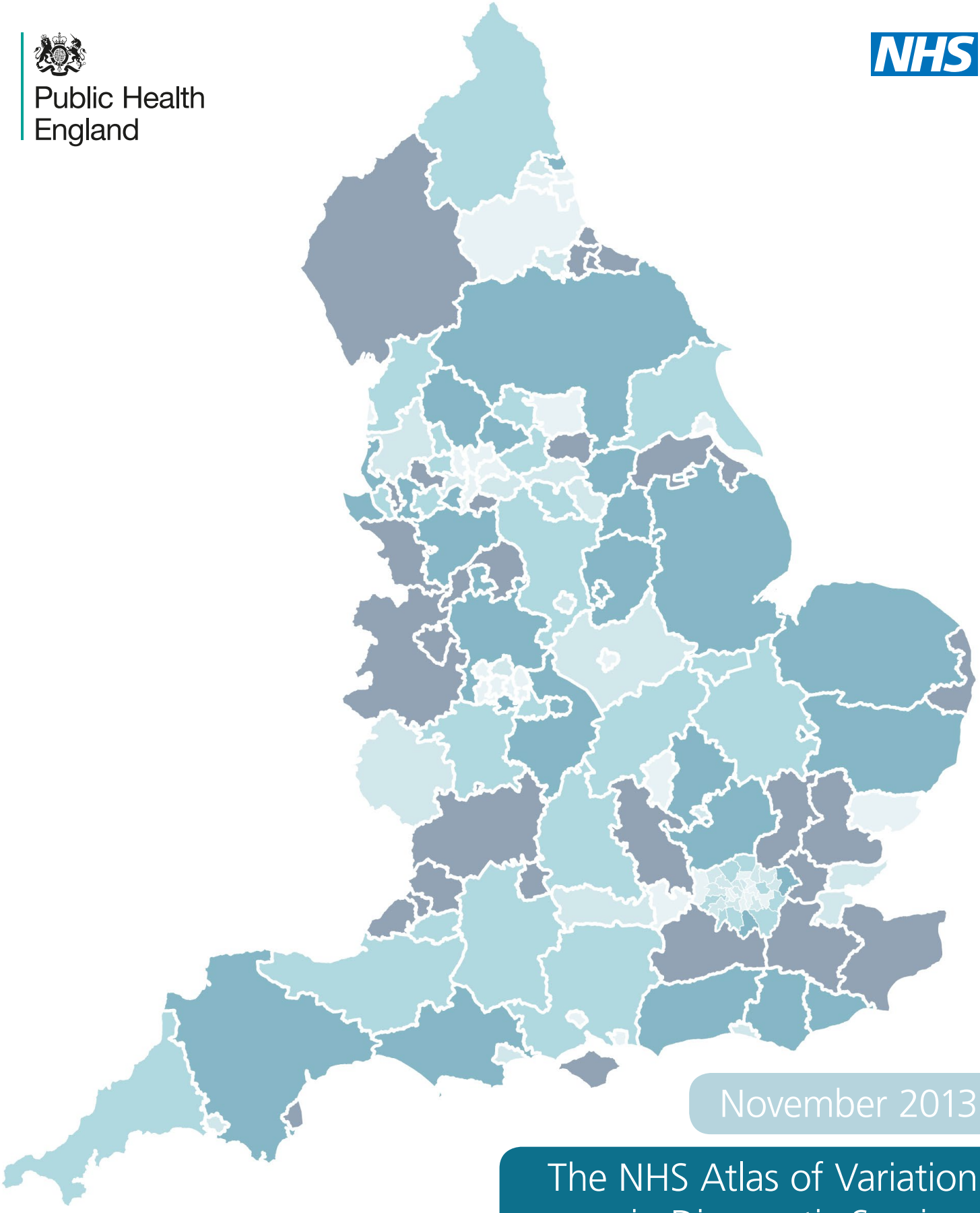
Public Health England

NHS



November 2013

The NHS Atlas of Variation in Diagnostic Services

Reducing unwarranted variation to increase value and improve quality

RightCare

www.rightcare.nhs.uk

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The Diagnostic Services Atlas has been prepared in partnership with a wide range of organisations:

Public Health England (PHE). Public Health England's mission is to protect and improve the nation's health and to address inequalities through working with national and local government, the NHS, industry and the voluntary and community sector. PHE is an operationally autonomous executive agency of the Department of Health.

http://www.gov.uk/phe

NHS England works with NHS staff, patients, stakeholders and the public to improve the health outcomes for people in England. We create the culture and conditions for health and care services and staff to deliver the highest standard of care and ensure that valuable public resources are used effectively to get the best outcomes for individuals, communities and society for now and for future generations.

http://www.england.nhs.uk/

British Society of Paediatric Gastroenterology and Hepatology and Nutrition (BSPGHAN) is a professional organisation with the specific roles of promoting research, training and standards of clinical practice for health professionals and scientists in paediatric gastroenterology, hepatology and nutrition. BSPGHAN provides professional leadership and promotes standards of care for children with nutritional, gastrointestinal and hepatological disorders. Membership includes consultants and specialist trainees in paediatric gastroenterology, hepatology and nutrition as well as specialist dietitians, nurses and nutrition pharmacists.

http://bspghan.org.uk/

The **Child and Maternal Health Intelligence Network** is hosted and facilitated by PHE. The network provides wide-ranging, authoritative data, evidence and practice relation to child and maternal health which you can use to improve the quality of care and outcomes for communities, patients and their families.

http://www.chimat.org.uk/

The **Health and Social Care Information Centre** (HSCIC) is the national source of NHS, health and social care information. We collect, process, link, analyse and publish national information for health and social care communities in England. The HSCIC is a new Executive Non-Departmental Public Body (ENDPB) incorporating functions from the previous HSCIC, IT systems delivery functions that were undertaken by NHS Connecting for Health, and Strategic Health Authority informatics functions.

http://www.ic.nhs.uk

The **Joint Advisory Group on GI Endoscopy** (JAG) ensures the quality and safety of patient care by defining and maintaining the standards by which endoscopy is practised. The JAG was established in 1994 under the auspices of the Academy of Medical Royal Colleges (AMRC), and operates within the Clinical Standards Department of the Royal College of Physicians, with a UK-wide remit. The JAG's core objectives are to agree and set acceptable standards for competence in endoscopic procedures, and to quality assure endoscopy units, endoscopy training, and endoscopy services.

http://www.thejag.org.uk/

Public Health England

Knowledge and Intelligence Team (South East) is part of the knowledge and intelligence service for the Chief Knowledge Officer's directorate (CKO) in Public Health England. CKO aims to deliver an internationally recognised, high-performing knowledge and intelligence service encompassing research, statistics and know-how. Our main aim is to ensure that decisions we make about our health, and the health of the population, are based on the best information available and will deliver the best outcomes.

http://www.gov.uk/phe

NHS England
National Pathology Programme

The **National Pathology Programme** (NPP) has eight programme themes: Pathology Access and Care Management (PACMAN); developing a common language for pathology information – development of the National Medicine Laboratory Catalogue in collaboration with the Royal College of Pathologists (RCPath); business process: information for the requesting and reporting of pathology tests; pathology leadership in collaboration with the RCPath and the Royal College of Radiologists; education, learning and collaboration with non-pathologists and patients; quality and safety in pathology; implementation, leverage and consistent messaging; responding to new pathology initiatives.

For more information, please visit http://www.strategicprojectseoe.co.uk/index.php?id_sec=340

NHS Improving Quality

NHS Improving Quality (NHSIQ) is the driving force for improvement across the NHS in England. We are working to improve health outcomes for people by providing improvement and change expertise. Hosted by NHS England, we have created an improvement organisation that is in alignment with the needs and challenges of the NHS. We are doing this by working to the five domains of the NHS Outcomes Framework.

http://www.nhsiq.nhs.uk/

NHS
Screening Programmes
Newborn Hearing

The **NHS Newborn Hearing Screening Programme** (NHSP) is part of Public Health England. The programme is recognised as a world leader in screening, and is engaged with babies and their families from the initial screen through treatment to early intervention and support. Our vision is improving outcomes for every child through a high-quality hearing screening programme, safe and effective assessments and family-centred intervention.

http://hearing.screening.nhs.uk/

Office for National Statistics

Office for National Statistics (ONS) is the UK's largest independent producer of official statistics and the recognised national statistical institute of the UK. Our main responsibilities as the Executive Office of the UK Statistics Authority include the collection, compilation, analysis and dissemination of economic, social and demographic statistics that serve the public good and meet our legal obligations (domestic and international); the provision of statistical leadership and methodological advice for the benefit of UK official statistics; representing the UK in the international arena; and the development and maintenance of definitions, methodologies, and classifications of statistics.

http://www.ons.gov.uk/ons/index.html

Stroke Improvement National Audit Programme (SINAP) is a national clinical audit, which collected information from hospitals about stroke patient care in the first three days in hospital. SINAP was run by the Royal College of Physicians Stroke programme on behalf of the Intercollegiate Stroke Working Party (ICSWP) and commissioned by the Healthcare Quality Improvement Partnership (HQIP). Data submission for SINAP has now ended. The new stroke audit, the Sentinel Stroke National Audit Programme (SSNAP), is now the single source of stroke data nationally.

http://www.rcplondon.ac.uk/projects/stroke-improvement-national-audit-programme-sinap

http://www.rcplondon.ac.uk/projects/sentinel-stroke-national-audit-programme

The **Trauma Audit and Research Network** (TARN) is a collaboration of hospitals from England, Wales, Ireland and other parts of Europe, which supports a highly skilled team on a non-profit-making basis at the University of Manchester, Salford Royal Hospital, Salford. The TARN database is the largest trauma database in Europe with more than 400,000 cases and over 40,000 paediatric patients. Our foundation in research ensures that we provide accurate and relevant information to help doctors, nurses and managers improve their services.

https://www.tarn.ac.uk/

UK EUS Users Group in co-operation with the JAG and relevant specialist societies is working to standardise UK training. The Group can also promote methods of assessment of "best practice" and continuing professional development (CPD) particularly through the Users Group website.

http://www.ukeususers.org/v1/

The **UK Genetic Testing Network** (UKGTN) undertakes a wide variety of work in collaboration with healthcare professionals, scientists, commissioners and patient representatives to advise on policy, develop service delivery and provide information resources to all users of NHS genetic testing services. The UKGTN promotes equity of access to genetic testing for rare conditions while seeking to ensure that the highest possible quality standards in genetic testing are delivered.

http://www.ukgtn.nhs.uk/

The **University of Leeds** is internationally renowned for its outstanding research and is a member of the prestigious Russell Group. Integrating research and teaching is at the heart of our strategy and our courses are taught by highly respected academics who are experts in their fields. Our research has a real impact on the world, addressing major global issues including climate change, medicine and healthcare.

http://www.leeds.ac.uk/

Case-study provided by:

University College London (UCL)
http://www.ucl.ac.uk/

King's College London
http://www.kcl.ac.uk/

University of Manchester
http://www.manchester.ac.uk/

Cambridge University Health Partners
http://www.cuhp.org.uk/

Right Care continues to pay homage to the inspirational publication, *The Dartmouth Atlas of Health Care*, and the vision and commitment of Professor John Wennberg who first charted this territory.

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Foreword

We are excited to introduce the *NHS Atlas of Variation in Diagnostic Services*, the latest publication in the series of impressive NHS Atlases, which have highlighted variation in the provision of healthcare services.

Diagnostic services are of great importance in the NHS because, when used correctly, they support or rule out potential diagnoses, and underpin the effective and efficient management of patient pathways. Many diagnostic tests and investigations are embedded within complex care pathways, which means NHS commissioners face the difficult task of understanding what is required, and from whom, and to assess critically whether what is being provided will lead to high-quality outcomes, and meet peoples' needs and expectations. The data included in the Diagnostic Services Atlas will facilitate effective commissioning processes to build a system for improving patient experience.

Unwarranted variation in the rates of diagnostic testing is of the utmost relevance to individual patients with the over-use, as well as under-use, of diagnostic tests being potentially serious issues. For example, effective capacity planning in imaging services should enable improved patient access balanced against the need to avoid over-use of interventions that have the potential to cause harm, such as ionising radiation. It is important to appreciate the value of the results from diagnostic tests in guiding the most appropriate next steps in the care pathway and ruling out inappropriate interventions to provide effective patient care and to ensure value for money.

The NHS England Outcomes Framework is intended to drive continuous quality improvement, and move the focus from process targets to outcome measures. Achieving these outcomes for patients will depend on commissioning the right level of effective and high-quality services, including diagnostic services, supported through the Outcomes Indicator Set, which can be used to set priorities and drive local improvement in the delivery of diagnostic services.

Although the data presented in the Diagnostic Services Atlas may be open to more than one interpretation, the power of the Atlas series lies not in the answers they provide but in the questions they raise. There is an urgent need for work to improve our understanding of variation in the rates of many diagnostic services, and to understand whether the variation observed is random, warranted (i.e. true clinical variation), or caused by other factors such as poor access to services or need for education. Why do commissioners in one locality commission over four times the number of audiology assessments per head of population than commissioners in another (see Map 23, pages 102–103), and why is there 170-fold variation in the usage of rheumatoid factor testing (see Map 45, pages 146–147)?

Our work across the NHS through the auspices of NHS England will be focussed upon addressing the issues raised by and described in this Diagnostic Services Atlas, with the aim of ensuring that patients have timely, equitable access to the appropriate diagnostic tests and the reports generated. Subsequent decisions about patient care can then be made as quickly and accurately as possible.

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November 2013

Preface

The magnitude of variation for many of the indicators in the *NHS Atlas of Variation in Diagnostic Services* may surprise some people. In a context of evidence-based medicine and guidelines, how is it possible that the degree of variation in diagnostic testing is so great?

One answer may be that the important focus on the quality and safety of treatment and care during the last decade has diverted attention from what many people perceive as being at least as important, that is, the art and science of diagnosis. In other NHS Atlases of Variation in Healthcare, the focus of the indicators is on intervention and treatment, and therefore on people with diagnoses who are in need of treatment. In this Atlas, the focus is on people with symptoms who are in need of a diagnosis. For people with a diagnosis, although there are variations in treatment, there is some consistency regarding what happens to them. This is in direct contrast to people in need of a diagnosis, who face a more disorderly health service.

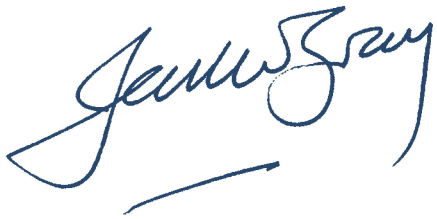
Diagnosis is based on the history given by the patient, and on the physical examination and observations carried out by the clinician. These clinical skills, however, are complemented and supplemented by a range of services delivered by pathologists, geneticists, radiologists and healthcare scientists. Over the last 60 years, advances in the precision of diagnostic equipment and testing have been astonishing, ranging from testing for mutations in the BRCA1 gene in women at risk of familial breast cancer to the power of modern CT scanning. Despite these advances in technology, the knowledge and skills of the highly trained professionals, and the sophisticated equipment for which they are responsible, are not well used.

There are several reasons why such variation in the use of diagnostic services exists. First, the evidence base is much weaker for diagnosis than for treatment, a problem being addressed by the National Institute for Health Research (NIHR). Second, there is the practice of what is sometimes referred to as "defensive medicine", the practice of testing "just in case", a particular challenge in the context of biochemical and other laboratory tests, which is why a relatively large number of such indicators are presented in the Pathology Services section. Third, younger doctors, who perhaps were trained in a shorter period of time, have become more reliant on technology. The end result is that although considerable advances have been made in both the accuracy of diagnosis of some conditions and the monitoring of chronic disease (laboratories perform both functions), these advances take place in the context of the phenomena of under-diagnosis and of over-diagnosis, the latter being a recently recognised problem, arising not from faulty equipment but from the inappropriate application of technology by clinicians. At the time of writing, over-diagnosis is the subject of a major series in the *British Medical Journal*.

Of critical importance in tackling the problems revealed by the Diagnostic Services Atlas is the contribution that healthcare scientists, radiologists, pathologists and the various sub-specialties can make. All too often, their roles are perceived as managing machinery and equipment, and they are expected to respond to clinicians' requests, no matter how ill-considered these requests may be. It is important to emphasise that the key challenge to better value diagnostic services lies not in the imaging departments or the laboratories, but in clinical practice, both in general practice and in the various specialties. No single group of professionals can make effective diagnoses on their own. Each professional plays a part in the diagnostic process; the alternative is that the diagnostic process remains disorderly.

Healthcare scientists, pathologists and radiologists need to be recognised as professionals with immense knowledge and skill, and to be given the opportunity to apply that skill for the benefit of the whole population and not just for those patients referred for tests. This requires not only a change in perception of the role these professionals have to play, but also a change in the culture of those professions. There is a need for new knowledge and skills, which these professionals are in the process of shaping and adopting, to take a position of shared clinical leadership, ready to respond quickly to clinical colleagues on behalf of the population. All these changes require excellent communication not only between clinicians but also with patients.

The recent investment by the NIHR in Diagnostic Evidence Co-operatives is very welcome. Variation in diagnostic services is one of the few topics in healthcare about which the old maxim "More research is needed" is completely apposite.



Professor Sir Muir Gray, CBE

Philip DaSilva

Reducing unwarranted variation: right care in the diagnosis and monitoring of patients

The NHS Atlas of Variation in Healthcare, first published in November 2010, received much positive feedback from stakeholders and extensive coverage in the media. It was followed by a second compendium Atlas in December 2011 and a variety of specialist subject atlases during 2012 and 2013. Although diagnostic disciplines have been covered in some of the previous atlases, this is the first time that an Atlas dedicated to diagnostic tests in the areas of imaging, endoscopy, physiological diagnostics, pathology and genetics has been produced.

As in previous Atlases, it is important to emphasise that some variation is warranted because different populations have different levels of need. The maps in this Atlas not only cover activity but also quality and the distribution of diagnostic services throughout the population. During work on the NHS Atlas series, the Right Care team has engaged with commissioners, providers, clinicians, managers and patient groups, nationally and locally, to work towards achieving better value for populations by identifying and questioning variation with the aim of reducing unwarranted variation, and improving value for individual patients by responding to the imperative for shared decision-making.

As is the case for most healthcare services, the demand for diagnostic services continues to rise. The reasons for increased demand include:

- increased life-expectancy – people are living longer with long-term chronic diseases that require regular monitoring, and many tests have more than one function, in this case monitoring as well as diagnosing disease;
- previously unrecognised unmet need and undiagnosed populations in conditions where intervention as a result of early identification and diagnosis would influence the course of a disease;
- newly introduced preventive strategies, where using diagnostic data can be a powerful motivator for patients to make lifestyle changes;
- continual advances in the available technologies and techniques.

In September 2012, a visioning event brought together leaders in diagnostic services from across the NHS to explore what diagnostic services could look like in 2020 and beyond, and how the health system needs to plan and transform to meet the emergent vision[1]. Three principles were developed into aggregate models:

- **Improving availability and access to information, while supporting patients in the self-management of symptoms, diagnosis and care:** Improve patients' access to information, including access to their own medical records and accredited medical information tailored for patients; increase use of technology, including self-monitoring and technology-enabled healthcare management.
- **Acceleration of widespread innovation adoption:** Ensure rapid processes for decision-making to promote rapid spread and adoption of new technologies. This may need "Technology Adoption Specialists".
- **Redesign of pathways to support patients to manage their conditions and improve access to services:** Test new pathways across systems so patients can access diagnostic services in the most appropriate settings for the complexity of their needs from a flexible workforce working across seven days of provision.

Overall, the vision for diagnostic services from 2020 is that of an innovative, technologically enabled, integrated service providing the highest quality, convenience and timeliness for patients from a range of locations, in order to accelerate accurate diagnosis, appropriate treatment intervention and recovery. The future of diagnostic services is one where the service user will be at the heart of service design, delivery and evaluation.

1 Department of Health – Diagnostic Services in 2020 and beyond: Visioning for the future v1.9 (Dec 2012).

Why does unwarranted variation matter?

As outlined earlier, the existence of variation in healthcare is not necessarily negative in all cases or situations. It has long been acknowledged that some variation is inevitable in the healthcare provided to, and outcomes experienced by, patients. John Wennberg, however, who championed research into clinical variation over four decades and founded the pioneering Dartmouth Atlas of Health Care, concluded that:

> *"much of the variation … is accounted for by the willingness and ability of doctors to offer treatment rather than differences in illness or patient preference".*

Wennberg defines unwarranted variation in healthcare as variation that cannot be explained on the basis of illness, medical evidence, or patient preference.[2]

In the *NHS Atlas of Variation in Healthcare: November 2010*,[3] unwarranted variation was shown to be ubiquitous in England across a wide range of conditions. In the 2011 King's Fund report, *Variations in Health Care – the Good, the Bad and the Inexplicable*,[4] the authors concluded that:

> *"the existence of persistent unwarranted variations in health care directly impacts on equity of access to services, the health outcomes of populations and efficient use of resources".*

In evaluating variation in clinical practice, Wennberg[5] suggests categorising healthcare into three groups as follows:

Effective care, defined as interventions for which the benefits far outweigh the risks; in this case the "right" rate of treatment is 100% of patients defined by evidence-based guidelines to be in need, and unwarranted variation is generally a matter of under-use.

Preference-sensitive care, defined as when more than one generally accepted treatment option is available, such as elective surgery; here, the right rate should depend on informed patient choice, but treatment rates can vary extensively due to differences in professional opinion.

Supply-sensitive care, which comprises clinical activities such as consultations, diagnostic tests, and hospital admissions, for which the frequency of use relates to the capacity and performance of the local healthcare system; these measures commonly reflect care for people with long-term conditions; as Wennberg notes, high rates of use of supply-sensitive care do not necessarily correlate with better outcomes.

The key to meeting these challenges is:

- understanding the concept of variation and its causes;
- identifying variation, and ascertaining whether it is warranted or unwarranted;
- reducing unwarranted variation in quality, safety and outcome, and in activity and cost.

In reducing unwarranted variation, the aim is to maximise the value – the relationship between overall outcomes and all costs, including opportunity costs – of healthcare resources both for individual patients and for populations.

Variation in diagnostics services can be manifest in several ways (see Box I.1)

2 Wennberg J (2010) *Tracking Medicine: A Researcher's Quest to Understand Health Care*. Oxford University Press.

3 Right Care (2010) *NHS Atlas of Variation in Healthcare, November 2010*. http://www.rightcare.nhs.uk/atlas/

4 Appleby J, Raleigh V (2011) *Variations in Health Care – the Good, the Bad and the Inexplicable*. The King's Fund. http://www.kingsfund.org.uk/publications/healthcare_variation.html

5 Wennberg J (2011) Time to tackle unwarranted variations in practice. *British Medical Journal* 342:d1513

Box I.1: Manifestations of variation in diagnostic services

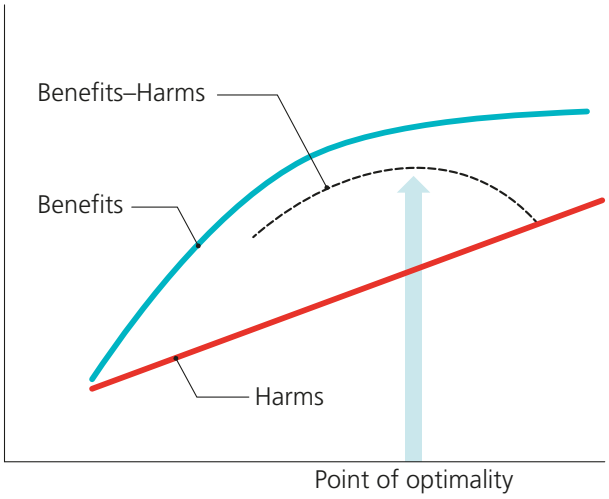
- Test results – differences in units of measurement and the reference ranges for test results, and differences in the composition of "profiles" (where a test, such as a liver function test, has several component results)
- Clinical application of testing – revealing the extent of variation in both the referral and the appropriateness of test requests and, therefore, the potential clinical impact of under-testing versus the lack of utility and avoidable cost of over-testing
- Inconsistency of coding in both transmitting and receiving systems may lead to apparent variation
- Organisational designs for diagnostic services – structural differences reflected in both the provision and availability of the full range of services for local populations, and the profile of the workforce, revealing services doing similar work with different skill mixes
- Productivity of the workforce (tests per whole-time equivalent) – differences can reflect the technology and techniques in use, or can be the result of having to maintain a 24-hour service without the volume of tests to utilise fully the minimum resources that have to be provided
- Cost (and price) per test – a function of the factors above, plus differences in economies of scale, and the indirect and overhead costs that each diagnostic service has to bear

Does unwarranted variation in diagnostic testing matter?

Tests are generally used to eliminate or to help give an early warning of a particular condition, to help confirm a suspected diagnosis, or to help ascertain how a condition is progressing. Providing too few resources for testing can prevent the early recognition and diagnosis of disease, and the identification of changes in its severity. In the worst case for a patient, this can lead to late-stage diagnosis and premature death; even in the best case, it can lead to a longer and more costly stay in hospital or frequent visits to a general practitioner.

There are, however, consequences of over-resourcing. Avedis Donabedian pointed out that as resources are increased, value increases quickly at first, but then the rate of increase slows down (known as the Law of Diminishing Returns). This is because all healthcare, even when delivered at high quality, can do harm as well as good but, unlike the benefit, harm is directly proportional to the resources invested.[6] For each unit increase of resources invested, each increment of benefit decreases whereas eaach increment of harm remains constant. When the increase in both benefit and harm is plotted on the same graph, it reveals the maximum benefit to harm, called the point of optimality by Donabedian (see Figure I.1).

FIGURE I.1: Donabedian's point of optimality, the point of maximum benefit to harm of an intervention for a population



Is there a "right" rate of testing?

The reasons why it is important to investigate variation in the rates of testing are the same as those for investigating variation in the rates of treatment interventions. The assessment of variation in the rates of testing, however, is more complicated than the assessment of variation in the rates for a treatment intervention. This is because a test may be performed for more than one reason, such as making a diagnosis or excluding a diagnosis. It is difficult, therefore, to determine the "right" rate of testing for any test, i.e. the "right" rate to give the optimum balance of benefit to harm and cost. For instance, for a screening test that is part of a screening programme, a test rate of 100% may not be the right rate because not everyone may

6 Donabedian A (2002) *An Introduction to Quality Assurance In Healthcare*. Oxford University Press.

want to be tested; in such circumstances, if everyone has been tested, then the rate would indicate some people had received a screening test who had not been properly informed about the test and its purpose. This is in contrast to the treatment of people who have had a stroke, for example, where the aim should be for 100% of patients to be admitted to a stroke unit.

From a population perspective, it is important to consider whether variation in the rates of testing reflects under-use or over-use of a technology, or whether it is linked to the clinically indicated level of intervention.

Late diagnosis: the problems with under-use

Late diagnosis is a problem because the clinician fails to order a test to confirm the diagnosis, even though the patient's signs and symptoms, or a diminution of their everyday living activities, clearly indicate the need for a test. This represents an under-use of diagnostic services, which is inappropriate, reflecting the under-use of both the technology available and the skills of the professionals who manage the services.

For patients, the under-use of diagnostic tests may result in:

- a delay in treatment;
- the establishment of inappropriate treatment;
- the limitation of treatment to options for behaviour change only.

The under-use of diagnostic services increases the likelihood of disease being diagnosed late and of being associated with poorer patient outcomes. In a recent study of patients presenting with acute abdominal symptoms, surgical outcomes were improved by earlier access to, and increased use of, CT scanning.[7]

Over-use: the potential for over-diagnosis

In recent years, there has been much interest, particularly in the United States,[8] in the over-use of test technologies resulting in "over-diagnosis". Over-diagnosis was first described in the literature on cancer, and was defined as:

> *"a condition is diagnosed that would otherwise not go on to cause symptoms or death".*[9]

There are many reasons for over-diagnosis, and it leads to an increase in the number of people who become patients, and in the likelihood of "over-treatment", including:

- a change in the threshold for defining a disease, such as Type 2 diabetes or high blood pressure;
- a change in the criteria for defining a disease and its severity by a recognised international agency or body;
- the provision of a screening service in the absence of strong evidence of a favourable balance of benefit to harm;
- the introduction of new tests and technologies that have an increased sensitivity;
- the introduction of new technologies that have the ability to identify lesions and other functional abnormalities that will not develop into harmful disease within the patient's lifespan;
- the practice of ordering a battery of tests "just in case", sometimes referred to as "defensive medicine" – this is particularly pertinent when the test or assay requested is perceived to have a negligible cost, as is the case for biochemical and other laboratory tests.

In England, the National Screening Committee (NSC) tries to avoid over-diagnosis by preventing the introduction of screening programmes for which there is no strong evidence that they do more good than harm. Regarding the introduction of new tests and technologies that have an increased sensitivity, in a recent paper on time trends in pulmonary embolism, it was found that, since the introduction of computed tomography pulmonary angiography (CTPA), a highly sensitive imaging technology it was assumed would improve outcomes for people with this disease, there have been changes consistent with over-diagnosis and over-treatment of pulmonary embolism.[10]

The focus of this discussion is not the quality of diagnostic services, but the value to individual patients and to populations. It is important to realise that the

7 Symons NR, Moorthy K, Almoudaris AM et al (2013) Mortality in high-risk emergency general surgical admissions. *British Journal of Surgery* 100; 1318-1325. doi: 10.1002/bjs.9208. Epub 2013 Jul 17. http://www.ncbi.nlm.nih.gov/pubmed/23864490

8 Welch HG, Schwartz LM, Woloshin S (2011) *Overdiagnosed: Making People Sick in the Pursuit of Health*. Beacon Press.

9 Imore JG, Fletcher SW (2012) Overdiagnosis in Breast Cancer Screening: Time to Tackle an Underappreciated Harm. *Ann Intern Med* 156; 536.

relationship between the benefit and harm of healthcare applies equally to testing as to treatments. The Law of Diminishing Returns highlights that when a new technology is introduced the people who receive it initially are only those who will definitely benefit from it, but when the application is widened to a larger group the benefit flattens off, whereas the harm it does, even if the technology is administered at high quality and safely, increases as a straight line (see Figure I.1); there comes a point when further investment of resources leads to a decrease in value. For instance, over-use of CT scanning may cause over-exposure to radiation in some patients. Depending on the type of CT scan, the radiation dose can be considerably higher than that of a plain-film X-ray.

Over-use has important implications for the NHS, particularly if there is widespread uptake of online testing of the human genome. The National Institute for Health Research (NIHR) is investing more resources in research on diagnosis and testing, and there is general agreement that the evidence base needs to be strengthened urgently.

Does unwarranted variation in diagnostic testing matter to patients?

People in the local population, especially those who are patients or carers, need to be assured that service providers are addressing their needs. Therefore, they are likely to be concerned about the existence of unwarranted variation and its consequences. If patients experience a several-fold difference in their chance of being diagnosed promptly, of receiving the right care to control symptoms or prevent deterioration, of being admitted to hospital as an emergency or of dying prematurely, and if this variation is largely dependent on where they live or which general practice they are registered with, they have a right to ask why, and to demand better.

What can we do about unwarranted variation?

A key observation about the data presented in the maps and charts is that they do not tell us why there is variation. Nor is it a simply a matter of deciding which end of the range demonstrates good or poor performance, and of targeting the outliers.

The strength of these maps lies not in the answers they provide but in the questions they generate. For instance, a local clinician or commissioner will want to know whether their commissioning decisions are increasing value, and, if not, to understand the reasons why.

- What are the differences between local providers and the best providers?
- Do local providers offer similar services to those offered by the best providers?
- How do local providers compare in the way services are delivered, such as the systems for referral, access, pathways of care, clinical processes and prescribing, extent of integration, support and training for staff, audit of outcomes and adherence to evidence-based guidelines?

Where can we find data on variation in the provision of diagnostic services?

Several information sources have been used to construct the maps in this Atlas. Many of these sources can be used on an on-going basis to monitor the progress in reducing the variation in the provision of diagnostic services (see "Map and chart presentation", pages 33–37).

Reducing unwarranted variation in individual diagnostic disciplines

In the following sections, for each of the individual disciplines in diagnostics, there is an overview of the discipline, and a description of the services provided for patients. The reasons for variation in service provision in each discipline are discussed, some of which are common to all disciplines across diagnostic services, such as patterns of disease prevalence, the availability of a trained workforce, and local custom and practices, whereas others are different, arising from the differences in the nature of the specific interventions and tests.

Imaging services

Diagnostic imaging is a rapidly evolving field driven by technological developments. Historically, in the UK, imaging has been used to confirm a diagnosis and

10 Wiener RS, Schwartz LM, Woloshin S (2011) Time Trends in Pulmonary Embolism in the United States: Evidence of Overdiagnosis. *Arch Intern Med* 171; 831-837.

to indicate appropriate management of a particular condition. There has been a perception that imaging was inappropriate if it did not lead to a change in the management of a condition. The high costs of new technologies tended to perpetuate this belief, but the use of imaging is now being driven by different factors, including changes in patient expectation and increased speed, safety and capability of new technology.

Effective and good-quality imaging is important for further medical decision-making, and can reduce unnecessary procedures. In some countries, it might have been possible to avoid a significant proportion of all abdominal surgical interventions (exploratory laparotomy) if simple diagnostic imaging services such as ultrasound had been available.[11] Most patients now expect a definite diagnosis to be sought irrespective of whether, in the opinion of their clinician, a change of management is likely to ensue. This is likely to give the patient a greater feeling of certainty, even if the test(s) is negative. In addition, newly trained clinicians have tended to place greater reliance on imaging and other diagnostic tests than their predecessors, which acts as another driver for reliance upon medical imaging technologies.[12] This trend may be further exacerbated by the shortening period of time for medical training, which could mean that imaging diagnosis will become a fundamental guide to the management of most conditions.

Current Government policy is to develop primary- and community-based assessment and treatment services in the NHS. The more productive use of resources in the context of "Choose and Book" and the 18-week patient pathway is driving diagnostic work to an earlier point in the patient pathway, offering patients a better service. This re-sequencing has been associated with significant increases in imaging in other countries.[13] A "significant" increase in imaging in the NHS may not necessarily lead to an overall increase in cost if diagnosis is performed earlier in the patient pathway and the number of secondary care outpatient appointments is reduced, thereby improving patient experience; however, this is an aspect of diagnostic services where more research is needed. It is also important to balance access for the community with the need to avoid destabilising all services in the acute setting. Commissioners need to create a population, system-wide approach, to ensure that the application of local protocols is factored into any planning.

The Picture Archiving and Communications System (PACS) enables radiological and other images to be stored electronically and viewed on screens, so that both the image and relevant information, including the report, can be accessed and compared with previous images at the touch of a button. With the development of the PACS, it is possible to separate the local acquisition of some images from remote reporting. In this way a local service can be provided to patients without the necessity for the reporting clinician to be on the same site. Although there are obvious advantages to such a system, it is important to take into account several considerations including credentialing of reporting clinicians, patient consent, and patient confidentiality. Ultrasound and all interventional imaging should be reported by the health professional undertaking the investigation.

It is incumbent on providers of imaging services to demonstrate, among other things, improved patient experience through effective image waiting times and reporting turn-around times for all modalities [see Box I.2 for details about the Imaging Services Accreditation Scheme (ISAS)[14]]. This information should be measured and shared with commissioners, users of the service and patients to support monitoring and the achievement of continual improvement in the service. This will also ensure that key policy drivers for healthcare services are being met, including those for cancer, stroke and emergency care.

