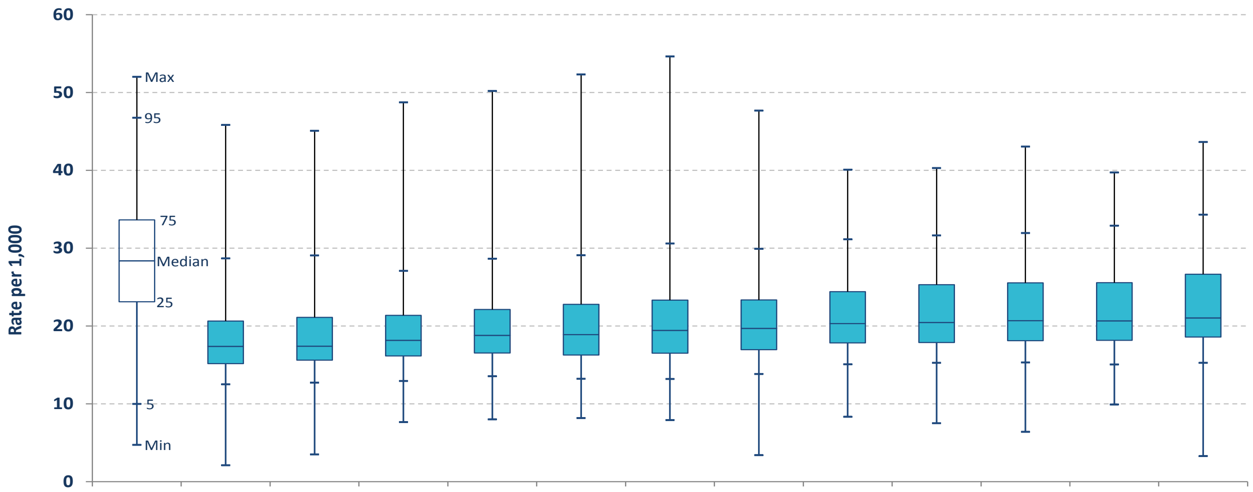
The median increased significantly.

CT scanning is one of the key diagnostic tests that can contribute to the early diagnosis of cancer, however it does have wider clinical uses than the diagnosis of cancer.

Although some of the England variation can be attributed to the availability of both equipment and workforce, much of the variation could be due to local clinical practices that have evolved over time, which may need re-assessing.

It is not clear what the optimum level of CT activity for a population should be. From an individual patient's perspective, it is important to consider the benefits and the risks of CT scanning because unlike MRI, CT scanning is associated with a heavy radiation dose to the patient. Thus, the use of CT needs to be justified because of the potential harm it could cause.

Map 1: Boxplot of CT activity by CCG



	Example	2013/14 Q1	2013/14 Q2	2013/14 Q3	2013/14 Q4	2014/15 Q1	2014/15 Q2	2014/15 Q3	2014/15 Q4	2015/16 Q1	2015/16 Q2	2015/16 Q3	2015/16 Q4	
Max-Min (Range)		43.7	41.6	41.1	42.2	44.1	46.7	44.3	31.7	32.8	36.6	29.8	40.4	NARROWING Significant
95th-5th percentile		16.2	16.3	14.2	15.1	15.9	17.4	16.1	16.1	16.4	16.6	17.8	19.0	WIDENING Significant
75th-25th percentile		5.5	5.5	5.2	5.6	6.5	6.8	6.4	6.6	7.4	7.4	7.4	8.1	WIDENING Significant
Median		17.4	17.4	18.2	18.8	18.9	19.4	19.7	20.3	20.4	20.7	20.7	21.0	INCREASING Significant

[1] The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504
[2] https://data.oecd.org/healthcare/magnetic-resonance-imaging-mri-exams.htm

In the UK and the US there is concern about the potential for overuse of CT and the potential risk of harm, as highlighted in the published literature:

> *"our findings that in some patients worrisome radiation doses from imaging procedures can accumulate over time underscores the need to improve their use"*[3]

> *"we have to adopt a public health mind set … and talk explicitly about the elements of danger in exposing our patients to radiation"*[4]

Although overuse may be less of an issue in England, whole-body screening by CT is being promoted by some private providers in this country. Such screening is of questionable benefit to the individuals concerned while increasing the level of radiation to which they are exposed, and often generating referrals to the NHS.

In the conclusions of the 16th COMARE Report (paragraph 8.3, page 64)[5], it states:

> *"In recent years there has been an emerging use of CT to scan asymptomatic individuals. This issue was covered in the 12th COMARE report (COMARE, 2007[6]), which determined that the benefits to the individual would not be the same as those for a symptomatic patient and that the practice of whole-body scanning on asymptomatic individuals could not be supported."*

Options for action

Commissioners and service providers need to collaborate to review rates of CT activity in the locality to identify whether there is any unwarranted variation. Commissioners may wish to investigate the source of referrals as part of this review.

To address unwarranted variation, commissioners, clinicians and service providers need to work together to apply evidence-based practice at a local level, including:

- using evidence based patient pathways for diagnostics
- promoting research to understand the benefits and harms resulting from different rates of CT investigation
- promoting audit to identify both underuse and overuse of the technology
- developing referral guidelines to include the need to assess whether a CT scan is the most appropriate modality or whether an alternative diagnostic procedure would be more effective[5]
- optimising scanning protocols to reduce dosage[5]
- appointing 'radiation protection champions' locally, including a radiologist, radiographer and medical physicist[5]

RESOURCES

- iRefer, Royal College of Radiologists imaging referral guidelines, is available to all NHS professionals in the UK. http://www.rcr.ac.uk/content.aspx?PageID=995 For iRefer – England, NHS professionals need to register to use the portal. Login to http://portal.e-lfh.org.uk/ To access guidelines, select the "Launch iRefer" link in the left-hand menu.
- NHS Radiology Improvement Team. Page 1: Computerised Tomography. Radiology Success Factors. November 2007. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf
- The Royal College of Radiologists. Sustainable future for diagnostic radiology: establishing network solutions for radiology services. BFCR(15)12. 2015. https://www.rcr.ac.uk/publication/sustainable-future-diagnostic-radiology-establishing-network-solutions-radiology

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[3] Fazel R et al (2009) Exposure to low dose ionizing radiation from medical imaging procedures. *New England Journal of Medicine* 361:849-857.
[4] Lauer MS (2009) Elements of danger – the case of medical imaging. *New England Journal of Medicine* 361:841-842.
[5] Committee on Medical Aspects of Radiation in the Environment (COMARE). Sixteenth Report. Patient radiation dose issues resulting from the use of CT in the UK. Public Health England: 2014.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343836/COMARE_16th_Report.pdf
[6] Committee on Medical Aspects of Radiation in the Environment (COMARE). Twelfth Report. The impact of personally initiated X-ray computed tomography scanning for the health assessment of asymptomatic individuals. Health Protection Agency: 2007.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/304607/COMARE12thReport.pdf

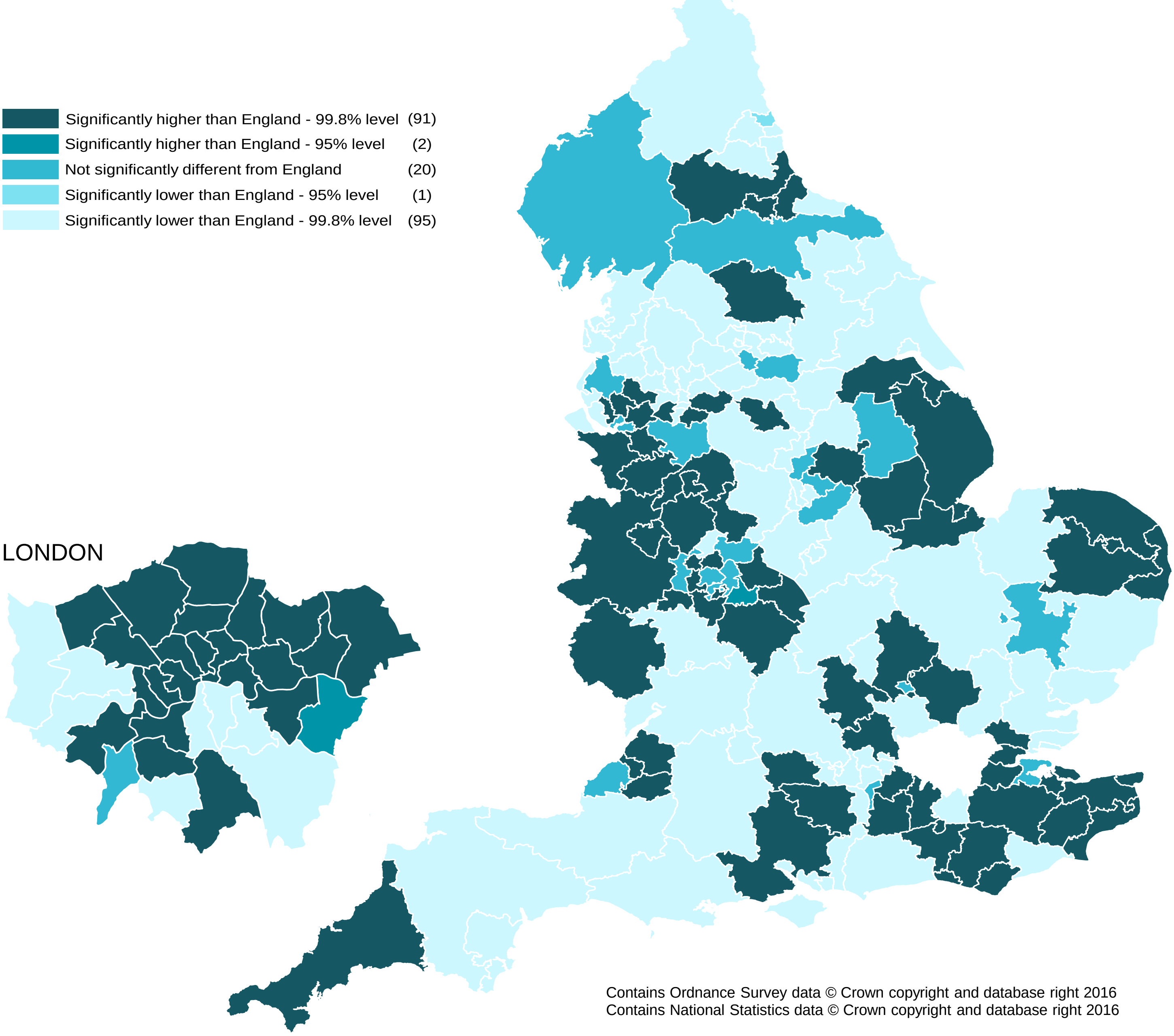
IMAGING SERVICES

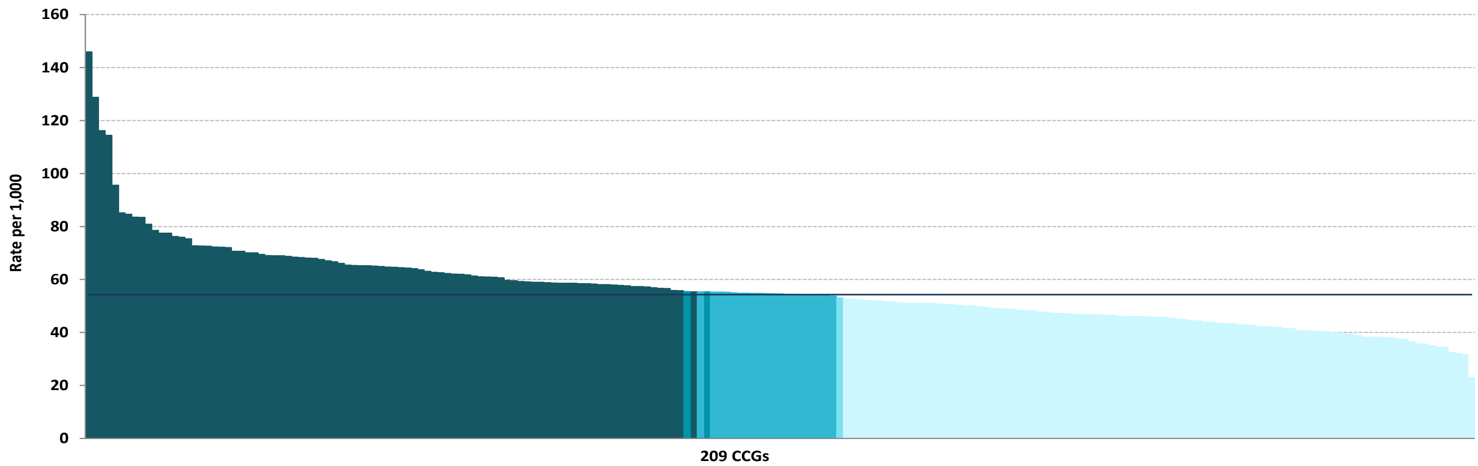
MAP 2: Rate of magnetic resonance imaging (MRI) activity per weighted population by CCG

Adjusted for age, sex and 'need', 2015/16

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION





Context

Magnetic resonance imaging (MRI) uses magnetism and radio waves to build up a series of cross-sectional images of the body. It is similar to a computerised axial tomography scan, but it does not use X-rays. As MRI pictures can be very precise and provide detailed information, MRI has the potential to reduce the number of diagnostic procedures that need to be performed. The cost of MRI equipment means that it is used primarily at centres where it is kept most busy.[1]

Magnitude of variation

The map and column chart display the latest annual period (2015/16), during which CCG values ranged from 22.8 to 145.9 per 1,000 weighted population, which is a 6.4-fold difference between CCGs. The England value for 2015/16 was 54.3 scans. Although not strictly comparable, the Organisation for Economic Co-Operation and Development (OECD)[3] data shows that in Europe MRI activity ranges from 22.8 per 1,000 inhabitants in Poland to 90.9 per 1,000 inhabitants in 2013 in France.

The boxplot shows the distribution of CCG values for the period 2013/14 to 2015/16 by quarter.

The maximum to minimum range widened significantly. This is due in greater part to the maximum value increasing while the minimum value remained relatively constant.

There was a significant widening of both the 95th to 5th percentile gap, and of the 75th to 25th percentile gap. The median increased significantly.

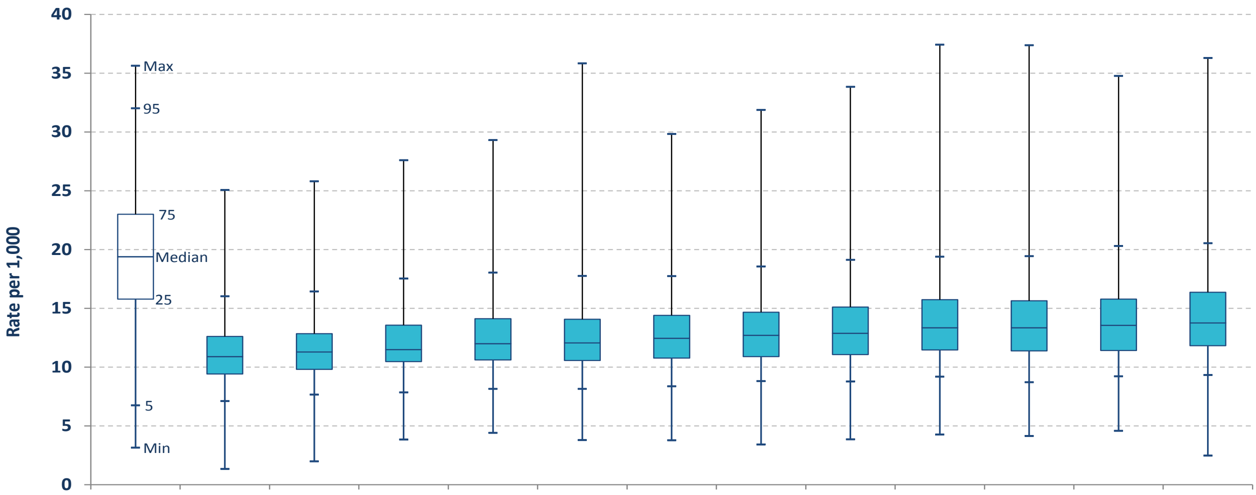
In *Improving Outcomes: a Strategy for Cancer*[2], MRI scanning is one of the key diagnostic tests that GPs should access. This is to enable more people to be checked earlier when presenting with relevant symptoms, and will contribute to the early diagnosis of cancer. It must be noted, that although this test is used to diagnose some cancers it is more commonly used in other clinical settings.

Reasons for geographical variation include availability of equipment and trained workforce as well as local clinical practice.

There may also be access issues for patients.

It is likely that underuse, rather than overuse, is the reason for the degree of variation observed.

Map 2: Boxplot of MRI activity by CCG



	Example	2013/14 Q1	2013/14 Q2	2013/14 Q3	2013/14 Q4	2014/15 Q1	2014/15 Q2	2014/15 Q3	2014/15 Q4	2015/16 Q1	2015/16 Q2	2015/16 Q3	2015/16 Q4	
Max-Min (Range)		23.7	23.8	23.8	24.9	32.0	26.0	28.5	30.0	33.2	33.2	30.2	33.8	WIDENING Significant
95th-5th percentile		8.9	8.8	9.7	9.9	9.6	9.4	9.7	10.3	10.2	10.7	11.1	11.2	WIDENING Significant
75th-25th percentile		3.2	3.0	3.1	3.5	3.5	3.6	3.8	4.0	4.3	4.3	4.4	4.5	WIDENING Significant
Median		10.9	11.3	11.5	12.0	12.1	12.4	12.7	12.9	13.3	13.3	13.5	13.8	INCREASING Significant

[1] The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504
[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213785/dh_123394.pdf
[3] https://data.oecd.org/healthcare/magnetic-resonance-imaging-mri-exams.htm
[4] Morris Z, Whiteley WN, Longstreth WT Jr et al. Incidental findings on brain magnetic resonance imaging: systematic review and meta-analysis. BMJ339:doi:10.1136/bmj.b3016 (Published 17 August 2009).

There is increasing concern, however, about the increasing detection of incidental findings, that is, findings unrelated to the original reason for undertaking MRI. Incidental findings can lead to unnecessary investigation and anxiety for patients. In one systematic review and meta-analysis, the authors conclude that:

> *"Incidental findings on brain MRI are common, prevalence increases with age, and detection is more likely using high-resolution MRI sequences than standard resolution sequences. These findings deserve to be mentioned when obtaining informed consent for brain MRI in research and clinical practice."*[4]

Options for action

Commissioners and service providers need to collaborate to review rates of MRI activity in the locality to identify whether there is any unwarranted variation. Commissioners may wish to investigate the source of referrals as part of this review.

To address unwarranted variation, commissioners, clinicians and service providers need to work together to apply evidence-based practice at a local level, including:

- using evidence-based patient pathways for diagnostics
- promoting research to understand the benefits and harms resulting from different rates of MRI investigation
- promoting audit to identify both underuse and overuse of the technology

RESOURCES

- iRefer, The Royal College of Radiologists imaging referral guidelines, is available to all NHS professionals in the UK. http://www.rcr.ac.uk/content.aspx?PageID=995 For iRefer – England, NHS professionals need to register to use the portal. Login to http://portal.e-lfh.org.uk/ . To access guidelines, select the "Launch iRefer" link in the left-hand menu.
- NHS Radiology Improvement Team. Page 3: Magnetic Resonance Imaging. Radiology Success Factors. November 2007. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf
- The Royal College of Radiologists. Sustainable future for diagnostic radiology: establishing network solutions for radiology services. BFCR(15)12. 2015. https://www.rcr.ac.uk/publication/sustainable-future-diagnostic-radiology-establishing-network-solutions-radiology

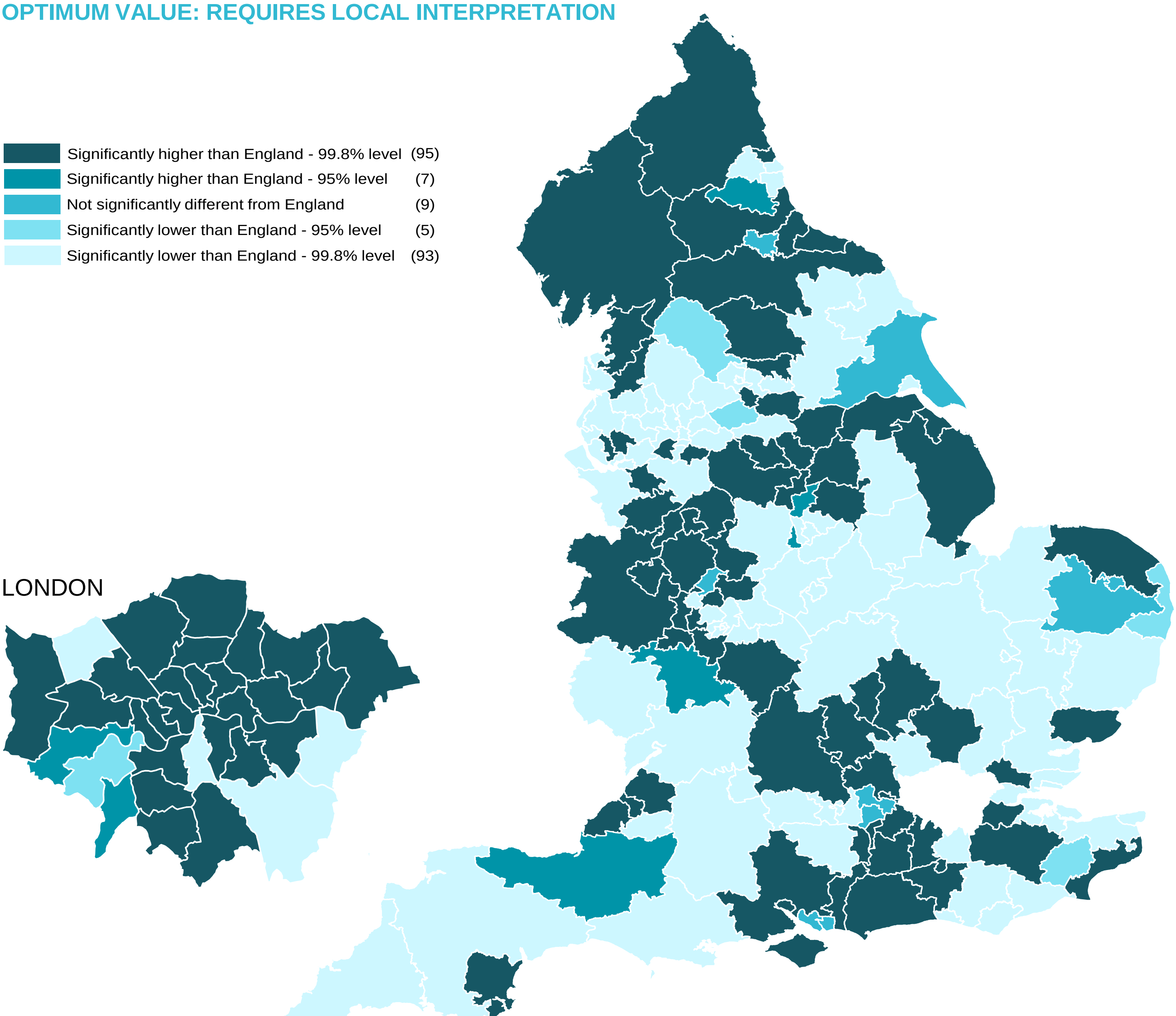
IMAGING SERVICES

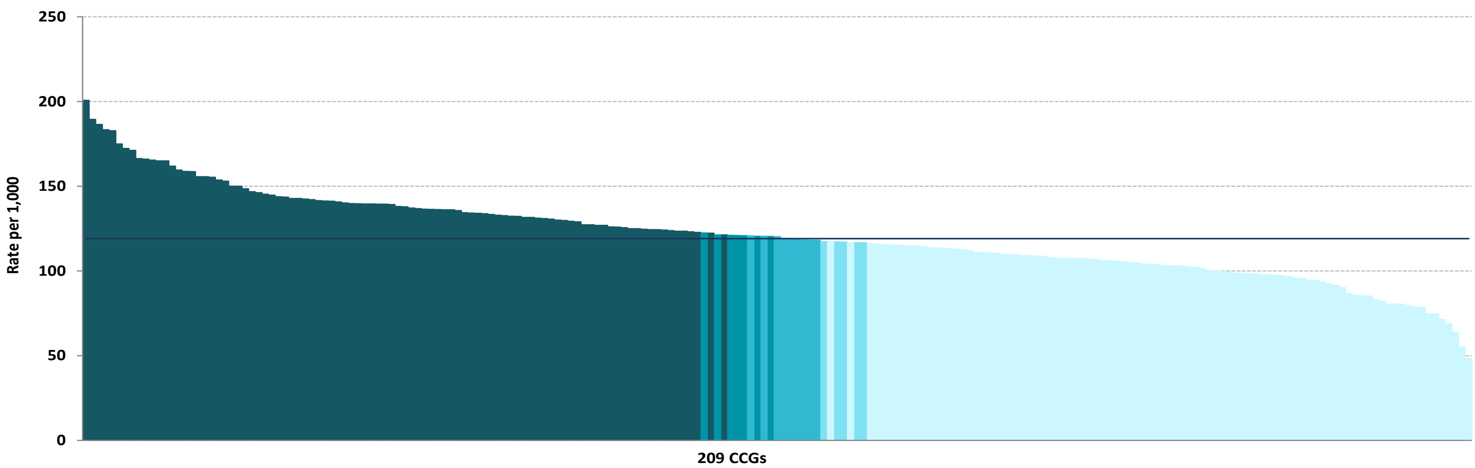
MAP 3: Rate of non-obstetric ultrasound activity per weighted population by CCG

Adjusted for age, sex and 'need', 2015/16

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION





Context

During an ultrasound scan high-frequency sound waves (5-10MHz) are used to image parts of the body.