The Diagnostic Imaging Dataset (DID) is a new central collection of detailed information about diagnostic imaging tests carried out on NHS patients, to be extracted and submitted monthly (see Box I.3 for the type of information captured in the DID). The dataset will be collected at patient level and will include patient identifiers to enable linkage to other datasets, most notably cancer registration data. Combined, these data items give powerful information about access of NHS patients to diagnostic imaging tests across the country, and will help to address unwarranted variation.

11 World Health Organization (2013) Diagnostic imaging. http://www.who.int/diagnostic_imaging/en/

12 Bosanquet DC, Cho JS, Williams N et al (2013) Requesting radiological investigations – do junior doctors know their patients? A cross-sectional survey. JRSM Short Rep 2013 January 14. doi: 10.1258/shorts.2012.012043 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3572658/

13 OECD Health Data 2005 – Statistics and Indicators for 30 countries (OECD Publishing).

14 UKAS Assessment and Accreditation for ISAS. http://isas-uk.org/default.shtml

Box I.2: The Imaging Services Accreditation Scheme (ISAS)[15]

- ISAS is a patient-focused accreditation scheme available to UK imaging services.
- Accreditation is independent attestation of an organisation's competence to provide diagnostic imaging services such that the users have confidence in the outcomes.
- The United Kingdom Accreditation Service (UKAS) was selected by The Royal College of Radiologists and The College of Radiographers to deliver and manage ISAS.
- UKAS assesses imaging services against the ISAS standard and ensures, through regular monitoring, that required standards are maintained.
- The scheme includes an enhanced package of support and an optional staged pathway to help imaging services preparing for and going through initial assessment for ISAS.

Box I.3: Information captured by the Diagnostic Imaging Dataset (DID)[16]

- Referral source and patient type
- Details of the test (type of test and body site)
- Demographic information such as GP registered practice, patient postcode, ethnicity, gender and date of birth
- Waiting times for each diagnostic imaging event, from time of test request through to time of reporting

In addition, the use of the most up-to-date evidence through the application of referral guidelines, such as iRefer (see Box I.4), and those produced by NICE and professional bodies (e.g. the Royal College of Radiologists), will help to reduce unwarranted variation. At the time of writing, the potential to extend the coverage of the DID to other areas of diagnostic services is being explored.

Box I.4: iRefer – The Royal College of Radiologists' Radiology Referral Guidelines[17]

- iRefer, the 7th edition of the adult and paediatric imaging referral guidelines from The Royal College of Radiologists (RCR), is now available via the N3 platform free of charge to all NHS organisations in England.
- The iRefer guidelines are evidence-based, and designed to help clinicians, healthcare professionals, radiographers and radiologists determine the most appropriate imaging procedures for a range of clinical problems.
- The Radiology Referral Guidelines have an important role in improving the quality of care for patients.

Endoscopy services

Endoscopy is a sub-speciality housed principally within medical and surgical gastro-enterology; however, endoscopic procedures are also performed by radiologists, general practitioners and nurses.

Demand for lower gastro-intestinal (GI) endoscopy (colonoscopy and flexible sigmoidoscopy) is set to double over the next five years.[18] This increase in demand is being driven by the extension to the faecal occult blood (FOB) testing screening programme for people aged 70–75 years, and by the forthcoming flexible sigmoidoscopy bowel screening programme, aimed at people over 55 years of age. In addition, the demand for endoscopy for patients with symptoms is increasing alongside the need for surveillance of patients at enhanced risk. In England, demand is expected to continue to rise due to projected increases in the proportion of the population older than 65 years.

There is known to be variation in endoscopy across several factors: from referral rates and conversion to test rates, through to the identification of polyps and cancers detected. In the same way as for other medical and diagnostic disciplines, identifying and understanding variation in any system can be helpful in monitoring, managing and improving a clinical service, and identifying innovative and exemplar practice.

15 http://isas-uk.org/default.shtml

16 Diagnostic Imaging Dataset Statistics. http://data.gov.uk/dataset/diagnostic_imaging_dataset_statistics_

17 http://nww.irefer.nhs.uk/about/#Abt2

18 NHS Improvement (2012) Rapid review of endoscopy services. http://www.improvement.nhs.uk/documents/endoscopyreview.pdf

The Joint Advisory Group on Gastrointestinal Endoscopy (JAG) operates within the Clinical Standards Department of the Royal College of Physicians. The JAG has a UK-wide remit to agree and set acceptable standards for competence in endoscopic procedures and to provide quality assurance for endoscopy units, training and services. The JAG also runs an accreditation process (see Box I.5).

Box I.5: The Joint Advisory Group on Gastrointestinal Endoscopy Accreditation Scheme

- JAG is a patient-centred and workforce-focused accreditation scheme.
- Accreditation is independent against recognised standards.
- JAG has been developed for all endoscopy services and providers across the UK in both the NHS and the independent sector.
- It gives local commissioners assurance that an endoscopy service has the competence to deliver against the measures in the endoscopy Global Rating Scale (GRS) Standards[19] (see "Tools", page 31).

As with other diagnostic disciplines, the emergence of new technology is affecting the number, use and costs of endoscopic techniques. For example, capsule endoscopy allows direct visualisation of the entire small bowel in a non-invasive manner, and has become the gold standard in evaluating obscure gastro-intestinal bleeds unidentified by traditional endoscopic techniques.[20] The capsule is the size and shape of a pill and contains a tiny camera. After a patient swallows the capsule, it takes pictures of the inside of the gastro-intestinal tract and allows for visualisation of the whole bowel, but most importantly of the small bowel which is inaccessible to an endoscope (see Maps 20A and 20B, pages 90–93). Capsule endoscopy facilitates diagnosis of diseases such as Crohn's disease, which in some patients may be localised to the small bowel, and of tumours of the small bowel.

In localities where there are low intervention rates for endoscopy services, the shortage of appropriately trained health professionals is an important contributory factor.

Physiological diagnostics services

There are eight physiological science specialisms involved in providing diagnostic investigations:

- audiology;
- cardiac physiology;
- gastro-intestinal physiology;
- ophthalmic and vision science;
- respiratory and sleep physiology;
- urodynamics;
- neurophysiology;
- vascular science.

Each specialism provides diagnostic investigations that assess the function of major organ systems. For example, neurophysiology diagnostic services are used to investigate the function of the central and peripheral nervous systems. Investigations will provide information to identify pathology, and to underpin diagnosis, and treatment and care regimes. In some cases, physiological diagnostics services may also restore and monitor function through the provision of a range of therapeutic intervention strategies.

The demand for physiological diagnostics investigations is increasing as a result of:

- the introduction of scientific and technological advances, for example, telemedicine and remote monitoring;
- the increased prevalence of long-term conditions, coupled with an ageing population;
- an increase in the demand for long-term follow-up of patients with complex conditions, and of patients receiving extended drug therapy;
- delivering services seven days a week, and supporting both emergency and elective care;

19 JAG Accreditation System. https://www.jagaccreditation.org/

20 Appleyard M, Glukhovsky A, Swain P (2001) Wireless-capsule diagnostic endoscopy for recurrent small-bowel bleeding. *N Engl J Med* 344; 232–3.

- reducing inequalities in the provision of, and access to, treatment and care;
- supporting the implementation of NICE and other evidence-based guidance.

Physiological diagnostics investigations are a key component in most clinical pathways, underpinning clinical decision-making and contributing across the entire pathway of care. In England, around 300 specialist physiological diagnostics investigations are available, with over 15 million procedures (excluding routine ECG) undertaken each year.[21] These investigations are key to improving outcomes for patients through:

- the earlier identification and diagnosis of disease;
- more rapid treatment of conditions;
- responsive and effective monitoring.

Although some physiological diagnostics services have been brought together within a physiological diagnostic service hub, it is more usual for services to be co-located with, or adjacent to, the relevant clinical specialty, even when they have a broader range of input and provide investigations across several specialties. For instance, only 60% of the activity of both cardiac and respiratory physiological diagnostics services is delivered to the associated clinical specialties of cardiology and respiratory medicine.

Scientific and technological developments in the delivery of physiological diagnostics services have conferred considerable benefit on patients.

- The miniaturisation and portability of equipment allows investigations to be taken to the location of the patient, and enables the results to be delivered rapidly in support of clinical decision-making, thereby improving patients' experiences of healthcare.
- Innovation in physiological diagnostics services means that many investigations can be delivered in the community, closer to where patients reside.
- Innovation is also driving the delivery of non-invasive investigations that protect patient dignity: for instance, the use of carotid duplex investigations delivered by vascular scientists can streamline pathways for transient ischaemic attack (TIA) and stroke, and reduce the need for invasive treatment procedures.

To improve patient outcomes, commissioners need to work with local providers to ensure that the adoption of innovation is timely, appropriate and effective. The systematic and consistent adoption of innovation is pivotal in reducing unwarranted variation in provision.

The existence of variation in access to physiological diagnostics services is well documented; a shortage of appropriately trained healthcare scientists is a contributory factor to unwarranted variation in the provision of services. The implementation of the Any Qualified Provider (AQP) policy, which introduced a choice of provider services, has improved access to adult hearing services by reducing inequalities in access, and has improved the quality of hearing services offered to all adult patients. To support the primary assessment of presenting symptoms, this policy of extended choice has also instituted the delivery of some diagnostic tests closer to where patients reside. Certain cardiac and respiratory investigations are also provided in this way.

The introduction and uptake of the Improving Quality In Physiological diagnostic Services (IQIPS) accreditation programme establishes a drive for quality and improved outcomes at the heart of physiological diagnostics services, encourages the sharing of best practice, and provides a mark of quality across all service providers (see Box 1.6). In addition, accreditation through IQIPS plays a central role in delivering service improvement, and driving quality and innovation to meet the challenges of healthcare provision in the future.

The physiological diagnostics services that are commissioned must meet local need, reflect proven innovations and best practice, realise improved health outcomes for patients, and be delivered by a healthcare science workforce that is fit for purpose and affordable.

21 Department of Health (2007) What is Physiological Measurement? A guide to the tests and procedures conducted by Physiological Measurement diagnostic services. http://www.improvement.nhs.uk/physiologydiagnostics/documents/WhatisPhysiologicalMeasurement.pdf

Box I.6: The Improving Quality In Physiological diagnostic Services (IQIPS) programme

- IQIPS accreditation gives patients assurance of the quality of physiological diagnostics investigations.
- It gives commissioners assurance of the quality delivery of the physiological diagnostics services they commission from providers.
- IQIPS is hosted by the Royal College of Physicians (RCP), and accreditation is independently delivered by the United Kingdom Accreditation Service (UKAS) against the recognised IQIPS standard.
- It demonstrates commitment to quality by promoting a responsive and learning culture.
- It is a professionally owned and led programme to improve service quality, privileging patient experience, improved outcomes and safe practice.

Pathology services

Pathology is fundamental to the scientific study of the nature of disease. It addresses four components of disease:

1. cause (aetiology);
2. mechanisms of development (pathogenesis);
3. structural alterations of cells (morphological changes);
4. the consequences of changes (clinical manifestations).

As a service discipline, pathology uses this scientific knowledge to develop diagnostic tests that play a vital role in the management of disease.

Each year, approximately 37 million test reports are transmitted from NHS laboratories using PMIP messages via the Spine Data Transfer Service. Each report contains batches of test results on individual patients grouped as profiles such as "full blood counts". Overall, about 500 million individual results are reported per year.

Assessing the value of an individual test or a change in the rate of testing, however, is not straightforward because tests are performed for many reasons:

- to screen for disease in a population;
- to help confirm a diagnosis in an individual;
- to help exclude a diagnosis in an individual;
- to monitor the progress of a disease or a treatment;
- to assess prognosis, risk, or treatment stratification;
- to monitor side-effects of interventions or patient compliance with therapy;
- to measure drug levels for either therapeutic or toxicological reasons.

For biochemical tests, at least 50% of the laboratory workload is related to chronic disease management, and hence of particular relevance to primary care and the prevention of complications.

Several issues dominate the landscape for pathology:

- the continuing ramifications of Lord Carter's Independent Review of NHS Pathology Services in England[22,23,24];
- the wider challenge to reduce costs in the NHS.

These two factors have led most pathology services to re-assess how best to organise their work. Lord Carter established a case for change in which organisational consolidation appeared desirable for many reasons, including:

- reducing variation in practice;
- securing improvements in quality;
- improving productivity and the utilisation of assets;
- making it easier to introduce new technology and techniques;

22 The Carter Review of Pathology. http://collections.europarchive.org/tna/20081105144224/http:/www.thecarterreview.com

23 Lord Carter of Coles (Chair) (2006) Report of the Review of NHS Pathology Services in England. An Independent Review for the Department of Health. http://www.connectingforhealth.nhs.uk/systemsandservices/pathology/projects/nlmc/carterreview2006.pdf

24 Lord Carter of Coles (Chair) (2008) Report of the Second Phase of the Review of NHS Pathology Services in England. An Independent Review for the Department of Health. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_091984.pdf

› reducing costs to the system by achieving economies of scale.

Around the country, collaborative arrangements between NHS Trusts (a sharing of capacity and capability), the outsourcing of in-house provision, and the formation of managed networks and large-scale consolidations are beginning to emerge.

Continuing research and development in the areas of genomics (the study of DNA, genes and chromosomes) and proteomics (the analysis of individual proteins and collections of proteins) are expected to yield new, more sophisticated and specialised diagnostic tests. These techniques will create opportunities for pathology services to add value in many care pathways: an investment in the diagnostic phase of the pathway to reduce cost in the treatment phase. This provides considerable benefits to patients, such as more accurate and specific results, faster turn-around, and improved selection of pharmacological intervention for individuals – the development of stratified medicine. The challenge for commissioners is to look at the overall pathway, and to invest in the specialised pathology services, such as molecular pathology and genomics, that will achieve patient and pathway benefits from earlier diagnosis and targeted therapy.

In other ways, technological change is leading to a re-assessment of the workforce and of the organisation of pathology: for example, point-of-care testing, where tests are provided at locations convenient to patients, automated processes in microbiology and IT systems to enable the electronic ordering of tests and lab-to-lab communication.

Variations in the practice and performance of pathology services have become increasingly evident. The issue was highlighted in Lord Carter's Independent Review, and for several years now the National Pathology Benchmarking Service has helped to provide participating trusts with intelligence on variation by using comparative analysis of laboratories. Variation manifests itself in several ways (see Box I.1, page 19).

Direct-access pathology for service users in primary care accounts for about half of the work done by pathology services, and is commissioned by clinical commissioning groups (CCGs). Highly specialised tests, which require specialist equipment and/or specialist skills, are commissioned at a national level.[25] Commissioners need to be increasingly concerned with:

› helping patient understanding of pathology tests, building partnerships with professionals, and moving to increased self-management in long-term conditions;

› raising the quality of pathology services to improve the experience for patients and clinicians – such as the number and timing of collections from GP surgeries, the speed of turn-around for the result, the quality of interpreted results, and the availability of pathologists and senior scientists to answer queries;

› ensuring that laboratories comply with minimum standards (through accreditation and the application of robust quality assurance systems), and provide a consistent service;

› ensuring that laboratories provide analyses linked to internationally approved standards, where these exist, and use the appropriate unit of measurement[26,27];

› ensuring that electronic communication of pathology data is correctly coded;

› ensuring that providers offer affordable pathology services which provide value for money and are sustainable for the long-term.

25 Department of Health (2012) Pathology Services Commissioning Toolkit. http://www.gov.uk/government/publications/the-pathology-services-commissioning-toolkit

26 For current units, see http://www.ychi.leeds.ac.uk/pmipunits

27 For those laboratories taking up the new approach with SNOMED-CT coding, see http://www.laboratorymedicine.nhs.uk

The main actions for commissioners wanting to address unwarranted variation in pathology testing are shown in Box I.7.

Box I.7: Actions to address unwarranted variation in pathology testing

- Agree with pathology specialists the optimal role for investigations within care pathways
- Agree with laboratories protocols for the monitoring of long-term conditions including re-testing intervals
- Ensure laboratories are CPA/UKAS accredited
- Ensure laboratories use methods based on international standards and methods, and UK Standards for Microbiology Investigations (SMIs). http://www.hpa.org.uk/webw/HPAweb&Page&HPAwebAutoListName/Page/1296682027596
- Ensure laboratories publish their EQA and other performance data (e.g. turn-around times)
- Ensure laboratories use the up-to-date versions of Pathology Bounded Code List as on PMIP website: http://www.ychi.leeds.ac.uk/pmipunits
- Ensure laboratories have plans for transition to the National Laboratory Medicine Catalogue: http://systems.hscic.gov.uk/pathology/projects/nlmc/nlmcrelease/keymessages/index_html
- Ensure laboratories meet messaging standards recommended in the following article by Batstone in *The Bulletin of the Royal College of Pathologists*, October 2012, Number 160, pages 231–232, Ensuring correct transfer of the meaning of pathology results: statement of clinical requirements for safe practice. http://www.rcpath.org/Resources/RCPath/Migrated%20Resources/Documents/O/October2012Bulletinweb.pdf
- Ensure laboratories use Royal College of Pathologists' Histology Data Sets: http://www.rcpath.org/publications-media/publications/datasets/datasets-TP.htm
- Ensure laboratories participate fully in multidisciplinary teams and clinical networks

Genetic testing

Diseases with a genetic component are estimated to affect at least 5–6% of the population.

Clinical genetic scientists provide molecular and/or cytogenetic tests for both adults and children. The work of a clinical genetic scientist falls into four major categories:

- confirmation or exclusion of a diagnosis of a genetic condition;
- carrier testing or risk assessment in families where there is a known genetic condition;
- pre-symptomatic testing of individuals at risk of a late-onset genetic condition;
- pre-natal diagnosis of a genetic condition.

Cells contain chromosomes. Chromosomes contain DNA encoding the genes that instruct the body how to develop and function properly. Genetic conditions can arise from a problem with a chromosome or part of a chromosome (e.g. Down syndrome) or with an individual gene (e.g. cystic fibrosis or familial breast cancer).

Cytogenetic testing involves the microscopic analysis of chromosomal abnormalities, such as an increase or reduction in the number of chromosomes, or a translocation of part of one chromosome to another. Molecular cytogenetic testing makes use of DNA hybridisation to detect subtle chromosomal abnormalities such as microdeletions.[28] Molecular genetic testing uses the tools of DNA technology, such as PCR for fragment analysis or DNA sequence analysis, to look for mutations in individual genes.

Clinical genetic scientists (cytogeneticists and molecular geneticists) undertake investigations and research into a range of disorders. This includes analysing blood samples from individuals with a variety of problems such as congenital abnormalities, learning difficulties, reproductive difficulties and sexual development problems, as well as performing confirmatory tests in the many phenotypically distinct genetic conditions that have clear and unequivocal presentation, such as Huntington's disease, cystic fibrosis and familial breast cancer.

28 NHS Careers. http://www.nhscareers.nhs.uk/

Pre-natal diagnosis is carried out on amniotic fluid or chorionic villus samples, generally for a specified risk of a known condition. Analysis of other samples such as bone marrow or tumour samples from patients with certain types of cancer conditions, such as acute leukaemia, may be undertaken to aid in the diagnosis and management of the disease.

The technological developments of next generation sequencing have enabled some laboratories to develop panels of genes that are tested simultaneously, rather than sequentially, for the diagnosis of specific disorders. These tests may offer significant advantages to both patients and clinicians in enabling more timely diagnoses as well as being more cost effective. Other laboratories are developing diagnostic approaches to use exome sequencing (i.e. interrogating all of the coding sequences in the genome) to provide more comprehensive diagnostic tests for specified phenotypes.

The infrastructure for genetic testing in the UK is summarised in Box I.8. Genetic tests are provided for many referrers, including general practitioners, a range of medical and surgical secondary and tertiary specialists, as well as clinical geneticists and genetic counsellors. In a recent report by the Human Genomics Strategy Group,[29] it is expected that, as genomics capabilities expand, genetic testing will form part of routine medical practice.

Box I.8: The infrastructure for genetic testing in the UK

- The UK Genetic Testing Network (UKGTN) provides support to the UK regional genetic laboratories to promote equity of access to testing for genetic conditions based on clinical need.
- Regional genetics laboratories that provide molecular genetic tests have developed specialist expertise in medical areas different from one another. Many laboratories provide services on a national basis for a unique subset of disorders.
- If a regional laboratory receives a referral for a disorder for which it does not test, DNA extracted from the patient is forwarded to an appropriate UKGTN member laboratory to be tested. This approach is cost-effective by reducing the unnecessary duplication of services for rare disorders.
- A regional laboratory that wishes to offer a new test for a genetic condition to NHS patients on a national basis submits a gene dossier to allow that test to be evaluated for scientific validity and clinical utility. Approved tests, together with their criteria for testing, are published, and recommended to commissioners for funding.
- Laboratories that develop tests purely for local use are not required to submit a gene dossier to UKGTN. Clinical Pathology Accreditation (CPA) requires that full validation is undertaken for these tests.[30]
- The core cytogenetic services carried out in regional genetic laboratories are recorded for member laboratories on the UKGTN website. Gene dossiers can be submitted for new tests. In addition to conventional cytogenetic testing, over 20,000 micro-array tests are undertaken across the UK.
- Regional genetic laboratories may also undertake genetic testing for acquired conditions (cancer) or infectious diseases, which do not come under the remit of the UKGTN.

29 Human Genomics Strategy Group (2012) Building on our inheritance: genomic technology in healthcare. https://www.gov.uk/government/publications/genomic-technology-in-healthcare-building-on-our-inheritance

30 Clinical Pathology Accreditation (UK) Ltd. http://www.cpa-uk.co.uk/

Tools

Imaging services

iRefer

http://www.irefer.org.uk

The seventh edition of imaging referral guidelines from The Royal College of Radiologists (RCR) uses enhanced guidelines methodology that has been accredited by NHS Evidence. The resource consists of over 300 fully searchable guidelines designed to assist the clinician in selecting the most appropriate investigation for a given diagnostic or imaging problem. It is available to all NHS professionals in Scotland, Wales, Northern Ireland and England.

Imaging Services Accreditation Scheme (ISAS)

https://www.isas-uk.org/

ISAS is a patient-focused accreditation scheme available to UK imaging services. The ISAS web-based assessment tool (https://www.isas-uk.org/ISAS-web-based-tool.shtml) can be used for the purpose of assessment and accreditation of organisations that provide diagnostic imaging services.

Endoscopy services

The Joint Advisory Group on Gastrointestinal Endoscopy (JAG) Accreditation System incorporating the Endoscopy Global Rating Scale

https://www.jagaccreditation.org/

The Global Rating Scale (GRS) is a tool that enables units to assess how well they provide a patient-centred service. It is a web-based assessment tool that makes a series of statements requiring a yes or no answer. From the answers the system automatically calculates the GRS scores, which provides a summary view of a service.

GRS Planning and Productivity Tool (PPAT)

http://www.thejag.org.uk/downloads/Planning%20&%20Productivity/GRS%20Planning%20and%20Productivity%20Tool%2005102012.pdf

The PPAT has been designed to enable an endoscopy service to achieve control of endoscopy waits through better planning and improved productivity. Critically reviewing each objective of the tool will identify areas for improvement.

Physiological diagnostics services

Improving Quality In Physiological diagnostic Service (IQIPS)

https://www.iqips.org.uk

The IQIPS programme is professionally led with the aim of improving service quality, care and safety for patients undergoing physiological diagnostics and treatment. IQIPS involves self-assessment and external peer assessment against a set of 26 standards to assess accurately the level of performance in relation to established standards and to implement ways to improve continuously. The standards are organised into four domains: Patient experience; Safety; Facilities, resource and workforce; Clinical.

Pathology services

Clinical Pathology Accreditation (UK)

http://www.cpa-uk.co.uk

Clinical Pathology Accreditation (CPA) is a non-profit distributing organisation that assesses and declares the competence of medical laboratories in the public and independent sector, and External Quality Assessment (EQA) Schemes in the UK and overseas.

Lab Tests Online

http://www.labtestsonline.org.uk/

Lab Tests Online-UK is a web tool and smartphone app to help patients, carers and the public understand the many clinical laboratory tests that are used in the diagnosis, monitoring and treatment of disease.

Genetic testing

Clinical Pathology Accreditation (UK)

http://www.cpa-uk.co.uk

Clinical Pathology Accreditation (CPA) is a non-profit distributing organisation that assesses and declares the competence of medical laboratories in the public and independent sector, and External Quality Assessment (EQA) Schemes in the UK and overseas.

Map and chart presentation

Selection of indicators

In devising the Diagnostic Services Atlas, we have worked closely with the Chief Scientific Officer (CSO) and the national clinical directors (NCDs) associated with the five specialties of diagnostic services:

- Imaging;
- Endoscopy;
- Physiological diagnostics;
- Pathology;
- Genetics.

We have also worked with other NCDs who have responsibility for certain groups of patients undergoing some of the diagnostic tests, e.g. NCDs for major trauma, gastro-intestinal and liver disease, stroke, and cardiac conditions.

Although the transition from primary care trusts (PCTs) to clinical commissioning groups (CCGs) following NHS re-organisation has taken place, most of the data presented are available only at PCT level due to retrospective data collection. Two of the indicators relating to the repair of abdominal aortic aneurysm (AAA) and six of the endoscopy indicators have also been mapped at CCG level (Maps 12–13, 15 and 18–22). The two indicators in the Genetics section have been mapped by NHS area team (AT). Thus, for the Diagnostic Services Atlas, indicators have been constructed using populations from PCTs, CCGs (where possible), NHS Trusts and NHS ATs.

In some localities, CCGs have a different geography from that of the previous PCT. Despite the structural changes resulting from NHS reform, however, the indicators presented in the Diagnostic Services Atlas will provide new organisations with sufficient comparative data to help them consider the questions they need to ask about diagnostic services for their local populations.

Order of appearance

Indicators in the Diagnostic Services Atlas are grouped under headings to reflect the five specialties of diagnostic services (see above); within Pathology Services, indicators of related tests have been grouped together further, e.g. bone-related tests and haematological tests.

Overall, the indicators have been presented in an order that tends to reflect the volume of testing undertaken for each specialty of diagnostic services.

Data sources

Data for most of the indicators in the Diagnostic Services Atlas have been provided by colleagues in the Department of Health, Office for National Statistics (ONS), Royal College of Physicians, University of Leeds, Public Health England, the Trauma Audit and Research Network (TARN), the UK Genetic Testing Network (UKGTN) and NHS England from a variety of sources including:

- Health and Social care Information Centre Hospital Episode Statistics (HES);
- The Office for National Statistics mid-year population estimates;
- The Office for National Statistics mortality records;
- Health and Social care Information Centre indicators portal;
- Trauma Audit and Research Network (TARN), University of Manchester;
- NHS Newborn Hearing Screening Programme;
- Stroke Improvement National Audit Programme (SINAP), Royal College of Physicians;
- Connecting for Health Pathology Messaging Implementation Programme (PMIP);

- Health and Social care Information Centre Diagnostic Imaging Dataset (DID);
- Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01);
- Quality and Outcomes Framework;
- NHS Improving Quality;
- Regional NHS molecular genetics laboratories in England (as part of the UKGTN).

A metadata document with methodology, data extraction coding schemes and data sources for each indicator is available from the website at: http://www.rightcare.nhs.uk/atlas/

Classification

Data for each of the indicators are displayed as both a column chart and map to show variation in terms of magnitude and geographical location within England. London is shown as a page inset on all PCT, CCG and NHS Trust maps to keep detail that otherwise might be lost.

The charts and maps for all indicators are colour classified into thematic displays, which group the indicator values into categories and allow the reader to view and compare them on the column chart and map without having to refer to individual values. Data are displayed on the maps as geographical areas.

A simple method of classification using equal counts of geographical areas was used to display all indicators, regardless of distribution of data within indicators. Five equal counts of areas or "quintiles" were classified for all indicator data where possible. However, as most of the indicators include a total number of areas that are not divisible by five (e.g. 151 PCTs or 211 CCGs), in most cases the classifications do not include exactly the same number of areas. The method used to create the classification was to order by rank the areas from highest to lowest values, then divide the ranks into five equal categories. However, in some cases, indicators included tied ranks (i.e. where some area values were exactly the same) and no areas were split into different categories where the rank was equal; this meant that an equal split was not possible in these cases. For the few indicators where there were many tied ranks of equal data, the split between categories was adjusted to ensure a "best fit" of equal numbers, without splitting areas or centres with the same values.

The disadvantage with equal counts of data is that it does not take into account the distribution of the data, and categories can be created with very different ranges of variation between the highest and lowest values. This should be taken into consideration when comparing areas in different categories within indicators.

The classification is shaded from light teal (lowest value) to dark teal (highest value) on both the column charts and maps. The ranges and their shading do not indicate whether a high or low value represents either good or poor performance.

The charts have been originally produced in Microsoft Excel 2007 and the maps originally created using MapInfo Professional 11.0.

Exception-reporting

One indicator in the Diagnostic Services Atlas (Map 26) is from the Quality and Outcomes Framework 2011/12:[1] COPD10.[2] Under the QOF scheme, GPs are rewarded for achieving an agreed level of population coverage for each indicator. The level of achievement recorded depends on the GP practice treating the patients with the relevant problem. However, not all patients are treatable or willing to be treated, e.g. when patients do not attend for review despite repeated invitations, or if a medication cannot be prescribed due to a contra-indication or side-effect. In order for the practices not to be penalised due to circumstances beyond their control, they can exclude those patients from counting towards their achievement by "exception-reporting" them. Exception-reporting is allowed for a range of reasons. The QOF achievement that is reported annually is the exception-adjusted population coverage.

1 BMA and NHS Employers (2011) Quality and Outcomes Framework guidance for GMS contract 2011/12. Delivering investment in general practice. April 2011. http://www.nhsemployers.org/Aboutus/Publications/Documents/QOF_guidance_GMS_contract_2011_12.pdf

2 This indicator was identical in Quality and Outcomes Framework for 2012/13. Guidance for PCOs and practices. http://www.nhsemployers.org/Aboutus/Publications/Documents/QOF_2012-13.pdf but in 2013/14 general medical services (GMS) contract quality and outcomes framework (QOF). Guidance for GMS contract 2013/14. http://www.nhsemployers.org/Aboutus/Publications/Documents/qof-2013-14.pdf the indicator number has been changed from "COPD10" to "COPD indicator 004" and the time-frame has been changed from "in the preceding 15 months" to "in the preceding 12 months".

For Map 26, the map and the coloured columns in the chart show the actual population coverage for each PCT in which excepted patients have been included in the denominator, whereas the open columns show the published QOF achievement, which does not include excepted patients in the denominator.

Standardisation

Standardisation allows like to be compared with like, by making sure that differences in the number of events (e.g. deaths or infections) observed in two or more populations are not due to differences in the age and sex profile between the different populations. (For example, suppose population A has a higher death rate than population B. However, if population A also has a higher proportion of older people, then we would expect there to be more deaths and it would be misleading to infer that people are dying at a faster rate in population A than in population B.) The two main methods of standardisation are:

- directly standardised rates;
- indirectly standardised rates.

Directly standardised rates adjust for differences in age and sex distribution. The observed rates (e.g. of disease) for each age-band in the study area (e.g. the PCT or CCG) is applied to a standard population structure (in this case, the European Standard population) to obtain a weighted average rate. Direct standardisation has been used for the indicators in Maps 12A&B, 22A&B, 68 and 69.

Indirectly standardised rates adjust for the differences in age distribution, and possibly other demographic factors such as sex and deprivation, by applying the observed rates for each age-group in a standard population (in this case, England) to the population of the same age-groups in the study area (e.g. the PCT or CCG). Indirect standardisation using age, sex and deprivation has been used for the indicators in Maps 15A&B, 18A&B, 20A&B and 21A&B.

The Hospital & Community Health Services (HCHS) population has been used as a denominator in some indicators. This is a population adjusted by age and sex as well as by variables of "need", and is a form of standardisation that can be used when the data necessary to perform the standardisation are not available.

Confidence intervals

Some of the indicators (Maps 12A&B, 13A&B, 15A&B, 18A&B, 19A&B, 20A&B, 21A&B, 22A&B, 24, 68 and 69) have error terms associated with them to give an indication of the level of uncertainty of the calculation, referred to as confidence intervals. Statistical uncertainties usually arise because the indicators are based on a random sample of finite size from a population of interest. Confidence intervals are used to assess what would happen if we were to repeat the same study, over and over, using different samples each time. The precise statistical definition of a 95% confidence interval states that, on repeated sampling, 95 times out of 100 the true population value would be within the calculated confidence interval range and for 5 times out of 100 the true value would be either higher or lower than the range. Where these confidence intervals have been calculated for indicators in the Diagnostic Services Atlas, they are displayed on the columns of the relevant charts as a vertical line intersecting the top of each column. The smaller the confidence interval, the more stable the indicator; a larger number of events leads to a smaller interval.

For indicators where the confidence intervals are very wide (as displayed on the chart), caution is needed when interpreting the data because the limits indicate that much of the variation within the indicator may not be statistically significant.

Statistical dispersion and the interquartile range

For Maps 9 and 10, the chart shows an interquartile range around the median value for each Trust displayed on the chart. The interquartile range is the difference between the upper quartile and lower quartile of the total intervention times recorded within each Trust. This provides a measure of statistical dispersion for the data in each Trust.

The use of estimated data for local areas

The indicators of the use of various pathology tests – Maps 31–67 – are not based on actual counts of tests requested for the calendar year, but instead the data were obtained as part of a data quality audit subject to strict governance protocols. Pathology messages to primary care were intercepted for a period of 23 days in May–June 2012. These were pseudonymised and

processed to provide details of the compliance with the PMIP Pathology Bounded Code List (PBCL) and Laboratory Standard Representation (LSR) for codes and units of measure (UoM). In total, 1.8 million messages containing samples of 38 million test results for approximately 3 million patients on 1029 tests from 152 NHS laboratory PMIP sources were analysed.

An annual number was estimated for the tests, which was then converted into a rate per GP total list sizes for each PCT. Tests were not mapped where data were present in only a small number of PCT areas.

The use of categorical data

For two of the indicators – Maps 11 and 14 – categorical, as opposed to continuous, data have been used to display variation in service provision. The data for these maps were derived from the responses to a survey conducted by NHS Improvement – Diagnostics from March to May 2012, with ad-hoc updates from providers collected up to November 2012. The survey was sent to all Interventional Radiology services in England, and there are three categories of response for each NHS Trust:

1. there is core service provision with a formal rota and formal network pathways to an agreed recipient;

2. there are some core services available on a formal rota, and there is limited formal network provision;

3. there is no core service provision and no network pathway.

Exclusions

For the indicators in the Diagnostic Services Atlas mapped to PCT geography, the calculation of the full range of variation is given in the accompanying commentaries; in addition, the range has then been calculated from which as a general rule the five highest values and the five lowest values have been excluded. This is because "outliers" could be the result of errors in data management, e.g. some data may not have been returned or events may have been recorded twice. This exclusion was originally suggested by Professor Sir Mike Richards for Atlas 1.0, and Right Care has continued to use the "Richards heuristic" in Atlas 2.0, the Child Health Atlas, the Kidney Care Atlas, the Respiratory Disease Atlas, the Liver Disease Atlas and the Diagnostic Services Atlas. It is important to note, however, that for indicators where there is a lesser or greater number of local areas displayed, a different number of areas may be excluded from the highest and lowest values. In Table M.1 below the range of exclusions used is shown depending upon the number of local areas available.

Table M.1: Local area size ranges for exclusions

Local areas	Exclusions
45 or fewer	0
From 46 to 75	2
From 76 to 105	3
From 106 to 136	4
From 137 to 166	5
From 167 to 197	6
From 198 to 227	7
From 228 to 257	8
From 258 to 288	9
From 289	10

For example:

- For indicators showing NHS Trust service provision for imaging in stroke (Maps 6–8), there are only three exclusions at each end of the range due to the smaller number of sites providing services;
- For indicators showing a CCG geography (Maps 12B, 13B, 15B, 18B, 19B, 20B, 21B and 22B), in general, there are seven exclusions at each end of the range due to a larger number of CCGs (n=211) when compared with PCTs;
- For indicators showing an NHS area team (AT) geography (Maps 68 and 69), there are no exclusions applied because the number of NHS ATs is 27;
- For the indicator showing NHS Trust service provision for CT head imaging in major trauma (Maps 9 and 10), there are no exclusions applied, due to the removal of providers where there were less than 10 eligible patients included.

Domains in the NHS Outcomes Framework

Underneath the title for each indicator, the domain or domains in the NHS Outcomes Framework 2013/14 relevant to the indicator have been listed. The five domains are as follows:

- 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
- Domain 4 Ensuring that people have a positive experience of care
- Domain 5 Treating and caring for people in a safe environment and protecting them from avoidable harm

Table S.1: Summary of indicators in the Diagnostic Services Atlas, showing the range and magnitude of variation before and after exclusions;[1] each indicator has been assigned to one or more of the following categories – activity, cost, equity, outcome, quality (performance as compared with a standard), and safety. An asterisk next to the map number denotes that there is an additional related indicator but it is presented only in the form of a column chart within the relevant commentary

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
1	Rate of magnetic resonance imaging (MRI) activity per 1000 weighted population by PCT 2012/13	22.8–99.0	4.3	27.7–66.4	2.4	Activity
2	Rate of computed axial tomography (CT) activity per 1000 weighted population by PCT 2012/13	37.2–132.1	3.6	48.3–107.6	2.2	Activity
3	Rate of non-obstetric ultrasound activity per 1000 weighted population by PCT 2012/13	54.4–161.8	3.0	74.7–153.7	2.1	Activity
4	Rate of positron emission tomography computed tomography (PET CT) activity from independent sector treatment centres per 10,000 population by PCT 2011/12	0.6–13.8	24	0.9–13.3	14	Activity
5	Rate of dual-energy X-ray absorptiometry (DEXA) activity per 1000 weighted population by PCT 2012/13	0.3–15.2	59	1.8–11.5	6	Activity
6	Median time (minutes) from arrival at hospital to brain imaging for stroke patients by hospital October–December 2012	16–788	49	22–566	26	Quality
7	Proportion (%) of stroke patients undergoing brain imaging within 1 hour of arrival at hospital by hospital October–December 2012	4.0–81.3	20	8.0–72.0	9	Quality
8	Proportion (%) of stroke patients undergoing brain imaging within 24 hours of arrival at hospital by hospital October–December 2012	68–100	1.5	77.6–100	1.3	Quality
9	Median time (hours) to head computed axial tomography (CT) for patients admitted directly to hospital meeting NICE head injury guidelines by hospital 2012/13	0.15–1.2	8	Not applicable	Not applicable	Quality
10	Median time (hours) to pelvic computed axial tomography (CT) for patients admitted directly to hospital with pelvic injury by hospital 2012/13	0.17–2.2	13	Not applicable	Not applicable	Quality
11	Provision of endovascular aneurysm repair (EVAR) offered by interventional radiology services "within hours" by hospital Trust November 2012	Not applicable	Not applicable	Not applicable	Not applicable	Equity

1 For PCTs in England: 5 exclusions, Maps 1–3, 5, 12A, 13A, 15A, 16–17, 18A, 19A, 21A, 22A, 23-33, 35-38, 40–42, 44–45, 47–49, 52–54, 56–66; 4 exclusions, Maps 20A, 34, 39, 46, 50–51; 3 exclusions, Map 43; 2 exclusions, Maps 4, 55; 0 exclusions, Map 67.

For CCGs: 7 exclusions, 12B 15B, 18B, 19B, 21B, 22B; 6 exclusions, Maps 13B, 20B.

For hospitals: 3 exclusions, Maps 6–8; 0 exclusions, Maps 9–10.

For NHS area teams (ATs): 0 exclusions, Maps 68–69.

Exclusions not applicable (categorical survey data): Maps 11, 14.

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
12A	Rate of endovascular aneurysm repair (EVAR) procedures for abdominal aortic aneurysm (AAA) per 100,000 population by PCT Directly standardised by age, 2009/10–2011/12	1.6–10.0	6	2.1–8.9	4.3	Activity
12B	Rate of endovascular aneurysm repair (EVAR) procedures for abdominal aortic aneurysm (AAA) per 100,000 population by CCG Directly standardised by age 2009/10–2011/12	1.6–11.5	7	2.0–9.0	4.5	Activity
13A	Proportion (%) of elective procedures for abdominal aortic aneurysm (AAA) that were EVAR by PCT 2009/10–2011/12	29.4–91.7	3.1	36.1–86.7	2.4	Equity
13B	Proportion (%) of elective procedures for abdominal aortic aneurysm (AAA) that were EVAR by CCG 2009/10–2011/12	27.0–91.7	3.4	32.4–86.7	2.7	Equity
14	Provision of uterine fibroid embolisation procedures offered by interventional radiology services "within hours" by hospital Trust November 2012	Not applicable	Not applicable	Not applicable	Not applicable	Equity
15A*	Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by PCT Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	119.7–329.3	2.8	158.5–296.1	1.9	Activity
15B*	Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by CCG Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	82.0–222.4	2.7	107.4–198.2	1.8	Activity
16	Rate of computed tomography (CT) colonoscopy procedures per 10,000 population by PCT April–November 2012	0.34–24.5	73	0.66–19.2	29	Activity
17	Rate of barium enema procedures per 1000 weighted population by PCT April–November 2012	0.02–8.5	>1000	0.01–3.1	172	Activity
18A	Rate of gastroscopy (upper gastro-intestinal endoscopy) procedures per 10,000 population by PCT Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	78.2–208.3	2.7	97.1–178.6	1.8	Activity
18B	Rate of gastroscopy (upper gastro-intestinal endoscopy) procedures per 10,000 population by CCG Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	76.3–208.3	2.7	93.9–178.6	1.9	Activity
19A	Proportion (%) of patients undergoing gastroscopy (upper gastro-intestinal endoscopy) procedures who are aged under 55 years by PCT 2011/12	25.2–56.2	2.2	28.2–49.4	1.8	Activity

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
19B	Proportion (%) of patients undergoing gastroscopy (upper gastro-intestinal endoscopy) procedures who are aged under 55 years by CCG 2011/12	25.1–57.9	2.3	27.8–48.4	1.7	Activity
20A	Rate of capsule endoscopy procedures per 10,000 population by PCT Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	0.18–5.3	29	0.27–3.1	11	Activity
20B	Rate of capsule endoscopy procedures per 10,000 population by CCG Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	0.18–5.3	29	0.32–3.1	10	Activity
21A	Rate of endoscopic ultrasound procedures per 10,000 population by PCT Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	0.12–6.8	55	0.67–4.2	6	Activity
21B	Rate of endoscopic ultrasound procedures per 10,000 population by CCG Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12	0.20–9.9	50	0.65–4.7	7	Activity
22A	Admission rate for children for upper and/or lower gastro-intestinal endoscopy per 100,000 population aged 0–17 years by PCT Directly standardised by age 2009/10–2011/12	32.7–237.1	7	66.9–180.2	2.7	Activity
22B	Admission rate for children for upper and/or lower gastro-intestinal endoscopy per 100,000 population aged 0–17 years by CCG Directly standardised by age 2009/10–2011/12	43.5–207.0	4.8	65.3–163.2	2.5	Activity
23	Rate of audiology assessments undertaken per 1000 weighted population by PCT 2012/13	6.5–70.6	11	8.2–39.3	4.8	Activity
24	Mean time (days) from referral to assessment for hearing tests in newborns by PCT 2012	12.9–55.1	4.3	14.9–35.1	2.4	Quality
25	Rate of sleep studies undertaken per 1000 weighted population by PCT 2012/13	0.10–7.6	79	0.22–4.9	23	Activity
26	Percentage (%) of patients with COPD with a record of FEV_1 in the previous 15 months by PCT (QOF COPD10 with exception-reported patients included) 2011/12	65.1–87.4	1.3	72.7–84.7	1.2	Quality
27	Rate of urodynamic (pressures and flows) tests undertaken per 1000 weighted population by PCT 2012/13	0.05–6.7	144	0.21–5.0	23	Activity
28	Rate of echocardiography activity undertaken per 1000 weighted population by PCT 2012/13	1.2–42.0	34	8.8–32.1	3.7	Activity
29	Rate of diagnostic invasive electrophysiology activity undertaken per 1000 weighted population by PCT 2012/13	0.0–21.5	Not applicable	0.01–5.3	829	Activity

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
30	Rate of peripheral neurophysiology tests undertaken per 1000 weighted population by PCT 2012/13	0.07–9.3	124	0.20–7.4	37	Activity
31	Estimated annual rate of use for thyroid stimulating hormone (TSH) tests ordered by GPs per 1000 practice population by PCT 2012	6.2–355.8	57	124.4–276.5	2.2	Activity
32	Estimated annual rate of use for free thyroxine (fT4) tests ordered by GPs per 1000 practice population by PCT 2012	4.9–256.8	52	14.6–231.1	16	Activity
33	Estimated annual rate of use for free tri-iodothyronine (fT3) tests ordered by GPs per 1000 practice population by PCT 2012	0.05–53.4	999	0.42–17.0	40	Activity
34	Estimated annual rate of use for free thyroid peroxisomal (TPO) antibody tests ordered by GPs per 1000 practice population by PCT 2012	0.04–7.0	165	0.11–5.0	45	Activity
35	Estimated annual rate of use for carbohydrate antigen 125 (CA 125) tests ordered by GPs per 1000 practice population by PCT 2012	0.11–9.0	80	0.92–8.4	9	Activity
36	Estimated annual rate of use for prostate-specific antigen (PSA) tests ordered by GPs per 1000 practice population by PCT 2012	0.64–46.1	72	8.5–40.1	4.7	Activity
37	Estimated annual rate of use for lithium tests ordered by GPs per 1000 practice population by PCT 2012	0.05–6.2	116	0.60–4.3	7	Activity
38	Estimated annual rate of use for carbamazepine tests ordered by GPs per 1000 practice population by PCT 2012	0.04–1.2	30	0.07–0.6	9	Activity
39	Estimated annual rate of use for valproate tests ordered by GPs per 1000 practice population by PCT 2012	0.02–1.5	72	0.04–1.0	24	Activity
40	Estimated annual rate of use for digoxin tests ordered by GPs per 1000 practice population by PCT 2012	0.05–1.9	39	0.13–1.4	11	Activity
41	Estimated annual rate of use for phenytoin tests ordered by GPs per 1000 practice population by PCT 2012	0.04–0.9	22	0.06–0.6	11	Activity
42	Estimated annual rate of use for blood glucose (fasting) tests ordered by GPs per 1000 practice population by PCT 2012	0.05–203.7	>1000	0.08–179.1	>1000	Activity
43	Estimated annual rate of use for blood glucose (2 hours post glucose load) tests ordered by GPs per 1000 practice population by PCT 2012	0.04–14.6	386	0.06–11.0	184	Activity
44	Estimated annual rate of use for blood glycated haemoglobin (HbA1c) tests (IFCC) ordered by GPs per 1000 practice population by PCT 2012	4.6–252.4	55	34.1–131.6	3.9	Activity
45	Estimated annual rate of use for rheumatoid factor tests ordered by GPs per 1000 practice population by PCT 2012	0.05–22.5	416	0.10–16.3	170	Activity

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
46	Estimated annual rate of use for allergen-specific immunoglobulin E (IgE) assays (known as RAST) ordered by GPs per 1000 practice population by PCT 2012	0.04–17.2	435	0.11–7.8	73	Activity
47	Estimated annual rate of use for serum total cholesterol tests ordered by GPs per 1000 practice population by PCT 2012	5.0–335.8	68	106.6–272.3	2.6	Activity
48	Estimated annual rate of use for triglyceride tests ordered by GPs per 1000 practice population by PCT 2012	4.9–279.2	57	59.6–250.3	4.2	Activity
49	Estimated annual rate of use for high-density lipoprotein (HDL) cholesterol tests ordered by GPs per 1000 practice population by PCT 2012	5.0–270.4	54	46.1–264.9	6	Activity
50	Estimated annual rate of use for troponin tests ordered by GPs per 1000 practice population by PCT 2012	0.03–5.7	214	0.06–3.4	59	Activity
51	Estimated annual rate of use for brain natriuretic peptide (BNP or NTproBNP) tests ordered by GPs per 1000 practice population by PCT 2012	0.05–14.4	297	0.11–10.2	89	Activity
52	Estimated annual rate of use for haemoglobin tests ordered by GPs per 1000 practice population by PCT 2012	7.1–643.5	91	197.3–453.2	2.3	Activity
53	Estimated annual rate of use for vitamin B12 tests ordered by GPs per 1000 practice population by PCT 2012	1.8–131.3	72	20.2–102.9	5	Activity
54	Estimated annual rate of use for serum folate tests ordered by GPs per 1000 practice population by PCT 2012	0.05–131.4	>1000	0.82–96.1	117	Activity
55	Estimated annual rate of use for red cell folate tests ordered by GPs per 1000 practice population by PCT 2012	0.02–52.8	>1000	0.03–31.4	>1000	Activity
56	Estimated annual rate of use for ferritin tests ordered by GPs per 1000 practice population by PCT 2012	3.7–139.5	38	14.2–123.8	9	Activity
57	Estimated annual rate of use for serum calcium tests ordered by GPs per 1000 practice population by PCT 2012	5.8–880.2	153	46.3–526.5	11	Activity
58	Estimated annual rate of use for vitamin D tests ordered by GPs per 1000 practice population by PCT 2012	0.05–193.4	>1000	0.19–74.5	392	Activity
59	Estimated annual rate of use for parathyroid hormone (PTH) tests ordered by GPs per 1000 practice population by PCT 2012	0.04–19.8	466	0.20–6.3	31	Activity
60	Estimated annual rate of use for serum creatinine tests ordered by GPs per 1000 practice population by PCT 2012	8.2–870.7	106	157.0–662.4	4.2	Activity
61	Estimated annual rate of use for estimated glomerular filtration rate (eGFR) tests ordered by GPs per 1000 practice population by PCT 2012	0.31–774.3	>1000	8.0–447.4	56	Activity

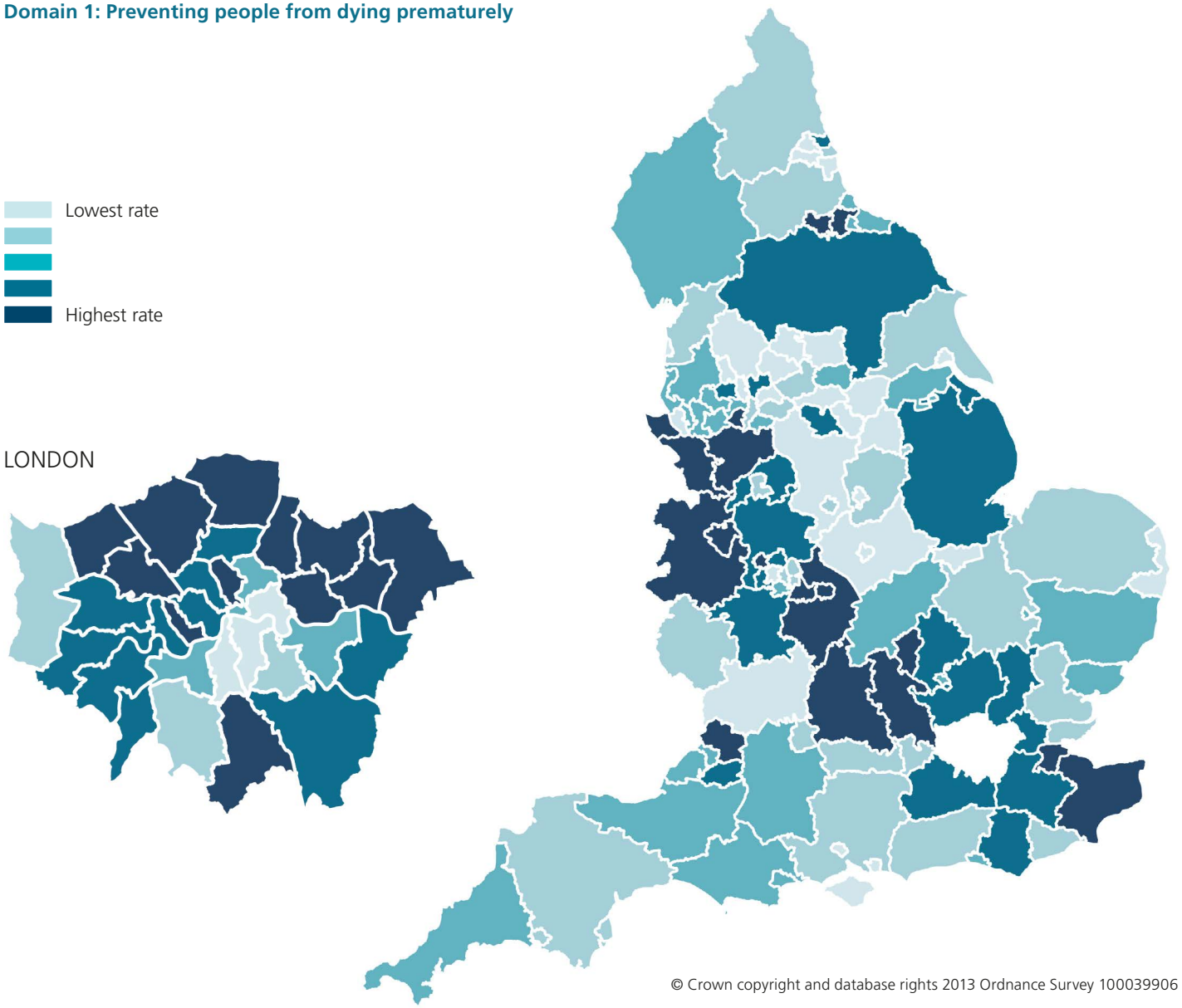
Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
62	Estimated annual rate of use for urine protein–creatinine tests ordered by GPs per 1000 practice population by PCT 2012	0.04–68.0	>1000	0.13–43.3	334	Activity
63	Estimated annual rate of use for alanine aminotransferase (ALT) tests ordered by GPs per 1000 practice population by PCT 2012	1.9–468.9	252	6.9–388.3	56	Activity
64	Estimated annual rate of use for creatine kinase tests ordered by GPs per 1000 practice population by PCT 2012	0.57–44.5	78	2.7–26.5	10	Activity
65	Estimated annual rate of use for urate tests ordered by GPs per 1000 practice population by PCT 2012	0.06–53.0	836	2.8–19.7	7	Activity
66	Estimated annual rate of use for the urine albumin to creatinine ratio (ACR) tests ordered by GPs per 1000 practice population by PCT 2012	0.07–108.4	>1000	2.1–74.7	35	Activity
67	Estimated annual rate of use for calprotectin tests ordered by GPs per 1000 practice population by PCT 2012	0.01–5.1	446	Not applicable	Not applicable	Activity
68	Rate of overall genetic test reporting undertaken per 100,000 population by NHS area team 2011/12	106.6–211.4	2.0	Not applicable	Not applicable	Activity and Equity
69	Rate of breast cancer test reporting undertaken in women aged 15 years and over per 100,000 population by NHS area team 2011/12	6.2–39.8	6	Not applicable	Not applicable	Activity and Equity

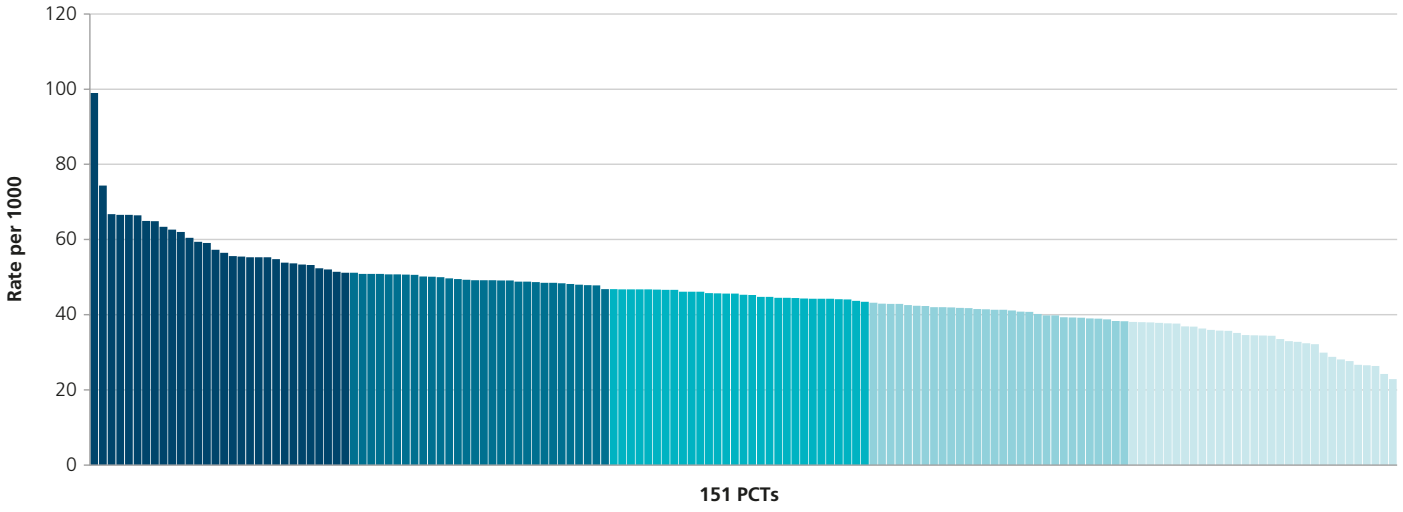
IMAGING SERVICES

Map 1: Rate of magnetic resonance imaging (MRI) activity per weighted population by PCT

2012/13

Domain 1: Preventing people from dying prematurely





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 CT 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 other 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

For PCTs in England, the rate of MRI activity ranged from 22.8 to 99.0 per 1000 weighted population (4.3-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 27.7–66.4 per 1000 weighted population, and the variation is 2.4-fold (see Table 1.1 for 2010/11 and 2011/12 data).

The degree of variation among PCTs in the rate of MRI activity per 1000 weighted population appears to have persisted over the last three financial years.

Although some of this 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.

There is concern about the increasing use of MRI because of incidental findings, that is, findings unrelated to the original reason for undertaking MRI. Incidental findings can lead to unnecessary investigation and anxiety. 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."*[2]

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.

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 under-use and over-use of the technology.

The Royal College of Radiologists plays a leading role in the education of all clinicians. Providers need to ensure that education and skills development are available to the relevant clinicians.

RESOURCES

- NHS Improvement. Commissioning A World Class Commissioning Service (NB: at the time of writing, contents were under review). http://www.improvement.nhs.uk/CommissioningAWorldClassImagingService/tabid/65/Default.aspx
- 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 (2007) Page 3: Magnetic Resonance Imaging. Radiology Success Factors. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf

Table 1.1: Rate of MRI activity per 1000 weighted population by PCT over three financial years[3]

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2010/11	18.1–76.5	4.2	25.1–58.3	2.3	Map 68, Atlas 2.0 (2011)
2011/12	18.9–84.0	4.5	26.3–65.1	2.5	
2012/13	22.8–99.0	4.3	27.7–66.4	2.4	

1 The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504

2 Morris Z, Whiteley WN, Longstreth WT Jr et al (2009) Incidental findings on brain magnetic resonance imaging: systematic review and meta-analysis. BMJ339:doi:10.1136/bmj.b3016 (Published 17 August 2009).

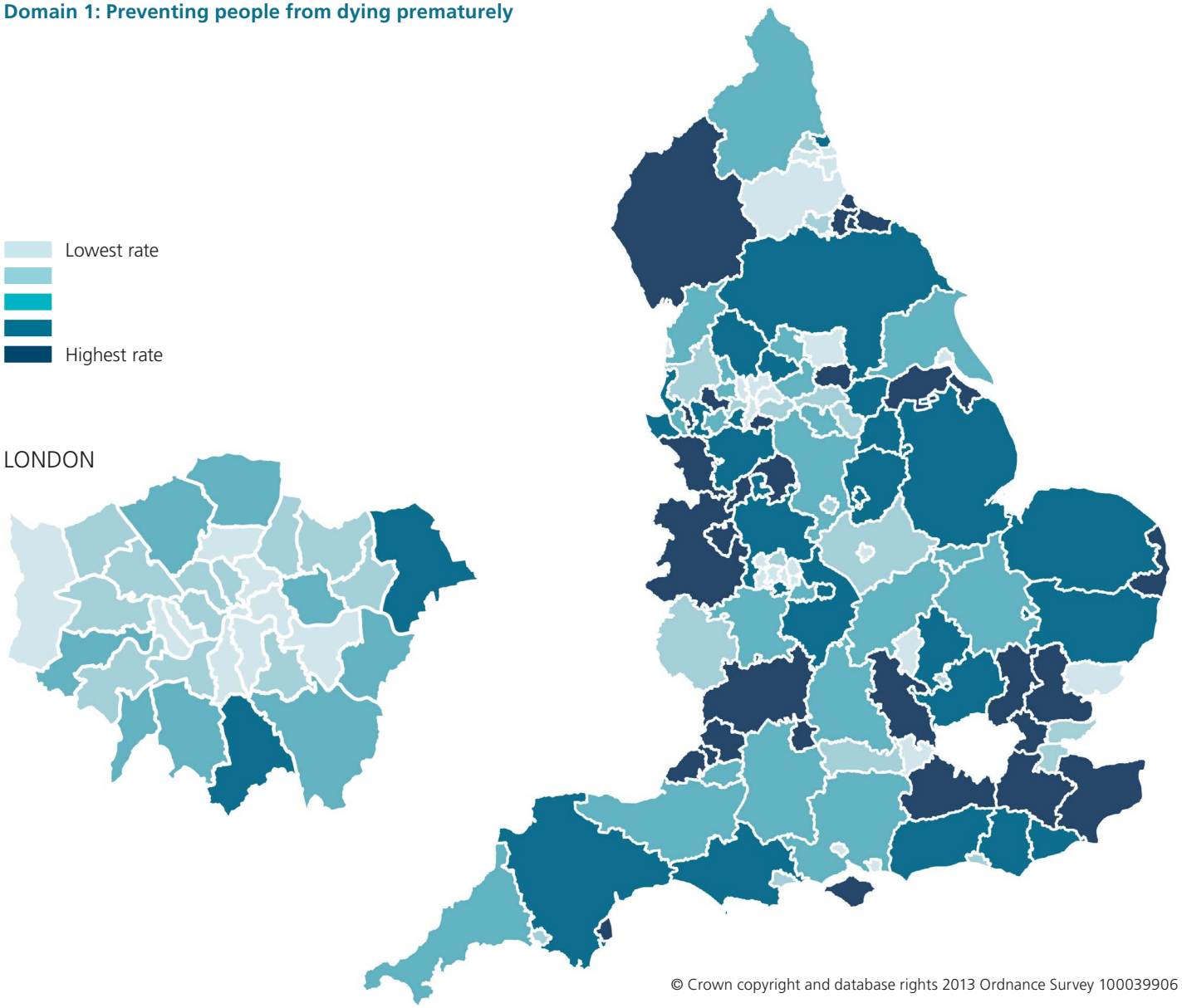
3 A similar indicator was presented in Atlas 1.0 (Map 31) using 2009/10 data, however, the numerator was not weighted: for the indicator in Atlas 1.0, the variation was 4-fold and after exclusions it was slightly greater than 2-fold.

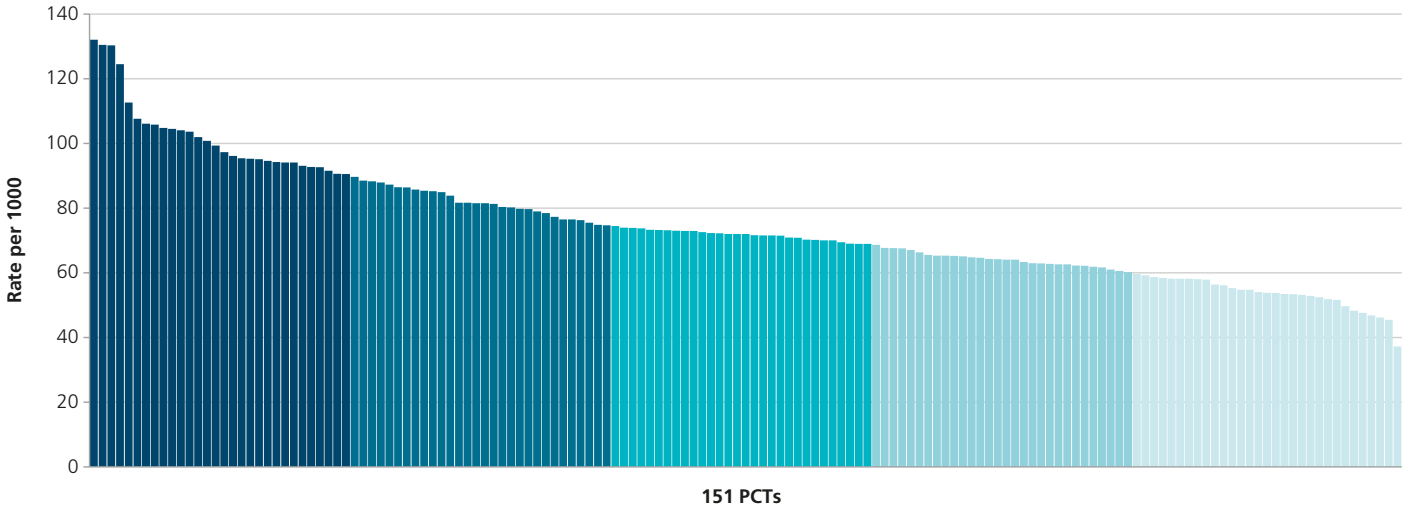
IMAGING SERVICES

Map 2: Rate of computed axial tomography (CT) activity per weighted population by PCT

2012/13

Domain 1: Preventing people from dying prematurely





Context

Computed axial tomography (a CAT or 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 and other imaging modalities such as ultrasound.

Magnitude of variation

For PCTs in England, the rate of CT activity ranged from 37.2 to 132.1 per 1000 weighted population (3.6-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 48.3–107.6 per 1000 weighted population, and the variation is 2.3-fold (see Table 2.1 for 2010/11 and 2011/12 data).

The degree of variation among PCTs in the rate of CT activity per 1000 weighted population appears to have persisted over the last three financial years.

Although some of this 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.

From the patient's perspective, it is important to reduce any unwarranted variation in CT activity because, unlike MRI, this intervention carries a heavy radiation dose. Thus, the use of CT needs to be justified because of the potential harm it could cause.

In the USA, there is concern about the potential for over-use of CT, and the harm it could cause, which has been 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"*[2]

> *"we have to adopt a public health mind set … and talk explicitly about the elements of danger in exposing our patients to radiation".*[3]

Although over-use 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.

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.

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 under-use and over-use of the technology.

RESOURCES

- NHS Improvement. Commissioning A World Class Commissioning Service (NB: at the time of writing, contents were under review). http://www.improvement.nhs.uk/CommissioningAWorldClassImagingService/tabid/65/Default.aspx
- 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 (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

Table 2.1: Rate of CT activity per 1000 weighted population by PCT over three financial years[4]

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2010/11	31.4–120	3.8	42.2–94.9	2.2	Map 69, Atlas 2.0 (2011)
2011/12	33.5–120.9	3.6	45.0–104.1	2.3	
2012/13	37.2–132.1	3.6	48.3–107.6	2.2	

1 The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504

2 Fazel R et al (2009) Exposure to low dose ionizing radiation from medical imaging procedures. *New England Journal of Medicine* 361:849-857.

3 Lauer MS (2009) Elements of danger – the case of medical imaging. *New England Journal of Medicine* 361:841-842.

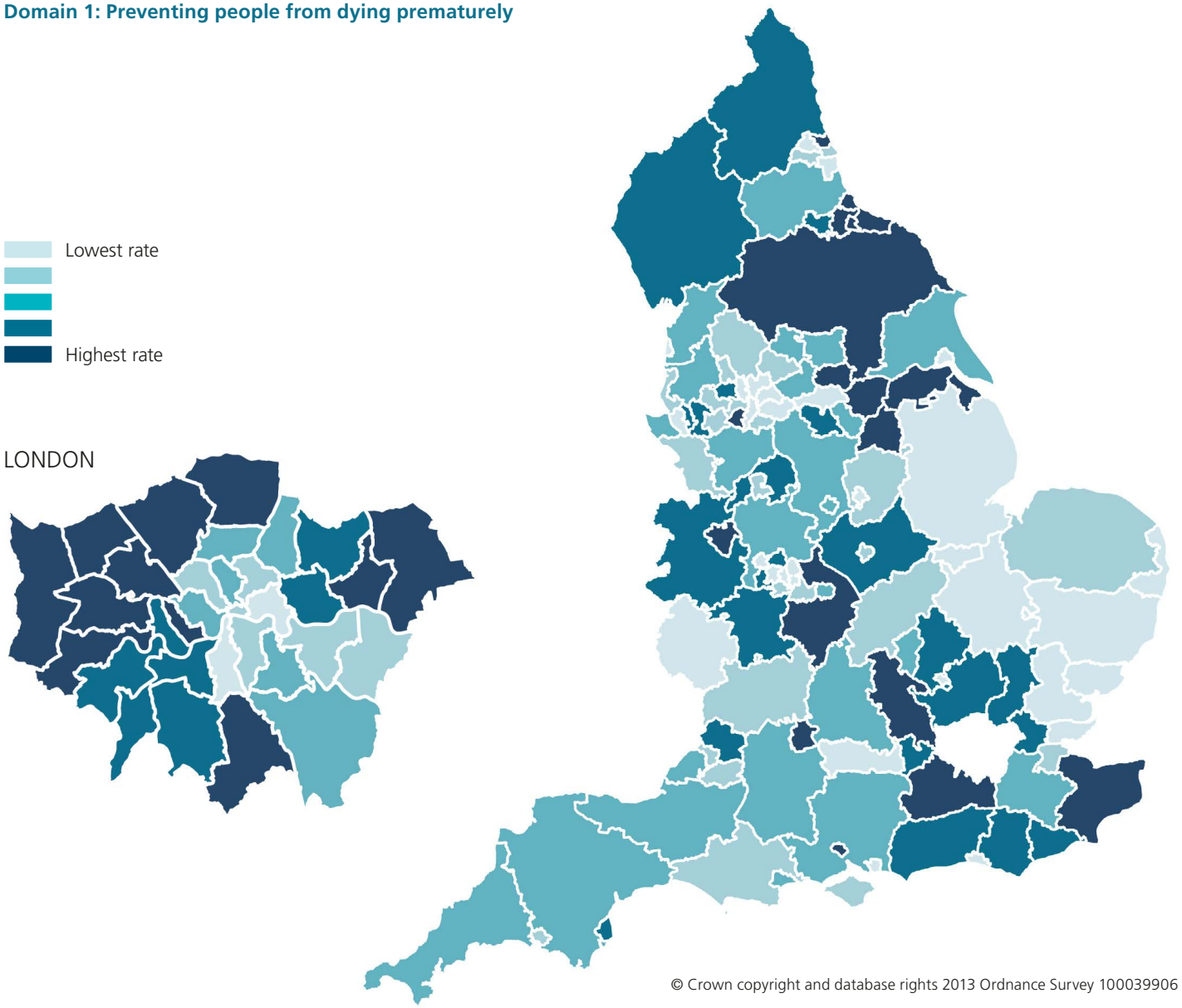
4 A similar indicator was presented in Atlas 1.0 (Map 32) using 2009/10 data, however, the numerator was not weighted: for the indicator in Atlas 1.0, the variation was 3-fold and after exclusions it was greater than 2-fold.