The advantage of ultrasound over other imaging modalities, such as X-rays or computerised axial tomography scans, is that it does not involve ionising radiation. Further advantages of ultrasound over other imaging modalities, such as magnetic resonance imaging, are that the equipment is cheaper and becoming smaller without compromising scan quality – some models are portable and some are hand-held.

Medical ultrasound falls into two main categories: obstetric and non-obstetric.

The uses of non-obstetric ultrasound are:

- as a diagnostic tool for problems of the soft tissues
- to detect problems with blood vessels (such as aneurysms), joints, ligaments and tendons, the skin and the eyes
- to guide an operator during certain surgical procedures such as biopsies

Although it is essential to record ultrasound images, interpretation is most often done by the operator at the time of the scan.

Magnitude of variation

The map and column chart display the latest period (2015/16), during which CCG values ranged from 48.2 to 200.8 per 1,000 weighted population, which is a 4.2-fold difference between CCGs. The England value for 2015/16 was 119.1 per 1,000 weighted population.

The boxplot shows the distribution of CCG values for the period 2013/14 to 2015/16 by quarter.

The gap between the maximum and minimum CCG values narrowed significantly. In contrast there was a significant widening of the 95th to 5th percentile gap.

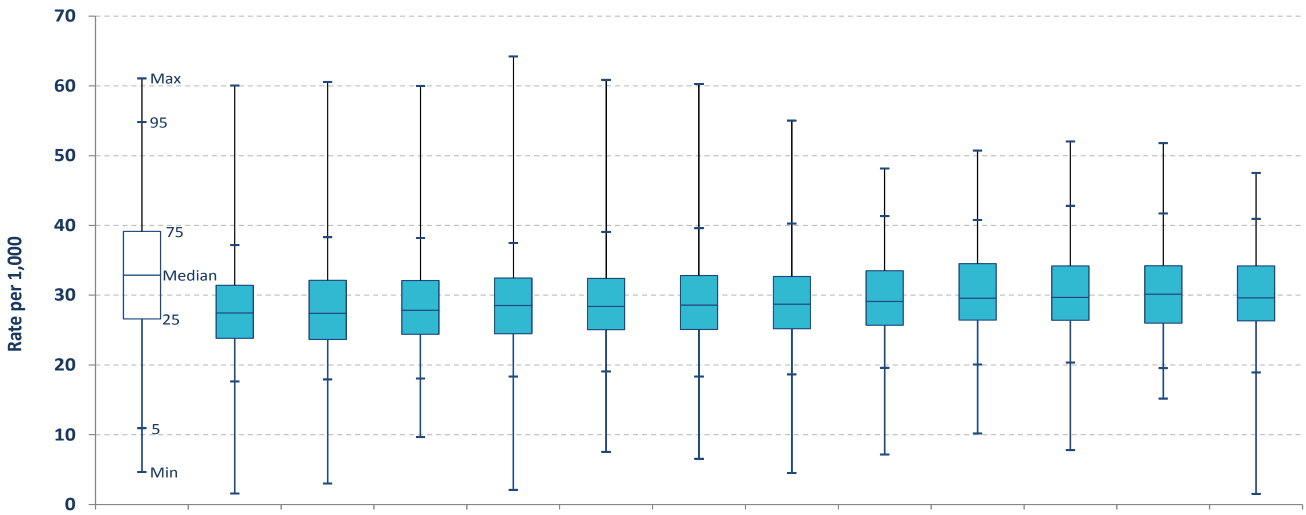
The median CCG value increased significantly.

Non-obstetric ultrasound is one of the imaging tests that could contribute to the early diagnosis of cancer, in particular relation to kidney, bladder or ovarian cancer and its use is a recommendation in *Improving Outcomes: a Strategy for Cancer*[1]. It must however be noted, that although this test is used to diagnose cancer, it does also have wider clinical uses.

Potential reasons for the degree of variation observed include differences in:

- access to non-obstetric ultrasound
- the conditions for which non-obstetric ultrasound is used as a diagnostic tool in various localities
- prevalence of the conditions for which non-obstetric ultrasound is one of the diagnostic tests

Map 3: Boxplot of non-obstetric ultrasound activity by CCG



	Example	2013/14 Q1	2013/14 Q2	2013/14 Q3	2013/14 Q4	2014/15 Q1	2014/15 Q2	2014/15 Q3	2014/15 Q4	2015/16 Q1	2015/16 Q2	2015/16 Q3	2015/16 Q4	
Max-Min (Range)		58.5	57.6	50.3	62.1	53.3	53.7	50.5	41.0	40.5	44.2	36.6	46.0	NARROWING Significant
95th-5th percentile		19.5	20.4	20.1	19.1	20.0	21.3	21.6	21.7	20.7	22.5	22.2	22.0	WIDENING Significant
75th-25th percentile		7.6	8.5	7.7	8.0	7.3	7.7	7.5	7.8	8.1	7.8	8.2	7.9	No significant change
Median		27.4	27.4	27.8	28.5	28.4	28.6	28.7	29.1	29.6	29.7	30.1	29.6	INCREASING Significant

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213785/dh_123394.pdf

Options for action

When addressing unwarranted variation in non-obstetric ultrasound activity, commissioners, clinicians and service providers need to review:

- the need for non-obstetric ultrasound in the local population
- whether the rate of activity matches the need, or whether adjustments can be made
- access to non-obstetric ultrasound
- local care pathways and whether they follow the latest evidence-based guidance from the Royal College of Radiologists (iRefer, see 'Resources')

RESOURCES

- British Medical Ultrasound Society. Guidelines for the safe use of diagnostic ultrasound equipment. November 2009. https://www.bmus.org/static/uploads/resources/BMUS-Safety-Guidelines-2009-revision-FINAL-Nov-2009.pdf
- iRefer, Royal College of Radiologists imaging referral guidelines, available to all NHS professionals in the UK. http://www.rcr.ac.uk/content.aspx?PageID=995 For iRefer – England, NHS professionals need to register to use the portal. Login to http://portal.e-lfh.org.uk/ To access guidelines, select the "Launch iRefer" link in the left-hand menu.
- NHS Radiology Improvement Team. Page 5: Ultrasound. Radiology Success Factors. November 2007. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf
- The Royal College of Radiologists. Sustainable future for diagnostic radiology: establishing network solutions for radiology services. BFCR(15)12. 2015. https://www.rcr.ac.uk/publication/sustainable-future-diagnostic-radiology-establishing-network-solutions-radiology

IMAGING SERVICES

MAP 4a: Median time (minutes) from arrival at hospital to brain imaging for stroke patients by CCG

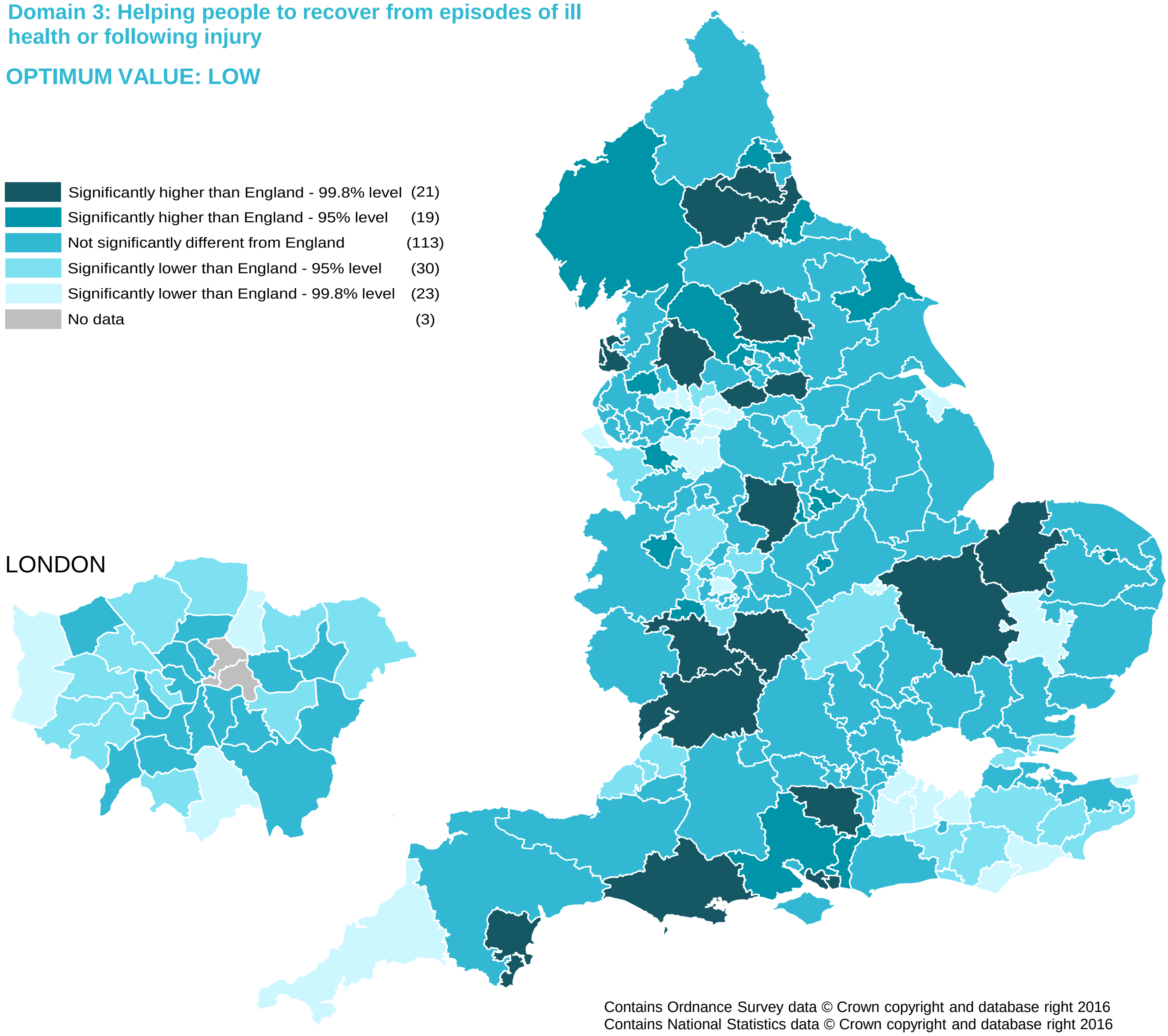
October–December 2015

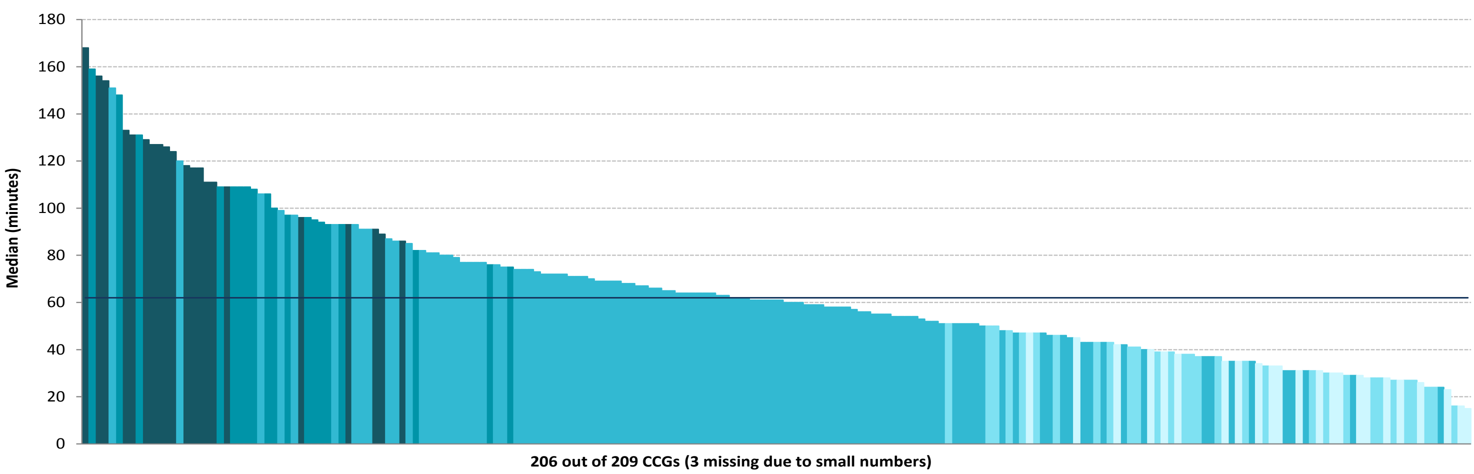
Domain 1: Preventing people from dying prematurely

Domain 2: Enhancing quality of life for people with long-term conditions

Domain 3: Helping people to recover from episodes of ill health or following injury

OPTIMUM VALUE: LOW





IMAGING SERVICES

MAP 4b: Median time (minutes) from arrival at hospital to brain imaging for stroke patients by stroke team

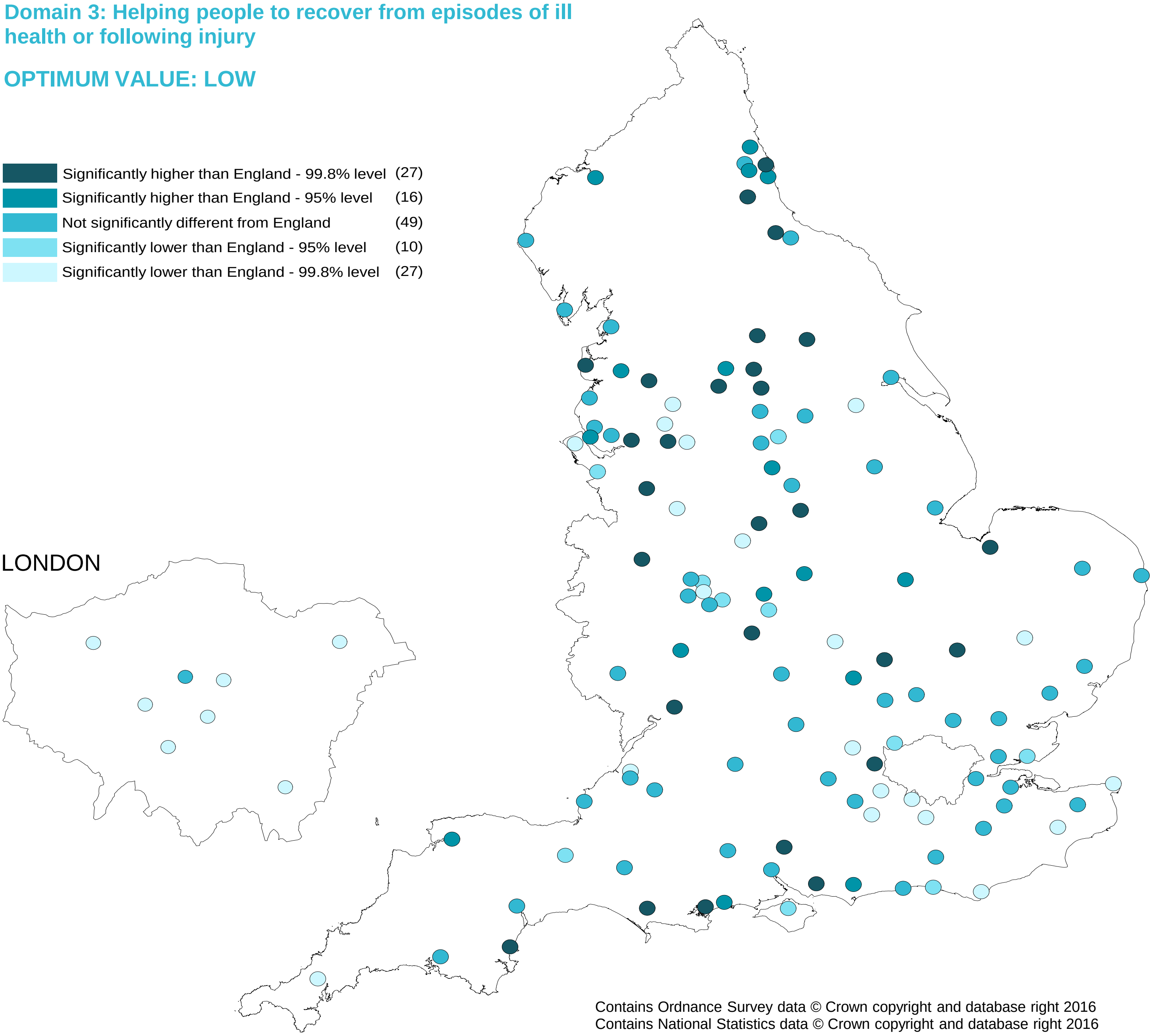
October–December 2015

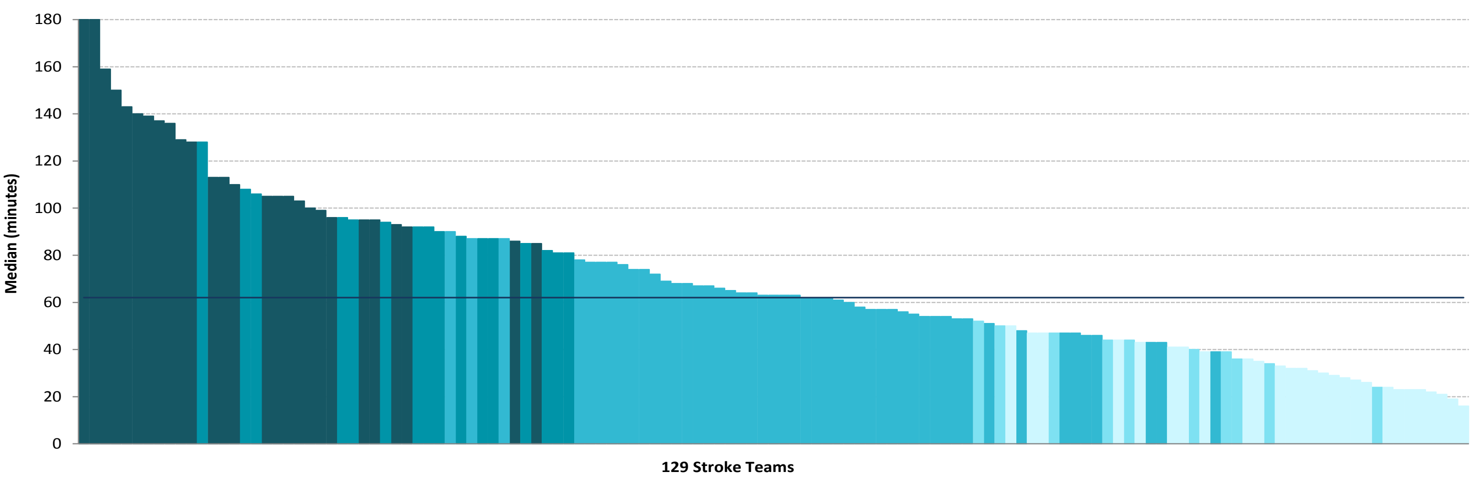
Domain 1: Preventing people from dying prematurely

Domain 2: Enhancing quality of life for people with long-term conditions

Domain 3: Helping people to recover from episodes of ill health or following injury

OPTIMUM VALUE: LOW





Context

Stroke is a preventable and treatable disease. Over the past 20 years a growing body of evidence has challenged the long-held perception that stroke is a consequence of ageing inevitably resulting in death or severe disability. There is now good evidence for:

- greater effectiveness of primary and secondary prevention strategies
- improved recognition of people at highest risk of stroke
- effective interventions soon after the onset of symptoms

The National Stroke Strategy (see 'Resources') outlines the changes necessary to improve outcomes for people with stroke.

In the NICE-accredited Royal College of Physicians (RCP) Intercollegiate Stroke Working Party guidelines (fourth edition, see 'Resources'), it is recommended that people with suspected acute stroke should receive brain imaging immediately (ideally in the next imaging slot and within one hour of admission) if the patient meets the need for urgent scanning according to specified criteria. About 50% of acute stroke admissions meet these criteria. All other stroke patients should have brain imaging performed within 12 hours of admission. A fifth edition of the RCP guideline was published in October 2016 (see 'Resources'). In the NICE guidelines (see 'Resources'), the recommendation is that brain imaging should be performed immediately in people with specific indications (for example, indications for thrombolysis), and as soon as possible in all other people with acute stroke.

The RCP audits the care of people who have had a stroke. The data for Maps 4a-6b is from the Sentinel Stroke National Audit Programme (SSNAP[1]).