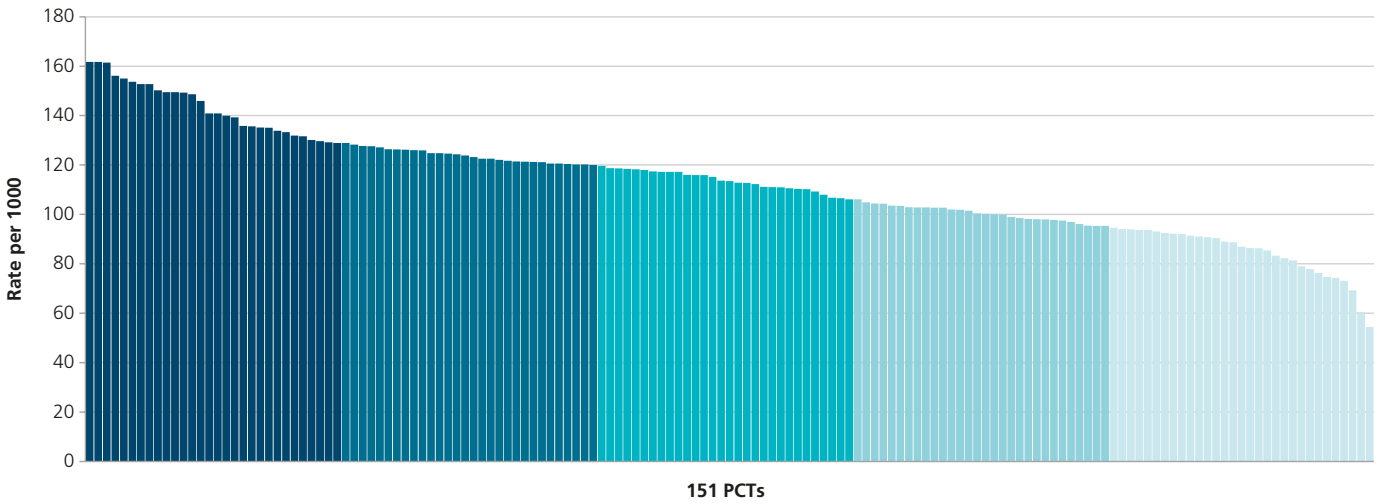
IMAGING SERVICES

Map 3: Rate of non-obstetric ultrasound activity per weighted population by PCT

2012/13

Domain 1: Preventing people from dying prematurely





Context

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

The advantage of ultrasound over other imaging modalities, such as X-rays or CT scans, is that it does not involve ionising radiation. Further advantages of ultrasound over other imaging modalities, such as MRI, are that:

- the equipment is cheaper;
- the equipment is becoming smaller without compromising scan quality – some models are portable and some are hand-held.

Medical ultrasound falls into two main categories:

1. Obstetric;
2. 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 (e.g. 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

For PCTs in England, the rate of non-obstetric ultrasound activity ranged from 54.4 to 161.8 per 1000 weighted population (3.0-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 74.7–153.7 per 1000 weighted population, and the variation is 2.1-fold (see Table 3.1 for 2011/12 data).

The variation among PCTs in the rate of non-obstetric ultrasound activity per 1000 weighted population appears to have persisted over the last two financial years.

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

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

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 (2009) Guidelines for the safe use of diagnostic ultrasound equipment. http://www.bmus.org/policies-guides/pg-safety03.asp
- 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 (2007) Page 5: Ultrasound. Radiology Success Factors. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf

Table 3.1: Rate of non-obstetric ultrasound activity per 1000 weighted population by PCT over two financial years

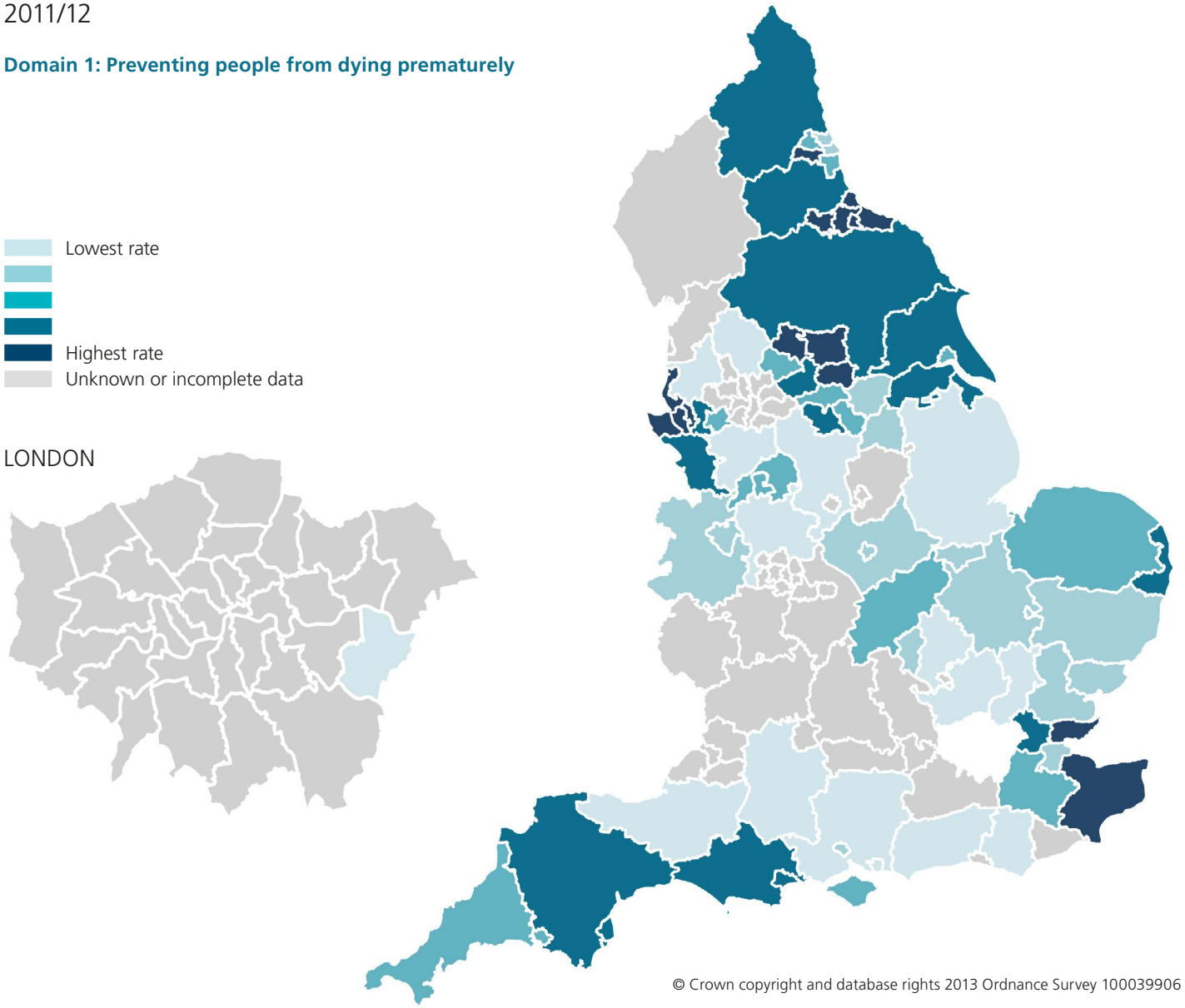
Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	52.5–160.9	3.1	69.1–145.4	2.1
2012/13	54.4–161.8	3.0	74.7–153.7	2.1

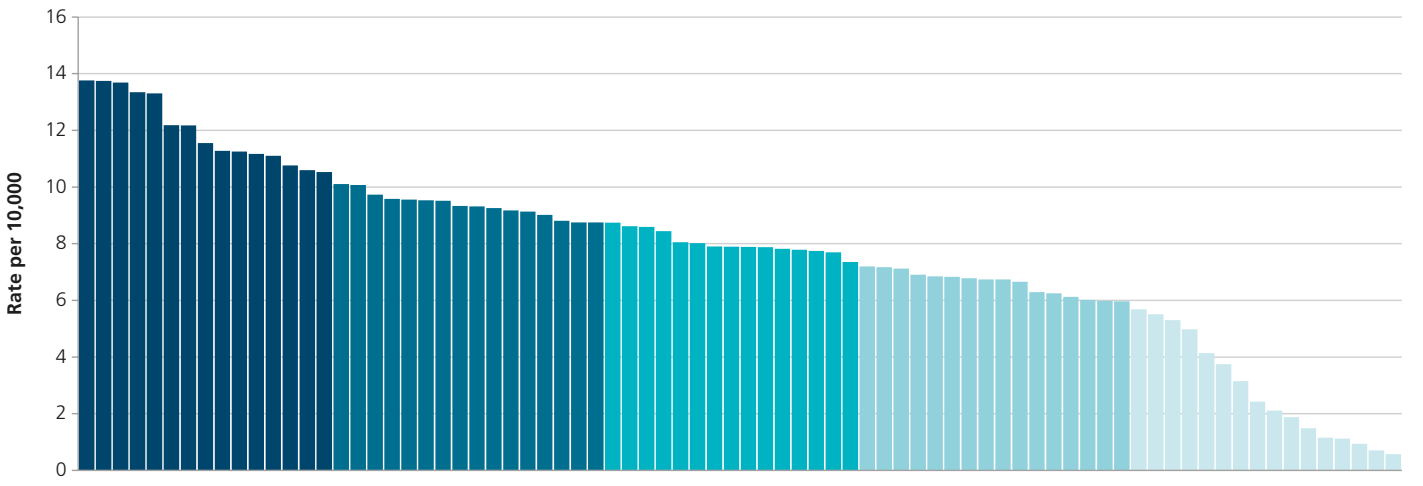
IMAGING SERVICES

Map 4: Rate of positron emission tomography computed tomography (PET CT) activity from independent sector treatment centres per population by PCT

2011/12

Domain 1: Preventing people from dying prematurely





78 of 151 PCTs (73 missing due to unknown or incomplete data)

Context

Positron emission tomography (PET) is a diagnostic imaging technique whereby patients are given a radioactive substance that emits positrons, which in turn give rise to gamma rays detectable by a gamma camera.[1] The advantages of a PET scan over other types of scan are that it shows how body organs and tissues are functioning, and can enable the distinction between living and dead tissue and between benign and malignant growths.

In general, PET scanning is used in combination with other tests, most commonly computed axial tomography (CT). When used in combination with CT, PET is highly sensitive enabling earlier and more accurate identification of tumours and diseases or changes in the body.

The main use of PET CT is to investigate confirmed cases of cancer to identify:

- staging of the cancer (how far it has spread);
- the cancer's response to treatment;
- whether any cancerous cells remain after treatment.

PET CT Scans can also be used for other conditions including those affecting the brain and nervous system, such as dementia and Parkinson's disease, and to determine whether patients would benefit from certain types of heart surgery such as coronary artery bypass grafting among others.

In England, PET CT scanning is currently delivered by several types of provider:

- NHS units under national contract;
- NHS units outside the national contract;
- independent sector;
- charities.

Data for this indicator are available only from those units under the PET CT Independent Sector Treatment Contract (ISTC; of 151 PCTs, 78 were under ISTC in 2011/12), which accounts for 50–60% of NHS activity. As commissioners may hold contracts with other providers, data may not show complete activity for each PCT. Moreover, specialised commissioning groups (SCGs) may not have commissioned PET CT for the entire SCG locality during the financial year, with some PCTs contracting for services for the local population.

Magnitude of variation

For PCTs in England, the rate of PET CT activity from independent sector treatment centres ranged from 0.6 to 13.8 per 10,000 population (24-fold variation). When the two PCTs with the highest rates and the two PCTs with the lowest rates are excluded, the range is 0.9–13.3 per 10,000 population, and the variation is 14-fold (see Table 4.1 for 2010/11 data).

The magnitude of variation increased from 2010/11 to 2011/12:

- there has been a 20% increase in PET CT activity overall – supported by evidence, PET CT is becoming part of the clinical pathway, which leads to an increase in referrals;
- an additional three PCTs submitted data;
- there are small numbers per population from a few PCTs with new activity;
- there has been a 25% reduction in activity for one PCT.

In the absence of complete data, the exact degree of variation for PET CT activity cannot be determined. Reasons for variation could include differences in:

- the availability of equipment, and of a skilled workforce;
- data collection and the reporting of activity;
- local clinical practice.

Options for action

Commissioners and service providers need to collaborate to review the rates of PET CT activity in the locality:

- to identify any unwarranted variation;
- to ensure that all activity is accurately coded and reported.

To address unwarranted variation, commissioners, clinicians and service providers need to apply evidence-based practice:

- using local patient pathways for diagnostics;
- promoting audit locally to identify under- and over-use of PET CT when compared with national indications (see "Resources", NHS Commissioning Board);
- promoting research to understand the benefits and harms of different rates of PET CT investigation, including clinical outcome measures.

It is difficult for commissioners to assess the true value of the PET CT service provided to the local population if it is not possible to benchmark it against all other PET CT services. Submission of activity data was not mandatory until April 2012, with the introduction of the Diagnostic Imaging Dataset (DID; see "Resources").

RESOURCES

- NHS Commissioning Board (2013) Clinical Commissioning Policy Statement: Positron Emission Tomography – Computerized Tomography. April 2013. Reference: NHSCB/B02/PS/a. http://www.england.nhs.uk/wp-content/uploads/2013/04/b02-ps-a.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.
- Diagnostic Imaging Dataset. A new central collection of detailed information about diagnostic imaging tests carried out on NHS patients, extracted from local Radiology Information Systems (RISs) and submitted monthly. http://www.england.nhs.uk/statistics/statistical-work-areas/diagnostic-imaging-dataset/

Table 4.1: Rate of PET CT scan activity per 10,000 population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2010/11	1.2–12.5	11	1.8–11.1	6
2011/12	0.6–13.8	24	0.9–13.3	14

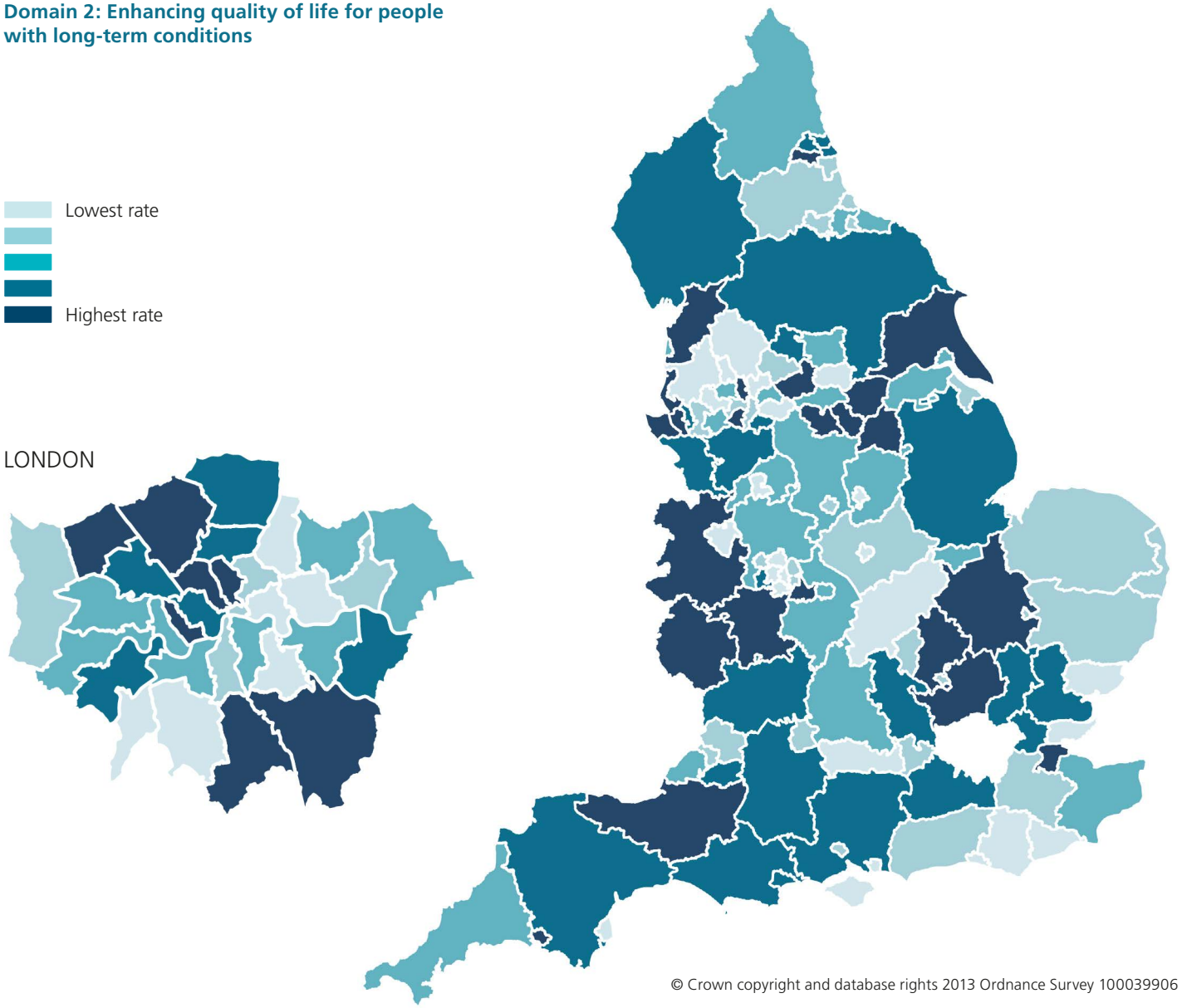
1 The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504

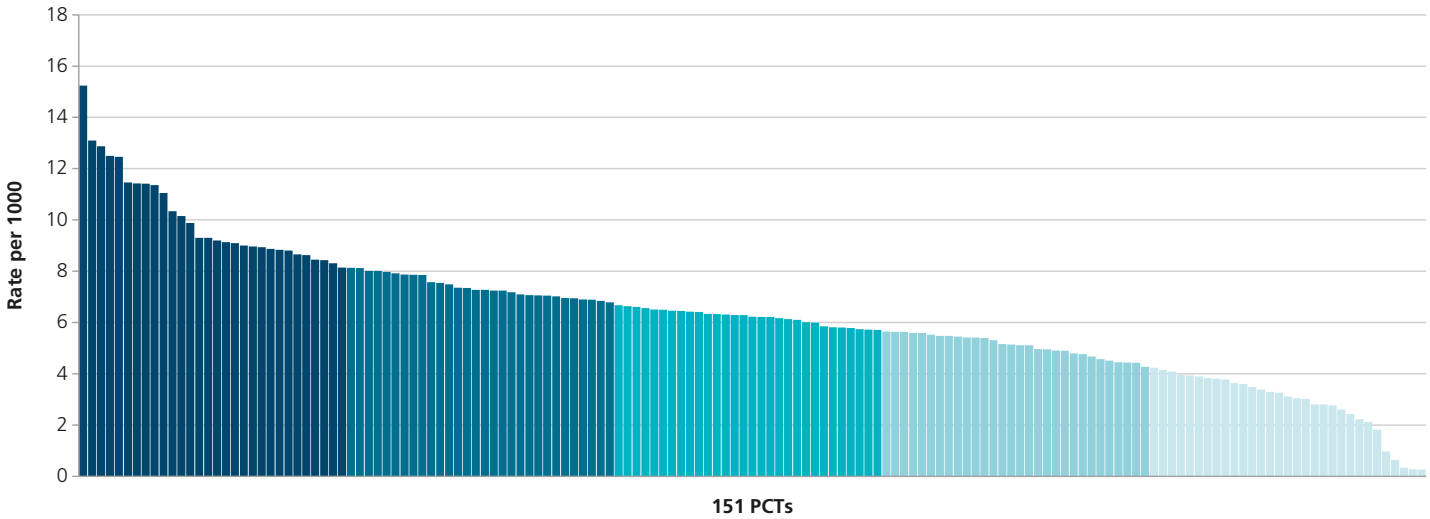
IMAGING SERVICES

Map 5: Rate of dual-energy X-ray absorptiometry (DEXA) activity per weighted population by PCT

2012/13

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





Context

Dual-energy X-ray absorptiometry (DEXA) is a type of X-ray used to measure the amount of calcium in bones. It is one of several techniques known as bone densitometry which can be used to measure the density of bones.

When measuring low bone density, a DEXA scan is more sensitive than a normal X-ray. It is also safer in that it delivers a much lower dose of radiation, which is equivalent to less than one day's exposure to natural background radiation.

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;
- 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.

DEXA Scans can also be used to measure the relative amount of body fat and muscle.

In addition to structural changes, 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.

Magnitude of variation

For PCTs in England, the rate of DEXA activity ranged from 0.3 to 15.2 per 1000 weighted population (59-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 1.8–11.5 per 1000 weighted population, and the variation is 6-fold (see Table 5.1 for 2010/11 and 2011/12 data).

The degree of variation among PCTs in the rate of DEXA activity after exclusions appears to be persisting at a relatively high level.

Possible reasons for variation include differences in:

- the use of other tests to measure bone density;
- population composition in different areas – populations with a greater proportion of older people may have higher rates of activity.

It is unlikely, however, that these factors explain all of the variation observed. Possible reasons for unwarranted variation include differences in:

- availability of imaging services;
- development of integrated systems for fracture prevention.

Options for action

Commissioners, clinicians and service providers need to review the prevention of falls and fractures in local populations, including issues ranging from excessive prescribing to the prevention of fragility fractures. The Department of Health's Impact Assessment of fracture prevention interventions will be useful in this review.[1]

RESOURCES

- NHS Improvement. Commissioning A World Class Commissioning Service (NB: at the time of writing, contents were under review). http://www.improvement.nhs.uk/CommissioningAWorldClassImagingService/tabid/65/Default.aspx
- 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 (2007) Page 2: Dual Energy Xray Absorptiometry. Radiology Success Factors. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fPublications%2fRadiology_Success_Factors%20-%20Nov%2007.pdf

Table 5.1: Rate of DEXA activity per 1000 weighted population by PCT over three financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2010/11	0.2–16.8	83	1.5–11	7	Map 70, Atlas 2.0 (2011)
2011/12	0.2–15.1	67	1.8–10.6	6	
2012/13	0.3–15.2	59	1.8–11.5	6	

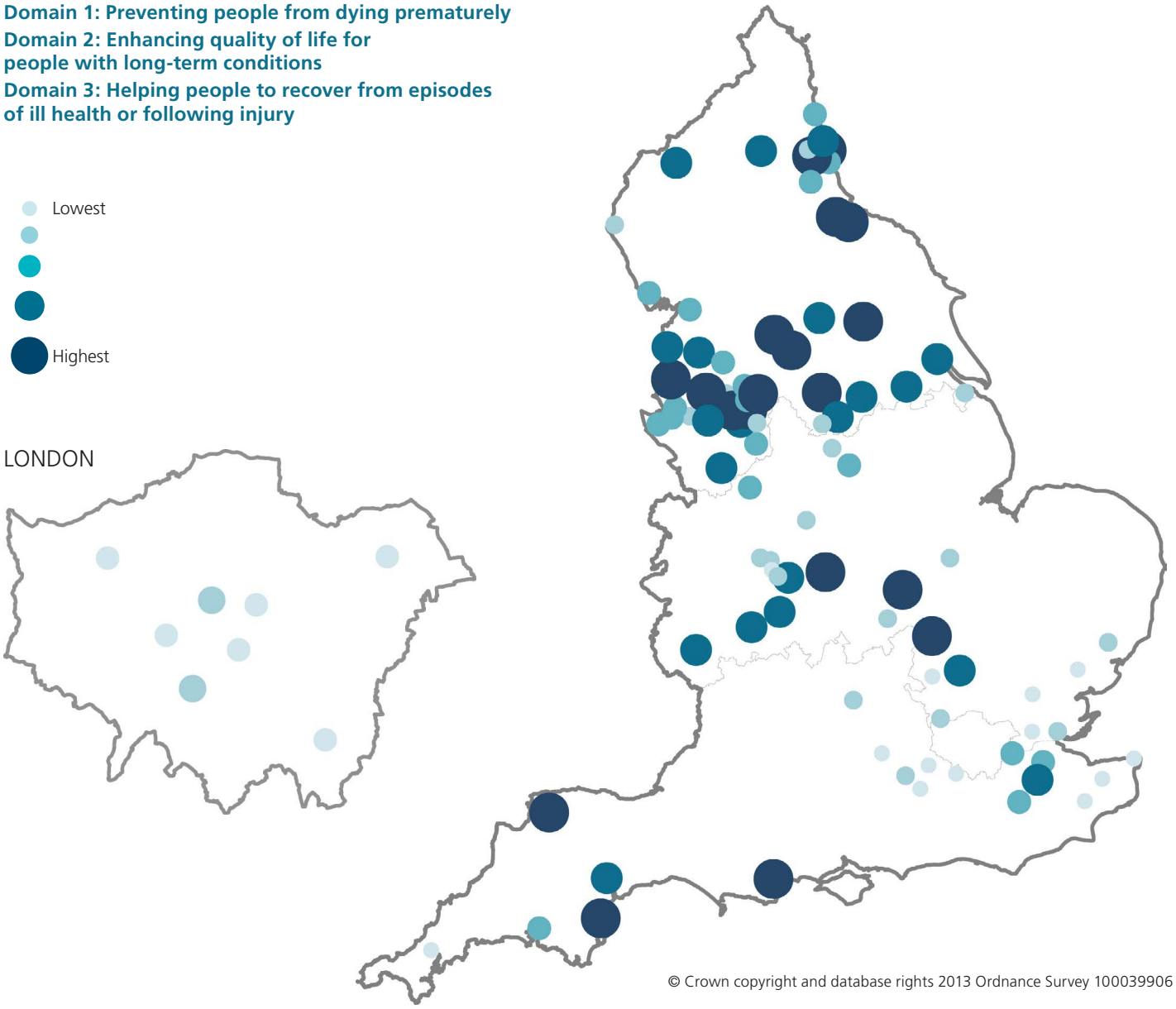
1 Department of Health (2009) Impact Assessment of fracture prevention interventions. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_106379.pdf

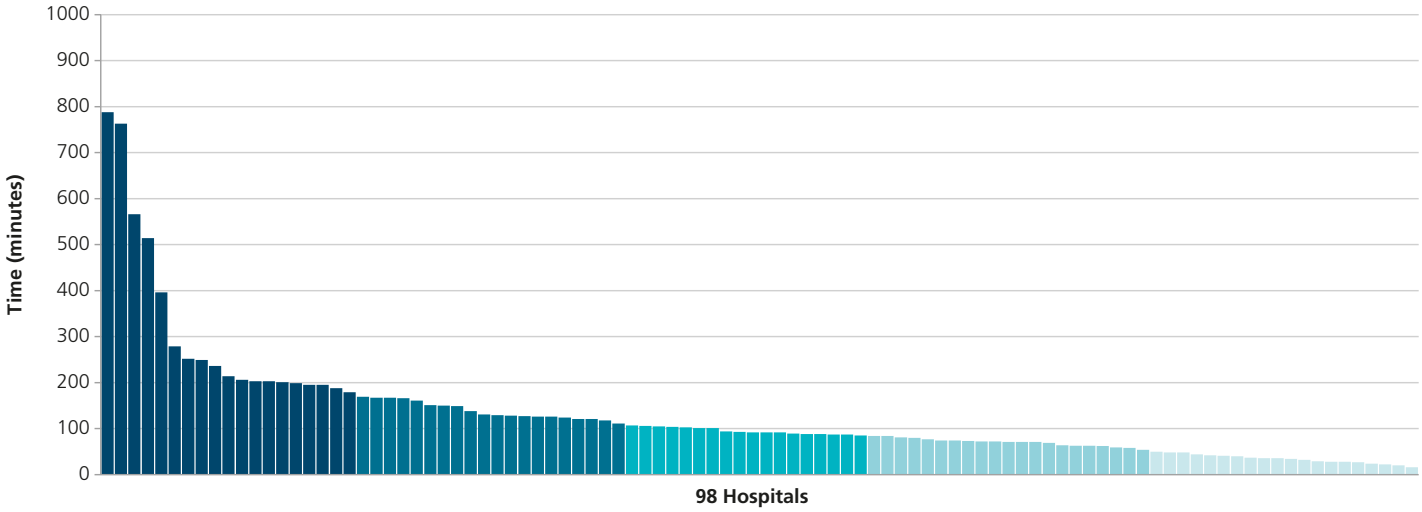
IMAGING SERVICES

Map 6: Median time (minutes) from arrival at hospital to brain imaging for stroke patients by hospital

October–December 2012

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





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.

The NICE Stroke guideline (see "Resources") covers interventions in the acute stage of a stroke ("acute stroke") or transient ischaemic attack (TIA). In relation to brain imaging for people who have had a stroke, NICE states:

> *"Brain imaging should be performed immediately[1] for people with acute stroke if any of the following apply:*
>
> - *indications for thrombolysis or early anticoagulation treatment*
> - *on anticoagulant treatment*
> - *a known bleeding tendency*
> - *a depressed level of consciousness (Glasgow Coma Score below 13[2])*
> - *unexplained progressive or fluctuating symptoms*
> - *papilloedema, neck stiffness or fever*
> - *severe headache at onset of stroke symptoms.*
>
> *For all people with acute stroke without indications for immediate brain imaging, scanning should be performed as soon as possible."*[3]

In the NICE guidelines, published in 2008, it is recommended that all patients should undergo brain imaging within 24 hours; however, the Royal College of Physicians Intercollegiate Stroke Working Party has updated the National Clinical Guidelines for Stroke (see "Resources") in which it is recommended that all patients should undergo brain imaging within 12 hours.

The Royal College of Physicians audits the care of people who have had a stroke. The data for Maps 6–8 are from the Stroke Improvement National Audit Programme (SINAP), a voluntary audit in which an estimated 147 hospital sites in England were eligible during the period October–December 2012; 98 hospitals are included in the data for these three indicators.

From January 2013, the Sentinel Stroke National Audit Programme (SSNAP) replaced SINAP (see "Resources"). SSNAP has now released national figures in their first public report (see "Resources"), and CCGs have been sent individual hospital-level data. For named hospital data in the public domain, it is hoped this will be published for 72-hour care in December 2013 and quarterly thereafter, as was done with SINAP.

Magnitude of variation

Map 6: Median time to brain imaging

For hospitals in England, the median time from arrival at hospital to brain imaging for stroke patients ranged from 16 to 788 minutes (49-fold variation). When the three hospitals with the highest medians and the three hospitals with the lowest medians are excluded, the range is 22–566 minutes, and the variation is 26-fold.

Map 7: Brain imaging within 1 hour of arrival

For hospitals in England, the proportion of stroke patients undergoing brain imaging within 1 hour of arrival at hospital ranged from 4.0% to 81.3% (20-fold variation). When the three hospitals with the highest proportions and the three hospitals with the lowest proportions are excluded, the range is 8.0–72.0%, and the variation is 9-fold.

1 The Guideline Development Group (GDG) felt that "immediately" is defined as "ideally the next slot and definitely within 1 hour, whichever is sooner", in line with the National Stroke Strategy.

2 Teasdale G, Jennett B (1974) Assessment of coma and impaired consciousness. A practical scale. *Lancet* 2(7872):81-84.

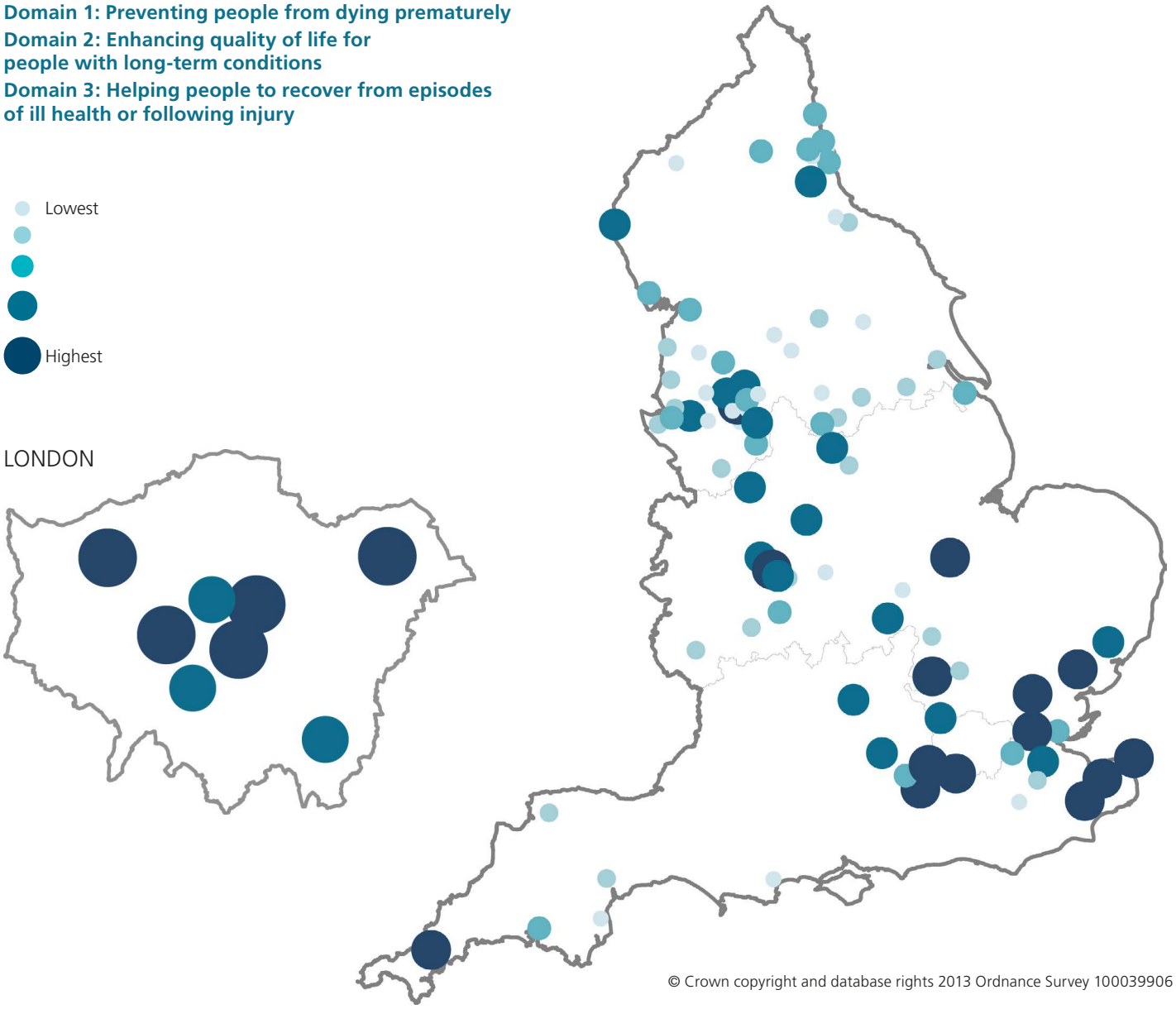
3 The GDG felt that "as soon as possible" is defined as "within a maximum of 24 hours after onset of symptoms".

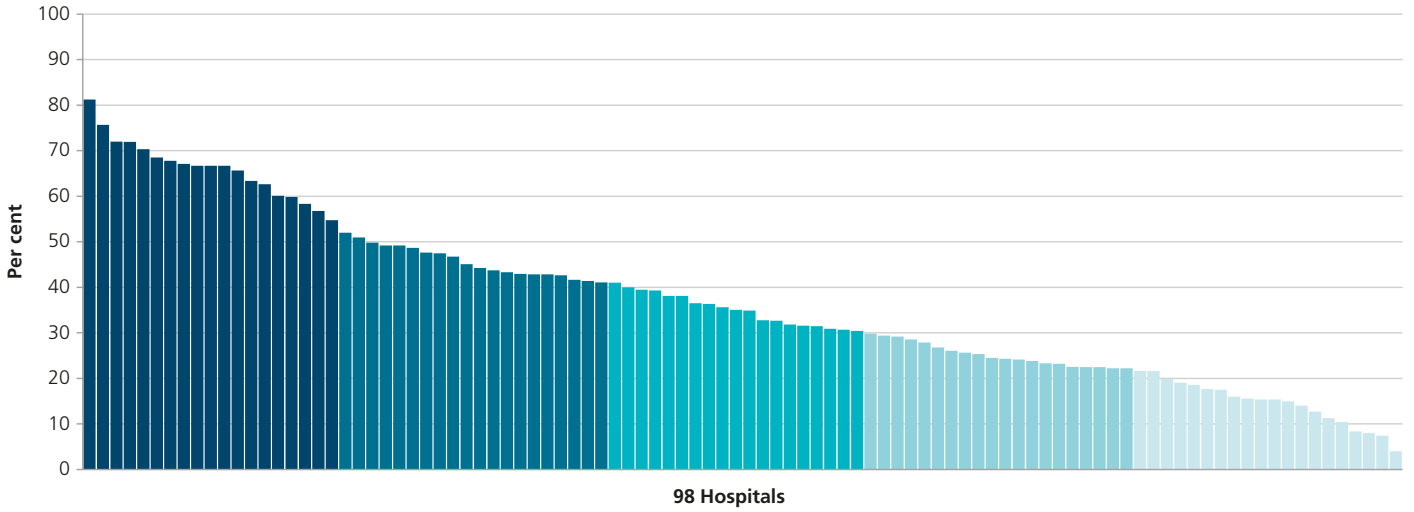
IMAGING SERVICES

Map 7: Proportion (%) of stroke patients undergoing brain imaging within 1 hour of arrival at hospital by hospital

October–December 2012

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



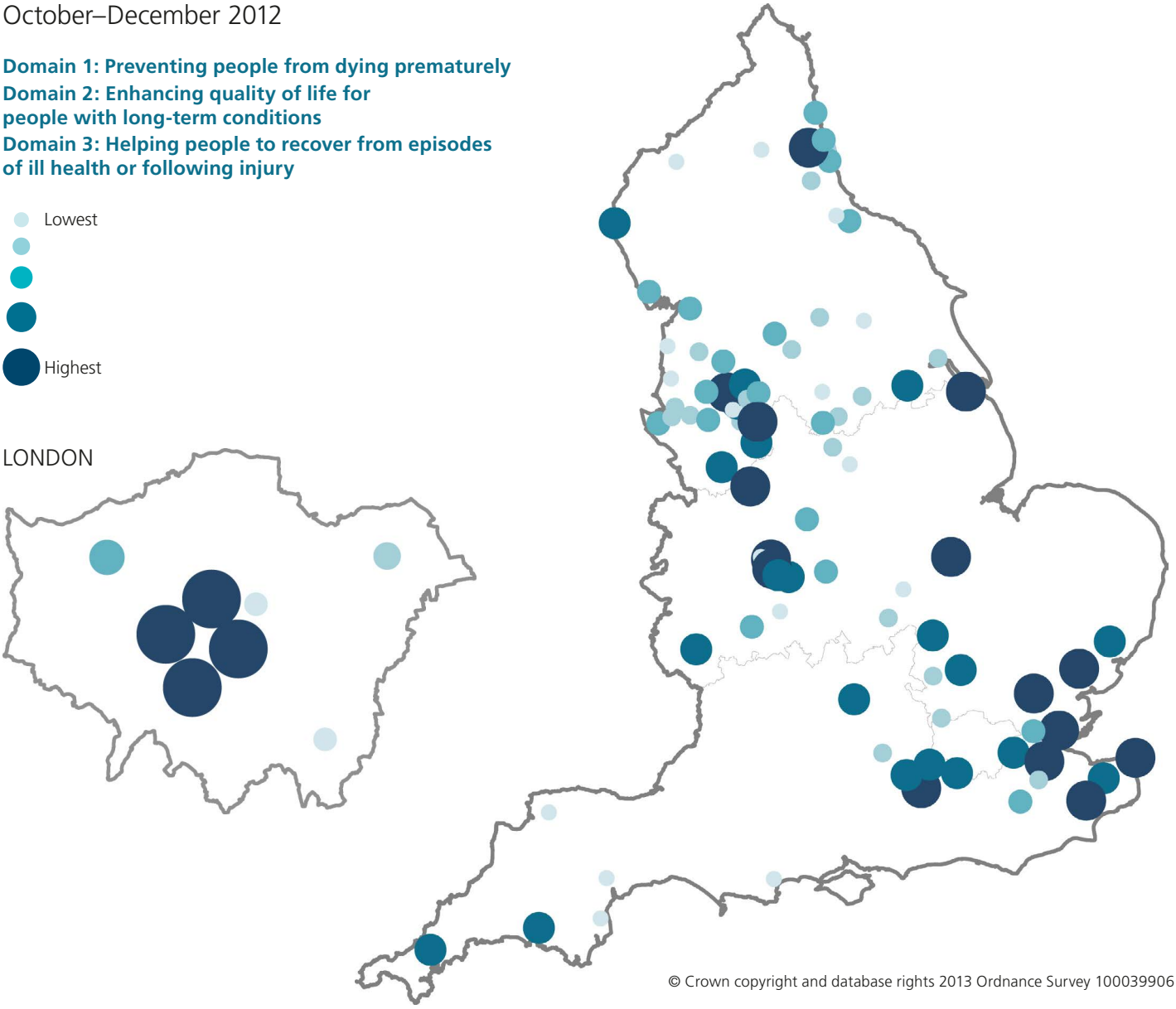


IMAGING SERVICES

Map 8: Proportion (%) of stroke patients undergoing brain imaging services within 24 hours of arrival at hospital by hospital

October–December 2012

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



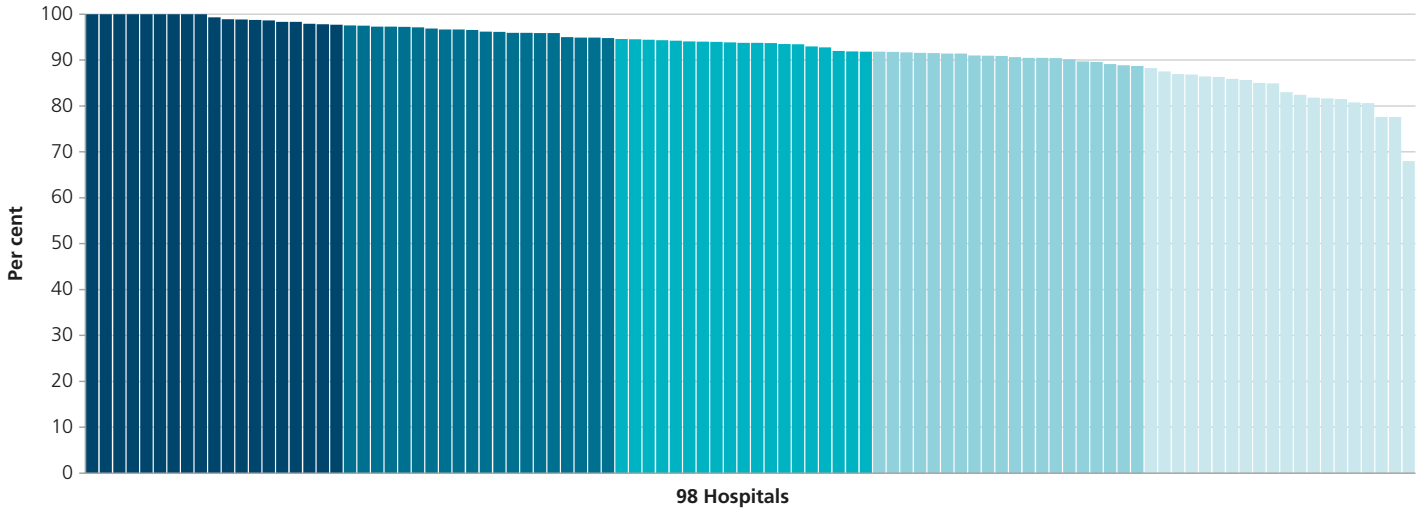


Table 6.1: Brain imaging at hospitals for patients with stroke October–December 2012: magnitude of variation data

Map	Description	Range	Fold difference	Range after exclusions	Fold difference after exclusions
6	Median time to brain imaging	16–788 minutes	49	22–566 minutes	26
7	Brain imaging within 1 hour of arrival at hospital	4.0–81.3%	20	8.0–72.0%	9
8	Brain imaging within 24 hours of arrival at hospital	68–100%	1.5	77.6–100%	1.3

Map 8: Brain imaging within 24 hours of arrival

For hospitals in England, the proportion of stroke patients undergoing brain imaging within 24 hours of arrival at hospital ranged from 68% to 100% (1.5-fold variation). When the three hospitals with the highest proportions and the three hospitals with the lowest proportions are excluded, the range is 77.6–100%, and the variation is 1.3-fold.

Data for the magnitude of variation for Maps 6–8 are shown in Table 6.1.

Reasons for the degree of variation observed, particularly for median time to imaging (Map 6), and proportion of patients undergoing brain imaging within 1 hour (Map 7), include:

- lack of understanding by the admitting clinical teams of the need for early brain imaging in acute stroke;
- 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 scan in each hospital is not known:

- the column chart for Map 7 shows that at 77 of 98 hospitals less than 50% of stroke patients, one in two people who had a stroke, underwent brain imaging within 1 hour of arrival at hospital;
- the column chart for Map 8 shows that at 25 of 98 hospitals less than 90% of stroke patients underwent brain imaging within 24 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, pages 193–194). 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 admitted stroke patients;
- to ensure that access to brain imaging for stroke patients meets NICE standards;
- to review the reporting of time to first scan for stroke patients among service providers;
- to negotiate a commitment that all hospital Trusts will report in the SSNAP audit.

RESOURCES

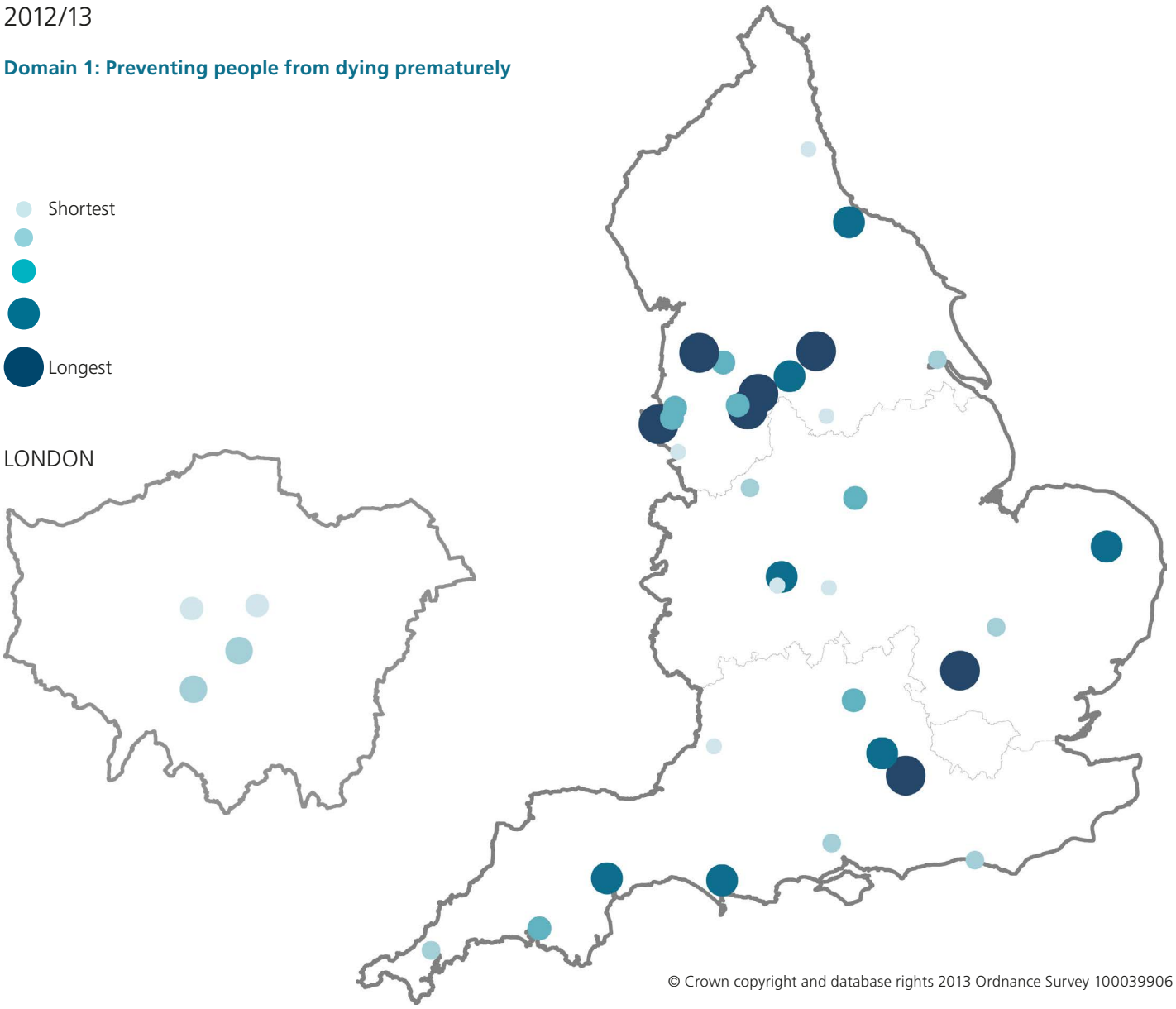
- Department of Health (2007) National Stroke Strategy. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_081059.pdf
- Department of Health (2008) Implementing the National Stroke Strategy – an imaging guide. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_085146
- Department of Health (2006) Improving stroke services: a guide for commissioners. http://webarchive.nationalarchives.gov.uk/20080728093105/dh.gov.uk/en/publicationsandstatistics/publications/publications
- Public Health England (PHE) Stroke Prevalence Modelling Briefing Document, & Stroke Prevalence Estimates Dec 2011. http://www.apho.org.uk/default.aspx?RID=61214
- NICE (2008) Diagnosis and initial management of acute stroke and transient ischaemic attack (TIA) (CG68). [In future, to be reviewed by The National Clinical Guidelines Centre for Acute and Chronic Conditions (NCGC-ACC).] http://guidance.nice.org.uk/CG68
- NICE Pathways. Stroke overview. http://pathways.nice.org.uk/pathways/stroke
- Intercollegiate Stroke Working Party (2012) National clinical guideline for stroke. 4th edition. Royal College of Physicians. http://www.rcplondon.ac.uk/resources/stroke-guidelines
- NHS Improving Quality. NHS Improvement – Stroke: Supporting the development of stroke care networks. Accelerating Stroke Improvement. http://www.improvement.nhs.uk/stroke/AcceleratingStrokeImprovement/tabid/134/Default.aspx
- NHS Improving Quality. NHS Improvement – Diagnostics: Supporting the delivery of high quality and effective diagnostics services. Supporting the National Stroke Strategy. http://www.improvement.nhs.uk/diagnostics/ImagingtoSupportStroke/tabid/97/Default.aspx
- Department of Health (2010) Action on stroke services: an evaluation toolkit ("ASSET"). http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4134498
- Sentinel Stroke National Audit Programme (SSNAP) As of January 2013, SSNAP replaced the Stroke Improvement National Audit Programme (SINAP); 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
- Royal College of Physicians, Clinical Effectiveness and Evaluation Unit on behalf of the Intercollegiate Stroke Working Party (2013) Sentinel Stroke National Audit Programme (SSNAP) Clinical audit first pilot public report. National results. August 2013. Based on stroke patients admitted to hospital between January – March 2013. http://www.rcplondon.ac.uk/sites/default/files/ssnap_first_pilot_national_report_january_-_march_2013_admissions_with_appendices_.pdf

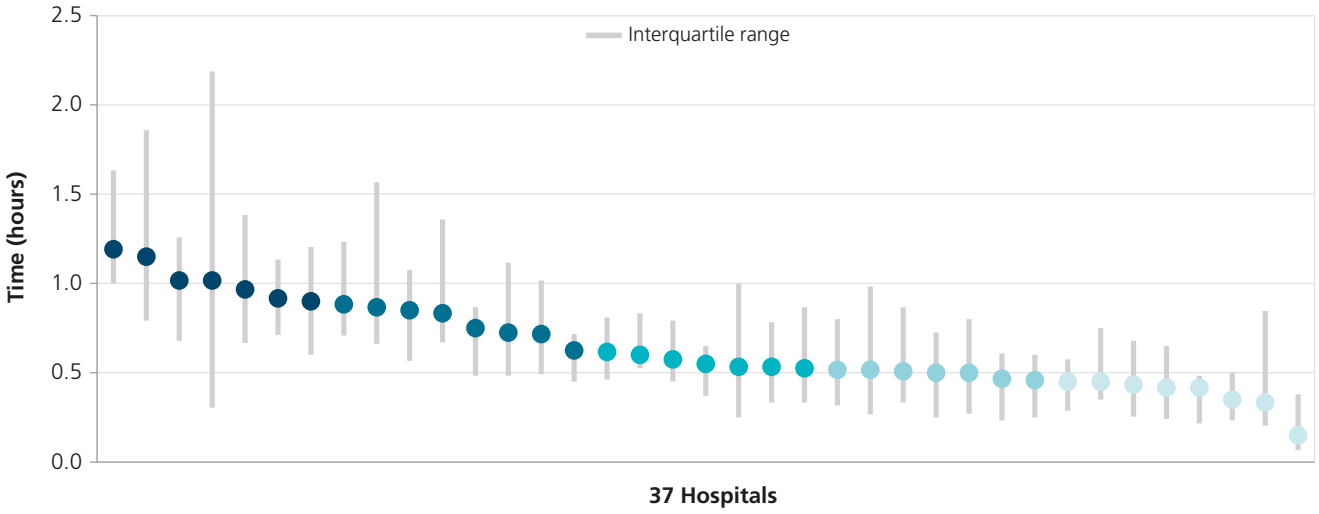
IMAGING SERVICES

Map 9: Median time (hours) to head computed axial tomography (CT) for patients admitted directly to hospital[1] meeting NICE head injury guidelines[2] by hospital

2012/13

Domain 1: Preventing people from dying prematurely





Context

Computed axial tomography (a CAT or 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.[3]

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

- bleeding;
- brain injury;
- fractures of the skull.

For the assessment of head injuries, CT scanning is superior to 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.

Maps 9 and 10 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 not influenced by clinical bias or preferences.

The data for these indicators are from the Trauma Audit and Research Network (TARN).[4] The TARN database is the largest trauma database 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.

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 9: Head injuries

For median time to head CT for patients admitted directly to hospital meeting NICE head injury guidelines, the range is from 0.15 to 1.2 hours (8-fold variation) across 37 hospitals in England.

Map 10: Pelvic injuries

For median time to pelvic CT for patients admitted directly to hospital with pelvic injury, the range is from 0.17 to 2.2 hours (13-fold variation) across 28 hospitals in England.

Data for the magnitude of variation for Maps 9–10 are shown in Table 9.1.

When interpreting the magnitude of variation, it is important to note:

- some trauma-receiving hospitals care for only very small numbers of patients in these and other categories;[5]
- some trauma-receiving hospitals do not submit any data, and therefore coverage is incomplete.

Availability of data poses problems for commissioners, especially in localities where there is no data coverage.

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. Without much improved data, it will be difficult to plan networked services effectively, and improve both quality and safety."*[6]

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
3 The Royal College of Radiologists. FAQs in radiology. http://www.rcr.ac.uk/content.aspx?PageID=504
4 TARN is a collaboration of hospitals from England, Wales, Ireland and other parts of Europe, established in 1989. https://www.tarn.ac.uk/
5 Indicator values created from <10 eligible patients have been removed because of insufficient reliability and the potential to be disclosive.
6 National Audit Office (2010) Major trauma care in England. http://www.nao.org.uk/publications/0910/major_trauma_care.aspx

Table 9.1: Median time to CT for trauma injuries by hospital 2012/13: magnitude of variation data

Map	Description	Number of hospitals	Range	Fold difference
9	Brain injuries	37	0.15–1.2 hours	8
10	Pelvic injuries	28	0.17–2.2 hours	13

Options for action

Based on the NAO recommendations, to reduce unwarranted variation in the median time to CT scan for various injuries:

- commissioners should use their commissioning powers to require all acute and foundation Trusts with emergency departments that receive trauma patients to submit data to TARN. The data collected should be used to inform the ongoing development of trauma networks;
- using TARN data, hospital Trusts should benchmark performance against that of other Trusts to help identify best practice and ways to improve patient care;
- TARN should undertake routine analysis of the data for clinical commissioning groups (CCGs), major trauma operational delivery networks, the Major Trauma Clinical Reference Group for NHS England, Monitor, and the Care Quality Commission (CQC), and the analyses used to manage the performance of trauma networks.

Following the NAO recommendations, the major trauma operational delivery 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 has been 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, however, 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 (2007) Head injuries (CG56) Triage, assessment, investigation and early management of head injury in infants, children and adults. http://guidance.nice.org.uk/CG56
- National Audit Office (2010) Major trauma care in England. http://www.nao.org.uk/report/major-trauma-care-in-england/
- NICE guidance in development. Complex fractures – assessment and management of complex fractures (including pelvic fractures and open fractures of limbs). Scheduled for publication in 2015. http://guidance.nice.org.uk/CG/Wave0/647
- Gibb I, Denton E (no date given; post 2010) Guidelines for imaging the injured blast/ballistic patient in a Mass Casualty scenario. http://system.improvement.nhs.uk/ImprovementSystem/ViewDocument.aspx?path=Diagnostics%2fNational%2fWebsite%2fImaging%20Guidelines%20for%20Major%20Incidents%20June1%202011.pdf

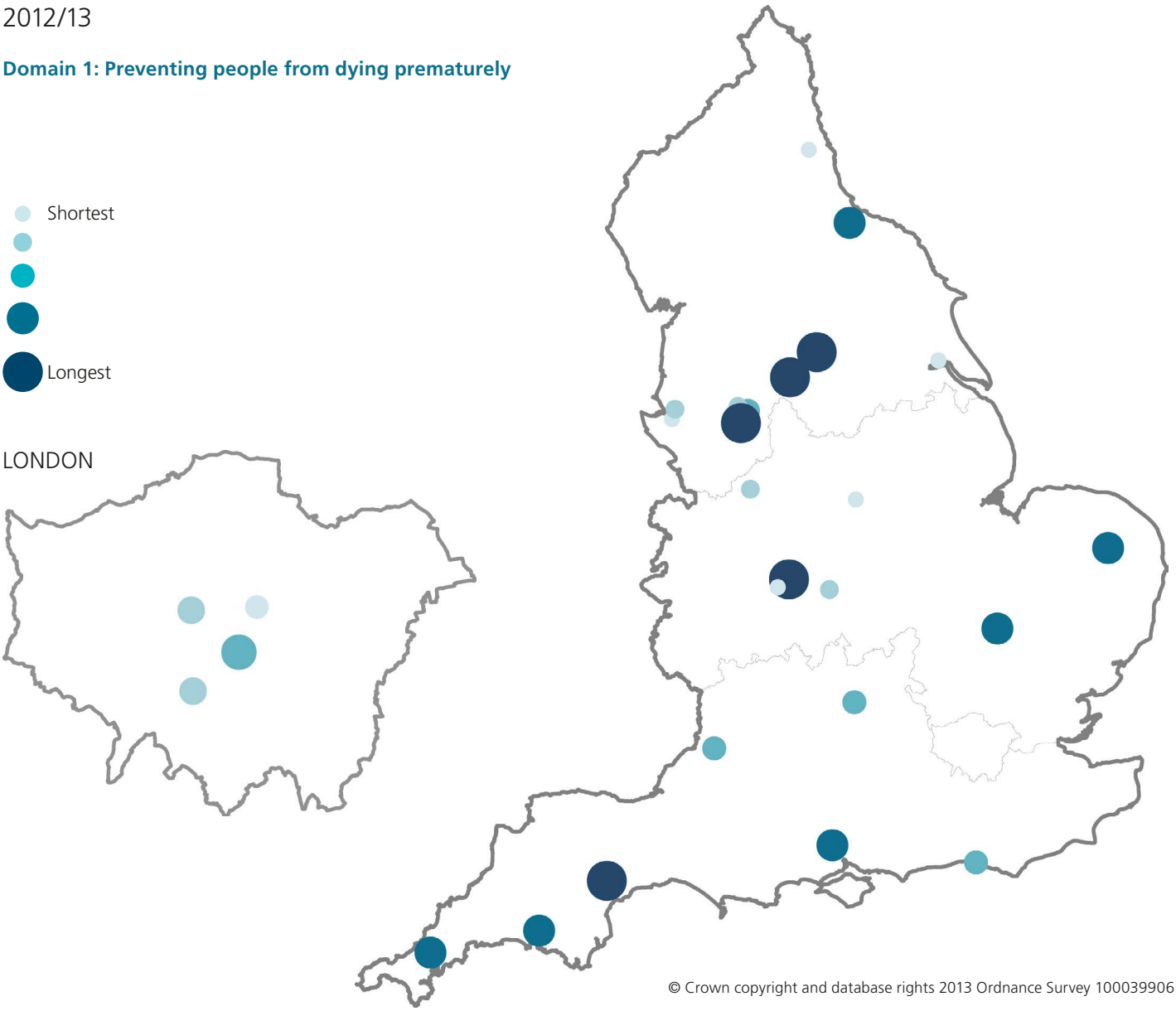
7 Whole body, and abdominal CT are counted as CT to pelvis.

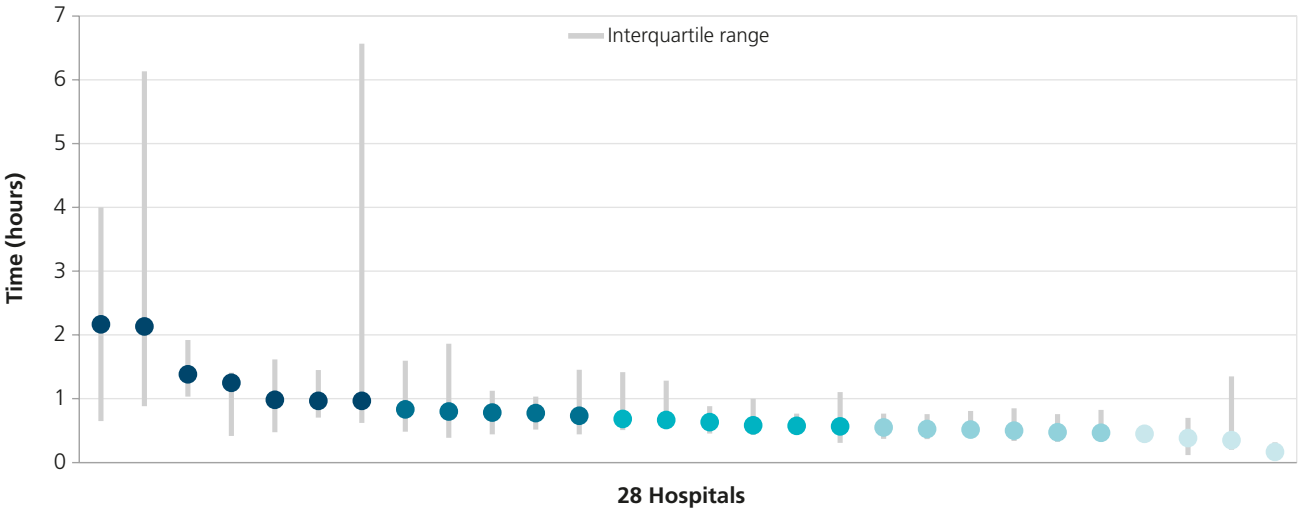
IMAGING SERVICES

Map 10: Median time (hours) to pelvic computed axial tomography (CT) for patients admitted directly to hospital[1] with pelvic injury[7] by hospital

2012/13

Domain 1: Preventing people from dying prematurely



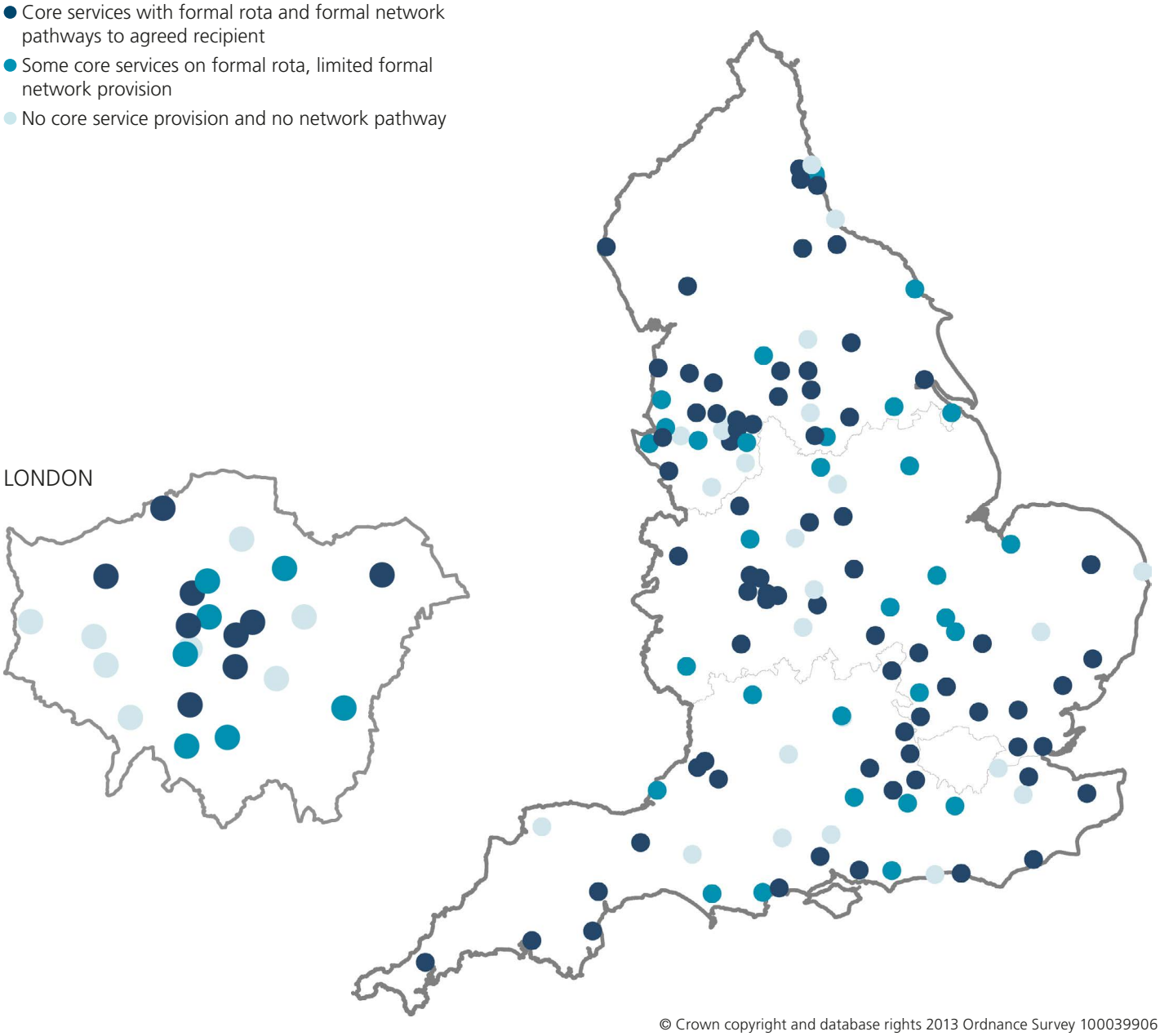


IMAGING SERVICES

Map 11: Provision of endovascular aneurysm repair (EVAR) offered by interventional radiology services "within hours"[1] by hospital Trust

November 2012

Domain 1: Preventing people from dying prematurely



Context

An aneurysm is caused by a weakness in the wall of an artery: when blood passes along the vessel, the blood pressure causes the artery wall to bulge and enlarge. Although aneurysms can occur in any artery, the most common place for aneurysm formation is the abdominal aorta. Aneurysms can be asymptomatic, but with a larger aneurysm (>5.5 cm) there is a risk of rupture, which can cause severe internal bleeding. Four out of five people with a ruptured aortic aneurysm will die.[2] To treat the risk of rupture, grafting is performed, via open surgery or endovascular aneurysm repair (EVAR; see Maps 12A and 12B).

Endovascular aneurysm repair is a "keyhole" surgery technique in which an incision is made in the groin 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 the artery walls.

NICE does not currently recommend EVAR in people whose aortic aneurysm has already ruptured.

In the UK EVAR Trial (*n*=1252 patients), the 30-day mortality rate for EVAR 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 have 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 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. 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. 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 Maps 13A and 13B provides a proxy for monitoring the equitable provision of services.

Data for Map 11 are based on responses to a survey of Interventional Radiology departments in England conducted during March to May 2012 by NHS Improvement – Diagnostics: the data are not continuous but fall into three categories. The map shows provision of EVAR by interventional radiology services.

Magnitude of variation

Map 11: Access to EVAR

For hospital Trusts in England (*n*=151), for EVAR:

- 81 (53.6%) provided core services with a formal rota and had formal network pathways to an agreed recipient (darkest shade of teal);
- 37 (24.5%) had some core services on a formal rota and limited formal network provision (mid shade of teal);
- 33 (21.9%) had no core service provision and no network pathway (lightest shade of teal).

Thus, one in five hospital Trusts were not able to provide core services for EVAR, nor did they have a network pathway to an agreed recipient.