Magnitude of variation

Map 4a: Median time to brain imaging by CCG

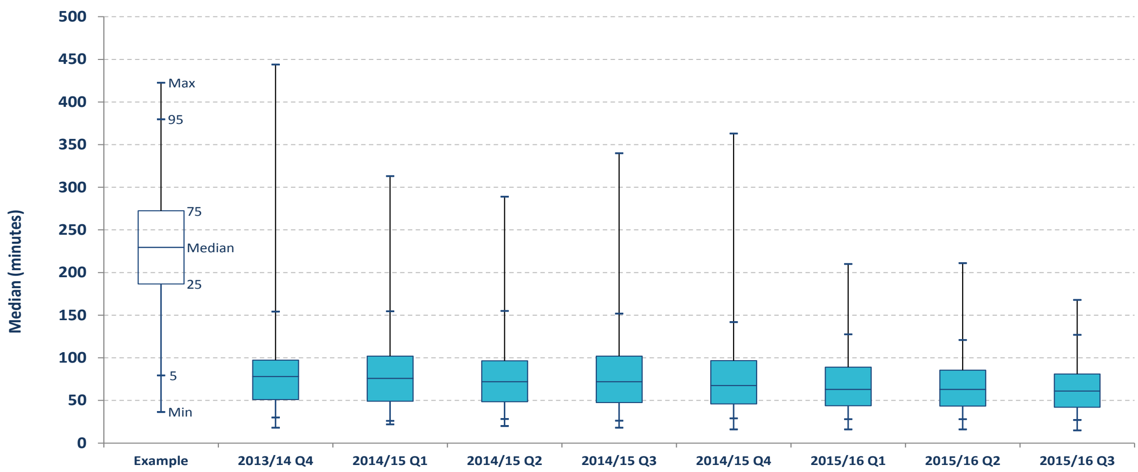
The map and column chart display the latest period (October-December 2015), during which CCG values ranged from 15 minutes to 168 minutes, which is a 11.2-fold difference between CCGs. The England value for this quarter was 62 minutes

The boxplot shows the distribution of CCG values for the period January-March 2014 to October-December 2015.

There has been a significant narrowing of the maximum to minimum range and also of the 95th to 5th percentile gap. This is mainly due to marked reductions in the maximum and 95th percentile values in the last three quarter periods displayed. There was no significant change in the 75th to 25th percentile gap.

The median of the CCG median times to brain imaging for patients has decreased significantly from 78 minutes to 61 minutes. Improvement in time to brain imaging increases the likelihood of better long-term outcomes. The median of the CCG median times is also close to meeting the RCP guidelines threshold of 60 minutes from arrival at hospital to brain imaging.

Map 4a: Boxplot of median time to brain imaging for stroke patients by CCG



	Example	2013/14 Q4	2014/15 Q1	2014/15 Q2	2014/15 Q3	2014/15 Q4	2015/16 Q1	2015/16 Q2	2015/16 Q3	
Max-Min (Range)		426.0	291.0	269.0	322.0	347.0	194.0	195.0	153.0	NARROWING Significant
95th-5th percentile		124.3	128.6	126.8	125.6	112.9	99.6	92.9	100.0	NARROWING Significant
75th-25th percentile		46.3	53.0	48.0	54.5	50.8	45.3	42.0	39.0	No significant change
Median		78.0	76.0	72.0	72.0	67.5	63.0	63.0	61.0	DECREASING Significant

[1] The Sentinel Stroke National Audit Programme (SSNAP); SSNAP aims to improve the quality of stroke care by auditing stroke services against evidence-based standards. http://www.rcplondon.ac.uk/projects/sentinel-stroke-national-audit-programme

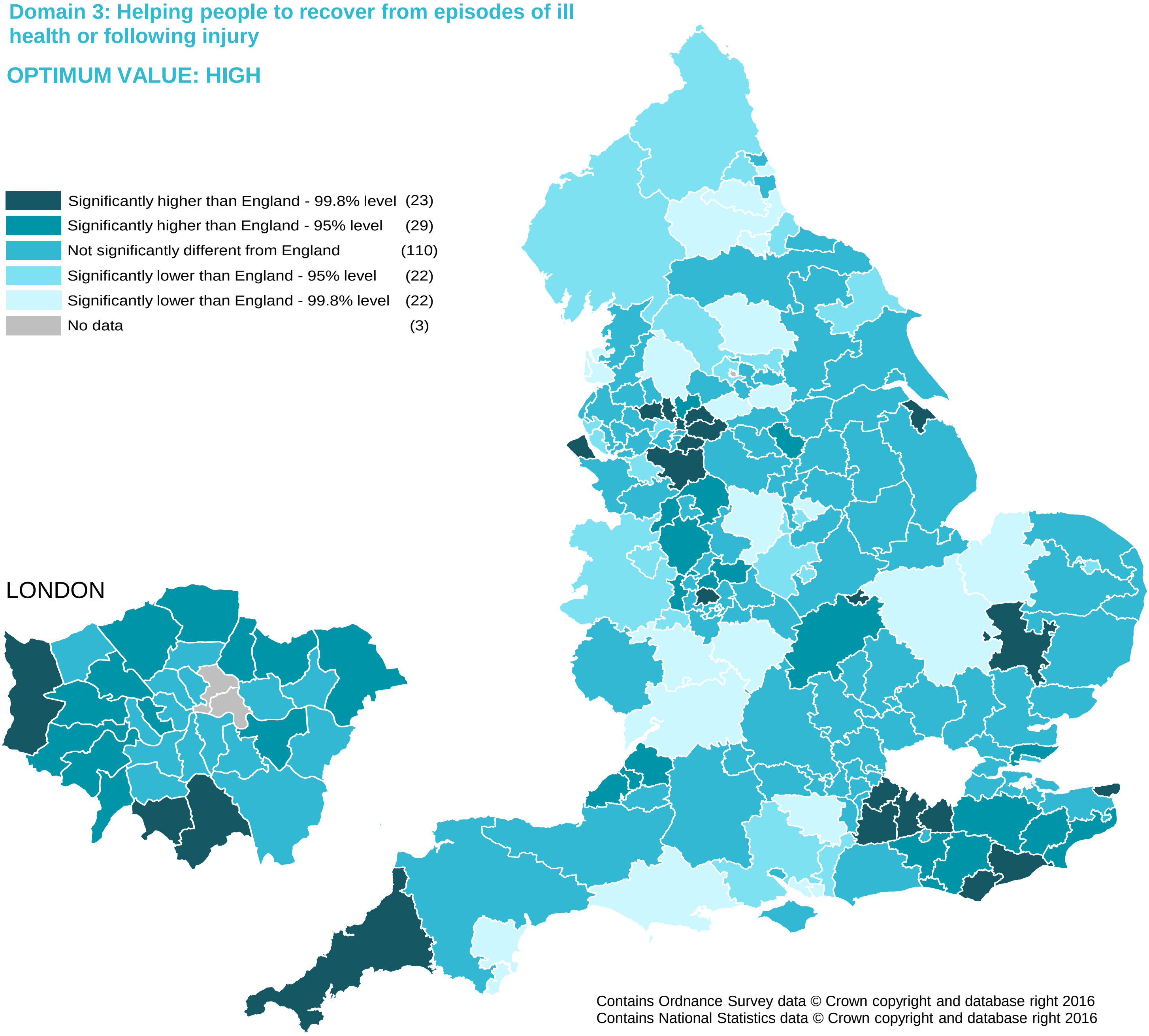
IMAGING SERVICES

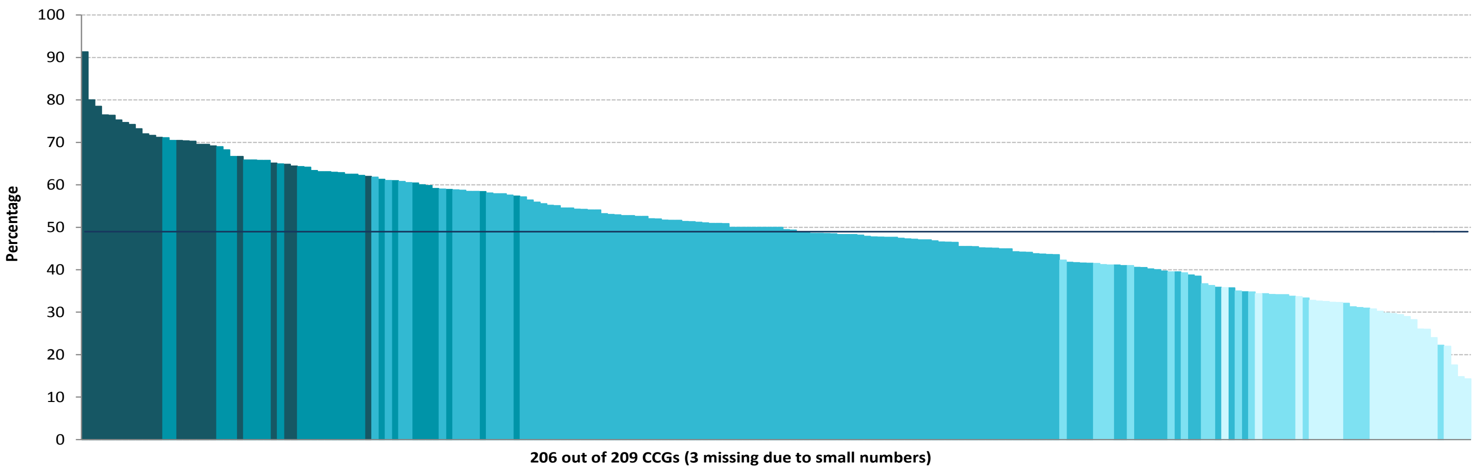
MAP 5a: Percentage of stroke patients undergoing brain imaging within one hour of arrival at hospital by CCG

October–December 2015

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions
Domain 3: Helping people to recover from episodes of ill health or following injury

OPTIMUM VALUE: HIGH





IMAGING SERVICES

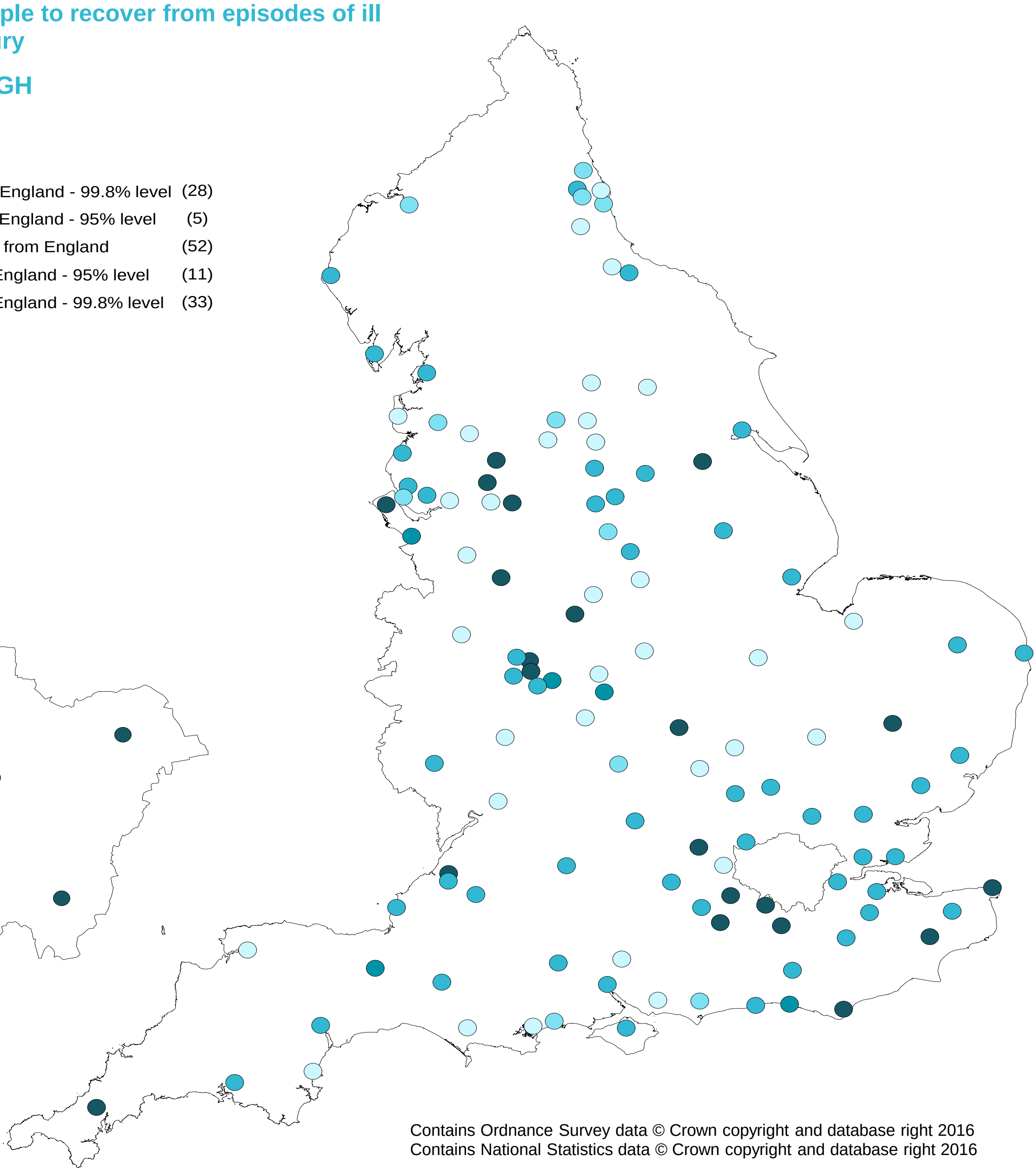
MAP 5b: Percentage of stroke patients undergoing brain imaging within one hour of arrival at hospital by stroke team

October–December 2015

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions
Domain 3: Helping people to recover from episodes of ill health or following injury

OPTIMUM VALUE: HIGH

	Significantly higher than England - 99.8% level	(28)
	Significantly higher than England - 95% level	(5)
	Not significantly different from England	(52)
	Significantly lower than England - 95% level	(11)
	Significantly lower than England - 99.8% level	(33)



LONDON

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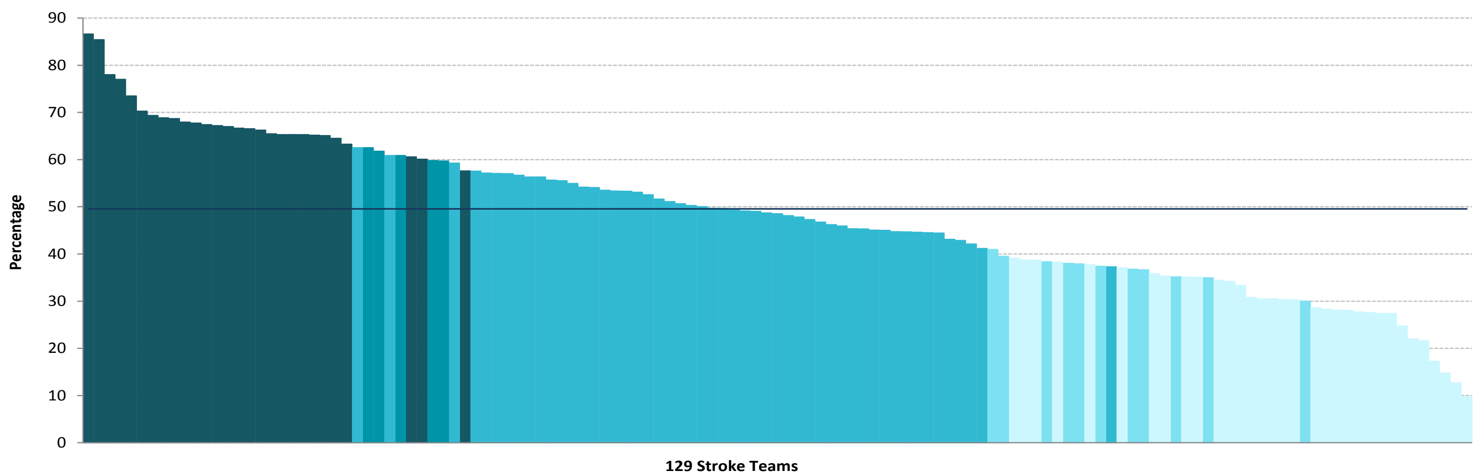
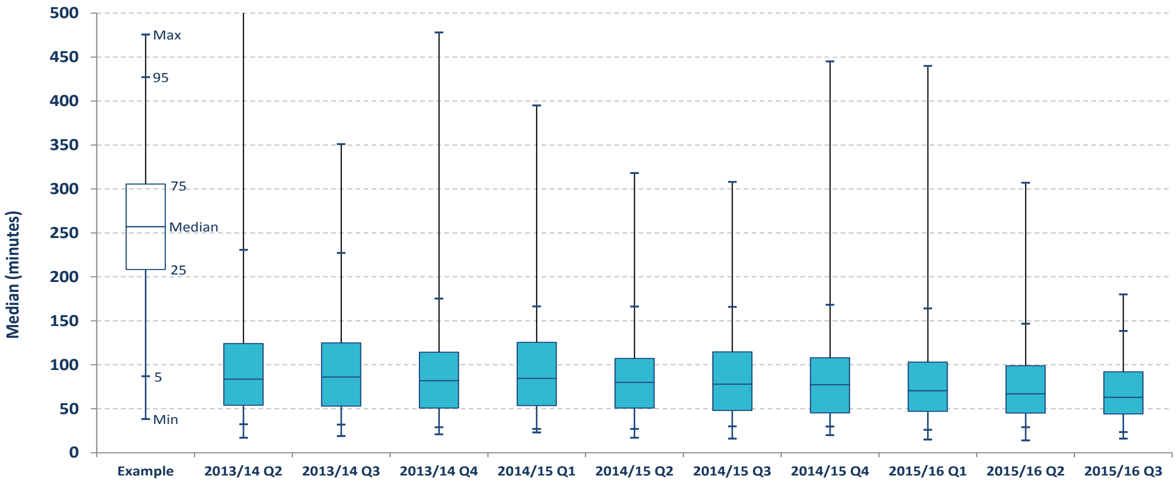
Contains National Statistics data © Crown copyright and database right 2016



Map 4b: Boxplot of median time to brain imaging for stroke patients by stroke team



Max-Min (Range)		997.0	332.0	457.0	372.0	301.0	292.0	425.0	425.0	293.0	164.0	NARROWING Significant
95th-5th percentile		198.4	195.1	146.3	139.4	139.4	135.9	138.3	138.0	117.8	115.0	NARROWING Significant
75th-25th percentile		70.4	72.0	63.5	72.0	56.5	66.8	62.8	56.0	54.0	48.0	NARROWING Significant
Median		83.8	86.0	82.0	84.5	80.0	78.0	77.5	70.5	67.0	63.0	DECREASING Significant

Map 4b: Median time to brain imaging by stroke team

The map and column chart display the latest period (October-December 2015), during which stroke team values ranged from 16 to 180 minutes, which is a 11.3-fold difference between hospital stroke teams. The England value for this quarter was 62.0 minutes. The boxplot shows the distribution of stroke team values for the period July-September 2013 to October-December 2015.

There has been significant narrowing of all three measures of variation; the maximum to minimum range, the 95th to 5th percentile gap and the 75th to 25th percentile gap. This strongly suggests that the variability across stroke teams of median times to provide brain imaging for patients has reduced both at the extremities, and at the centre of the distribution.

There was a significant decrease in the median of the stroke team median times from arrival at hospital to brain imagining from 83.8 minutes to 63 minutes, which is close to meeting the RCP threshold of 60 minutes for patients meeting the criteria for urgent scanning.

Map 5a: Brain imaging within one hour of arrival by CCG

The map and column chart display the latest period (October-December 2015), during which CCG values ranged from 14.3% to 91.3%, which is a 6.4-fold difference between CCGs. The England value for this quarter was 49%.

The boxplot shows the distribution of CCG values for the period January-March 2014 to October-December 2015. There was no significant change in any of the three variation measures over this period.

However, the CCG median value has increased significantly from 43% to 50%. Overall more patients have received brain imaging within an hour which will improve long-term patient outcomes, and the median value matches the estimate of the proportion of acute stroke admissions likely to meet the criteria for urgent scanning.

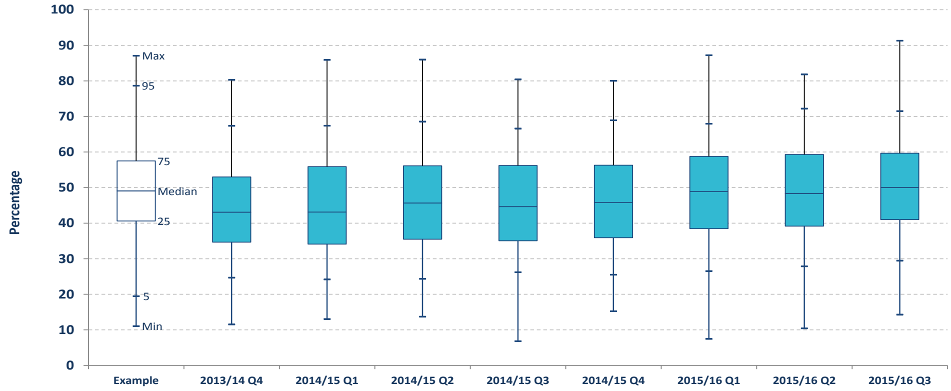
Map 5b: Brain imaging within one hour of arrival by stroke team

The map and column chart display the latest period (October-December 2015), during which stroke team values ranged from 9.8% to 86.6%, which is a 8.9-fold difference between hospital stroke teams. The England value for this quarter was 49.5%.

The boxplot shows the distribution of stroke team values for the period July-September 2013 to October-December 2015. There was no significant change in any of the three variation measures over this period.

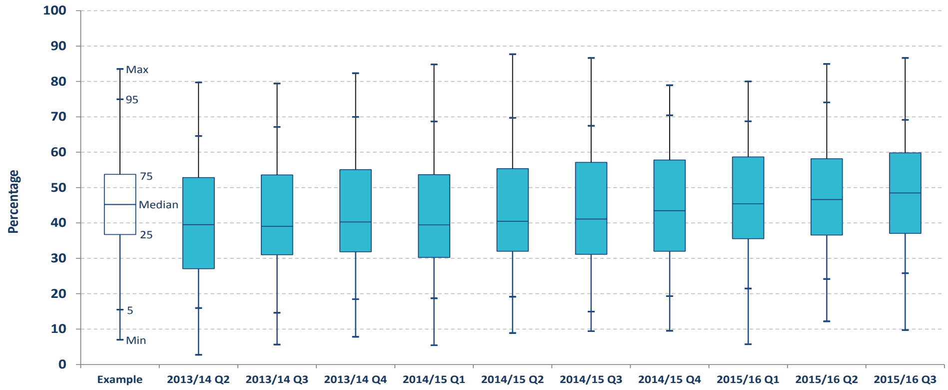
There was a significant increase in the median of stroke team values from 39.5% to 48.5% of patients being scanned within one hour of arrival at hospital; the median of stroke team values is close to the estimate of the proportion of acute stroke admissions which meet the criteria for urgent scanning.

Map 5a: Boxplot of stroke patients to brain imaging within one hour (%) by CCG



Max-Min (Range)		68.7	72.8	72.3	73.6	64.7	79.7	71.4	77.0	No significant change
95th-5th percentile		42.7	43.2	44.2	40.4	43.4	41.4	44.3	42.1	No significant change
75th-25th percentile		18.3	21.8	20.7	21.2	20.4	20.3	20.1	18.6	No significant change
Median		43.1	43.1	45.7	44.6	45.8	48.9	48.4	50.0	INCREASING Significant

Map 5b: Boxplot of stroke patients to brain imaging within one hour (%) by stroke team



Max-Min (Range)		77.0	73.8	74.5	79.3	78.8	77.2	69.4	74.3	72.7	76.8	No significant change
95th-5th percentile		48.6	52.5	51.5	49.9	50.6	52.5	51.1	47.2	49.9	43.3	No significant change
75th-25th percentile		25.7	22.6	23.2	23.4	23.3	26.0	25.8	23.1	21.6	22.7	No significant change
Median		39.5	39.1	40.3	39.5	40.5	41.1	43.5	45.4	46.6	48.5	INCREASING Significant

Map 6a: Brain imaging within 12 hours of arrival by CCG

The map and column chart display the latest period (October-December 2015), during which CCG values ranged from 74.5% to 100%, which is a 1.3-fold difference between CCGs. The England value for this quarter was 92.3%.

The boxplot shows the distribution of CCG values for the period January-March 2014 to October-December 2015.

There has been significant narrowing of all three measures of variation; the maximum to minimum range, the 95th to 5th percentile gap and the 75th to 25th percentile gap. This has been achieved despite increases in both 95th percentile and 75th percentile values and is largely due to much greater increases in the proportion of patients receiving brain imaging within 12 hours at the minimum and 5th percentile points of the CCG distribution.

The median of CCG values of the proportion of patients receiving brain imaging within 12 hours increased significantly.

Map 6b: Brain imaging within 12 hours of arrival by stroke team

The map and column chart display the latest period (October-December 2015), during which stroke team values ranged from 70.7% to 100%, which is a 1.4-fold difference between hospital stroke teams. The England value for this quarter was 92.7%.

The boxplot shows the distribution of stroke team values for the period January-March 2013 to October-December 2015.

There has been significant narrowing of all three measures of variation; the maximum to minimum range, the 95th to 5th percentile gap and the 75th to 25th percentile gap. This has been achieved despite increases in both 95th percentile and 75th percentile values and is largely due to much greater increases in the proportion of patients receiving brain imaging within 12 hours at the minimum and 5th percentile points of the stroke team distribution.

IMAGING SERVICES

MAP 6a: Percentage of stroke patients undergoing brain imaging within 12 hours of arrival at hospital by CCG

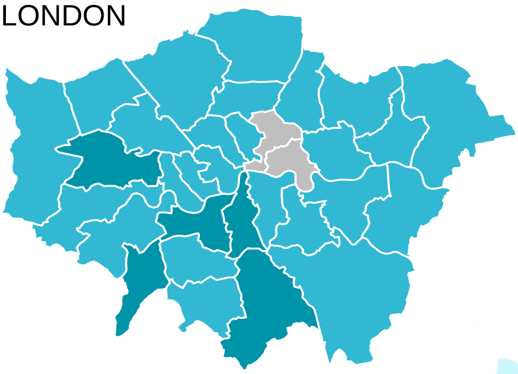
October–December 2015

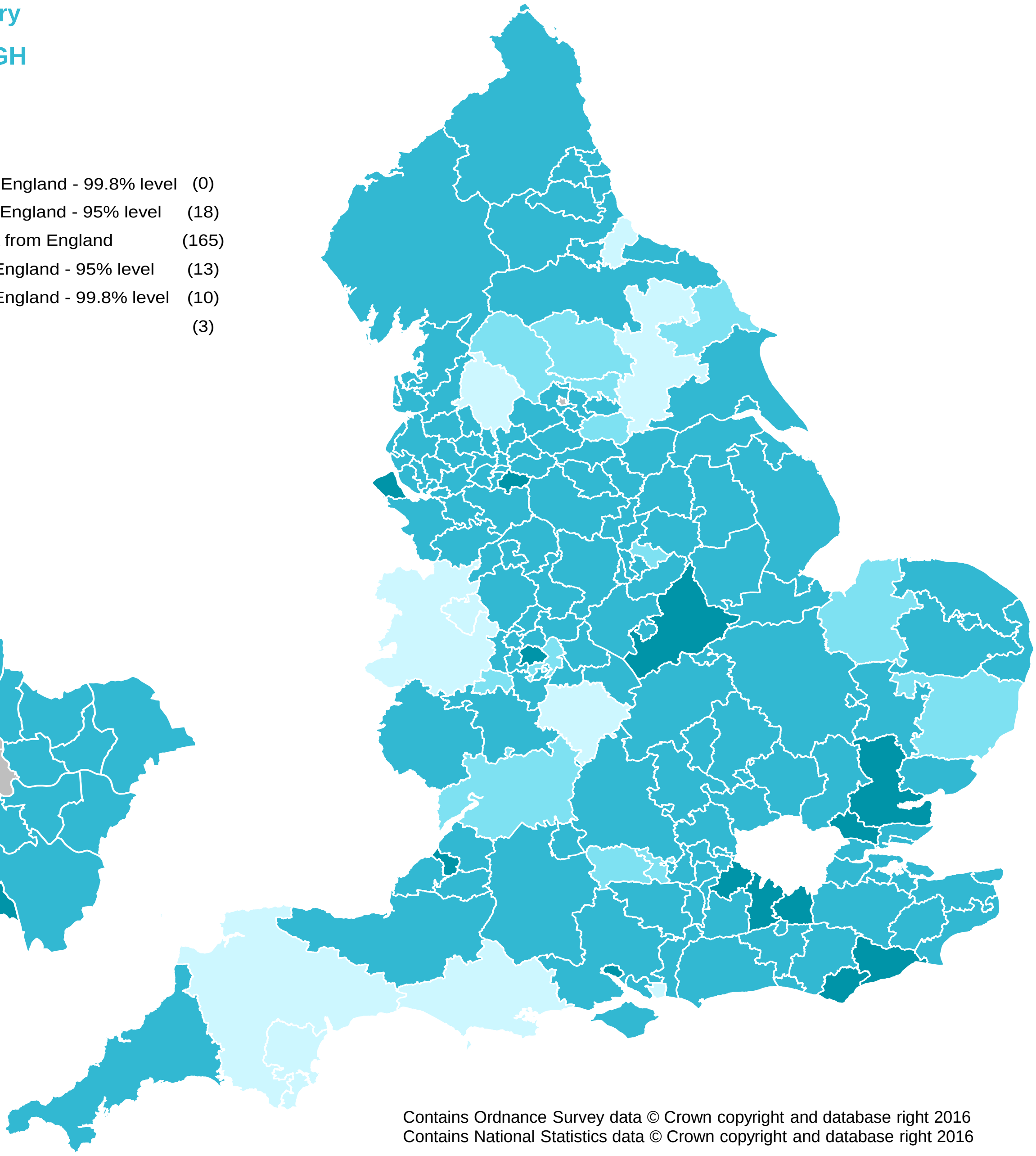
Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions
Domain 3: Helping people to recover from episodes of ill health or following injury

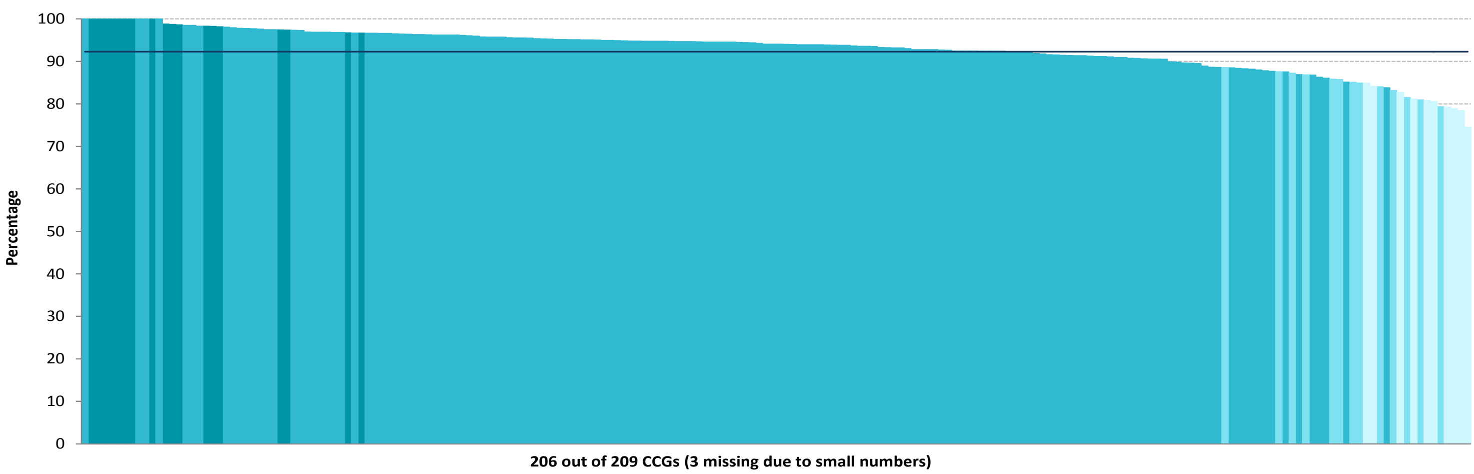
OPTIMUM VALUE: HIGH

Significantly higher than England - 99.8% level	(0)
Significantly higher than England - 95% level	(18)
Not significantly different from England	(165)
Significantly lower than England - 95% level	(13)
Significantly lower than England - 99.8% level	(10)
No data	(3)

LONDON







IMAGING SERVICES

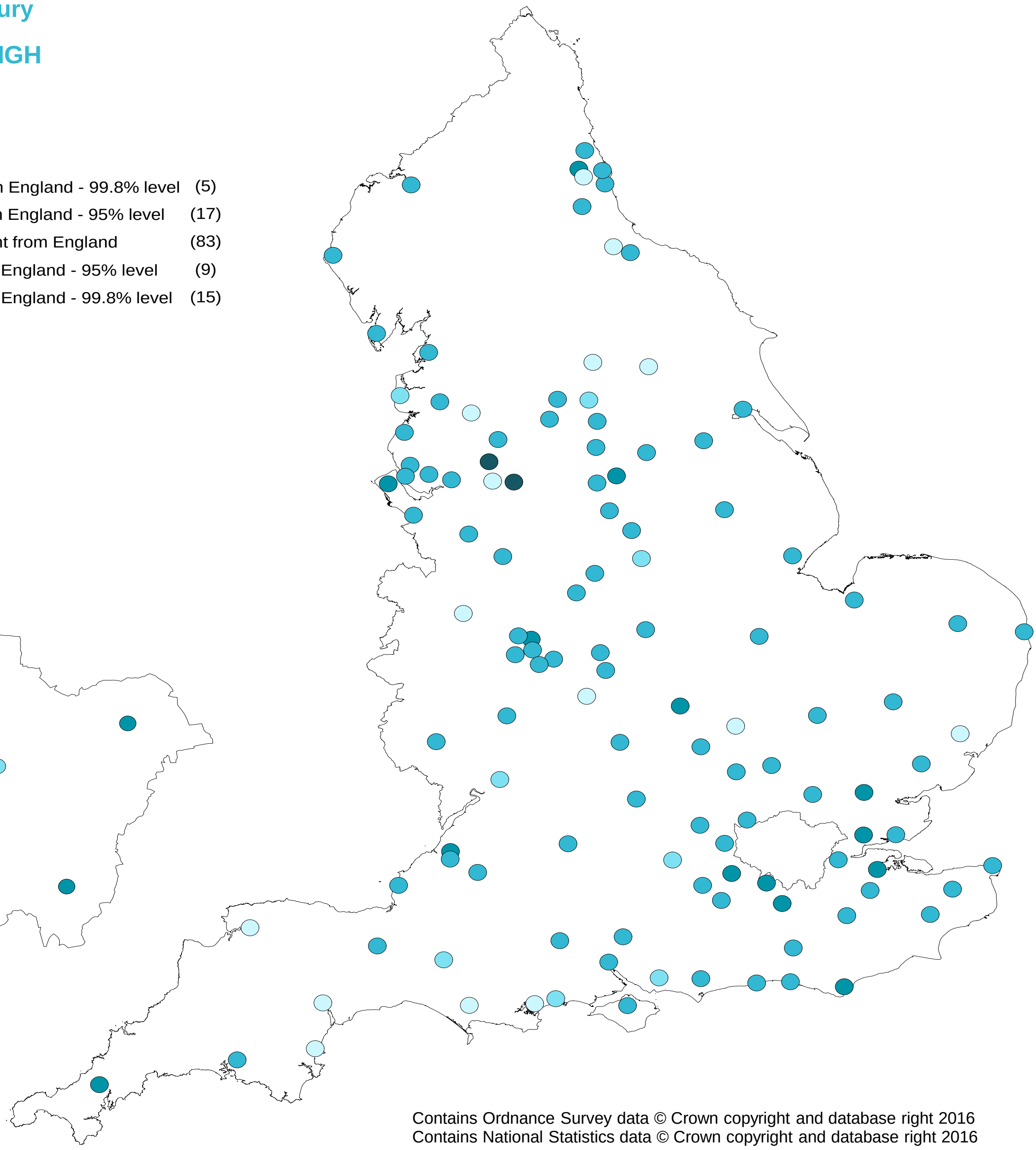
MAP 6b: Percentage of stroke patients undergoing brain imaging within 12 hours of arrival at hospital by stroke team

October–December 2015

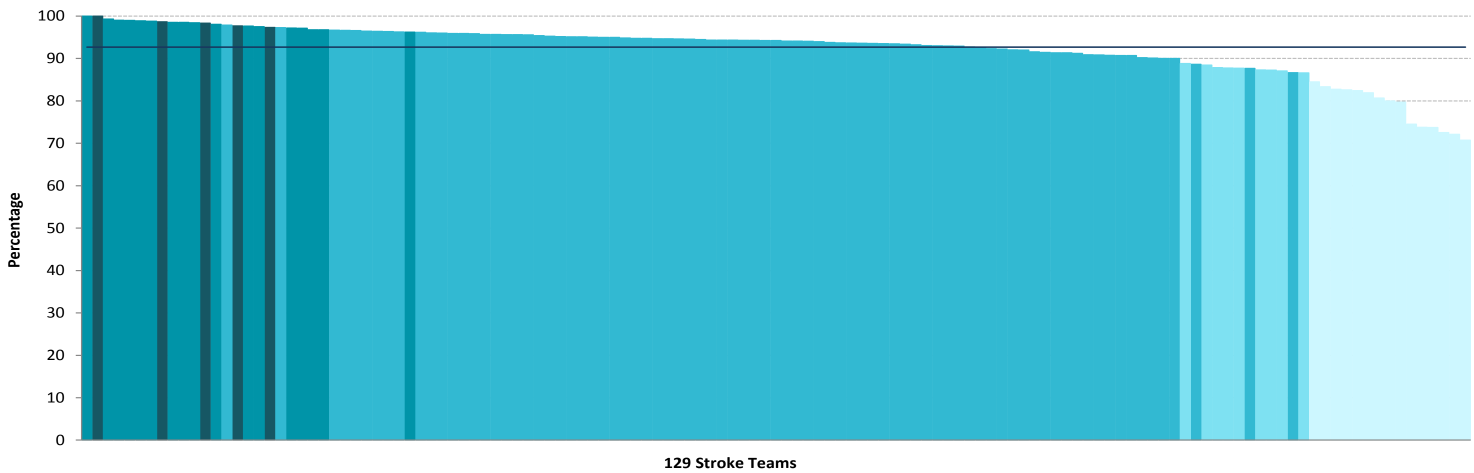
Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions
Domain 3: Helping people to recover from episodes of ill health or following injury

OPTIMUM VALUE: HIGH

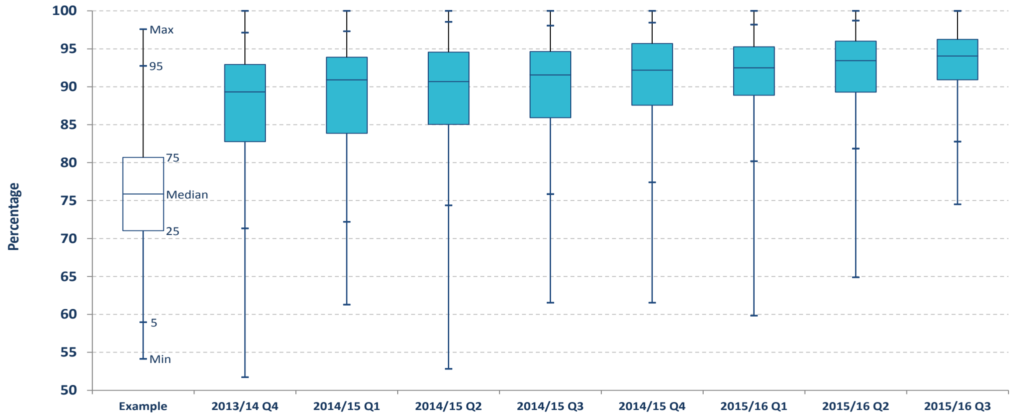
- Significantly higher than England - 99.8% level (5)
- Significantly higher than England - 95% level (17)
- Not significantly different from England (83)
- Significantly lower than England - 95% level (9)
- Significantly lower than England - 99.8% level (15)



LONDON

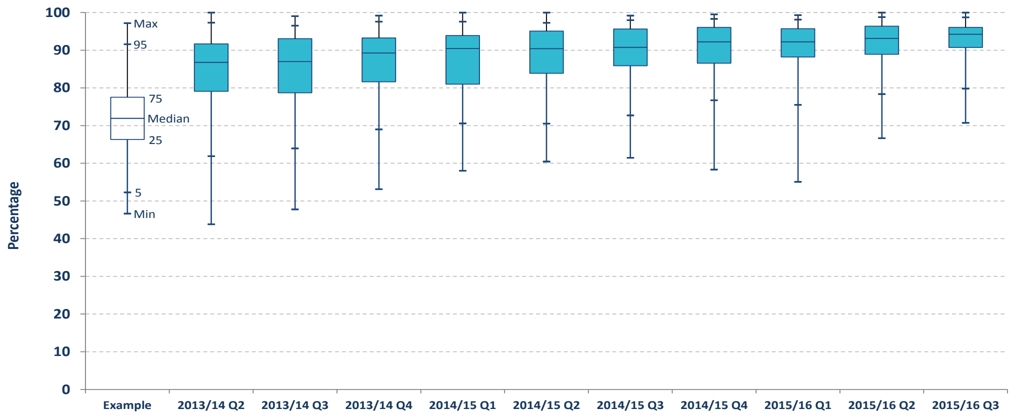


Map 6a: Boxplot of stroke patients to brain imaging within 12 hours (%) by CCG



Max-Min (Range)		48.3	38.7	47.2	38.5	38.5	40.2	35.1	25.5	NARROWING Significant
95th-5th percentile		25.8	25.1	24.2	22.2	21.0	18.0	16.9	17.2	NARROWING Significant
75th-25th percentile		10.2	10.0	9.5	8.7	8.1	6.4	6.7	5.3	NARROWING Significant
Median		89.3	90.9	90.7	91.6	92.2	92.5	93.4	94.0	INCREASING Significant

Map 6b: Boxplot of stroke patients to brain imaging within 12 hours (%) by stroke team



Max-Min (Range)		56.2	51.3	46.1	42.0	39.5	37.7	41.2	44.2	33.3	29.3	NARROWING Significant
95th-5th percentile		35.4	32.6	28.6	27.0	26.7	25.3	21.6	22.7	20.4	18.9	NARROWING Significant
75th-25th percentile		12.6	14.4	11.6	12.9	11.2	9.8	9.5	7.5	7.5	5.3	NARROWING Significant
Median		86.8	87.0	89.3	90.4	90.4	90.8	92.2	92.2	93.1	94.2	INCREASING Significant

Reasons for the degree of variation observed, particularly for median time to brain imaging (Maps 4a and 4b), and proportion of patients undergoing brain imaging within one hour (Maps 5a and 5b), include:

- lack of understanding by the admitting clinical teams of the need for early brain imaging in acute stroke and/or lack of protocols
- lack of access to imaging 24/7
- delays in patient transfer from admissions area to imaging facility

Although the percentage of people who meet the NICE criteria for immediate brain imaging in each hospital Trust is not known:

- the column chart for Map 5b shows that at 71 (out of 129) hospital Trusts less than 50% of stroke patients underwent brain imaging within one hour of arrival at hospital
- the column chart for Map 6b shows that at 27 (out of 129) hospital Trusts less than 90% of stroke patients underwent brain imaging within 12 hours of arrival at hospital

Options for action

Re-designing systems is pivotal to improving the assessment and treatment pathway for people who have a stroke (see *Case-study* section). Commissioners, clinicians and service providers need:

- to review the time to brain imaging in services providing stroke related care for the local population
- to review the patient pathway for people admitted with stroke
- to review the reporting of time to first scan for people with stroke among service providers

RESOURCES

- Department of Health. National Stroke Strategy. 5 December 2007. http://webarchive.nationalarchives.gov.uk/20130107105354/http:/www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081062
- Public Health England (PHE) Stroke Prevalence Modelling Briefing Document, & Stroke Prevalence Estimates Dec 2011. http://www.apho.org.uk/default.aspx?RID=61214
- NICE. Stroke and transient ischaemic attack in over 16s: diagnosis and initial management. NICE guidelines [CG68]. July 2008. http://guidance.nice.org.uk/CG68
- NICE Pathways. Stroke overview. http://pathways.nice.org.uk/pathways/stroke
- Intercollegiate Stroke Working Party. National clinical guideline for stroke. Fourth edition. 3 September 2012. Royal College of Physicians.https://www.rcplondon.ac.uk/file/1299/download?token=mcyQFjEq
- Intercollegiate Stroke Working Party. National clinical guideline for stroke. Fifth edition. 3 October 2016. Royal College of Physicians. http://www.rcplondon.ac.uk/resources/stroke-guidelines