1 No definition for "within hours" was supplied by the instigator of the survey.

2 Reimerink JJ, van den Laan MJ, Koelemay MJ, Balm R, Legemate DA (2013) Systematic review and meta-analysis of population-based mortality from ruptured abdominal aortic aneurysm. *British Journal of Surgery* 100; 1405-1413. doi: 10.1002/bjs.9235

3 The United Kingdom EVAR Trial investigators (2010) Endovascular versus Open Repair of Abdominal Aortic Aneurysm. New England Journal of Medicine 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 (2010) Long-Term Outcome of Open or Endovascular Repair of Abdominal Aortic Aneurysm. *New England Journal of Medicine* 362; 1881-1889. http://www.nejm.org/doi/full/10.1056/NEJMoa0909499

5 Stather P, Sidloff D, Dattani N et al (2013) Systematic review and meta-analysis of the early and late outcomes of open and endovascular repair of abdominal aortic aneurysm. *British Journal of Surgery* 100; 863-872. doi: 10.1002/bjs.9101

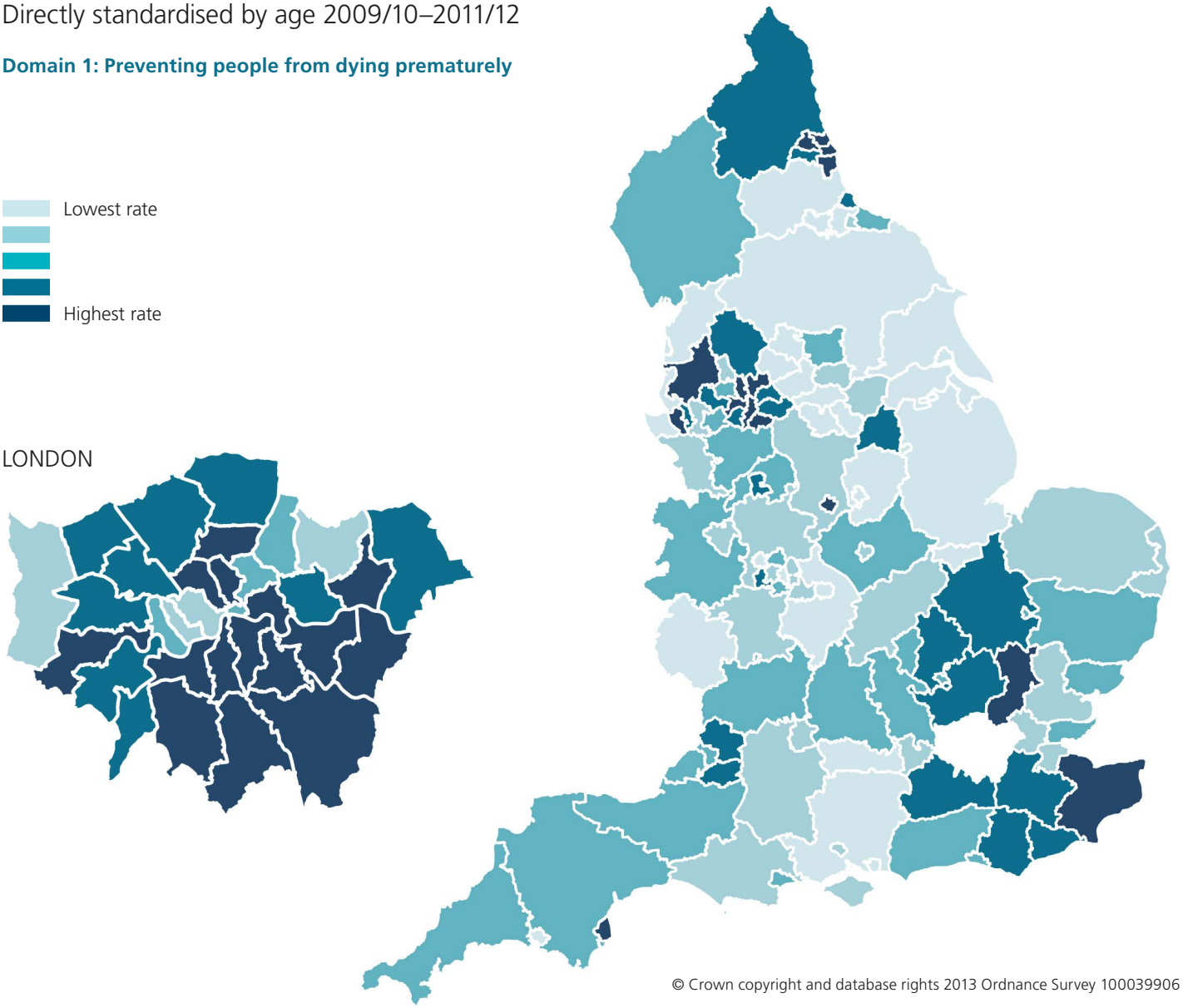
6 Biancari F, Catania A, D'Adrea V (2011) Elective Endovascular vs. Open Repair for Abdominal Aortic Aneurysm in Patients Aged 80 years and Older: Systematic Review and Meta-Analysis. *European Journal of Vascular & Endovascular Surgery* 42; 571-576.

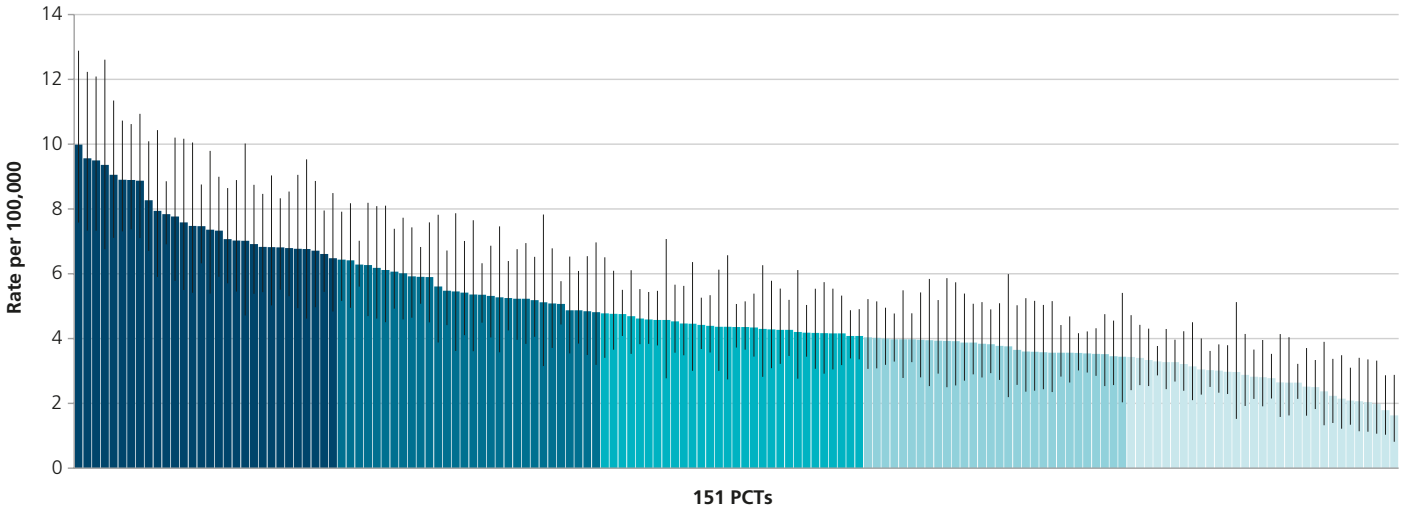
IMAGING SERVICES

Map 12A: Rate of endovascular aneurysm repair (EVAR) procedures for abdominal aortic aneurysm (AAA) per population by PCT

Directly standardised by age 2009/10–2011/12

Domain 1: Preventing people from dying prematurely



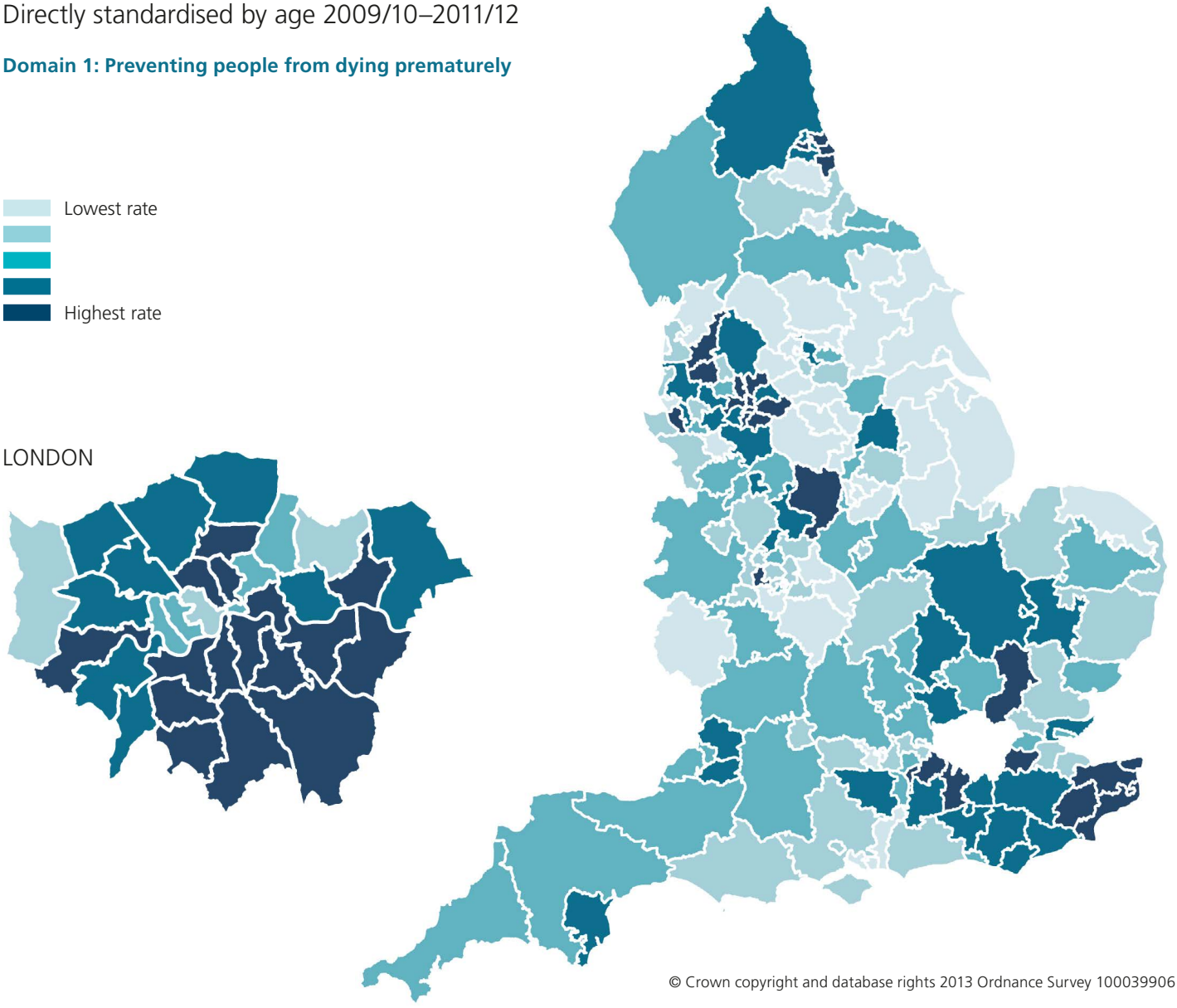


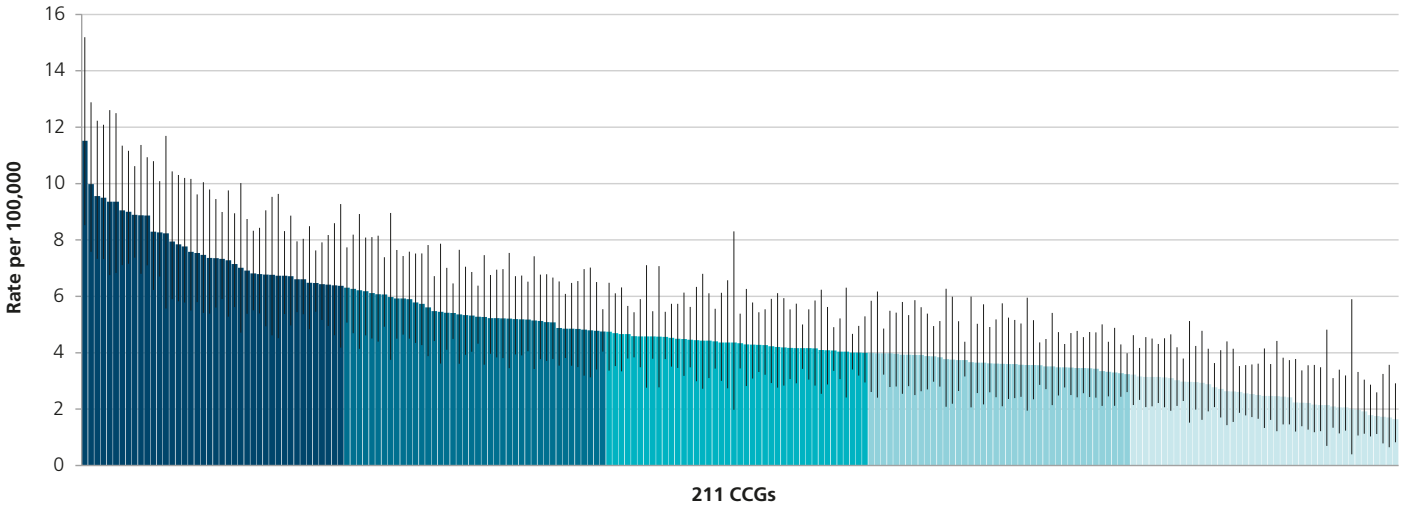
IMAGING SERVICES

Map 12B: Rate of endovascular aneurysm repair (EVAR) procedures for abdominal aortic aneurysm (AAA) per population by CCG

Directly standardised by age 2009/10–2011/12

Domain 1: Preventing people from dying prematurely



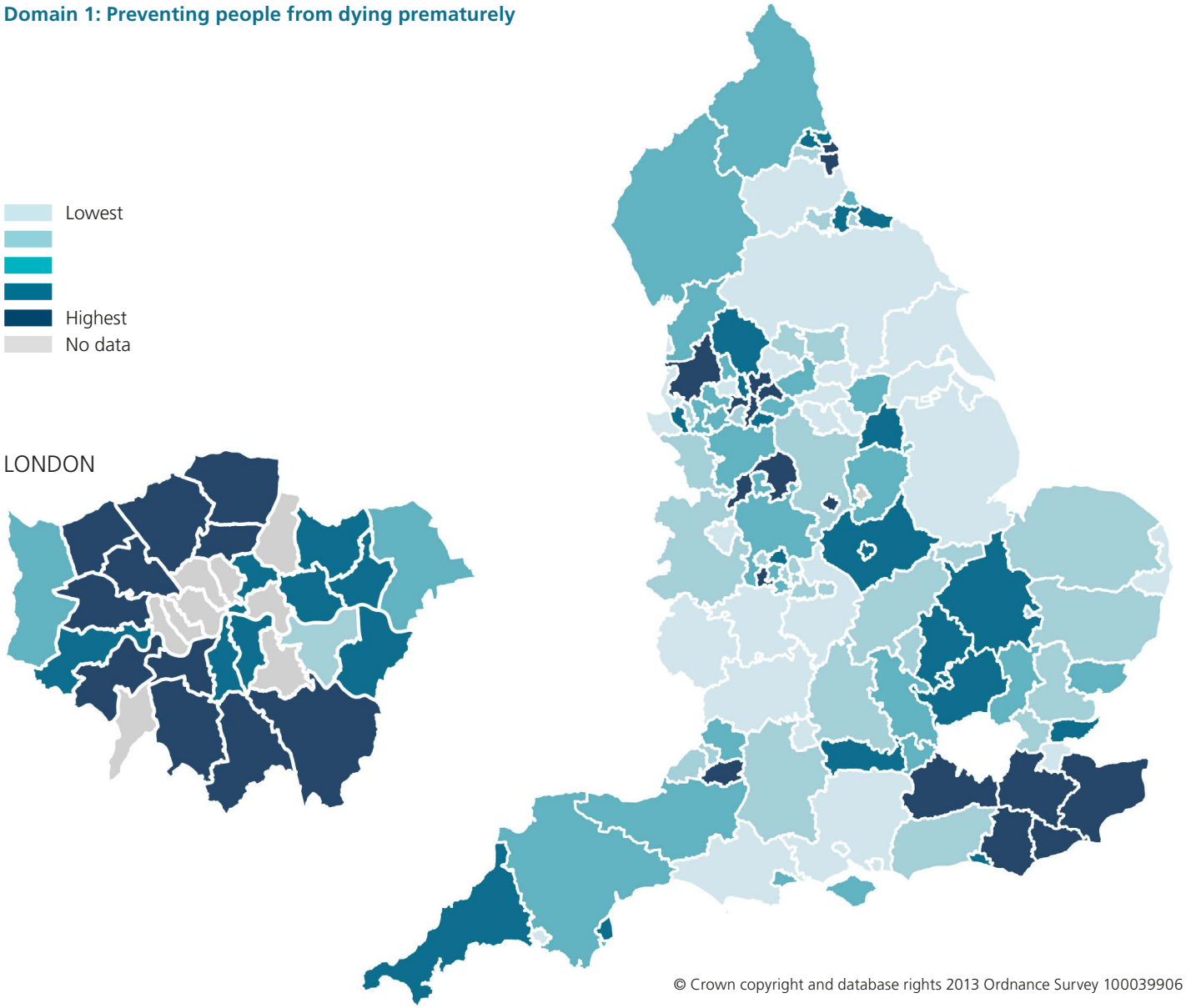


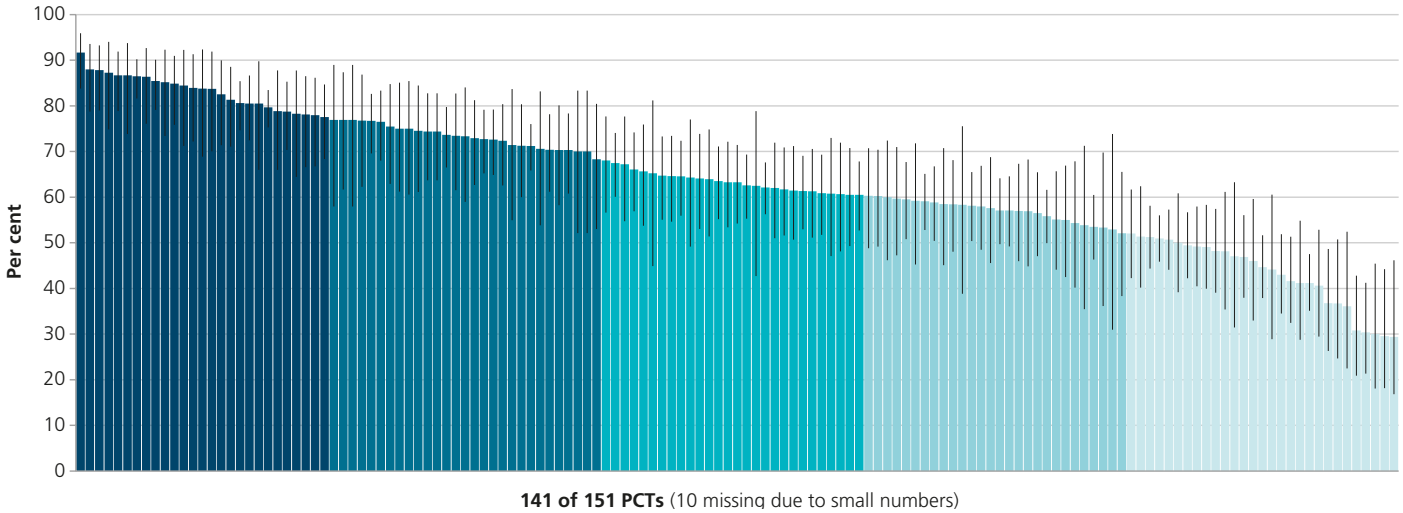
IMAGING SERVICES

Map 13A: Proportion (%) of elective procedures for abdominal aortic aneurysm (AAA) that were EVAR by PCT

2009/10–2011/12

Domain 1: Preventing people from dying prematurely





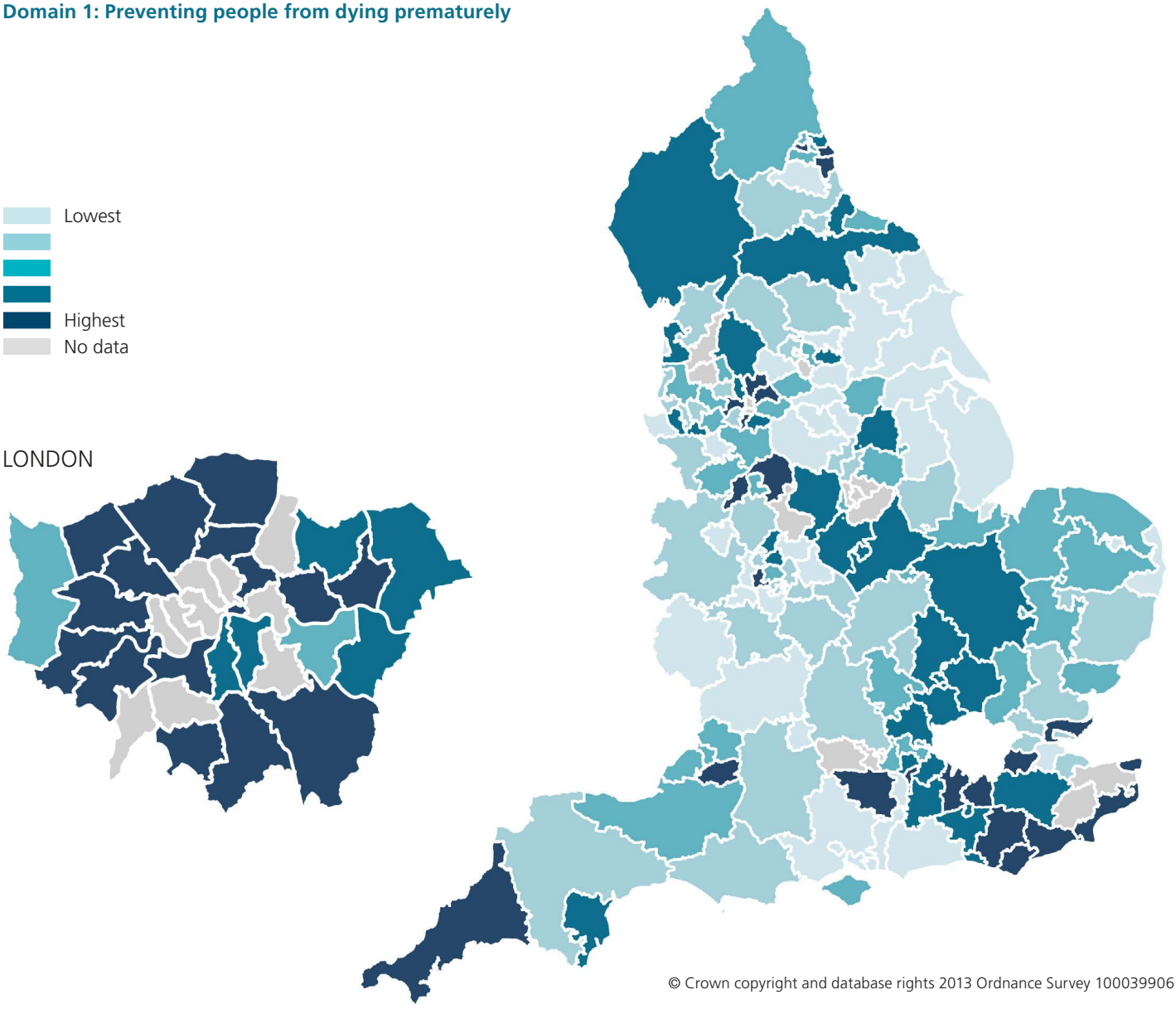
141 of 151 PCTs (10 missing due to small numbers)

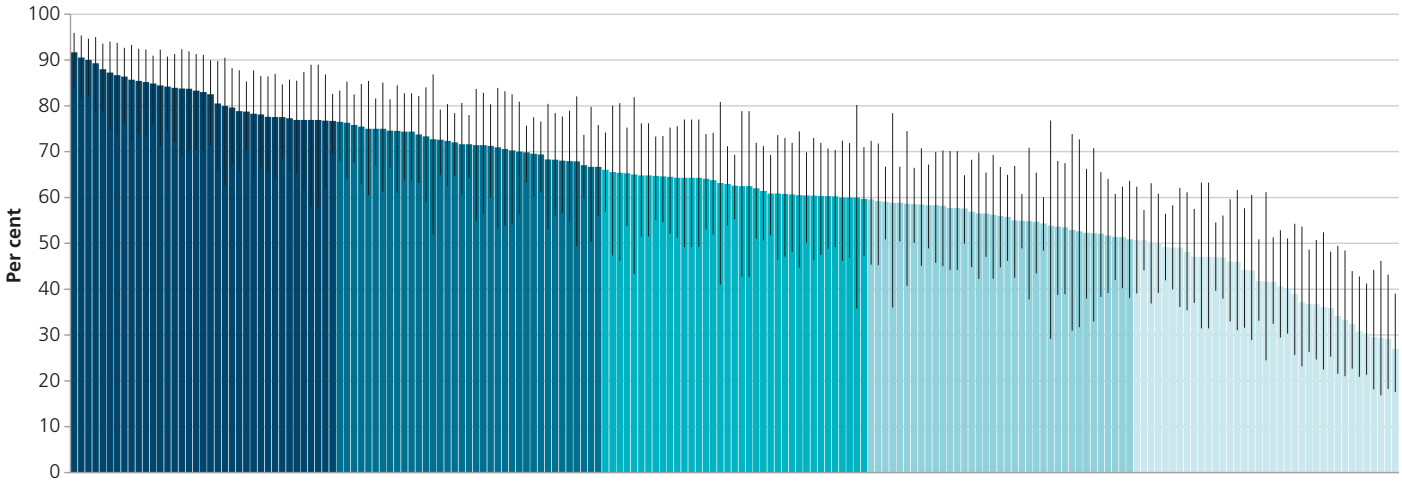
IMAGING SERVICES

Map 13B: Proportion (%) of elective procedures for abdominal aortic aneurysm (AAA) that were EVAR by CCG

2009/10–2011/12

Domain 1: Preventing people from dying prematurely





185 of 211 CCGs (26 missing due to small numbers)

Table 12.1: Rate of EVAR procedures for AAA per 100,000 population by PCT and CCG 2009/10–2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	1.6–10.0	6	2.1–8.9	4.3
CCG	1.6–11.5	7	2.0–9.0	4.5

Table 13.1: Proportion (%) of elective procedures for AAA that were EVAR by PCT and CCG 2009/10–2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	29.4–91.7	3.1	36.1–86.7	2.4
CCG	27.0–91.7	3.4	32.4–86.7	2.7

Maps 12A and 12B: EVAR activity

For PCTs in England, the rate of EVAR procedures for AAA was 1.6–10.0 per 100,000 population (6-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 2.1–8.9 per 100,000 population, and the variation is 4.3-fold (see Table 12.1 and Map 12A).

For CCGs in England, the rate of EVAR procedures for AAA was 1.6–11.5 per 100,000 population (7-fold variation). When the seven CCGs with the highest rates and the seven CCGs with the lowest rates are excluded, the range is 2.0–9.0 per 100,000 population, and the variation is 4.5-fold (see Table 12.1 and Map 12B).

Maps 13A and 13B: EVAR activity in relation to open surgery for AAA

For PCTs in England, the proportion of elective procedures for AAA that were EVAR ranged from 29.4% to 91.7% (3.1-fold variation).[1] When the five PCTs with the highest proportions and the five PCTs with the lowest proportions are excluded, the range is 36.1–86.7%, and the variation is 2.4-fold (see Table 13.1 and Map 13A).

For CCGs in England, the proportion of elective procedures for AAA that were EVAR ranged from 27.0% to 91.7% (3.4-fold variation).[2] When the six CCGs with the highest proportions and the six CCGs with the lowest proportions are excluded, the range is 32.4–86.7%, and the variation is 2.7-fold (see Table 13.1 and Map 13B).

The degree of variation after exclusions in the balance between EVAR and open surgery for AAA is relatively large irrespective of geography. Based on an assumption that there is no difference in the prevalence of aneurysms (>5.5 cm), potential reasons for variation in the provision of EVAR include differences in:

- access to EVAR, either through the local provider or via a referral pathway;
- surgical signature in different localities.

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;
- the rate of activity in relation to need;
- the balance between EVAR and open surgery locally;
- levels of access to EVAR;
- local care pathways for aneurysms;
- the speed of centralisation to specialist services.

Commissioners need to ensure that their hospital service has a clear pathway for referral if open surgery for AAA and EVAR are not provided.

RESOURCES

- NICE (2009) Abdominal aortic aneurysm – abdominal stent-grafts (TA167). 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.mhra.gov.uk/home/groups/clin/documents/news/con103000.pdf

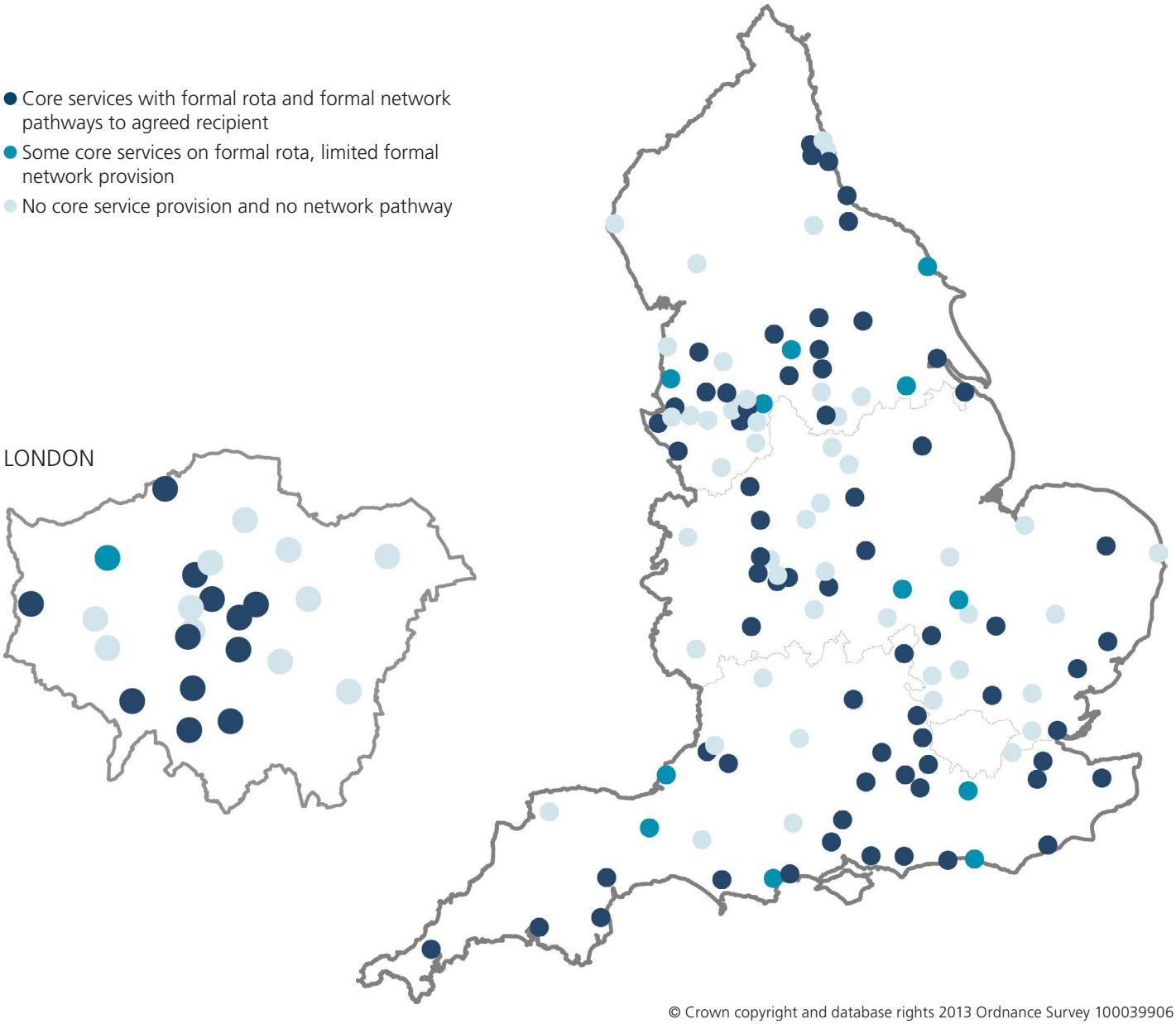
1 Owing to small numbers, data from 10 PCTs have been removed.
2 Owing to small numbers, data from 26 CCGs have been removed.

IMAGING SERVICES

Map 14: Provision of uterine fibroid embolisation procedures offered by interventional radiology services "within hours"[1] by hospital Trust

November 2012

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



Context

Fibroids are non-cancerous tumours in or around the uterus; they are also referred to as myomas or fibromyomas. About 40% of women will develop fibroids at some stage in their life, but they occur most commonly in women who are 30–50 years old. Fibroids develop in about 55% of women who have an African–Caribbean background.

In many women, fibroids do not cause symptoms; however, 1 in 3 women with fibroids experience pelvic pain or heavy bleeding. Fibroids can also exert pressure on the bladder or bowel. Medication is the first line of treatment but, if medication is ineffective, in severe cases surgery or other non-surgical interventions are considered.

Uterine fibroid embolisation is a non-surgical procedure for treating fibroids. A catheter is inserted via the groin into the uterine arteries. Contrast medium is used to help the operator, an interventional radiologist, identify the blood supply feeding the fibroids. Under X-ray guidance, micro-particles are injected to block those blood vessels and thereby shrink the fibroids. This technique is much less invasive than open surgery, blood loss is reduced, and recovery time is shorter than that for hysterectomy. Re-growth is rare after uterine fibroid embolisation, whereas re-growth usually occurs when any hormonal treatment ceases, and it can occur after laser treatment.

Uterine fibroid embolisation is usually recommended for women who have large fibroids. Over 90% of women are relieved of symptoms, and fibroid volumes can be reduced by up to 60%. Uterine fibroid embolisation, however, can fail in 5–10% of women, and symptoms can recur in 25%. Typically, women are admitted to hospital for pain relief immediately after the procedure.

Owing to potential effects on the uterus and, rarely, the ovaries, it is unclear whether the procedure should be offered to women who still want to conceive.

Data for Map 14 are based on responses to a survey of Interventional Radiology departments in England conducted during March to May 2012 by NHS Improvement – Diagnostics: the data are not continuous but fall into three categories.

Magnitude of variation

For hospital Trusts in England (n=151), for uterine fibroid embolisation:

- 78 (51.7%) provided core services with a formal rota and had formal network pathways to an agreed recipient (darkest shade of teal);
- 13 (8.6%) had some core services on a formal rota and limited formal network provision (mid shade of teal);
- 60 (39.7%) had no core service provision and no network pathway (lightest shade of teal).

Thus, two of every five hospital Trusts were not able to provide core services for uterine fibroid embolisation, nor did they have a network pathway to an agreed recipient.

Potential reasons for variation in service provision for uterine fibroid embolisation include differences in:

- the prevalence of symptomatic uterine fibroids in the local population;
- the balance of medical treatment, surgical treatment and non-surgical interventions for fibroids that is available locally;
- access to uterine fibroid embolisation through local providers or via a formal network pathway;
- the availability of skilled operators.

Options for action

When addressing unwarranted variation in uterine fibroid embolisation, commissioners, clinicians and service providers need to review:

- the need for uterine fibroid embolisation in the local population;
- the rate of activity in relation to need;
- levels of access to uterine fibroid embolisation;
- local care pathways for uterine fibroids;
- availability of training opportunities for radiologists in the treatment of uterine fibroids.