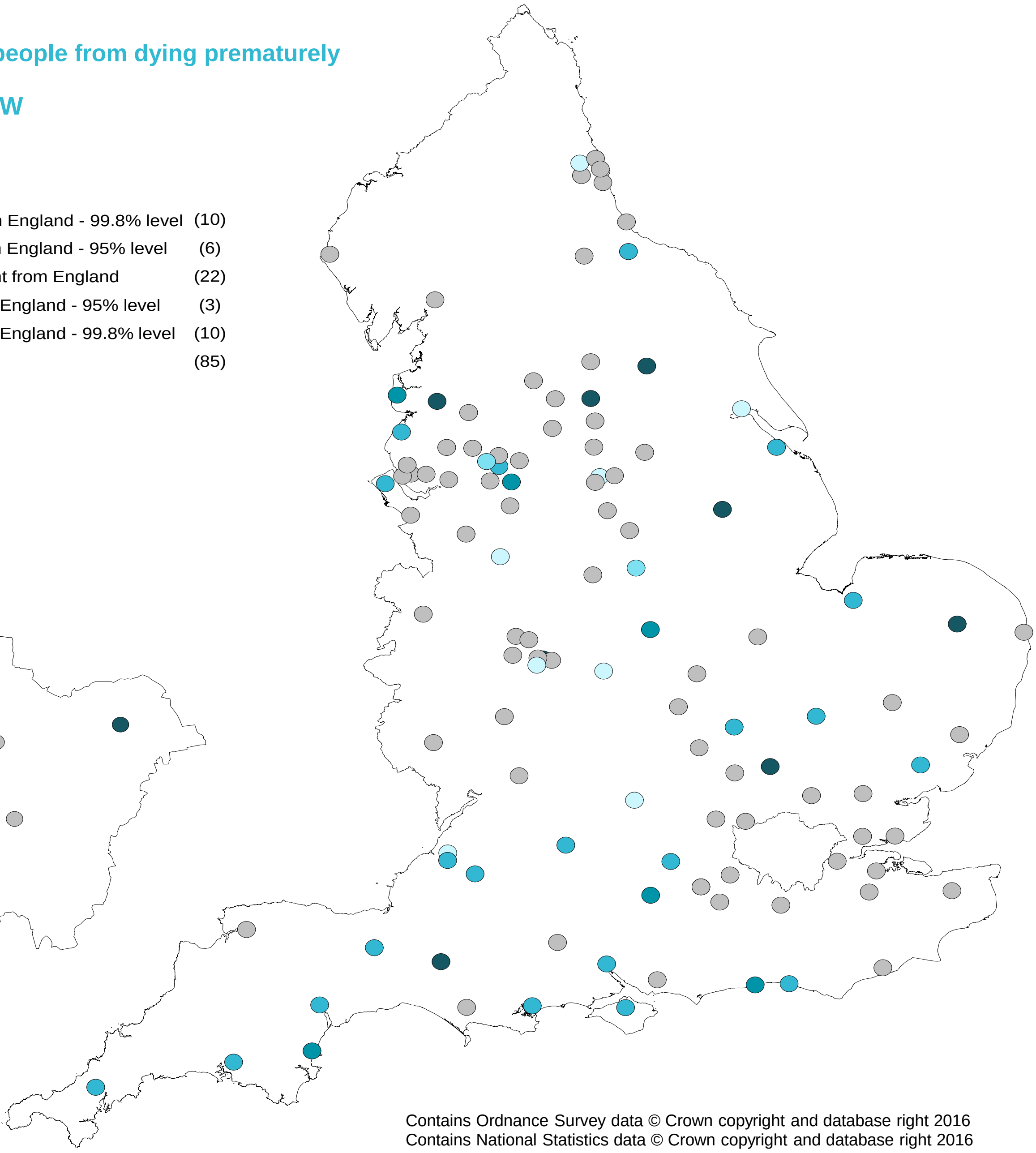
IMAGING SERVICES

MAP 7: Median time (minutes) to head computed axial tomography (CT) for patients admitted directly to hospital[1] meeting NICE head injury guidelines[2] by NHS Trust

2014/15

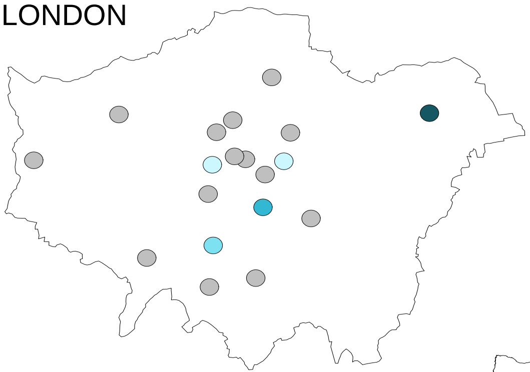
Domain 1: Preventing people from dying prematurely

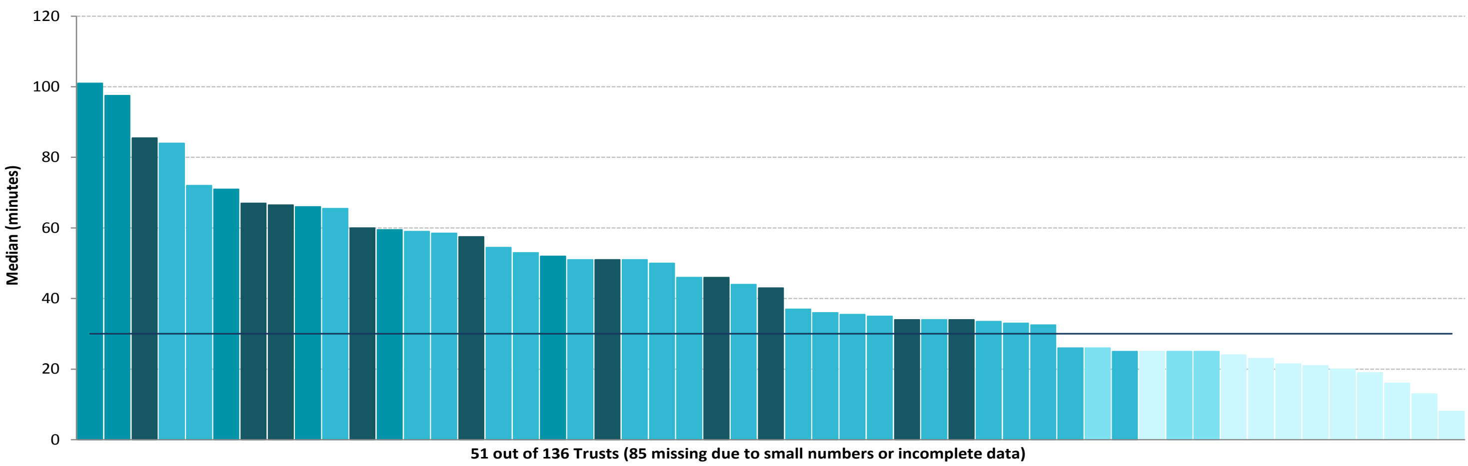
OPTIMUM VALUE: LOW



■	Significantly higher than England - 99.8% level	(10)
■	Significantly higher than England - 95% level	(6)
■	Not significantly different from England	(22)
■	Significantly lower than England - 95% level	(3)
■	Significantly lower than England - 99.8% level	(10)
■	No data	(85)

LONDON





[1] Patients directly admitted to hospital are defined as patients who are brought from the scene of the incident straight to the hospital without visiting another hospital first.

[2] NICE head injury guidelines defined as Glasgow Coma Scale (GCS) <13 and/or intubated and Abbreviated Injury Scale (AIS) 1+ head injury

IMAGING SERVICES

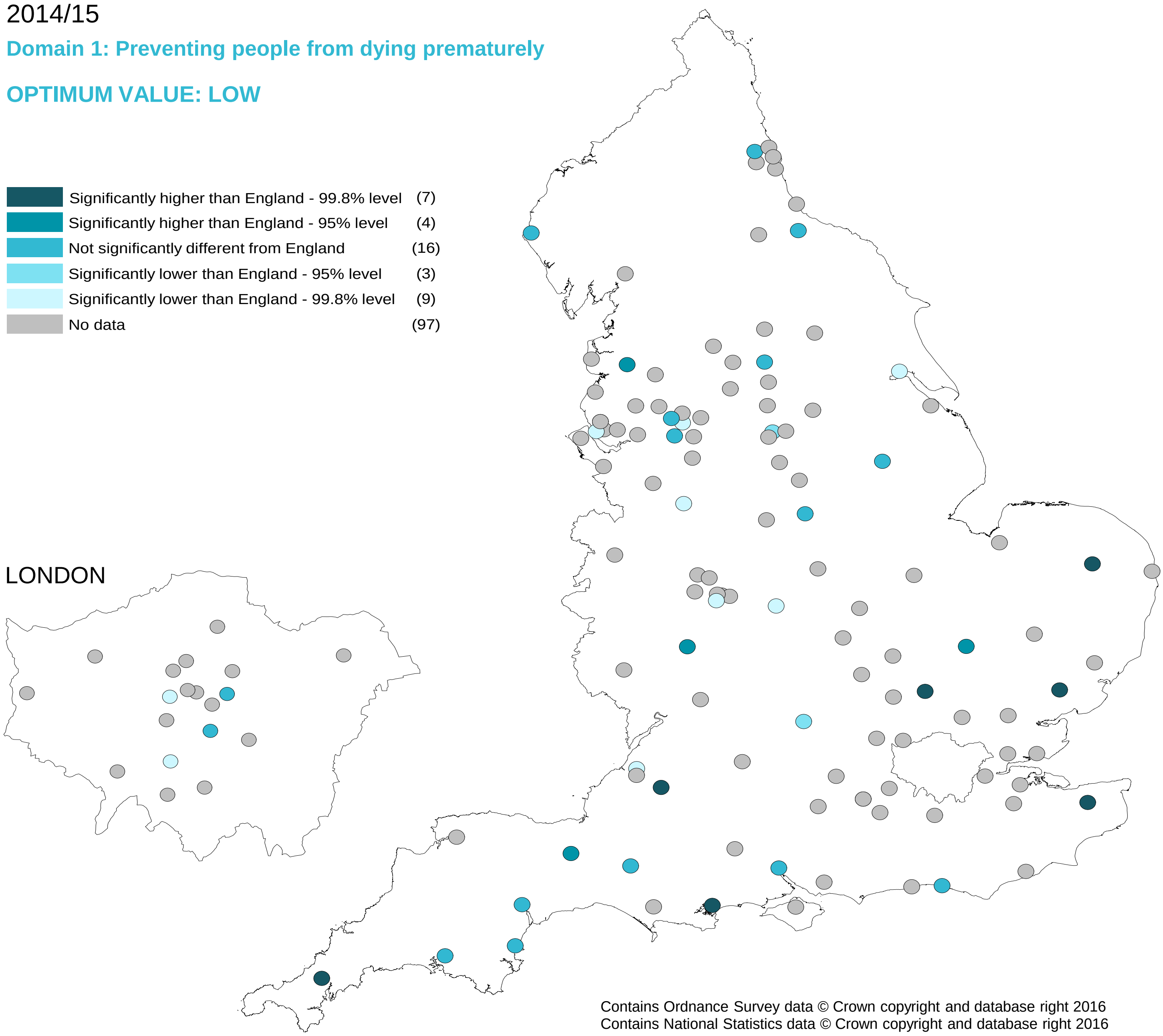
MAP 8: Median time (minutes) to pelvic computed axial tomography (CT) for patients admitted directly to hospital[1] with pelvic injury[3] by NHS Trust

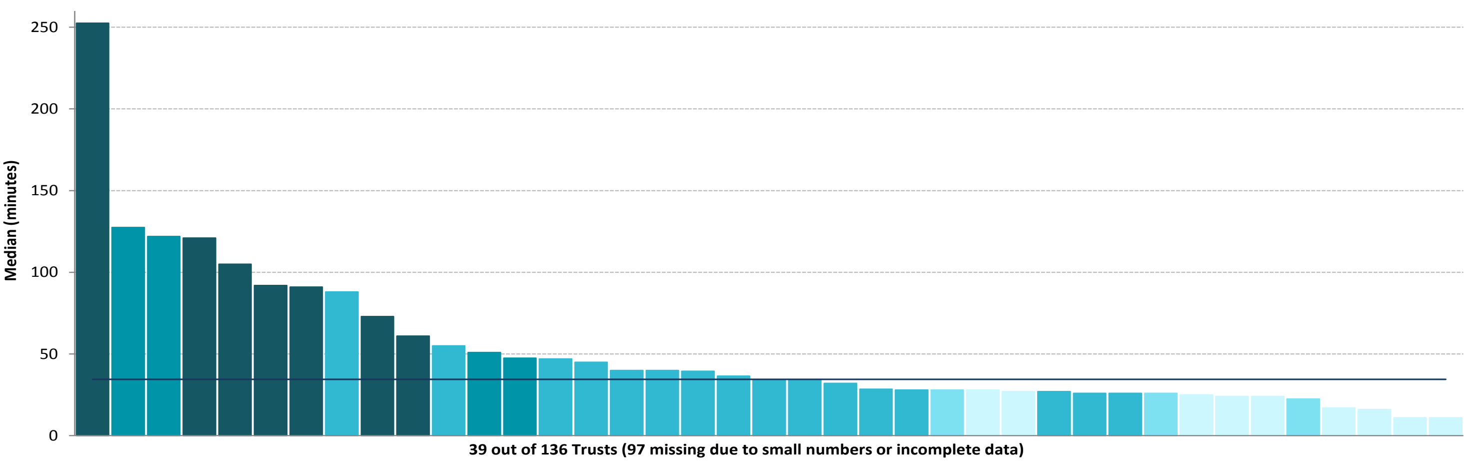
2014/15

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: LOW

Significantly higher than England - 99.8% level	(7)
Significantly higher than England - 95% level	(4)
Not significantly different from England	(16)
Significantly lower than England - 95% level	(3)
Significantly lower than England - 99.8% level	(9)
No data	(97)





[3]Whole body, and abdominal CT are counted as CT to pelvis.

Context

Computed axial tomography (CT scan) is an X-ray technique using a scanner that takes a series of pictures across the body allowing a radiologist to view the images in a two- or three-dimensional form.[4]

In patients with head injuries, CT scanning of the head is used to detect:

- traumatic brain injury (TBI)
- fractures of the skull

For the assessment of head injuries, CT scanning is sufficient for detecting TBI requiring neurosurgery, whereas more detail of smaller injuries is visible on magnetic resonance imaging (MRI).

In patients with pelvic injuries, CT scanning of the pelvis is used to detect internal bleeding, broken bones and damage to internal organs.

The data for these indicators is from the Trauma Audit and Research Network (TARN)[5]. The TARN database is the largest trauma registry in Europe, with the overall aim of collecting and analysing clinical and epidemiological data to provide a statistical base:

- to support clinical audit
- to aid the development of trauma services
- to inform the research agenda

Maps 7 and 8 show provider-level data:

- the disadvantage is that they are difficult to visualise in relation to discrete geographical populations
- the advantage in relation to access to trauma services is that, unlike indicators for long-term conditions, they are less influenced by clinical bias or preferences

The online Electronic Data Collection & Reporting (EDCR) was launched to all participating Trusts in England and Wales between September 2005 and March 2006.

Magnitude of variation

Map 7: Median time to head CT

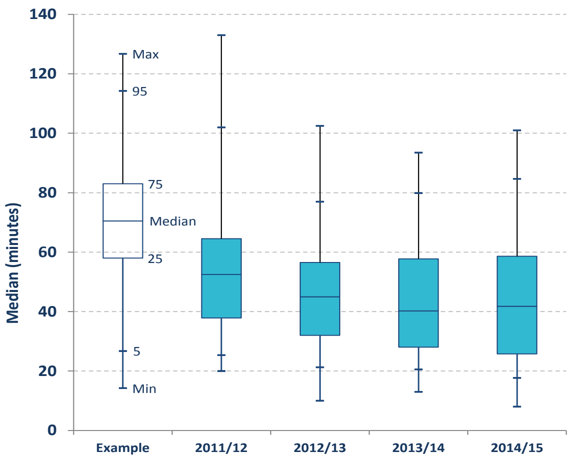
The map and column chart display the latest period (2014/15), during which NHS Trust values ranged from 8 minutes to 101 minutes, which is a 12.6-fold difference between NHS Trusts. The England value for 2014/15 was 30 minutes.

The boxplot shows the distribution of NHS Trust values for the period 2011/12 to 2014/15. There was no significant change in any of the three variation measures between 2011/12 to 2014/15.

The median time to head CT for patients decreased by 10 minutes from 52 minutes in 2011/12 to 42 minutes in 2014/15. This decrease was not statistically significant.

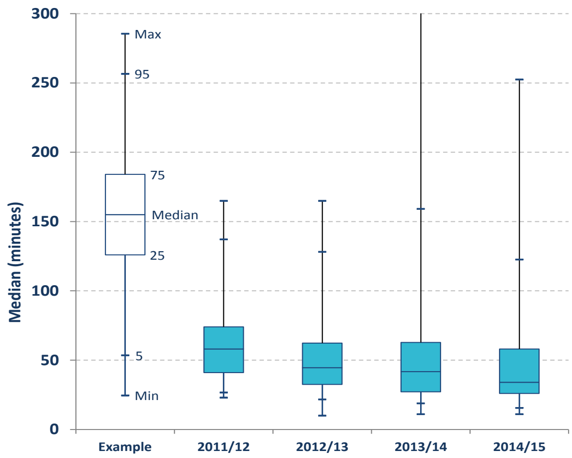
It should be noted however, that only 38% of 2014/15 Trust values were available for analysis, which was due to either small number suppression or data not being supplied.

Map 7: Boxplot of median time to head CT by NHS Trust



Max-Min (Range)		113	93	81	93	No significant change
95th-5th percentile		77	56	59	67	No significant change
75th-25th percentile		27	25	30	33	No significant change
Median		52	45	40	42	No significant change

Map 8: Boxplot of median time to pelvic CT by NHS Trust[6]



Max-Min (Range)		142	155	1064	242	No significant change
95th-5th percentile		110	106	140	107	No significant change
75th-25th percentile		33	30	36	32	No significant change
Median		58	44	42	34	DECREASING Significant

[4] The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504
[5] TARN is a collaboration of hospitals from England, Wales, Ireland and other parts of Europe, established in 1989. https://www.tarn.ac.uk/
[6] Map 8 - Pelvic injuries boxplot vertical axis is truncated, 2013/14 maximum = 17.9 hours

Map 8: Median time to pelvic CT

The boxplot shows the distribution of indicator values for the period 2011/12 to 2014/15.

The map and column chart display the latest period (2014/15), during which NHS Trust values ranged from 11 minutes to 252 minutes, which is a 23-fold difference between NHS Trusts. The England value for 2014/15 was 35 minutes.

The boxplot shows the distribution of NHS Trust values for the period 2011/12 to 2014/15. There was no significant change in any of the three variation measures between 2011/12 to 2014/15.

There was a statistically significant decrease of 24 minutes in the median time to pelvic CT for patients from 58 minutes in 2011/12 to 34 minutes in 2014/15.

It should be noted however, that only 28% of 2014/15 Trust values were available for analysis, which was due to either small number suppression or data not being supplied.

The degree of variation observed for both indicators is predominantly related to case-mix. Most cases of immediately life-threatening trauma associated with reduced consciousness or shock are brought to major trauma centres which will have been alerted to arrival by ambulance services. This enables the trauma centre to activate urgent imaging before the patient arrives. In contrast, although cases of atypical major trauma are serious, such as older people falling or children who have had an accident, they may appear not to be immediately life-threatening and patients are taken to non-major trauma centres, for which there is no "pre-alert" and therefore imaging tends to be accessed at a later point in time for those patients who are subsequently identified as having head or pelvic injuries.

The lack of availability of data poses problems for commissioners, especially in localities where there is varying data coverage. In 2010 issues about data were highlighted in the National Audit Office (NAO) report, 'Major trauma care in England':

> "*There remains a lack of accurate and complete information in hospitals and ambulance trusts on the treatment of people who suffer major trauma. In addition, other than mortality rates, there is also no information on patient outcomes*."[7]

Since the implementation of the Regional Trauma Networks in 2012, data returns to TARN have improved but they are variable. At the time of writing, patient reported outcome measures (PROMs) are being evaluated in a pilot study by TARN, and this may facilitate the development of other important outcome measures in future.

Options for action

TARN undertakes routine analysis of the data for clinical commissioning groups (CCGs) and the Major Trauma Clinical Reference Group. To reduce unwarranted variation in the median time to CT scan for various injuries, hospital Trusts, using TARN data, need to benchmark performance against that of other Trusts to help identify good practice and ways to improve patient care. This will need to take account of case-mix.

The Care Quality Commission needs to use the TARN analyses to monitor the performance of trauma networks.

Following the NAO recommendations Regional Trauma Networks went live in England in April 2012. Trauma services provided by major trauma centres are commissioned directly by NHS England. The submission of data by major trauma centres was mandated, and data submission and quality by major trauma centres are excellent. By contrast, trauma services provided by trauma units are commissioned by CCGs, and a considerable amount of major trauma is managed within trauma units. The return of data from trauma units needs to be improved to enhance the quality of data on which decisions are based concerning the commissioning, planning and provision of trauma services.

RESOURCES

- The Trauma Audit & Research Network (TARN). https://www.tarn.ac.uk/
- NHS Radiology Improvement Team (2007) Page 1: Computerised Tomography. Radiology Success Factors.http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf
- NICE. Head injury: assessment and early management. NICE guidelines [CG176]. January 2014. https://www.nice.org.uk/guidance/cg176
- NICE. Fractures (complex): assessment and management. NICE guidelines [NG37]. February 2016. https://www.nice.org.uk/guidance/ng37
- NICE pathways. Trauma overview. http://pathways.nice.org.uk/pathways/trauma
- National Audit Office. Major trauma care in England. 5 February 2010. http://www.nao.org.uk/report/major-trauma-care-in-england/
- Gibb I, Denton E. Guidelines for imaging the injured blast/ballistic patient in a Mass Casualty scenario. 1 June 2011. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fImaging%20Guidelines%20for%20Major%20Incidents%20June1%202011.pdf

[7] National Audit Office (2010) Major trauma care in England. http://www.nao.org.uk/publications/0910/major_trauma_care.aspx

IMAGING SERVICES

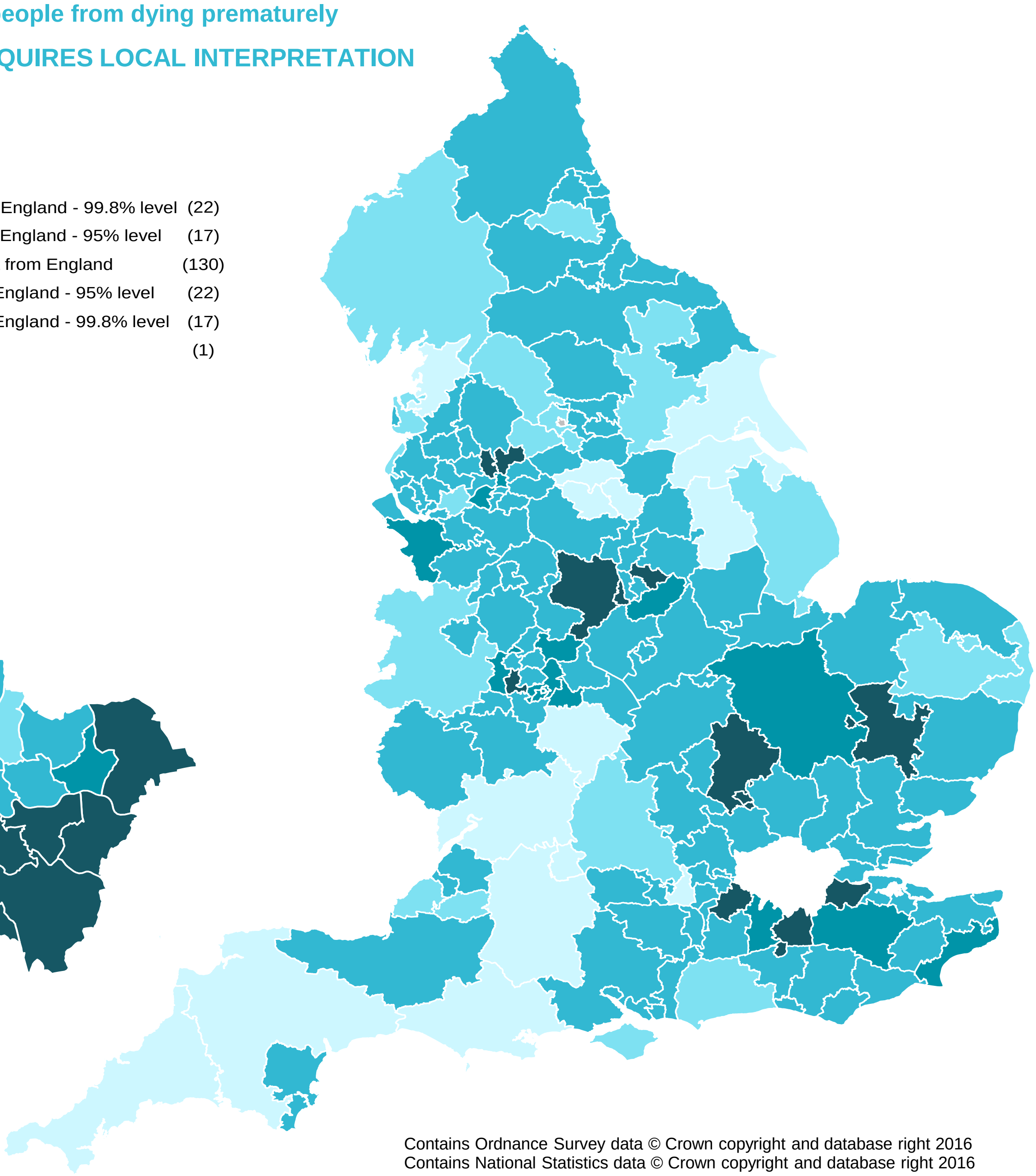
MAP 9: Rate of endovascular aneurysm repair (EVAR) procedures for abdominal aortic aneurysm (AAA) per population by CCG

Directly standardised for age, 2012/13–2014/15

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION

Significantly higher than England - 99.8% level	(22)
Significantly higher than England - 95% level	(17)
Not significantly different from England	(130)
Significantly lower than England - 95% level	(22)
Significantly lower than England - 99.8% level	(17)
No data	(1)



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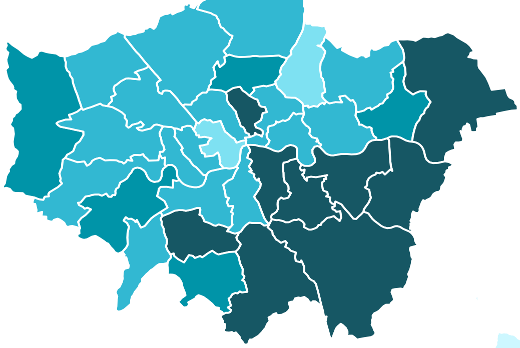
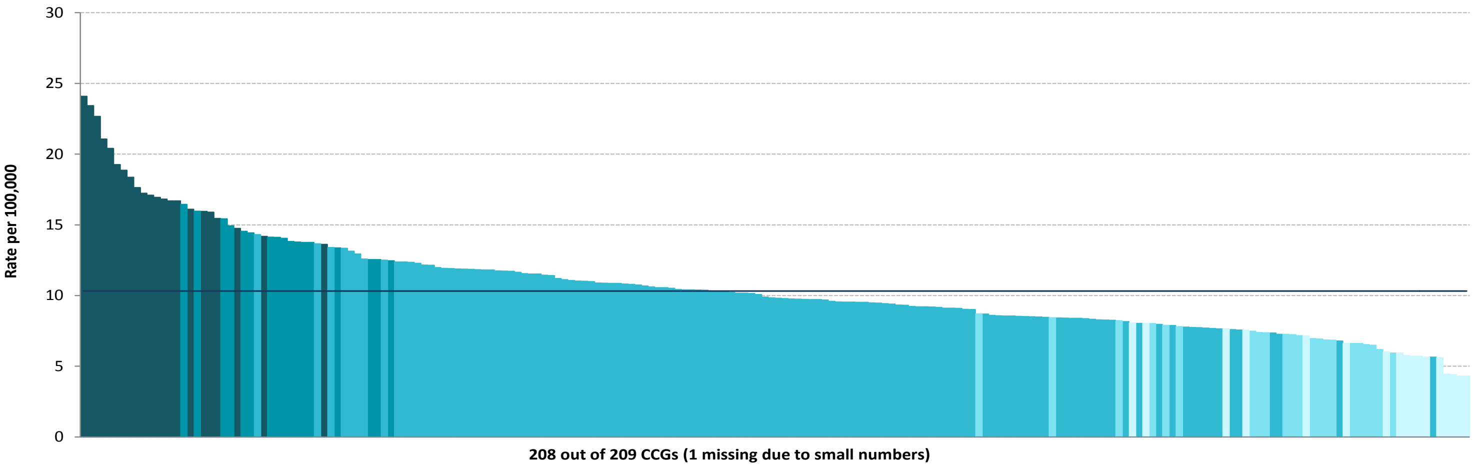




Context

An aneurysm is the result of stretching caused by a weakness in the wall of an artery, usually as a result of degeneration due to ageing and external factors such as smoking, high levels of cholesterol and high levels of blood pressure. Although aneurysms can occur in any artery, one of the common places for aneurysm formation is the abdominal aorta. Aneurysms can be asymptomatic, but with a larger aneurysm (>5.5cm) there is a risk of rupture, which can cause severe internal bleeding. Four out of five people with a ruptured aortic aneurysm will die.[1] To reduce the risk of rupture, the diseased aorta is replaced with an artificial graft via open surgery or lined internally with a covered stent: endovascular aneurysm repair (EVAR).

Endovascular aneurysm repair is a ‘keyhole’ surgery technique in which an incision is made in both groins to access the femoral artery. A stent-graft is then inserted into the artery using a catheter and wire, which is guided by X-rays to the site of the aneurysm, where the stent-graft is attached to line the inside of the artery walls.

NICE does not currently recommend EVAR in people whose aortic aneurysm has already ruptured, although recent studies suggest it is a reasonable option, with some advantages in reducing hospital stay.[2]

In the UK EVAR Trial (*n*=1252 patients) the 30-day mortality rate for EVAR in elective aneurysm repair was significantly lower when compared with open surgery (1.8% vs 4.3%), although in the long term there were no differences in total mortality or aneurysm mortality.[3] De Bruin et al found similar results six years after randomisation, but in a smaller group of patients (*n*=352).[4] In a systematic review and meta-analysis of early and long-term outcomes of open and endovascular repair of AAA there was no long-term survival benefit for patients who had EVAR when compared with open surgery for AAA.[5]

For EVAR, recovery time after operation is quicker because the large abdominal incision of open surgery is avoided, and pain levels and length of stay are reduced. After intervention the risk of the stent-graft moving or kinking, such that the AAA is not sealed (known as an endoleak), is higher for EVAR than that for open surgery. Lifelong surveillance is currently recommended after EVAR, and the development of complications requiring further surgery or endovascular treatment is higher after EVAR than it is after open surgery.[2,3,4] For fragile patients aged 80 years and older, the results of a meta-analysis suggest that elective EVAR is associated with significantly lower immediate post-operative mortality and morbidity than open repair.[6]

Over the last decade there has been a remodelling of vascular services in England, and the number of providers undertaking the repair of AAA has declined by about half.[7] Until this process of centralisation has been completed there is likely to be inequity of access to services, but any variation associated with this process should decline over time. The indicator shown in Map 10 provides a proxy for monitoring the equitable provision of services.

Responses to a survey of Interventional Radiology departments in England conducted during March to May 2012 by NHS Improvement – Diagnostics showed that at that time one in five NHS Trusts were not able to provide core services for EVAR, nor did they have a network pathway to an agreed recipient.[8]

Magnitude of variation

Map 9: EVAR for AAA rate

The map and column chart display the latest period (2012/13-2014/15), during which CCG values ranged from 4.3 to 24.1 per 100,000 population, which is a 5.6-fold difference between CCGs. The England value for 2012/13-2014/15 was 10.3 per 100,000 population. There are still CCGs with significantly low levels of access to EVAR

The boxplot shows the distribution of CCG values for the period 2009/10-2011/12 to 2012/13-2014/15. There was no significant change in any of the three variation measures between 2009/10-2011/12 and 2012/13-2014/15.

The median rate of EVAR procedures increased significantly from 8.5 to 9.8 per 100,000 population, between 2009/10-2011/12 and 2012/13-2014/15.

[1] Reimerink JJ, van den Laan MJ, Koelemay MJ et al. Systematic review and meta-analysis of population-based mortality from ruptured abdominal aortic aneurysm. *British Journal of Surgery* 2013; 100: 1405-1413. doi: 10.1002/bjs.9235
[2] The IMPROVE Trial Investigators. Endovascular or open repair strategy for ruptured abdominal aortic aneurysm: 30 day outcomes from IMPROVE randomised trial. *BMJ* 2014; 348 doi: http://dx.doi.org/10.1136/bmj.f7661
[3] The United Kingdom EVAR Trial investigators. Endovascular versus Open Repair of Abdominal Aortic Aneurysm. *New England Journal of Medicine* 2010; 362: 1863-1871. http://www.nejm.org/doi/full/10.1056/NEJMoa0909305
[4] Dr Bruin JL, Baas AF, Buth J et al for the DREAM Study Group. Long-Term Outcome of Open or Endovascular Repair of Abdominal Aortic Aneurysm. New England Journal of Medicine 2010; 362: 1881-1889. http://www.nejm.org/doi/full/10.1056/NEJMoa0909499
[5] Stather P, Sidloff D, Dattani N et al. Systematic review and meta-analysis of the early and late outcomes of open and endovascular repair of abdominal aortic aneurysm. British Journal of Surgery 2013; 100: 863-872. doi: 10.1002/bjs.9101
[6] Biancari F, Catania A, D’Adrea V. Elective Endovascular vs. Open Repair for Abdominal Aortic Aneurysm in Patients Aged 80 years and Older: Systematic Review and Meta-Analysis. European Journal of Vascular & Endovascular Surgery 2011; 42: 571-576.
[7] Earnshaw JJ, Mitchell DC, Wyatt MG et al. Remodelling of vascular (surgical) services in the UK. European Journal of Vascular and Endovascular Surgery 2012; 44: 465-467.
[8] NHS Improving Quality. Interventional radiology provision in 2013 - A survey of English NHS trusts.

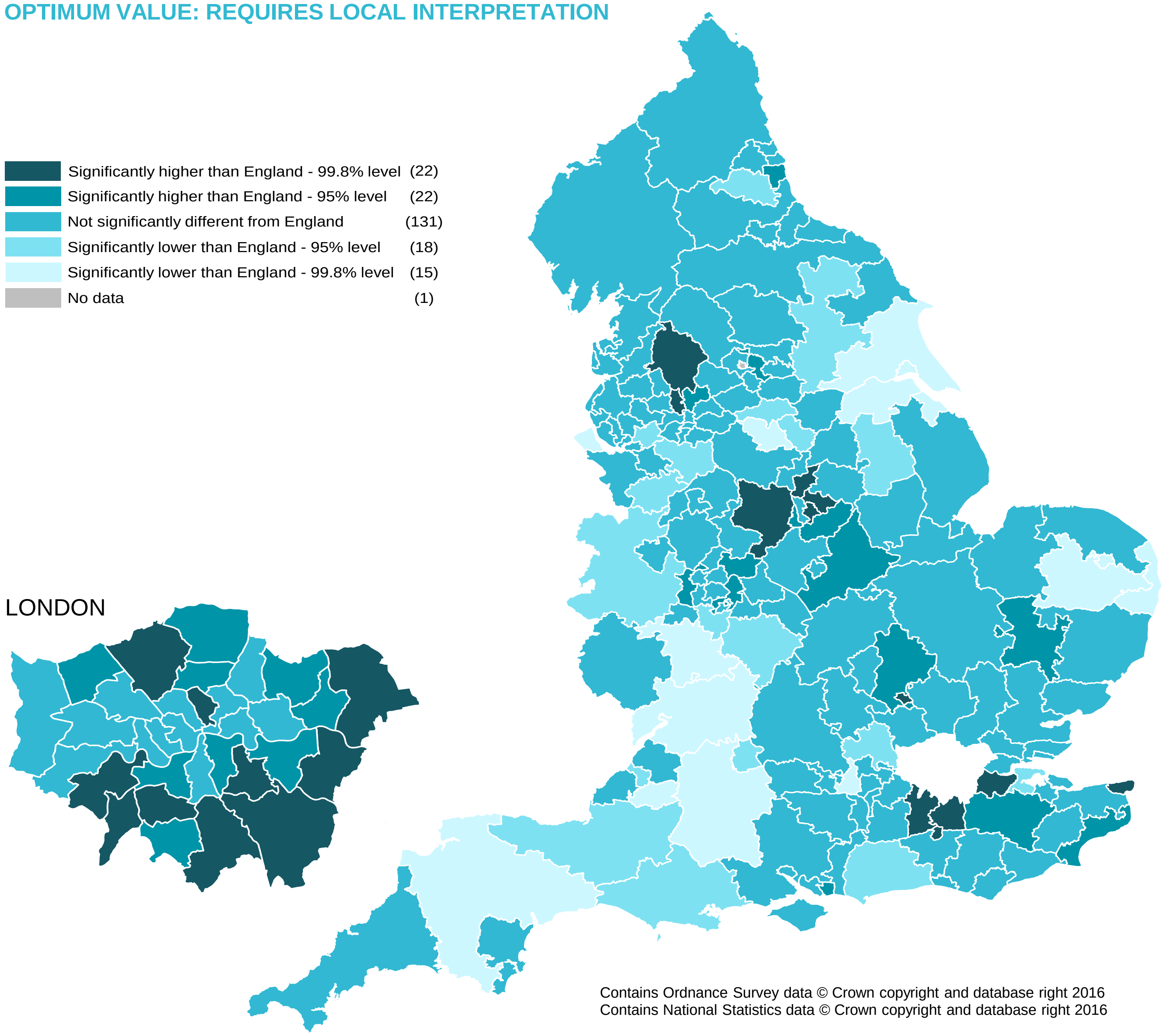
IMAGING SERVICES

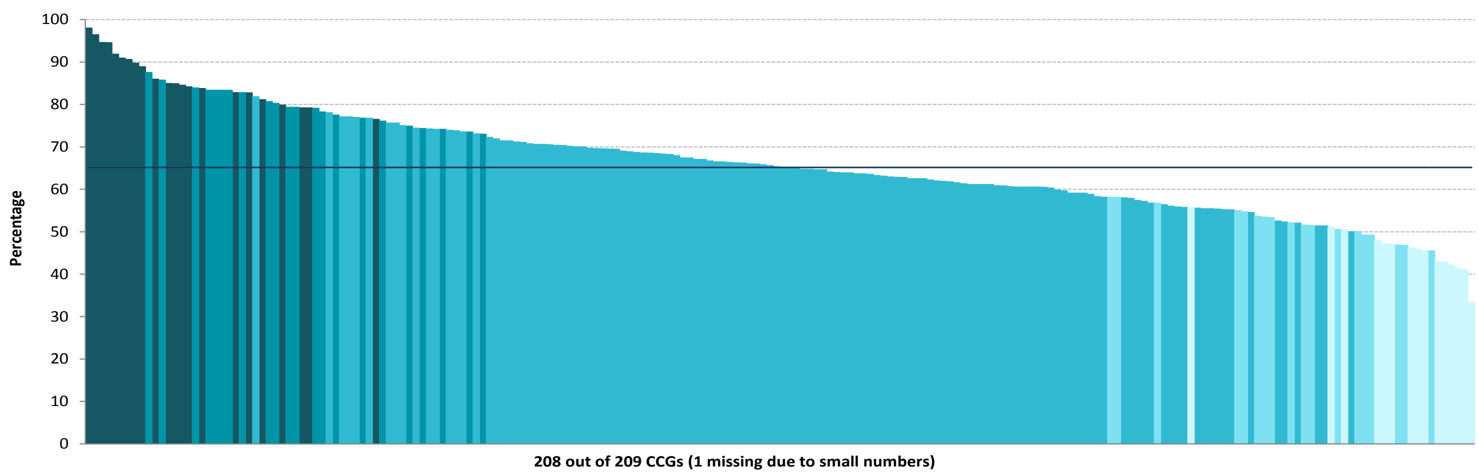
MAP 10: Percentage of elective procedures for abdominal aortic aneurysm (AAA) that were EVAR by CCG

2012/13–2014/15

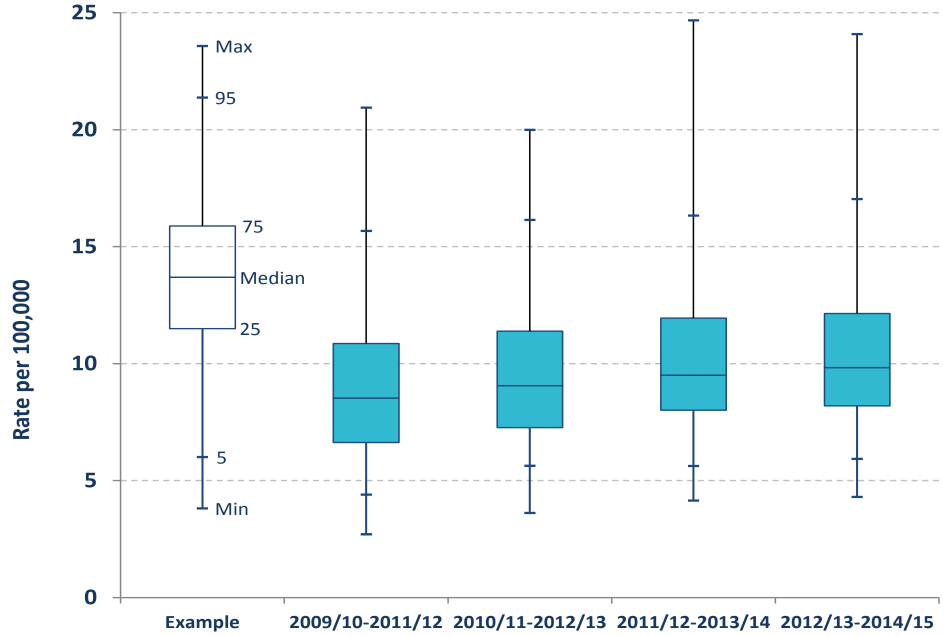
Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION



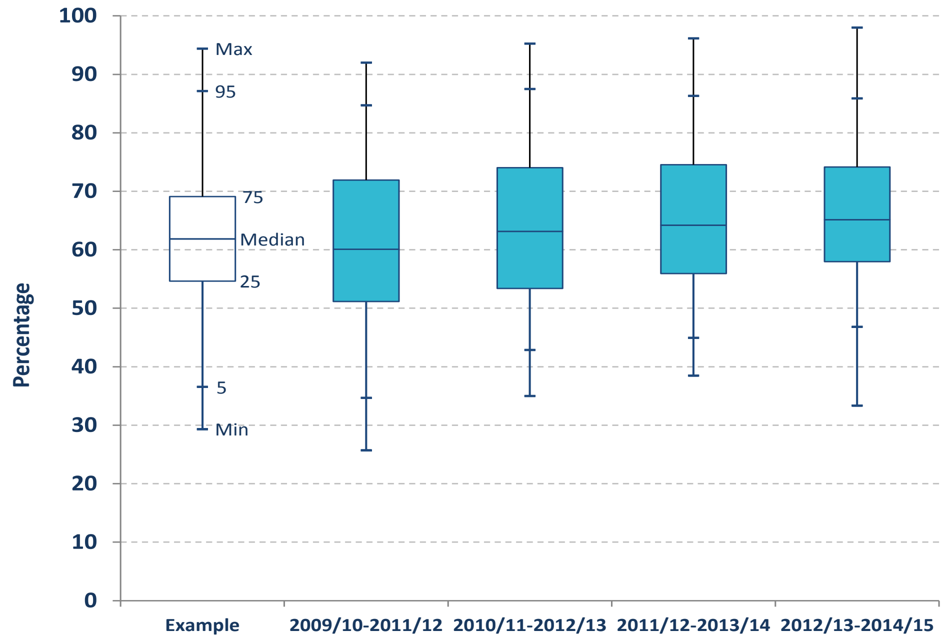


Map 9: Boxplot of EVAR for AAA rate by CCG



	Example	2009/10-2011/12	2010/11-2012/13	2011/12-2013/14	2012/13-2014/15	
Max-Min (Range)		18.2	16.4	20.5	19.8	No significant change
95th-5th percentile		11.3	10.5	10.7	11.1	No significant change
75th-25th percentile		4.2	4.1	3.9	3.9	No significant change
Median		8.5	9.1	9.5	9.8	INCREASING Significant

Map 10: Boxplot of elective AAA procedures that were EVAR (%) by CCG



	Example	2009/10-2011/12	2010/11-2012/13	2011/12-2013/14	2012/13-2014/15	
Max-Min (Range)		66.3	60.2	57.7	64.7	No significant change
95th-5th percentile		50.0	44.6	41.4	39.1	NARROWING Significant
75th-25th percentile		20.7	20.6	18.6	16.2	No significant change
Median		60.1	63.2	64.2	65.1	INCREASING Significant

High rates of EVAR may be appropriate due to the expertise located in vascular units that are also tertiary referral centres; however, high usage in other units could indicate that some patients are receiving this intervention inappropriately.

Map 10: Percentage of elective AAA procedures that were EVAR

The map and column chart display the latest period (2012/13-2014/15), during which CCG values ranged from 33.3% to 98%, which is a 2.9-fold difference between CCGs. The England value for this period was 65.2%.

The boxplot shows the distribution of CCG values for the period 2009/10-2011/12 to 2012/13-2014/15. There was a significant narrowing of the 95th to 5th percentile gap between 2009/10-2011/12 to 2012/13-2014/15.

The median increased significantly from 60.1 to 65.1 per 100,000 population between 2009/10-2011/12 and 2012/13-2014/15. This indicates that an increasing proportion of people are undergoing an EVAR procedure to treat AAA rather than open surgery. For some clinicians however, the use open surgery may be seen as more durable in younger patients and so the increased use of EVAR may not be warranted in all cases.

The degree of variation in the balance between EVAR and open surgery for elective repair of AAA is large. Based on an assumption that there is no difference in prevalence of aneurysms (>5.5cm), potential reasons for variation in the observed rate of EVAR include differences in:

- patient access to EVAR, either through the local provider or via a referral pathway, or problems related to long travelling distances
- local surgical custom and practice
- levels of expertise
- changes in OPCS4 codes over the time period which may not have been uniformly implemented in the Hospital Episode Statistics database for AAA repair procedures

Options for action

When addressing unwarranted variation in EVAR, commissioners, clinicians and service providers need to review:

- the need for EVAR in the local population, including screen-detected and non-screen-detected AAA
- the rate of EVAR activity in relation to need
- the balance between EVAR and open surgery locally
- levels of access to EVAR considering travelling times and access to centres providing EVAR
- local care pathways for aneurysms
- progress towards centralisation to specialist services

Commissioners need to ensure that service providers have a clear pathway for referral if open surgery for AAA and EVAR are not available at individual hospital Trusts.