RESOURCES

- NICE (2010) Uterine artery embolisation for fibroids (IPG367). http://www.nice.org.uk/guidance/IPG367
- Interventional Radiology: Improving Outcomes and Quality for Patients (2009). http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_109130
- Interventional Radiology: a guide to service delivery (2010) Gateway ref 15003. http://www.bsir.org/Images/_Members/_administrator/File/ir_roadmap_dh_121906.pdf

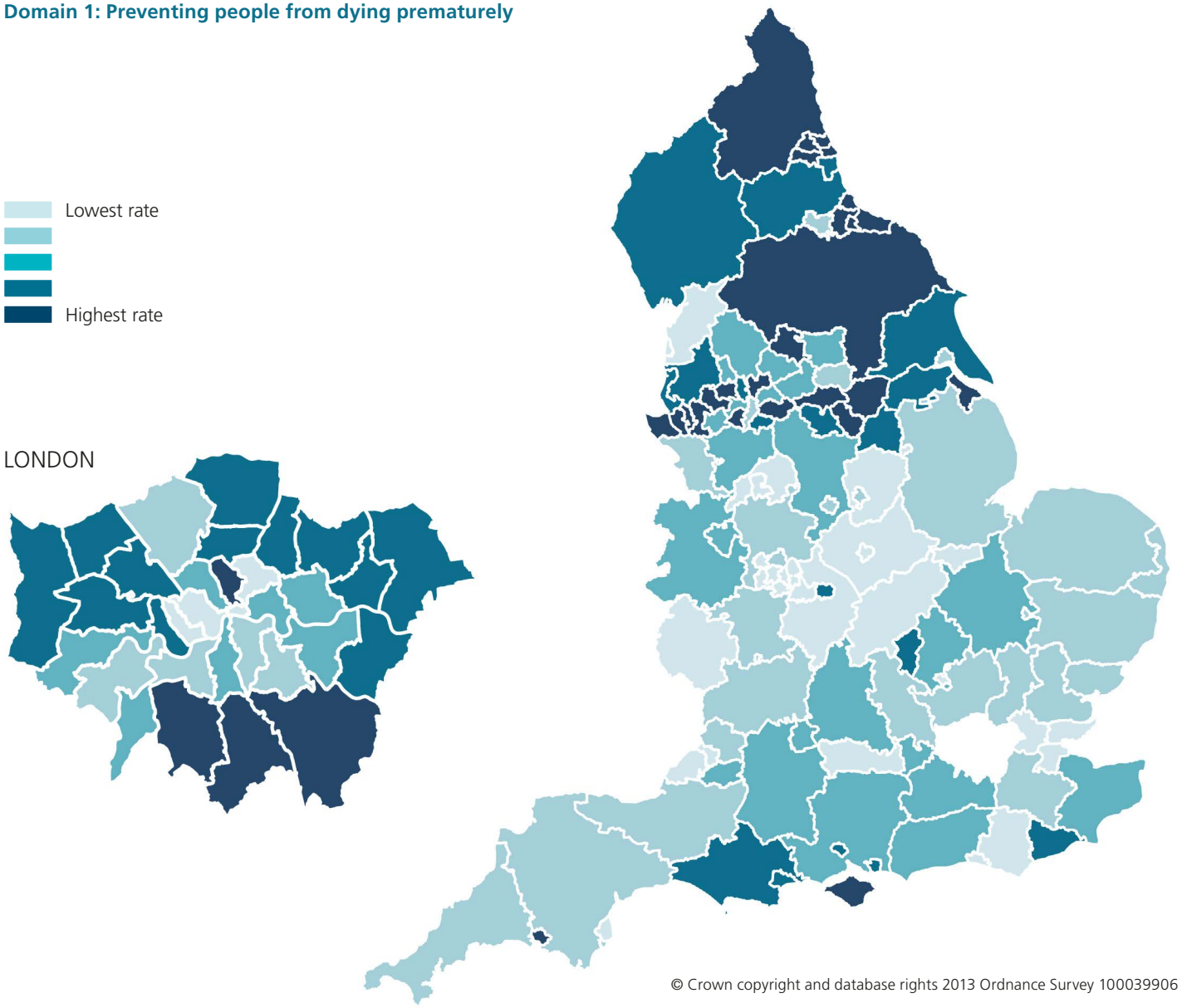
1 No definition for "within hours" was supplied by the instigator of the survey

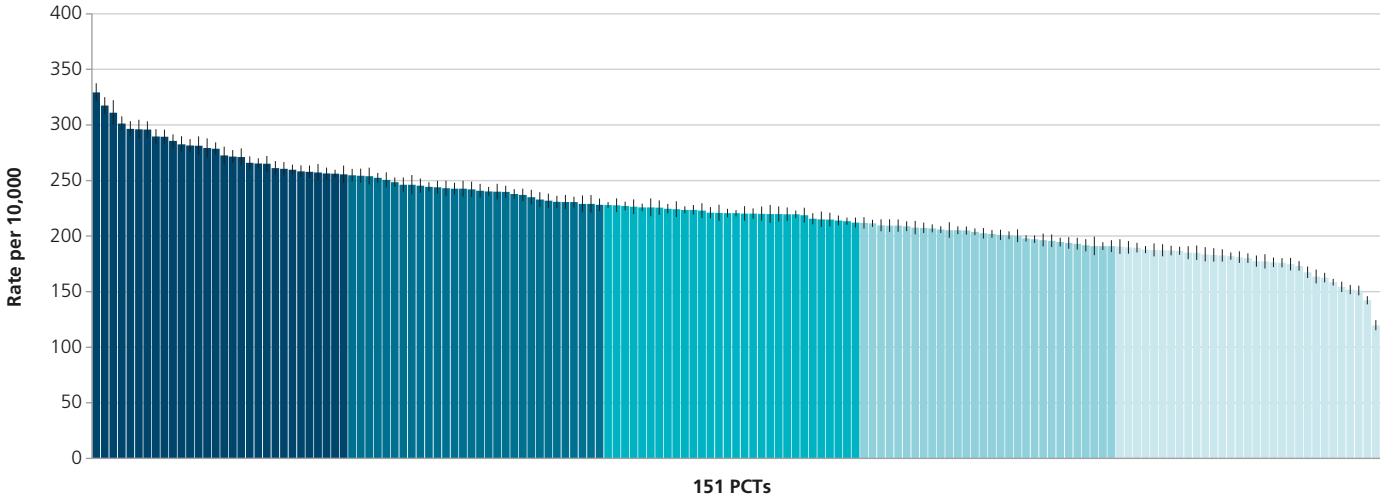
ENDOSCOPY SERVICES

Map 15A: Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per population by PCT

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely





Context

Colonoscopy is an investigation of the lining of the entire large bowel (colon) using an endoscope. Flexible sigmoidoscopy is similar to colonoscopy, but confined to an examination of the sigmoid colon (last part of the large bowel) using a flexible endoscope.

Both procedures are used to diagnose or exclude cancer of the bowel or to look for pre-cancerous polyps, small growths on the inner lining of the bowel or rectum. If polyps are found on examination, they are often removed. Flexible sigmoidoscopy and colonoscopy can also be used in the diagnosis of, and monitoring of treatment for, inflammatory bowel disease (IBD). About 60–70% of procedures are performed for the diagnosis of cancer, 15–20% for the diagnosis of and monitoring of treatment for IBD, and 10% for other reasons.

Flexible sigmoidoscopy is the preferred procedure in some services because sedation is not required, and it is quicker and carries less risk than colonoscopy. There is an argument that all patients with lower GI symptoms need full colonic imaging (by colonoscopy or CT colonoscopy), but this is not yet achievable in all localities.

Other countries with developed economies have higher rates of colonoscopy than the UK. In the most recent national colonoscopy audit, Scotland and Northern Ireland had higher rates of colonoscopy than England.

The National Awareness and Early Diagnosis Initiative (NAEDI) is aimed at improving cancer survival outcomes in England, including that for bowel cancer. Early diagnosis is vital. Increased demand (about 8 procedures per 1000 population per year) will soon be generated by the national flexible sigmoidoscopy screening programme, doubling the current rate of flexible sigmoidoscopy procedures.

For this indicator, the rates of colonoscopy procedures and flexible sigmoidoscopy procedures have been combined. This indicator has been mapped to two geographies:

- PCT (Map 15A);
- CCG (Map 15B).

Magnitude of variation

For PCTs in England, the rate of colonoscopy procedures and flexible sigmoidoscopy procedures ranged from 119.7 to 329.3 per 10,000 population (2.8-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 158.5–296.1 per 10,000 population (1.9-fold variation).

For CCGs in England, the rate of colonoscopy procedures and flexible sigmoidoscopy procedures ranged from 82.0 to 222.4 per 10,000 population (2.7-fold variation). When the seven CCGs with the highest rates and the seven CCGs with the lowest rates are excluded, the range is 107.4–198.2 per 10,000 population, and the variation is 1.8-fold.

The magnitudes of variation for the rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by both PCT and CCG are shown in Table 15.1; see also Maps 15A and 15B, respectively. The rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population over two financial years is shown in Table 15.2. The variation in the rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by PCT after exclusions appears to have decreased very slightly since 2009/10.

Table 15.1: Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by PCT and CCG 2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	119.7–329.3	2.8	158.5–296.1	1.9
CCG	82.0–222.4	2.7	107.4–198.2	1.8

Table 15.2: Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per 10,000 population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2009/10	71.6–194.1	2.7	88.0–175.6	2.0	Map 1, Atlas 2.0 (2011)
2011/12	119.7–329.3	2.8	158.5–296.1	1.9	

Reasons for variation in the combined rate for colonoscopy and flexible sigmoidoscopy procedures are historical, reflecting differences in:

- number of gastro-enterologists per head of local population;
- regional cancer rates;
- number of procedures conducted in the independent sector, which is relatively higher in the South East.

Possible reasons for unwarranted variation include differences in:

- access to endoscopy provision;
- the use of barium enema (see Map 17, pages 82–83);
- the application of guidelines for referral;
- professional practice for GPs and hospital clinicians;
- local service configuration.

The magnitudes of variation for the ratio between colonoscopy procedures and flexible sigmoidoscopy procedures by both PCT and CCG are shown in Table 15.3; see also Figures 15.1 and 15.2.

For PCTs in England, the ratio between colonoscopy procedures and flexible sigmoidoscopy procedures over two financial years is shown in Table 15.4.

Although the variation in the ratio between colonoscopy procedures and flexible sigmoidoscopy procedures after exclusions has decreased since 2009/10, it is still relatively high.

Options for action

Commissioners need to discuss with local gastro-endoscopy service providers and bowel surgeons:

- the referral rate for flexible sigmoidoscopy and colonoscopy in relation to local population needs;
- local service configuration.

The Joint Advisory Group (JAG) on GI endoscopy has developed a Productivity and Planning Assessment Tool (PPAT; see "Resources") for endoscopy services and commissioners. It provides a checklist of objectives that the most productive endoscopy services apply systematically to ensure endoscopy resource is used appropriately and efficiently. To ensure effective planning, JAG recommends that commissioners require local services to use the PPAT.

The Global Rating Scale (GRS; see "Resources") is a tool that enables units to assess the provision of a patient-centred service, including dimensions for quality and safety, and customer care. Applying the "Appropriateness" item reassures commissioners that referrals are vetted against best practice.

Although colonoscopy and flexible sigmoidoscopy are high-value interventions, evidence for the use of upper gastro-intestinal endoscopy for the detection and prevention of cancer is less strong. Commissioners and providers need to consider the totality of resources used for endoscopy procedures to achieve maximal value for individual patients and the population.

RESOURCES

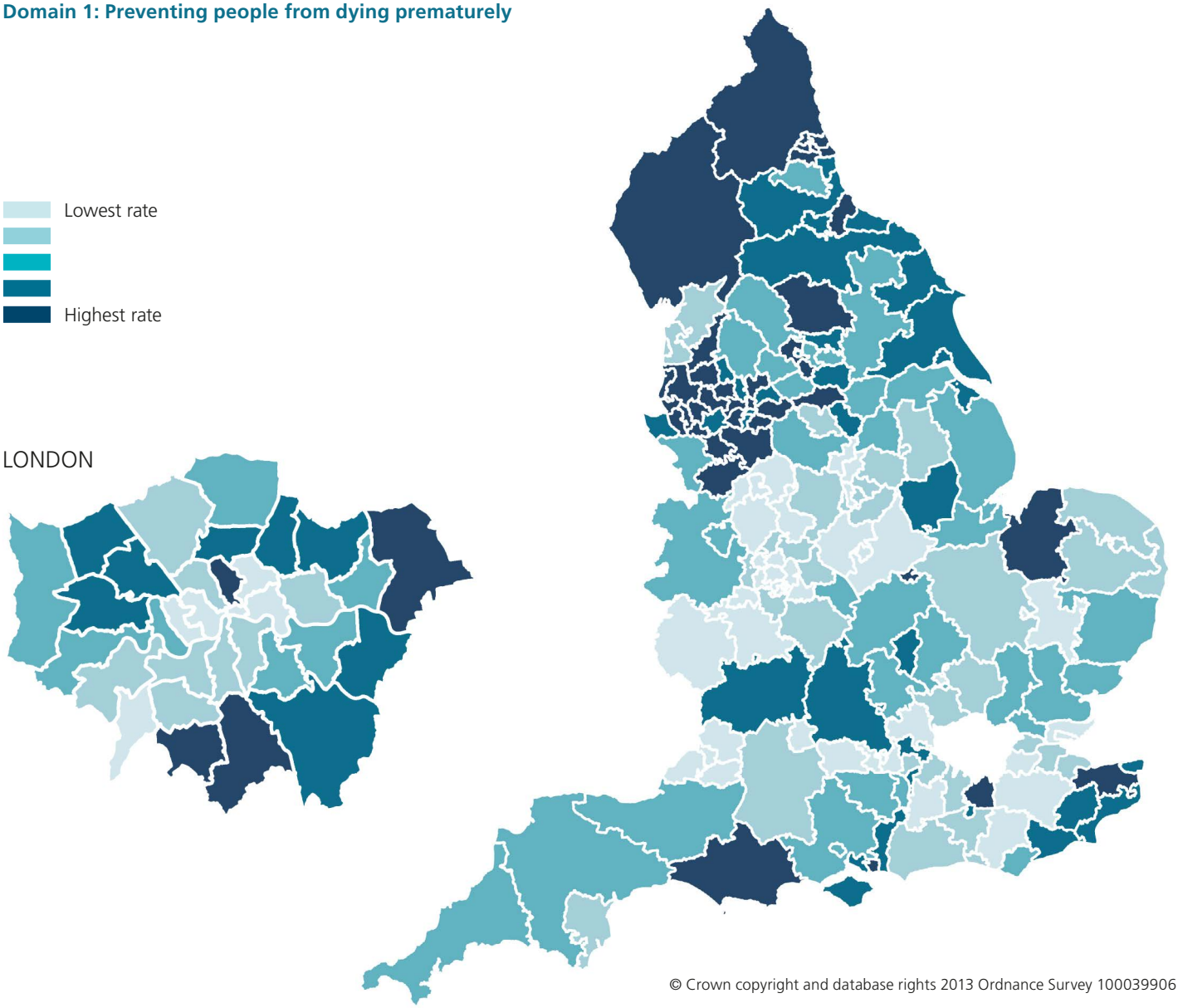
- Joint Advisory Group (JAG) for GI endoscopy. JAG defines and maintains the standards by which endoscopy is practised in the UK. Website has a section on "Commissioning".
  http://www.thejag.org.uk/
- Endoscopy Global Rating Scale (GRS). The Productivity and Planning Assessment Tool (PPAT) "is live on the GRS tab", and can be completed online to enable benchmarking.
  https://www.jagaccreditation.org/Page.aspx?ID=5
- NICE (2011) Colonoscopic surveillance for prevention of colorectal cancer in people with ulcerative colitis, Crohn's disease or adenomas (CG118).
  http://publications.nice.org.uk/colonoscopic-surveillance-for-prevention-of-colorectal-cancer-in-people-with-ulcerative-colitis-cg118
- NICE pathways. Colonoscopic surveillance overview.
  http://pathways.nice.org.uk/pathways/colonoscopic-surveillance
- Cairns SR, Scholefield JH, Steele RJ et al developed on behalf of The British Society of Gatroenterology, and the Association of Coloproctology for Great Britain and Ireland (2010) Guidelines for colorectal cancer screening and surveillance in moderate and high risk groups (update from 2002).
  http://www.bsg.org.uk/images/stories/docs/clinical/guidelines/endoscopy/ccs_10.pdf

ENDOSCOPY SERVICES

Map 15B: Rate of colonoscopy procedures and flexible sigmoidoscopy procedures per population by CCG

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely



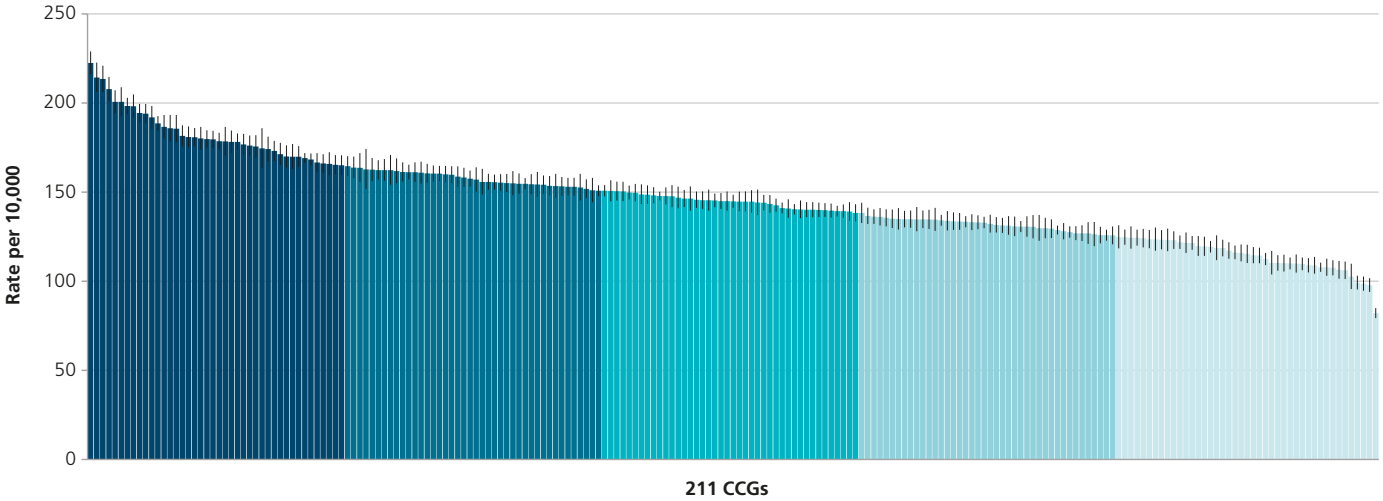


Table 15.3: Ratio of colonoscopy procedures to flexible sigmoidoscopy procedures by PCT and CCG 2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	0.6–10.5	17	0.7–3.8	5
CCG	0.4–10.5	24	0.7–3.3	4.9

Table 15.4: Ratio of colonoscopy procedures to flexible sigmoidoscopy procedures by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2009/10	3.9–12.4	20	0.7–3.9	6	Map 1, Atlas 2.0 (2011)
2011/12	0.6–10.5	17	0.7–3.8	5	

Figure 15.1: Ratio of colonoscopy procedures to flexisigmoidoscopy procedures by PCT 2011/12

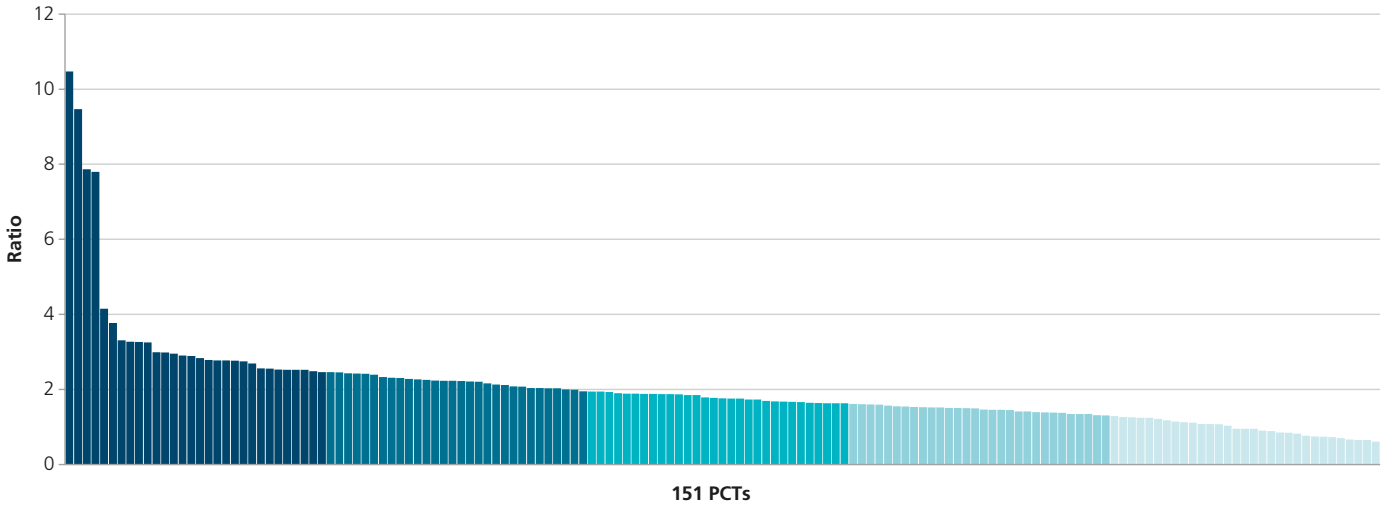
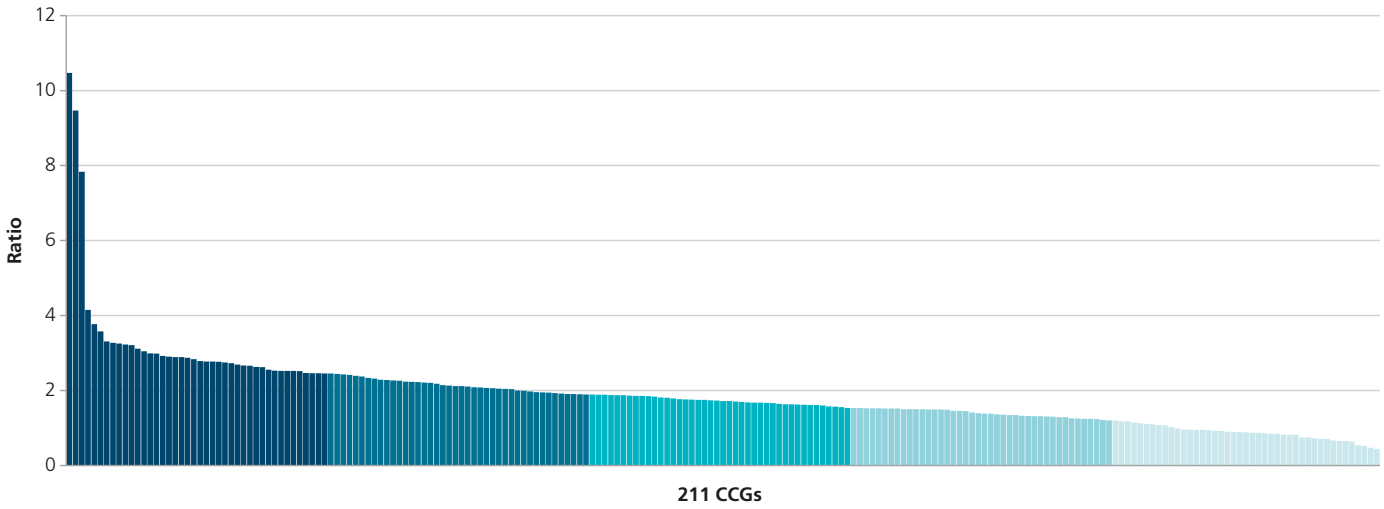


Figure 15.2: Ratio of colonoscopy procedures to flexisigmoidoscopy procedures by CCG 2011/12

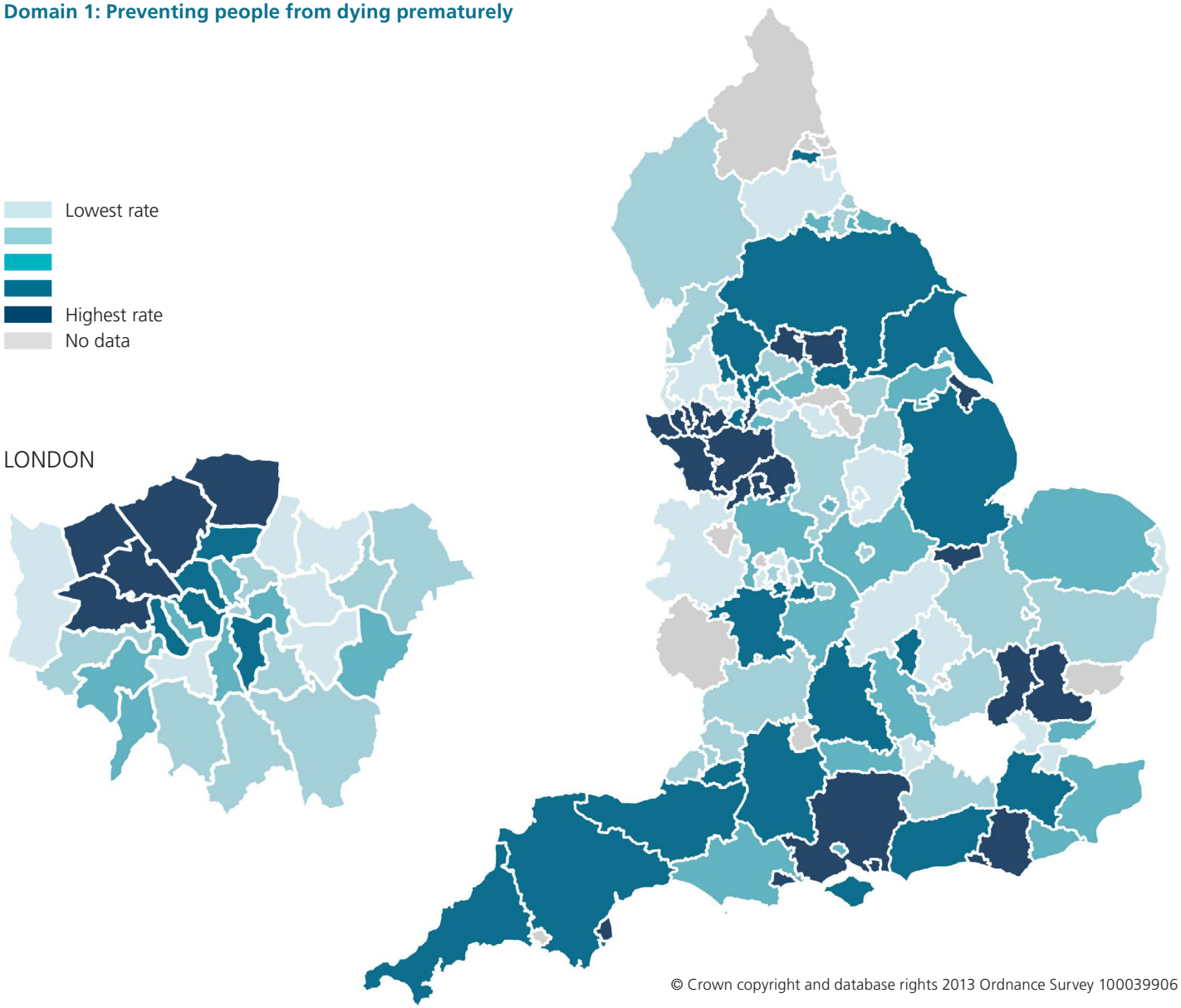


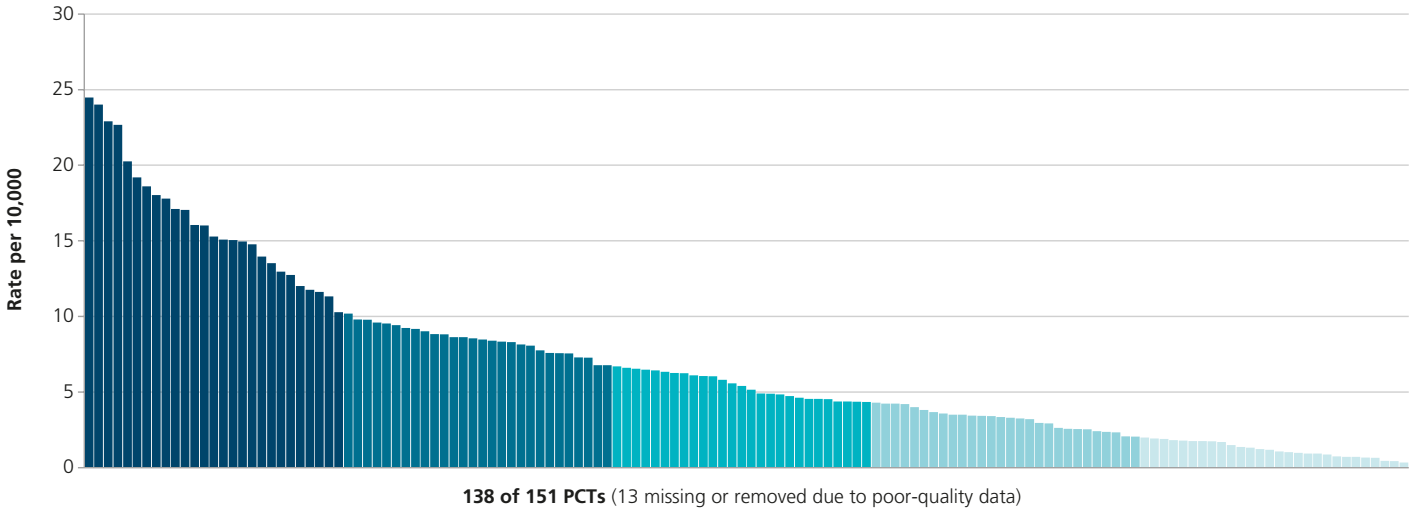
ENDOSCOPY SERVICES

Map 16: Rate of computed tomography (CT) colonoscopy procedures per population by PCT

April–November 2012

Domain 1: Preventing people from dying prematurely





138 of 151 PCTs (13 missing or removed due to poor-quality data)

Context

Computed tomography (CT) colonoscopy or colonography is a relatively new radiological technique designed to image the colon. It is sometimes referred to as "virtual colonoscopy" because a CT scanner and a computer are used to generate three-dimensional images of the colon. As such, CT colonoscopy is minimally invasive because there is no need to introduce an endoscope into the colon to obtain the images, and therefore no need for the sedation of patients. Patients do need to take a laxative preparation, however, and they will experience some discomfort.

CT Colonoscopy is used to investigate patients with symptoms suggestive of colorectal cancer. In a recent multicentre randomised controlled trial for the diagnosis of colorectal cancer or large polyps in symptomatic patients (SIGGAR), the detection rate for barium enema was 5.6% whereas that for CT colonoscopy was 7.3%.[1] The findings of the SIGGAR trial support considerable non-controlled evidence that CT colonoscopy is a superior test when compared with barium enema. Halligan et al suggest CT colonoscopy should be the preferred radiological test for patients with symptoms suggestive of colorectal cancer.[1] In localities where there is limited provision of CT colonoscopy, barium enema is still in use (see Map 17, pages 82–83).

CT Colonoscopy is inappropriate for the diagnosis of inflammatory bowel disease because biopsy material is invariably required to support the diagnosis. CT Colonoscopy needs to be used with caution in younger people due to the exposure to ionising radiation.

Magnitude of variation

For PCTs in England, the rate of CT colonoscopy procedures ranged from 0.34 to 24.5 per 10,000 population (73-fold variation).[2] When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.66–19.2 per 10,000 population, and the variation is 29-fold.

Reasons for the degree of variation observed in the rate of CT colonoscopy are differences in:

- access to CT colonoscopy;
- the availability of radiologists skilled in interpreting CT colonoscopy scans;
- training opportunities for radiologists in CT colonoscopy;
- the use of barium enema (see Map 17, pages 82–83) to image the colon in people with suspected bowel cancer.

Options for action

Commissioners, clinicians and service providers need:

- to review current levels of access to CT colonoscopy and optical colonoscopy to ensure that clinicians responsible for referrals for suspected bowel cancer no longer use barium enema to image the colon;
- to develop local referral guidelines for colonoscopy, flexible sigmoidoscopy and CT colonoscopy;
- to estimate, on the basis of local referral guidelines, the demand for colonoscopy, flexible sigmoidoscopy and CT colonoscopy to inform planning for capacity.

Commissioners and service providers need to provide training opportunities for radiologists in the interpretation of CT colonoscopy scans.

RESOURCES

- NICE (2011) Colonoscopic surveillance for prevention of colorectal cancer in people with ulcerative colitis, Crohn's disease or adenomas (CG118). http://publications.nice.org.uk/colonoscopic-surveillance-for-prevention-of-colorectal-cancer-in-people-with-ulcerative-colitis-cg118
- NICE pathways. Colonoscopic surveillance overview. http://pathways.nice.org.uk/pathways/colonoscopic-surveillance
- NICE (2005) Computed tomographic colonography (virtual colonoscopy) (IPG129). http://guidance.nice.org.uk/IPG129
- Cairns SR, Scholefield JH, Steele RJ et al developed on behalf of The British Society of Gatroenterology, and the Association of Coloproctology for Great Britain and Ireland (2010) Guidelines for colorectal cancer screening and surveillance in moderate and high risk groups (update from 2002). http://www.bsg.org.uk/images/stories/docs/clinical/guidelines/endoscopy/ccs_10.pdf

1 Halligan S, Wooldrage K, Dadswell E et al for the SIGGAR investigators (2013) Computed tomographic colonography versus barium enema for diagnosis of colorectal cancer or large polyps in symptomatic patients (SIGGAR): a multicentre randomised trial. *The Lancet*. Published online February 14, 2013. http://www.ncbi.nlm.nih.gov/pubmed/23414648

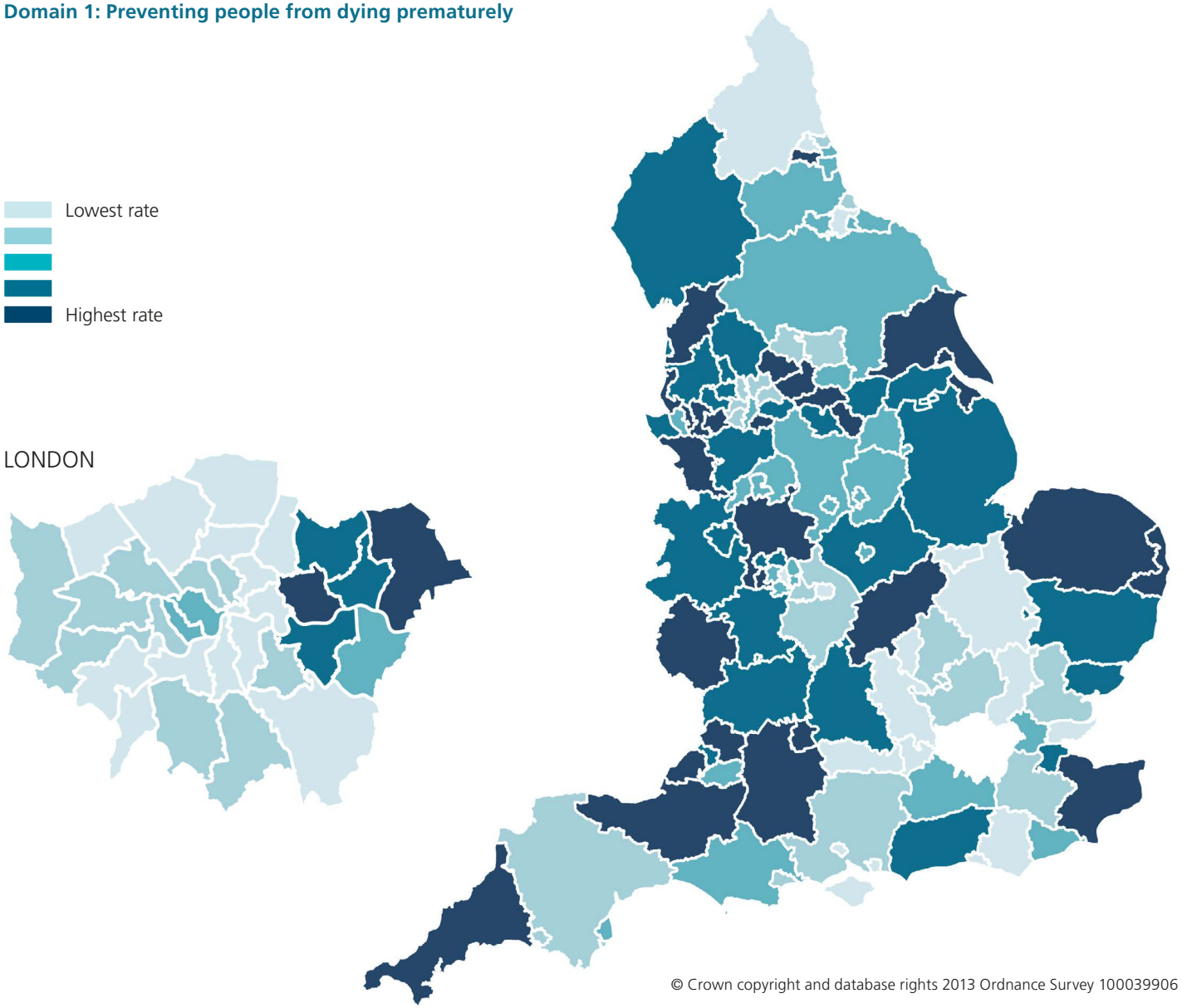
2 Data from 13 PCTs are missing or have been removed due to poor quality.