RESOURCES

- NICE. Endovascular stent-grafts for the treatment of abdominal aortic aneurysms. NICE technology appraisal guidance [TA167]. February 2009. http://guidance.nice.org.uk/TA167
- Royal College of Radiologists, British Society of Interventional Radiology, The Vascular Society of Great Britain and Ireland, The Vascular Anaesthesia Society of Great Britain and Ireland, and The Medicines and Healthcare products Regulatory Agency (MHRA) Committee on the Safety of Devices (2010) Joint Working Group to produce guidance on delivering an Endovascular Aneurysm Repair (EVAR) Service. http://www.vascularsociety.org.uk/wp-content/uploads/2012/11/mhra_8pp_leaflet_amended_more_pages_web_version.pdf

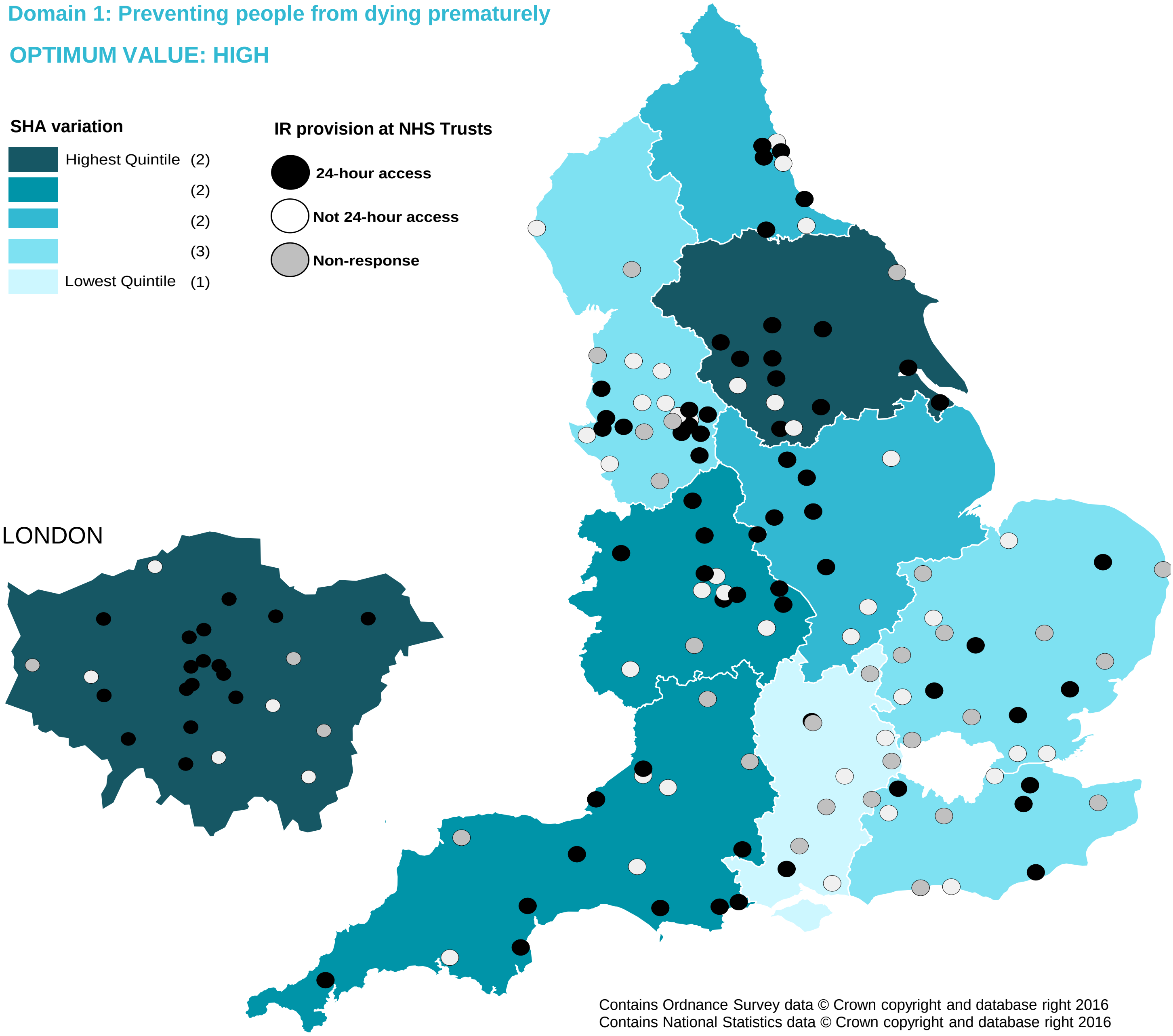
IMAGING SERVICES

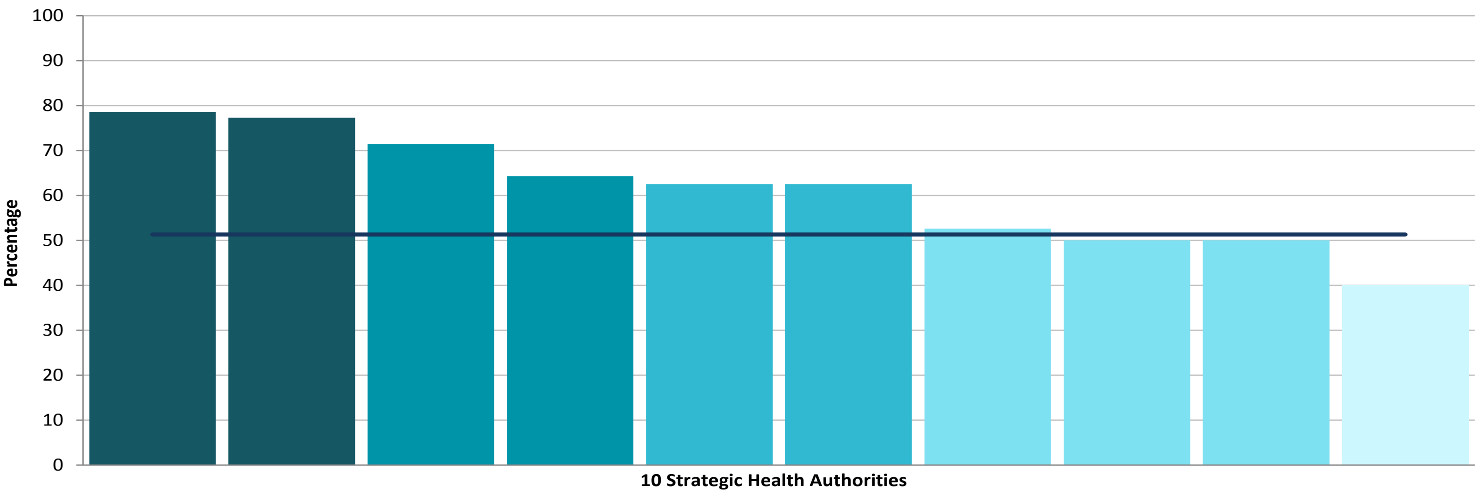
MAP 11: Percentage of NHS hospital Trusts that had formal arrangements for 24-hour access to nephrostomy by strategic health authority

2013

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: HIGH





Context

Interventional radiology (IR) refers to a range of techniques that use radiological image guidance for diagnosis and to target therapy, and interventional radiologists are trained in both radiology and interventional therapy.[1]

Most IR treatments are minimally invasive alternatives to open and laparoscopic surgery, with the advantages over the latter treatments of:

- reduced risk
- shorter hospital stays
- lower costs
- increased patient comfort
- quicker convalescence and return to work[1]

A wide range of conditions can be treated with IR, and IR services can often be life-saving, therefore, access to these services is necessary seven days a week.

Since 2011 there has been an annual survey by NHS Improving Quality (NHSIQ) of all hospitals in England to assess the level of provision of weekend and out-of-hours IR services. In 2011 and 2012 clinicians were asked to rate their IR services, but in 2013 and 2014 clinicians were asked to provide an overview of provision of four specific IR services:

- nephrostomy – in people with kidney stones, IR involves placing a tube in the kidney to allow urine to drain, and removing the stones with a variety of instruments placed through the skin into the kidney[1]
- endovascular intervention – in people with expanded arteries or aneurysms, IR treatment involves re-lining the vessel with a stent-graft[1]
- embolisation for haemorrhage – haemorrhage is the most common vascular emergency treated by IR, and bleeding often can be stopped permanently by embolisation[1]
- embolisation for post-partum haemorrhage – for women who suffer uncontrolled bleeding after childbirth and in women who have a high risk of bleeding from an abnormal placenta, IR can be used to prevent bleeding[1], and can avoid the need for hysterectomy

The delivery of IR services requires specialist expertise in the form of specifically trained radiologists, nurses and radiographers. Being able to provide such a skilled workforce is challenging for most NHS Trusts. As a result not all NHS Trusts are able to provide 24-hour access to IR services in the most effective way; some hospitals depend on informal and ad-hoc arrangements to deal with emergencies out of hours. Indeed in the IR survey ad-hoc or informal arrangements was the most common response to the question why cover for IR services was less than 24/7.

Despite an overall improvement in the formal provision of IR services over the four-year period of the survey, the questions are not directly comparable from 2011 to 2014. A more direct comparison is possible between the questions in the surveys for 2013 and 2014 (see Table 3); however, the response rate in 2013 and in 2014 was different, and some hospitals did not respond to the survey in both years. A core of 79-82 hospitals responded to the survey in both 2013 and 2014. One in five NHS Trusts did not respond to the survey.

For this series of indicators the 2013 data have been used, although the results for the 2014 survey are now available (see 'Resources'). The 2013 data was selected because it is possible to show not only which NHS Trusts had formal out-of-hours IR provision, but also the degree of variation in service provision across England using the strategic health authority (SHA) as a level of geography. Although the SHA is no longer part of the NHS structure, it is a useful proxy measure for larger populations; moreover, the larger geography is relevant to the need to develop an optimal system for out-of-hours IR services via a network of providers across a geographical area (see 'Options for action').

Table 3: **Percentage of hospitals responding to the NHSIQ survey that were providing formal out-of-hours IR services in 2013 and 2014**

	Formal out-of-hours provision (% hospitals)		Hospitals responding in 2013 & 2014 (n= 82, 79, 81 & 81, respectively)	
	2013	2014	% with improvement in formal out-of-hours provision	% with decline in formal out-of-hours provision
Nephrostomy	62.9% (73/116)	65.6% (61/93)	17.1%	11.0%
Endovascular intervention	60.3% (70/116)	77.8% (70/90)	19.0%	3.8%
Embolisation for haemorrhage	71.9% (82/114)	67.4% (62/92)	6.2%	14.8%
Embolisation for post-partum haemorrhage	49.1% (57/116)	59.8% (55/92)	21.0%	9.9%

[1] Kessel D. What is Interventional Radiology? British Society of Interventional Radiology website. http://www.bsir.org/patients/what-is-interventional-radiology/

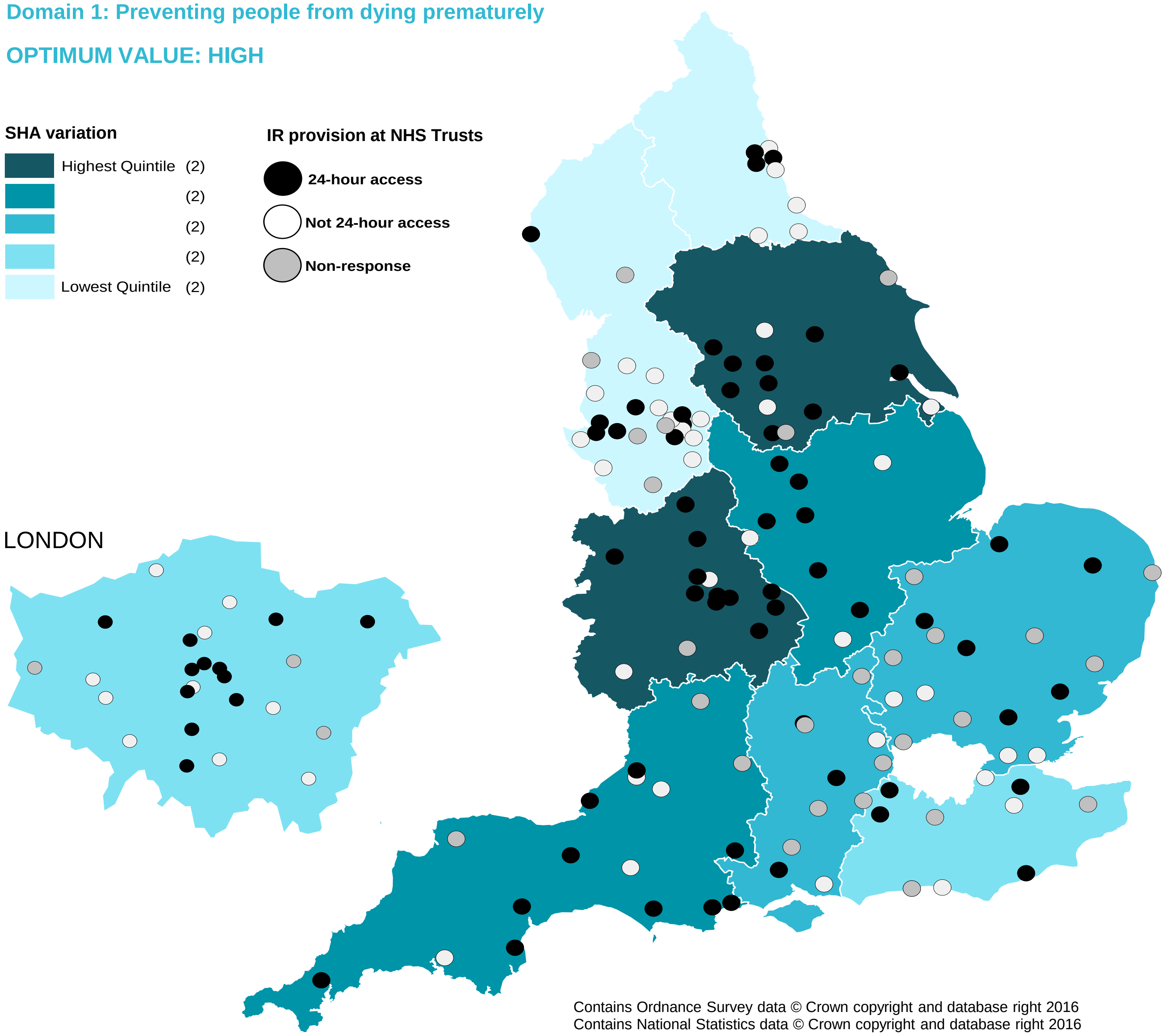
IMAGING SERVICES

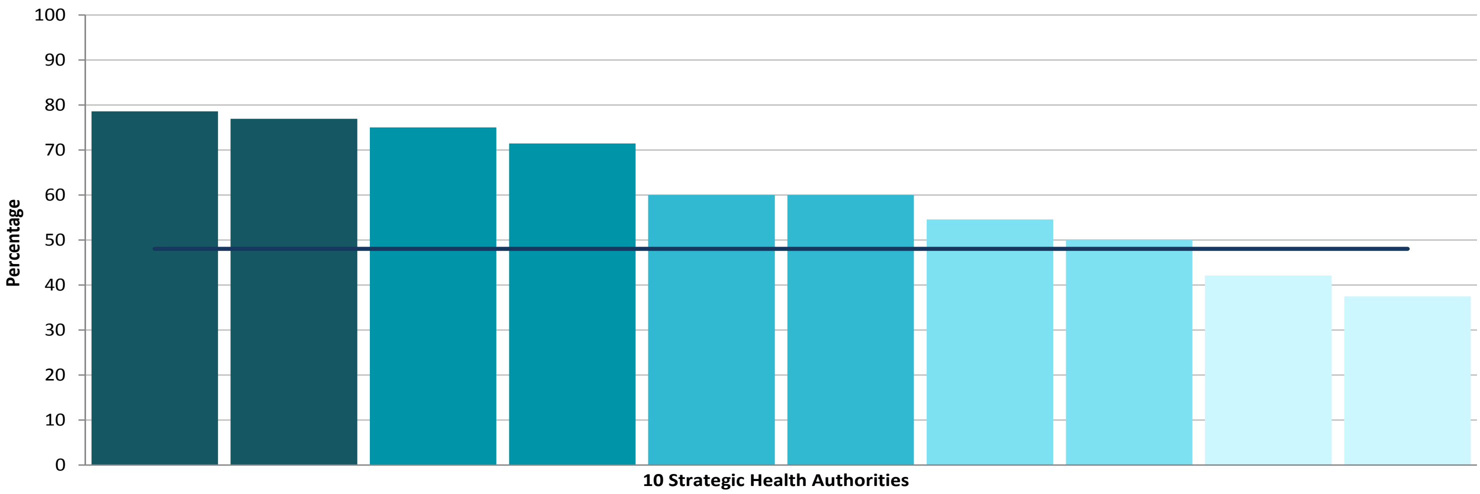
MAP 12: Percentage of NHS hospital Trusts that had formal arrangements for 24-hour access to endovascular intervention by strategic health authority

2013

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: HIGH





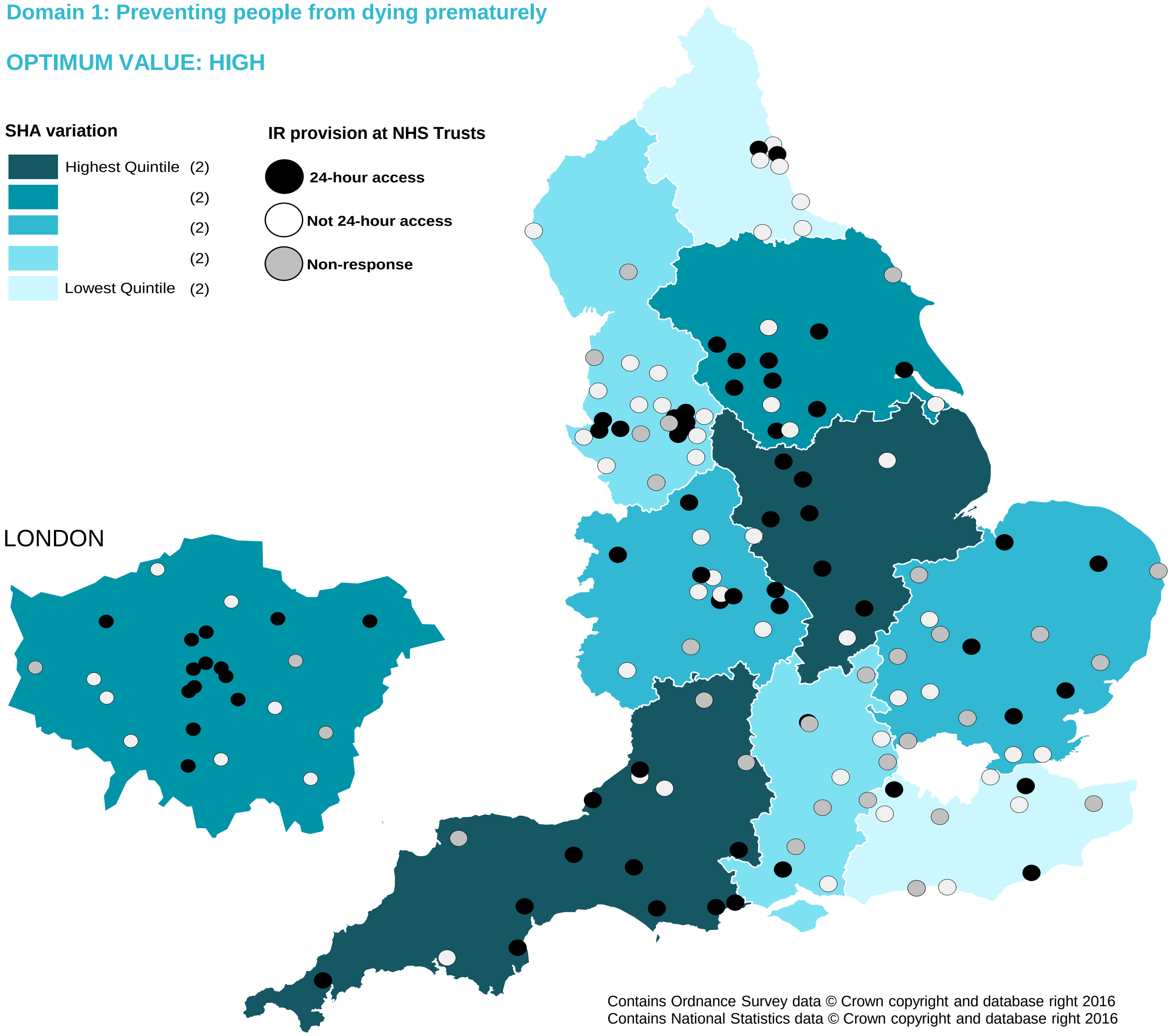
IMAGING SERVICES

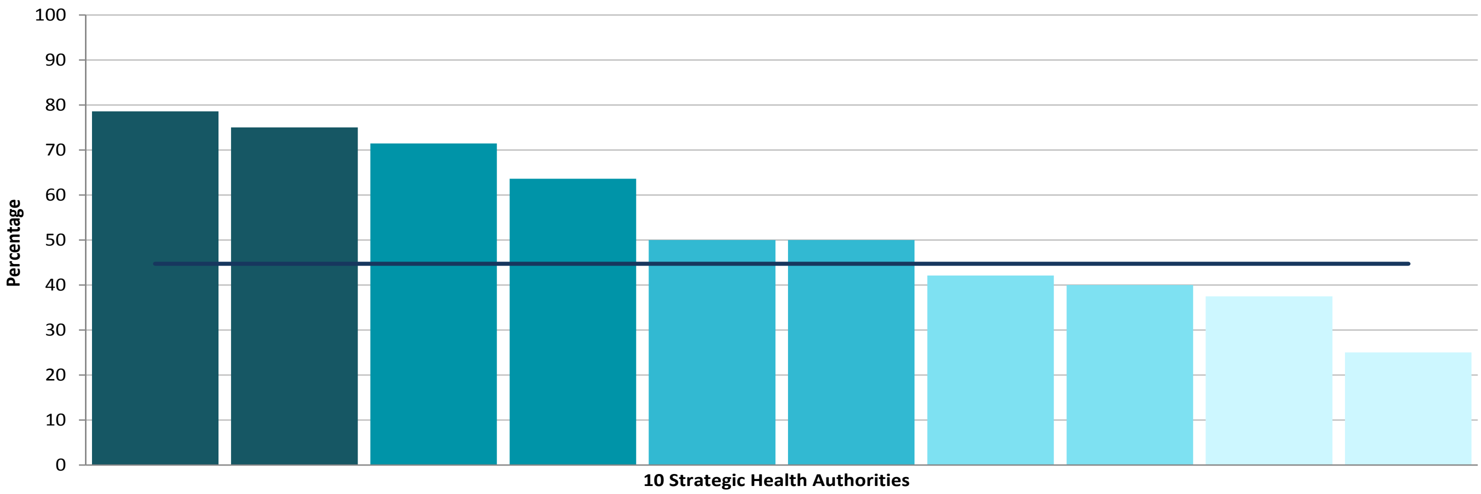
MAP 13: Percentage of NHS hospital Trusts that had formal arrangements for 24-hour access to embolisation for haemorrhage by strategic health authority

2013

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: HIGH





Magnitude of variation

Map 11: Nephrostomy

The percentage of NHS Trusts that had formal arrangements for 24 hour access to nephrostomy ranged from 40.0% to 78.6% across SHAs, a 2.0-fold difference. The value for all Trusts in England is 51%.

Map 12: Endovascular intervention

The percentage of NHS Trusts that had formal arrangements for 24-hour access to endovascular interventions ranged from 37.5% to 78.6% across SHAs, a 2.1-fold difference. The value for all Trusts in England is 48%.

Map 13: Embolisation for haemorrhage

The percentage of NHS Trusts that had formal arrangements for 24-hour access to embolisation of general haemorrhage ranged from 25.0% to 78.6% acorss SHAs, a 3.1-fold difference. The value for all Trusts in England is 45%.

Map 14: Embolisation for post-partum haemorrhage

The percentage of NHS Trusts that had formal arrangements for 24-hour access to embolisation for post-partum haemorrhage ranged from 25.0% to 75% across SHAs, a 3.0-fold difference. The value for England is 39%.

For this series of four indicators the reasons for the degree of variation observed are similar, the main one being differences in the availability of an appropriately skilled workforce, the components of which include differences in:

- interventional radiologist appointments
- interventional nurse appointments
- interventional nurse rota
- interventional radiographer rota
- network approach to service delivery
- new interventional radiology facilities

Options for action

Commissioners need to work with service providers to consider which models of IR service provision are appropriate to provide safe and effective care seven days a week for their local population including whether it is appropriate for every hospital to deliver every IR intervention seven days a week.
Commissioners need to explore whether it is possible to develop networks of service providers across a geographical area to ensure that everyone in need in the local population has access to IR.
Although it may be necessary to develop a nationally agreed system for commissioning IR services in the current situation and working within the budget available those responsible for population planning at CCG level or for sustainability and transformation planning in a geographical area and local providers of IR services need to develop and agree:

- a set of minimally acceptable standards below which no service should fall
- a complementary set of achievable standards that at least one-quarter of IR services should be able to meet

For the minimally acceptable standards, a starting point could be the existence of documentation outlining formal arrangements for out-of-hours service provision of IR. It is also important that commissioners continue to monitor arrangements for the provision of IR services for the local population.

RESOURCES

- NHS Improving Quality. Interventional Radiology Provision in 2014. A Survey of English NHS Trusts. Carried out by NHS Improving Quality in conjunction with the British Society for Interventional Radiology. http://www.nhsiq.nhs.uk/media/2647301/nhsiq_irsurvey.pdf
- The Royal College of Radiologists and with the British Society of Interventional Radiology. Provision of Interventional Radiology Services. October 2014. https://www.rcr.ac.uk/sites/default/files/publication/BFCR%2814%2912_POIR.pdf
- NHS Improving Quality. Providing access to interventional radiology services, seven days a week. May 2014. http://www.nhsiq.nhs.uk/media/2487426/interventionalradiology.pdf
- Interventional Radiology (IR): Improving Quality and Outcomes for Patients. A Report from the National Imaging Board. November 2009. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_109130
- Interventional Radiology: guidance for service delivery. A Report from the National Imaging Board. Sponsored by the Department of Health. November 2010. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215929/dh_122191.pdf
- NICE. Endovascular stent-grafts for the treatment of abdominal aortic aneurysms. NICE technology appraisal guidance [TA167]. February 2009. http://www.nice.org.uk/guidance/TA167
- Joint Working Group to produce guidance on delivering an Endovascular Aneurysm Repair (EVAR) Service. Royal College of Radiologists, British Society of Interventional Radiology, The Vascular Society of Great Britain and Ireland, The Vascular Anaesthesia Society of Great Britain and Ireland, and MHRA Committee on the Safety of Devices. Delivering an Endovascular Aneurysm Repair (EVAR) Service. December 2010. http://www.vascularsociety.org.uk/wp-content/uploads/2012/11/mhra_8pp_leaflet_amended_more_pages_web_version.pdf

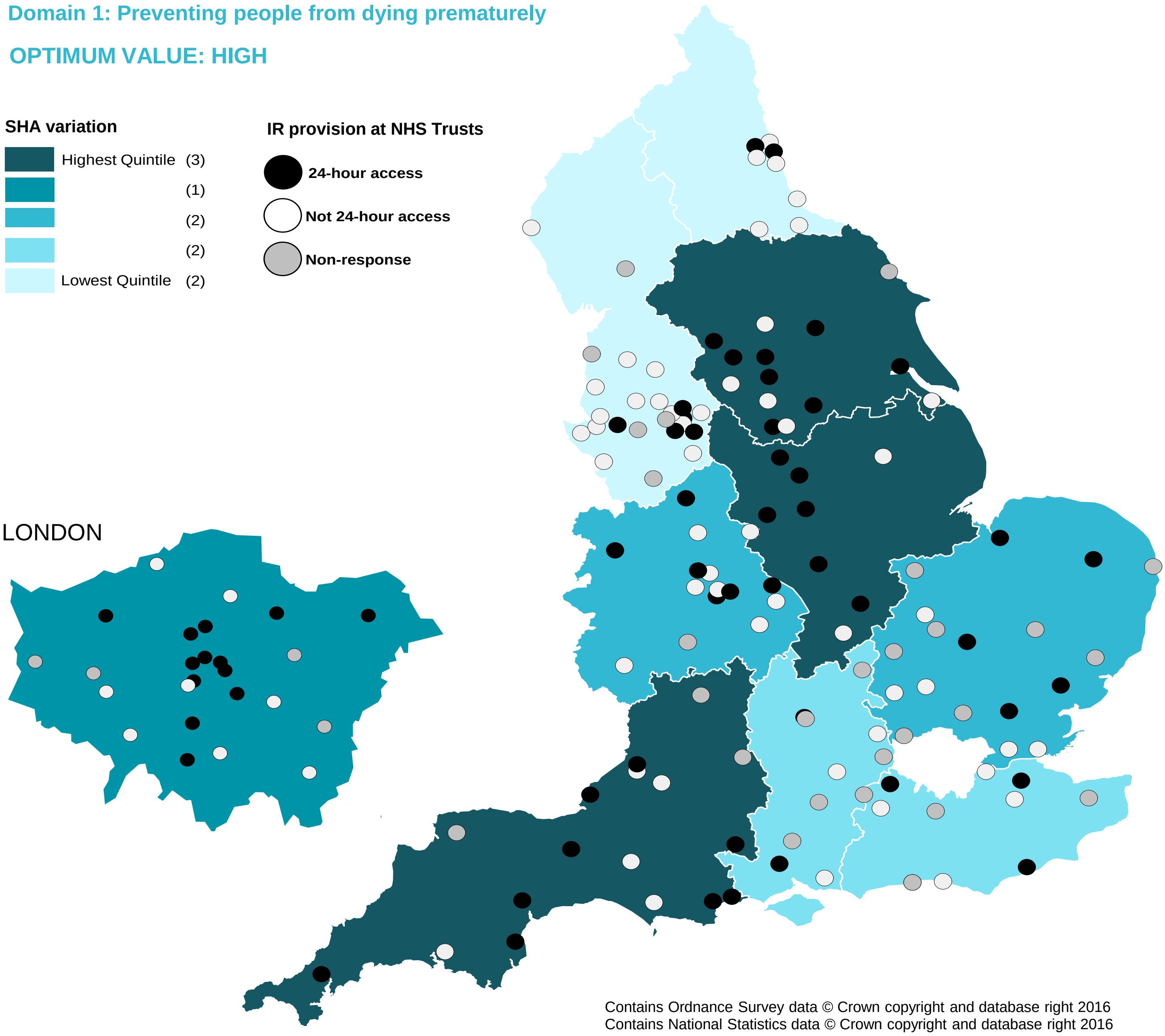
IMAGING SERVICES

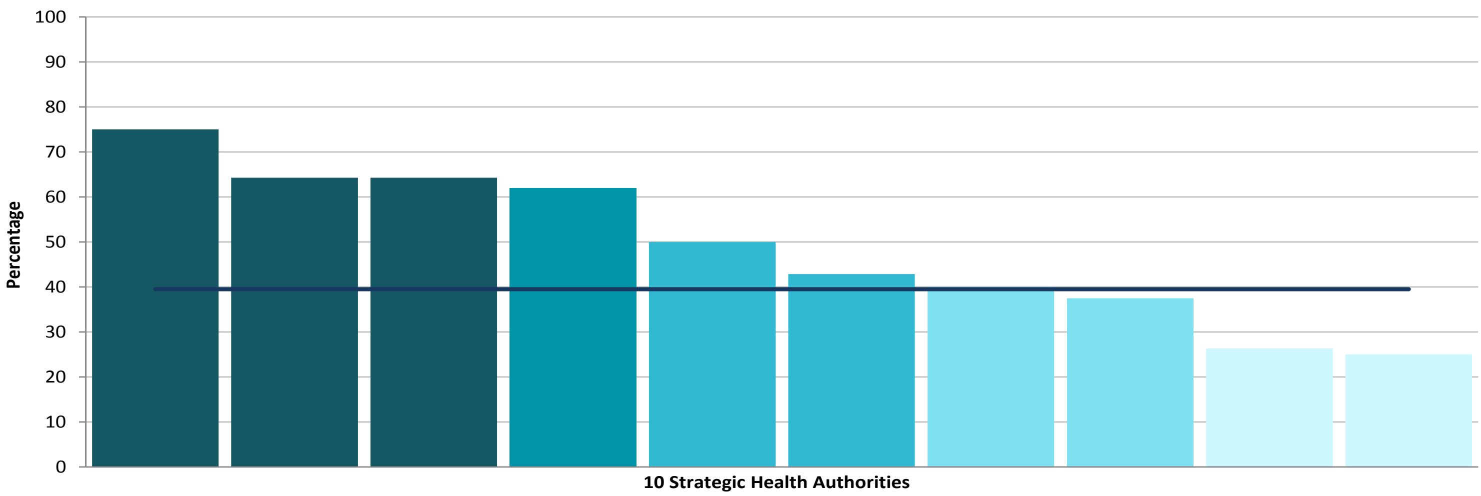
MAP 14: Percentage of NHS hospital Trusts that had formal arrangements for 24-hour access to embolisation for post-partum haemorrhage by strategic health authority

2013

Domain 1: Preventing people from dying prematurely

OPTIMUM VALUE: HIGH





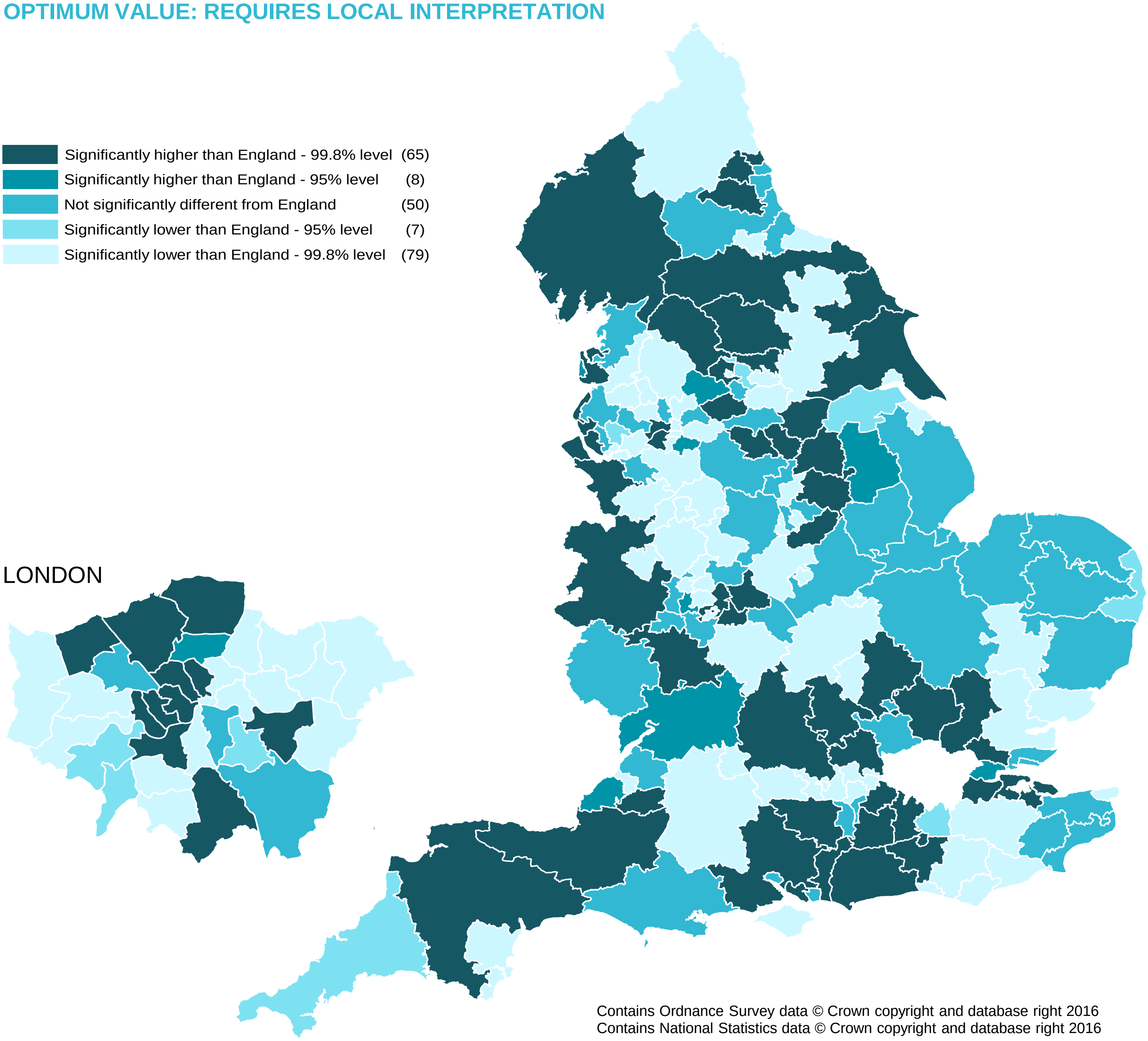
IMAGING SERVICES

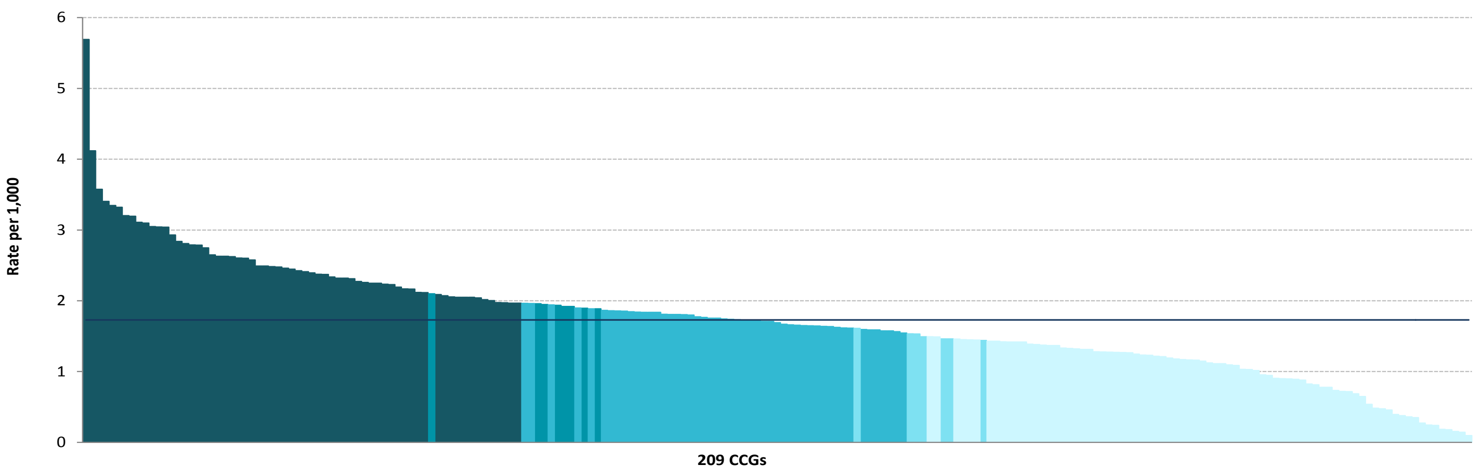
MAP 15: Rate of dual-energy X-ray absorptiometry (DEXA) activity per weighted population by CCG

Adjusted for age, sex and 'need', January–March 2016

Domain 2: Enhancing quality of life for people with long-term conditions

OPTIMUM VALUE: REQUIRES LOCAL INTERPRETATION





Context

Dual-energy X-ray absorptiometry (DEXA) is the best method of measuring bone density, and assessing the subsequent risk of fragility fracture.

There are two types of DEXA scan:

- axial or central, in which a scanning arm passes over the body to measure bone density in the centre of the skeleton
- peripheral (pDEXA), in which a scanning arm or portable device measures bone density in peripheral parts of the body, such as the wrist or heel

Measurements of bone density are used:

- in the diagnosis of osteoporosis or to assess the risk of osteoporosis developing
- to monitor the effectiveness of treatment for conditions such as osteoporosis
- in the diagnosis of other bone disorders, such as osteopenia, an early sign of bone loss where bone mineral density is lower than normal

Osteoporosis involves a gradual loss of calcium from the bones which results in the bones becoming thinner, more fragile and more likely to break. Osteoporosis is most commonly seen in women following the menopause, although it can affect men. The risk of a fragility fracture is affected by age, weight, prior history, family history, smoking habit and excessive consumption of alcohol. Following a suspected fragility fracture, investigation of bone density, for instance using DEXA, is advised such that osteoporosis treatment can be initiated to help prevent a subsequent fracture and the consequent considerable morbidity.

Magnitude of variation

The map and column chart display the latest period (January-March 2016), during which CCG values ranged from 0.1 to 5.7 per 1,000 weighted population, which is a 59.7-fold difference. The England value is 1.7 per 1,000 weighted population.

The boxplot shows the distribution of CCG values for the period 2013/14 to 2015/16 by quarter.

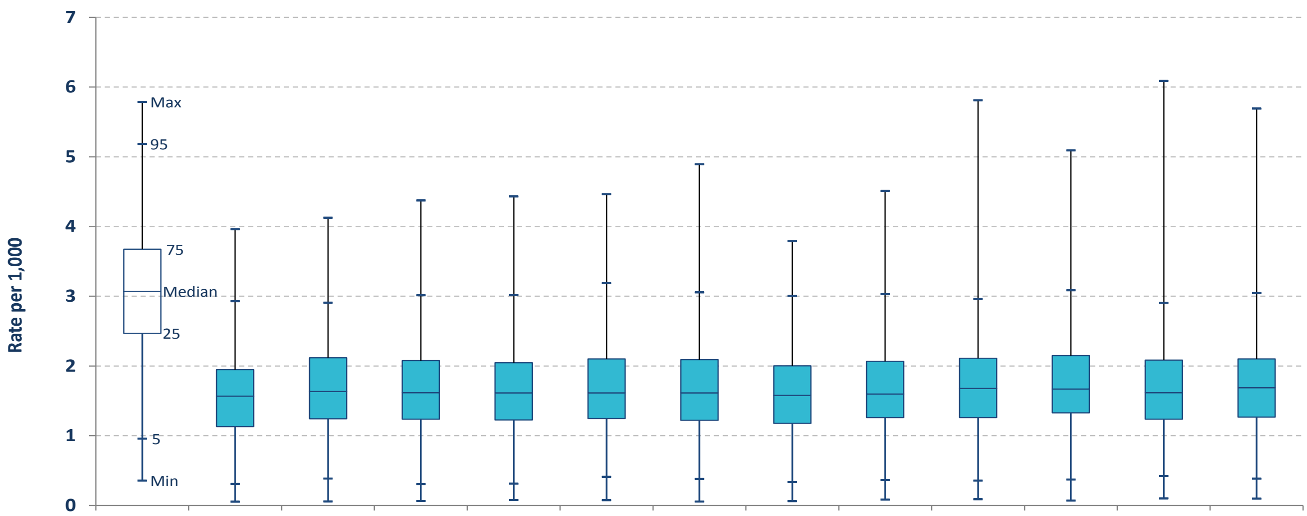
The gap between maximum and minimum CCG values widened significantly which is entirely due to the maximum CCG value increasing while the minimum CCG remained close to zero.

There was no significant change in either the 95th to 5th percentile gap or the 75th to 5th percentile gap. The median increased significantly.

One possible reason for warranted variation is differences in the use of other tests to measure bone density. It is unlikely, however, that this factor explains all of the variation observed. As this indicator has been designed to take account of the age-structure of the population, possible reasons for unwarranted variation include differences in:

- availability of imaging services
- the stage of development of integrated systems for fracture prevention

Map 15: Boxplot of DEXA activity by CCG



	Example	2013/14 Q1	2013/14 Q2	2013/14 Q3	2013/14 Q4	2014/15 Q1	2014/15 Q2	2014/15 Q3	2014/15 Q4	2015/16 Q1	2015/16 Q2	2015/16 Q3	2015/16 Q4	
Max-Min (Range)		3.9	4.1	4.3	4.4	4.4	4.8	3.7	4.4	5.7	5.0	6.0	5.6	WIDENING Significant
95th-5th percentile		2.6	2.5	2.7	2.7	2.8	2.7	2.7	2.7	2.6	2.7	2.5	2.7	No significant change
75th-25th percentile		0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	No significant change
Median		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.6	1.7	INCREASING Significant

Options for action

Commissioners, clinicians and service providers need to review the prevention of falls and fractures in local populations, including:

- excessive prescribing
- primary prevention through lifestyle advice regarding diet, physical exercise and smoking
- the prevention of fragility fractures, including the use of osteoporosis investigations and treatment as part of the routine management of suspected fragility fractures
- secondary prevention through investment in fracture liaison services (see 'Resources'), which are both clinically effective and cost-effective

Commissioners need to specify to service providers that all patients who experience a fragility fracture should have access to a Fracture Liaison Service (see 'Resources'), providing falls prevention and evaluation for osteoporosis and future fracture risk.

RESOURCES

- Royal College of Radiologists imaging referral guidelines, **iRefer**. iRefer is available to all NHS professionals in the UK. http://www.rcr.ac.uk/content.aspx?PageID=995 For iRefer – England, NHS professionals need to register to use the portal. Login to http://portal.e-lfh.org.uk/ To access guidelines, select the "Launch iRefer" link in the left-hand menu.

- Prevention Package for Older People Resources. 12 March 2010. http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/Publications/dh_103146

- Department of Health. Falls and fractures: effective interventions in health and social care. 22 July 2009. http://www.laterlifetraining.co.uk/wp-content/uploads/2011/12/FF_Effective-Interventions-in-health-and-social-care.pdf

- Department of Health. Fracture prevention services. An economic evaluation. 25 November 2009. http://www.cawt.com/Site/11/Documents/Publications/Population%20Health/Economics%20of%20Health%20Improvement/fractures.pdf

- NHS Radiology Improvement Team. Page 2: Dual Energy Xray Absorptiometry. Radiology Success Factors. November 2007. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf

- NICE. Osteoporosis: assessing the risk of fragility fracture. NICE guidelines [CG146]. August 2012. http://www.nice.org.uk/guidance/cg146

- NICE pathways. Osteoporosis overview. http://pathways.nice.org.uk/pathways/osteoporosis

- National Osteoporosis Society supported by The Royal College of General Practitioners. Osteoporosis Resources for Primary Care. https://www.nos.org.uk/health-professionals/osteoporosis-resources-for-primary-care

- National Osteoporosis Society. Fracture Liaison Service, including clinical standards, implementation toolkit and case-studies. https://www.nos.org.uk/health-professionals/fracture-liaison-services

- SIGN and Health Improvement Scotland. SIGN 142. Management of osteoporosis and the prevention of fragility fractures. March 2015. http://sign.ac.uk/pdf/SIGN142.pdf