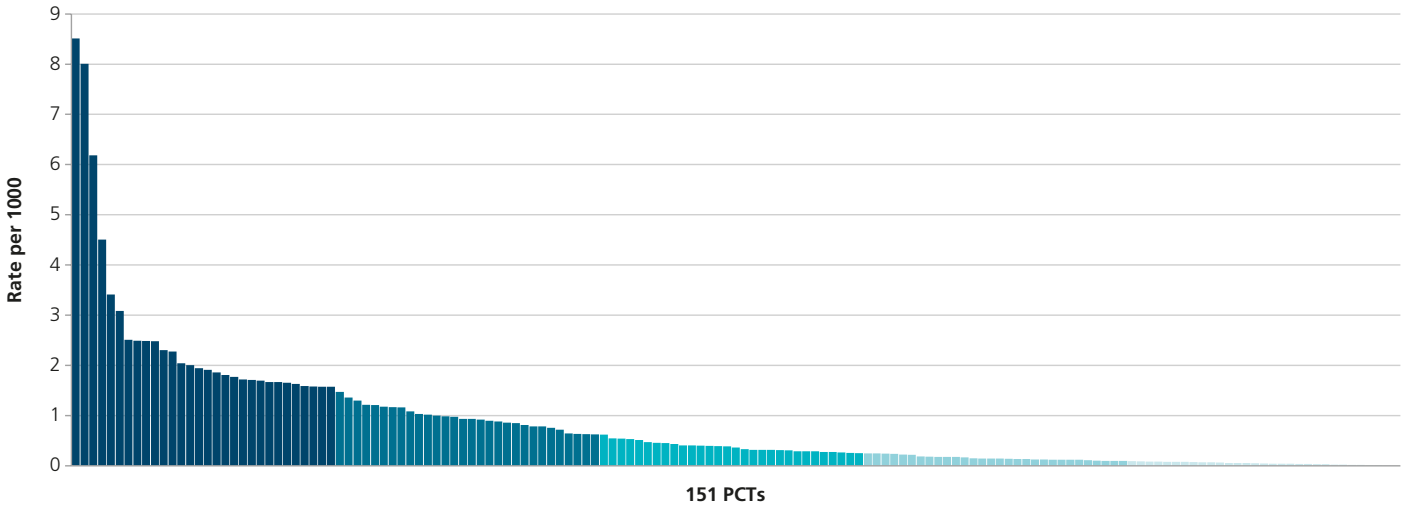
ENDOSCOPY SERVICES

Map 17: Rate of barium enema procedures per weighted population by PCT

April–November 2012

Domain 1: Preventing people from dying prematurely





Context

Barium enema is an X-ray procedure that creates images of the large intestine. During the procedure, barium sulphate liquid and air are introduced into the bowel, following which X-rays are taken to obtain double-contrast images of the colon and rectum.

Barium enema is used to identify the following problems in the colon and rectum:

- cancerous or non-cancerous growths (also known as adenomas or polyps);
- bowel cancer (in the colon or rectum);
- inflammation (ulcerative colitis and Crohn's disease);
- diverticular disease.

Other conditions for which barium enema may be performed include:

- blockage of the large intestine;
- intussusception, where one part of the intestine slides into another;
- Hirschsprung's disease.

The other methods of imaging the colon are computed tomography (CT) colonoscopy (see Map 16, pages 80–81) and optical colonoscopy. In a recent multicentre randomised controlled trial for the diagnosis of colorectal cancer or large polyps in symptomatic patients (SIGGAR), the detection rate for barium enema was 5.6% whereas that for CT colonoscopy was 7.3%.[1] The findings of the SIGGAR trial support considerable non-controlled evidence that barium enema is an inferior test when compared with CT colonoscopy. Halligan et al suggest CT colonoscopy should be the preferred radiological test for patients with symptoms suggestive of colorectal cancer.[1]

Barium enema is inappropriate for the diagnosis of inflammatory bowel disease because biopsy material is invariably required to support the diagnosis.

Barium enema is a useful test in a very small number of patients, particularly when it is necessary to visualise the structure of the colon, such as in megacolon.

Although in recent years it has become less common to perform a barium enema, it is still in use, particularly where there is a contra-indication for, or limited provision of, CT colonoscopy (see Map 16; pages 80–81).

Magnitude of variation

For PCTs in England, the rate of barium enema procedures ranged from 0.02 to 8.5 per 1000 weighted population (>1000-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.01–3.1 per 1000 weighted population, and the variation is 172-fold.

The principal reason for the degree of variation observed in the rates of barium enema procedures is insufficient capacity for, and therefore insufficient access to, CT colonoscopy and/or optical colonoscopy.

Options for action

Commissioners, clinicians and service providers need to review current levels of access to CT colonoscopy and optical colonoscopy to ensure that clinicians responsible for referrals no longer need to use barium enema to image the colon when it is not best practice to do so.

If, despite adequate provision for CT colonoscopy and optical colonoscopy in relation to need in the local population, there is still significant demand for barium enema procedures, it is important:

- to investigate the reasons for this;
- to take action to stop inappropriate requests for this test.

RESOURCES

- NHS Bowel Cancer Screening Programme (2012) Guidelines for the use of imaging in the NHS Bowel Cancer Screening Programme. 2nd edition. NHSBCSP No 5. http://www.cancerscreening.nhs.uk/bowel/publications/nhsbcsp05.pdf
- NICE (2011) Colonoscopic surveillance for prevention of colorectal cancer in people with ulcerative colitis, Crohn's disease or adenomas (CG118). http://publications.nice.org.uk/colonoscopic-surveillance-for-prevention-of-colorectal-cancer-in-people-with-ulcerative-colitis-cg118
- NICE pathways. Colonoscopic surveillance overview. http://pathways.nice.org.uk/pathways/colonoscopic-surveillance

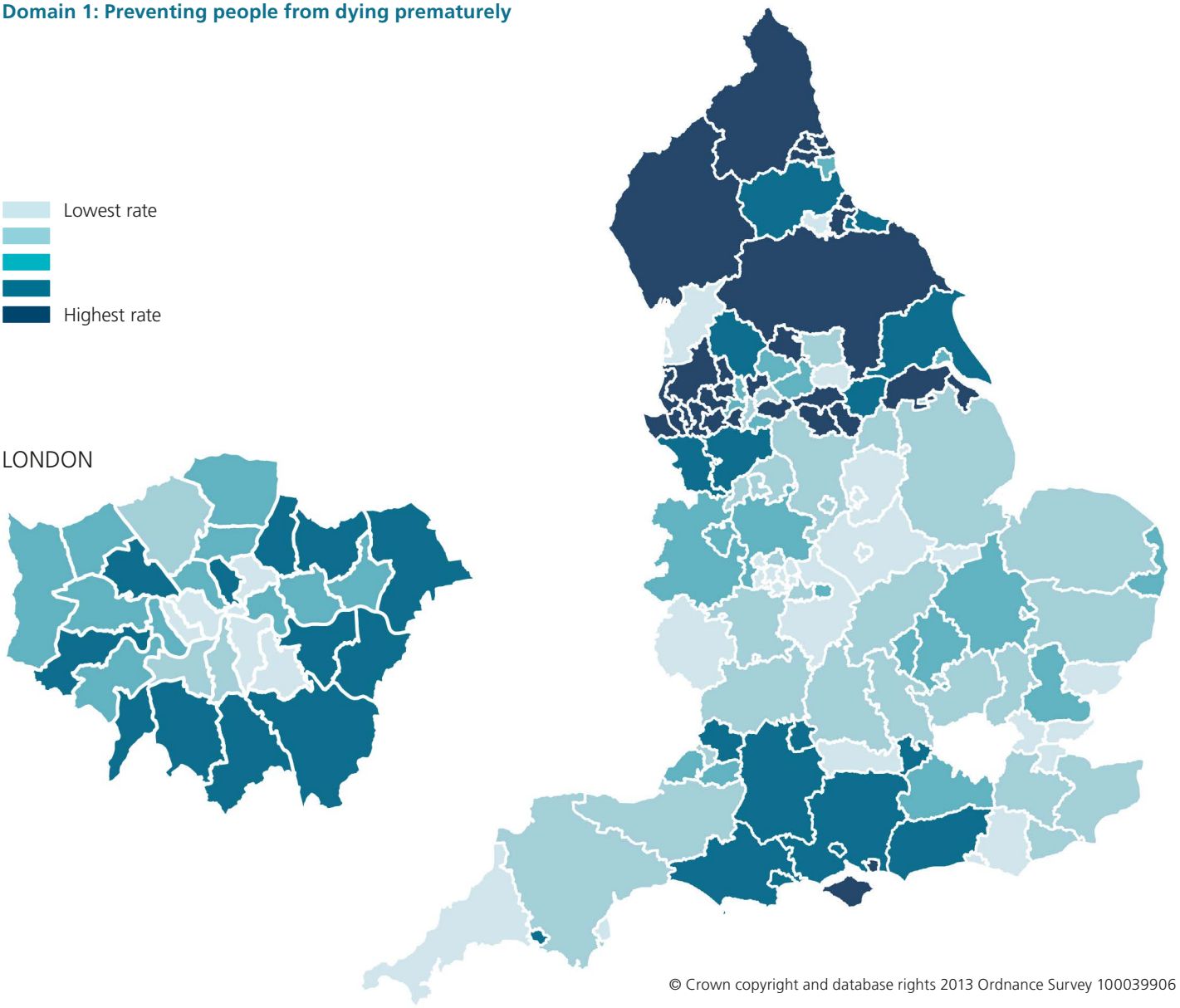
1 Halligan S, Wooldrage K, Dadswell E et al for the SIGGAR investigators (2013) Computed tomographic colonography versus barium enema for diagnosis of colorectal cancer or large polyps in symptomatic patients (SIGGAR): a multicentre randomised trial. The Lancet. Published online February 14, 2013. http://www.ncbi.nlm.nih.gov/pubmed/23414648

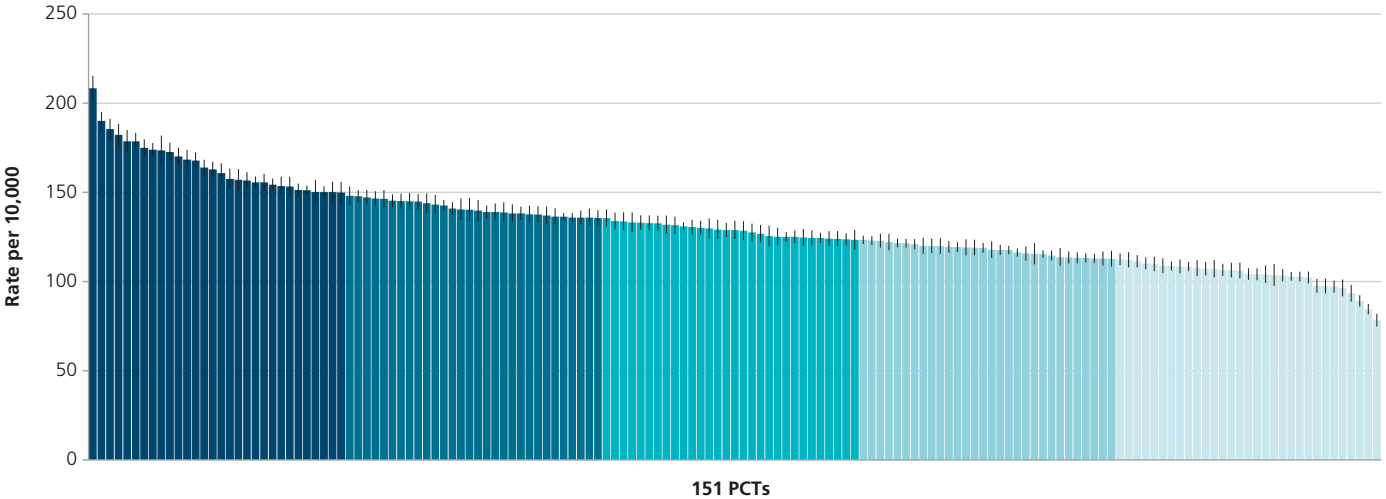
ENDOSCOPY SERVICES

Map 18A: Rate of gastroscopy (upper gastro-intestinal endoscopy) procedures per population by PCT

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely





Context

Gastroscopy is an investigation of the upper gastro-intestinal tract – mouth, oesophagus, stomach and duodenum (first part of the small intestine) – using a flexible endoscope. Diagnostic gastroscopy is used:

- to investigate dyspepsia in older people;
- to investigate difficulties and/or pain on swallowing (dysphagia);
- to identify cancer of the oesophagus or stomach, although it is difficult to identify pre-cancerous lesions using this technique;
- to investigate patients presenting with upper gastro-intestinal bleeding or anaemia;
- to detect complications of non-steroidal anti-inflammatory drugs (NSAIDs).

Value from the surveillance of chronic oesophageal disease to prevent cancer from a condition known as Barrett's oesophagus is being evaluated in research studies.

More than half a million gastroscopies are performed in the NHS in England every year. Much of the demand for gastroscopy comes through referrals made by primary care.

In general, the rate of gastroscopy (Maps 18A and 18B) needs to be at a level at which cancers can be detected in people aged over 55 years. If national guidelines for dyspepsia and reflux are being followed appropriately, the proportion of patients undergoing gastroscopy who are aged under 55 years (Maps 19A and 19B) should be relatively low. For instance if Helicobacter is present, treating patients with dyspepsia without a gastroscopy, and, if no alarm symptoms are present, treating patients with reflux symptomatically.

The proportion of people undergoing gastroscopy procedures who are aged under 55 years is an indicator of the appropriateness and effectiveness with which localities manage referrals for gastroscopy in the context of the NICE guidance on dyspepsia, and cancer referral (see "Resources").

Both indicators have been mapped to two geographies:

- PCT (Maps 18A and 19A);
- CCG (Maps 18B and 19B).

Magnitude of variation

Maps 18A and 18B: Gastroscopy rate

The magnitudes of variation for the rate of gastroscopy procedures per 10,000 population by both PCT and CCG are shown in Table 18.1; see also Maps 18A and 18B, respectively (for 2009/10 data for PCTs, see Table 18.2).

One reason for variation in the rate of gastroscopy procedures is differences in regional cancer rates, which in turn are affected by smoking habit and prevalence of obesity. The degree of variation observed, however, is greater than can be explained by variations in the incidence and prevalence of disease.

Possible reasons for unwarranted variation include differences in:

- thresholds for referral by GPs;
- the application of guidelines for referral;
- the amount of resources available locally for both diagnosis and surveillance.

The magnitude of variation in the rate of gastroscopy procedures per 10,000 population by PCT appears to have decreased slightly since 2009/10.

Table 18.1: Rate of gastroscopy procedures per 10,000 population by PCT and CCG 2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	78.2–208.3	2.7	97.1–178.6	1.8
CCG	76.3–208.3	2.7	93.9–178.6	1.9

Table 18.2: Rate of gastroscopy procedures per 10,000 population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2009/10	77.4–225.7	2.9	91.4–185.9	2.0	Map 42, Atlas 2.0 (2011)
2011/12	78.2–208.3	2.7	97.1–178.6	1.8	

Maps 19A and 19B: Proportion of patients undergoing gastroscopy who are <55 years

The magnitudes of variation for the proportion (%) of patients undergoing gastroscopy procedures who are aged under 55 years by both PCT and CCG are shown in Table 19.1; see also Maps 19.1A and 19.1B.

These data show that 33% or more of gastroscopies are being undertaken on patients under 55 years in two-thirds of PCTs (*n*=104) and in more than three-fifths of CCGs (*n*=132).

Options for action

Those responsible for commissioning need to work with all local GPs to ensure that the referral rate for gastroscopy relates to the needs of the local population, including:

- developing local guidelines for dyspepsia and chronic or recurrent upper abdominal pain;
- auditing local referral rates for gastroscopy to identify both under- and over-referral;
- liaison working between endoscopy services and all local GPs to update GPs on ways to maximise value from the endoscopy service for patients.

The NICE commissioning guide can help commissioners and providers develop referral criteria and determine local service levels (see "Resources").

Commissioners and providers may need to assess the relative value of gastroscopy and of colonoscopy and/or flexible sigmoidoscopy for local populations because there may be a case for shifting resources from gastroscopy and increasing the rate of colonoscopy and/or flexible sigmoidoscopy (see Map 15, pages 74–79).

The Joint Advisory Group (JAG) on GI endoscopy has developed a Productivity and Planning Assessment Tool (PPAT; see "Resources") for endoscopy services and commissioners. It provides a checklist of the objectives that the most productive endoscopy services apply systematically to ensure endoscopy resource is used appropriately and efficiently. For effective planning, JAG recommends that commissioners require local services to use PPAT.

The Global Rating Scale (GRS; see "Resources") enables provider units to assess the provision of patient-centred services, including dimensions for quality and safety, and customer care. Applying the "Appropriateness" item reassures commissioners that referrals are vetted against best practice.

RESOURCES

- Joint Advisory Group (JAG) for GI endoscopy. Website has a section on "Commissioning". http://www.thejag.org.uk/
- Endoscopy Global Rating Scale (GRS). The Productivity and Planning Assessment Tool (PPAT) can be completed online to enable benchmarking. See "Tools" (page 31) for further information. https://www.jagaccreditation.org/Page.aspx?ID=5
- NICE (2007) Upper GI endoscopy service commissioning guide. http://www.nice.org.uk/usingguidance/commissioningguides/uppergiendoscopyservices/uppergiendoscopyservices.jsp
- NICE (2004) Dyspepsia: Managing dyspepsia in adults in primary care (CG17). http://guidance.nice.org.uk/CG17
- NICE (2005) Referral for suspected cancer (CG27). http://publications.nice.org.uk/referral-guidelines-for-suspected-cancer-cg27

Table 19.1: Proportion (%) of patients undergoing gastroscopy procedures who are less than 55 years by PCT and CCG 2011/12

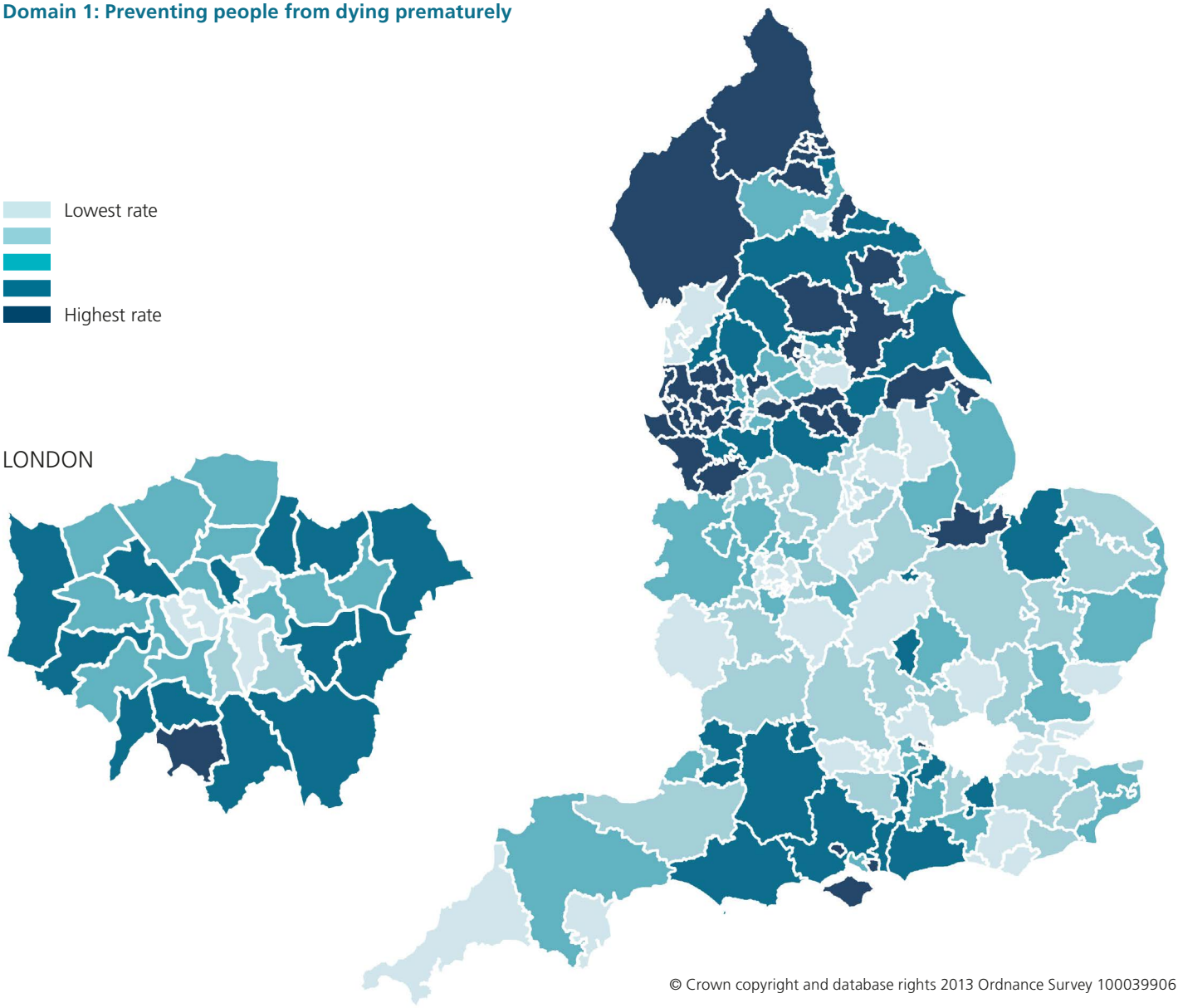
Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	25.2–56.2	2.2	28.2–49.4	1.8
CCG	25.1–57.9	2.3	27.8–48.4	1.7

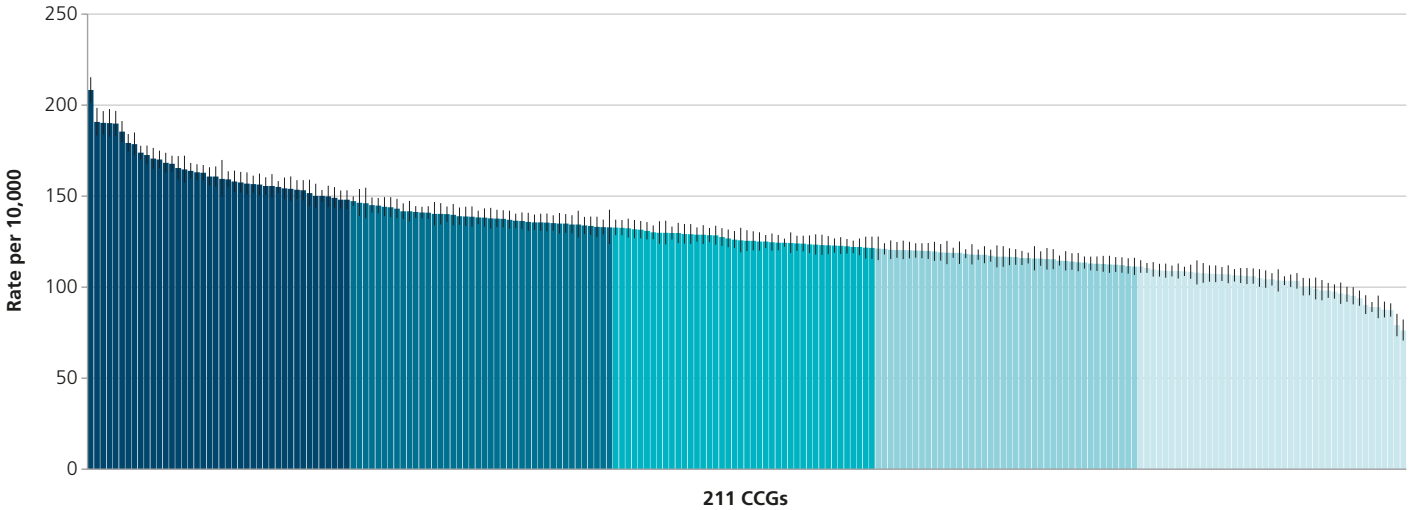
ENDOSCOPY SERVICES

Map 18B: Rate of gastroscopy (upper gastro-intestinal endoscopy) procedures per population by CCG

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely



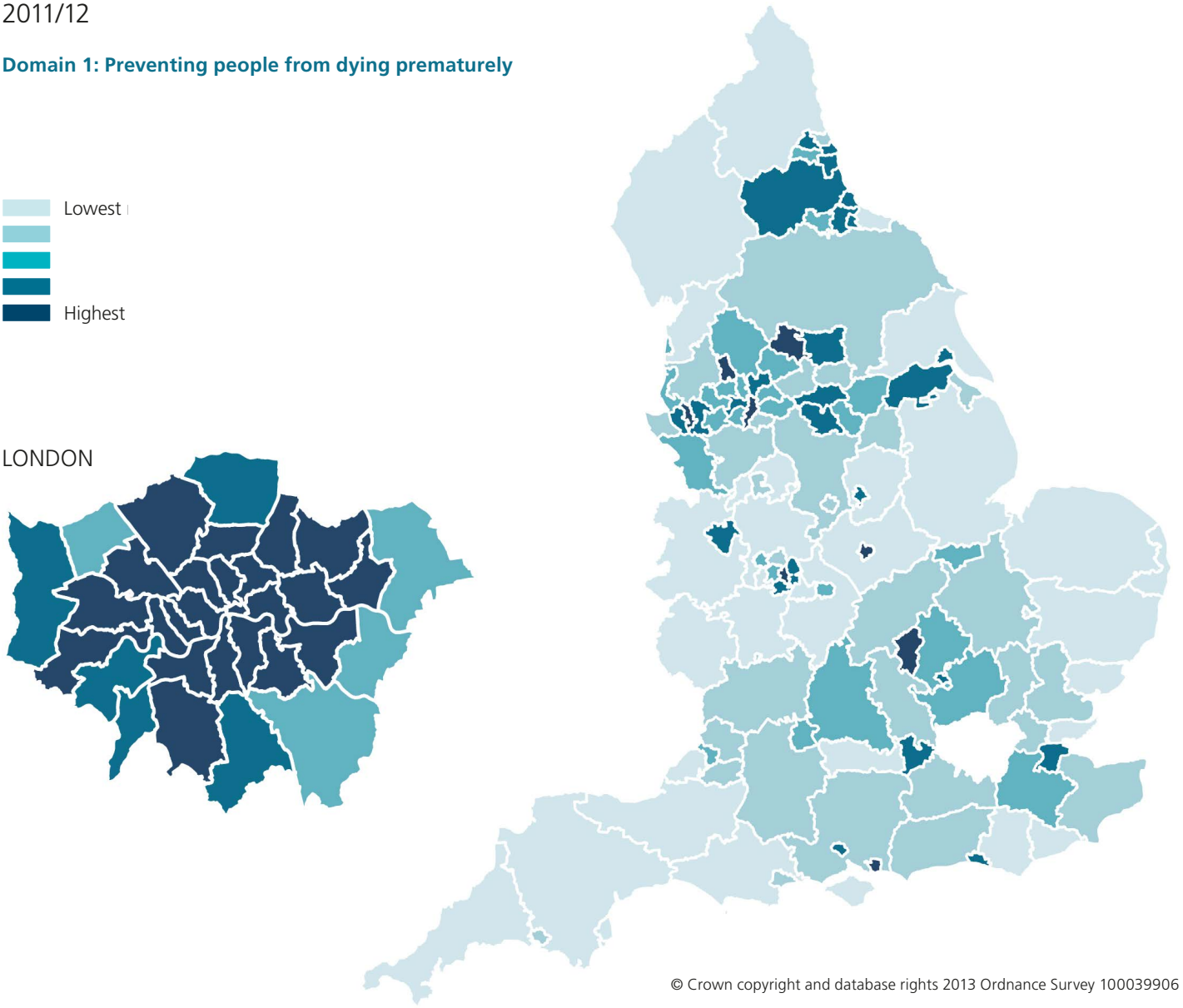


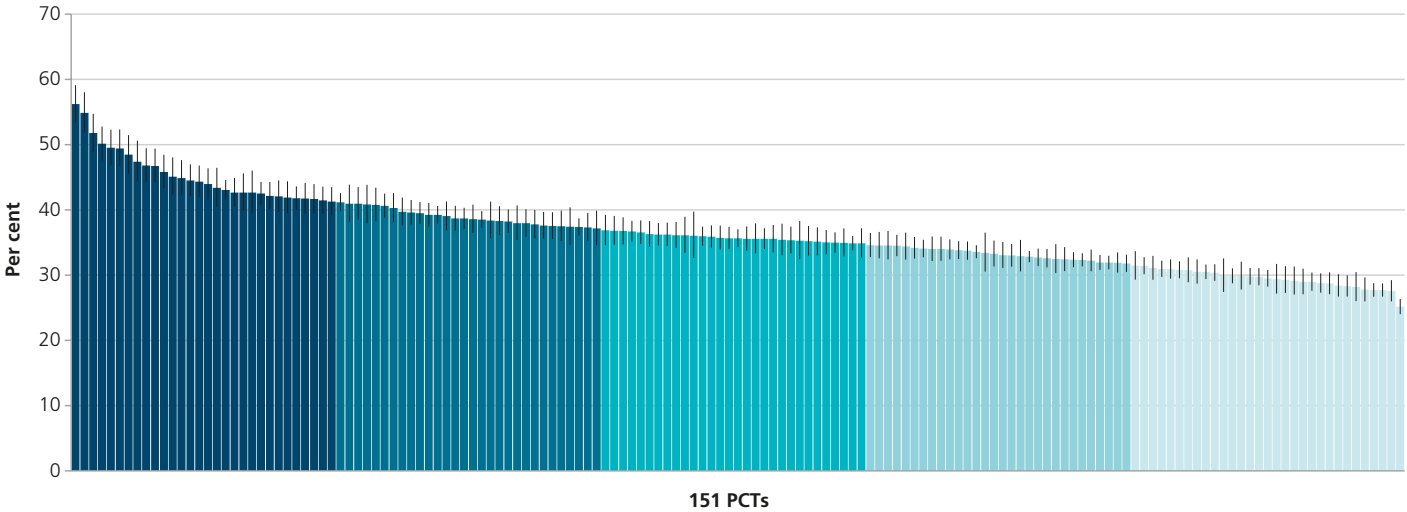
ENDOSCOPY SERVICES

Map 19A: Proportion (%) of patients undergoing gastroscopy (upper gastro-intestinal endoscopy) procedures who are aged under 55 years by PCT

2011/12

Domain 1: Preventing people from dying prematurely



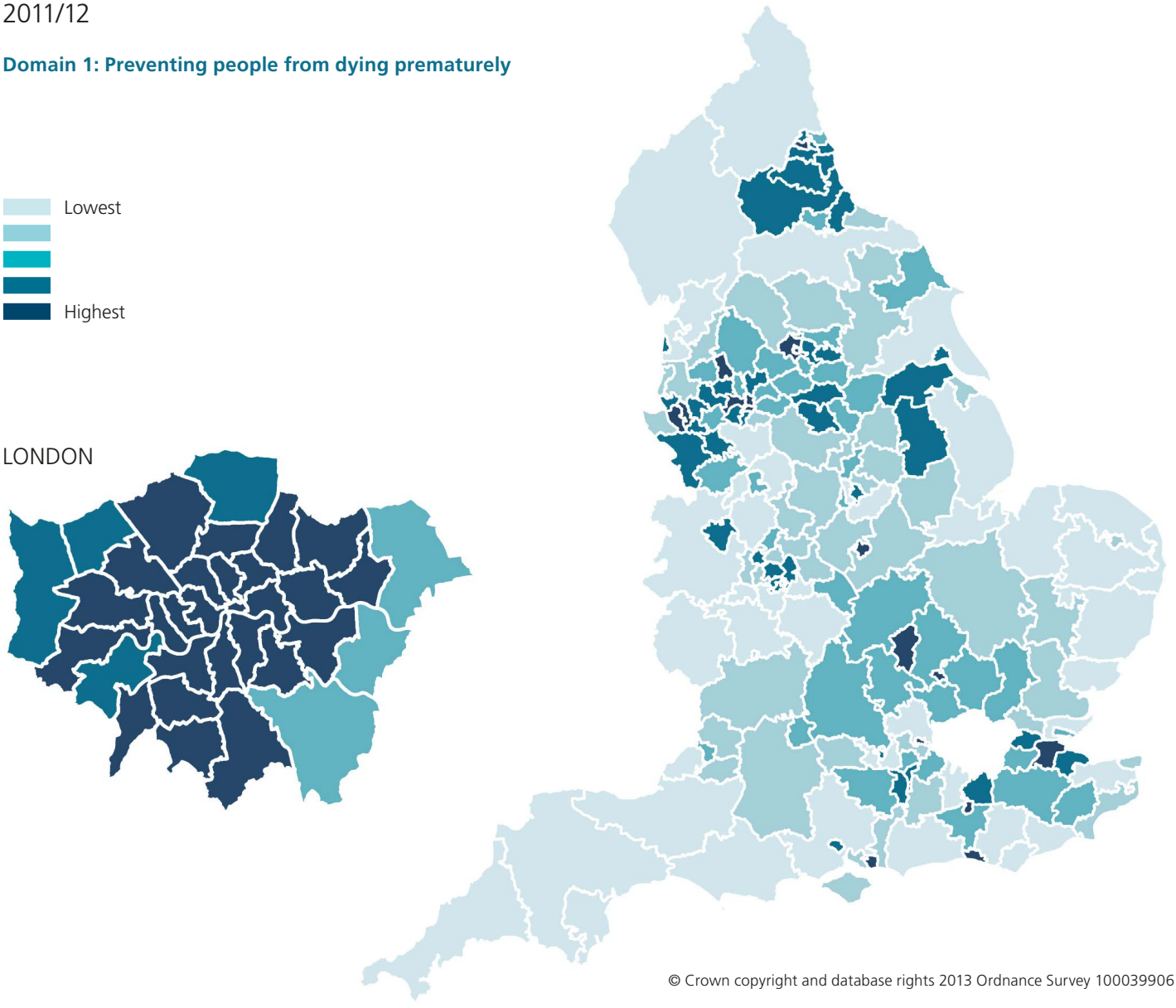


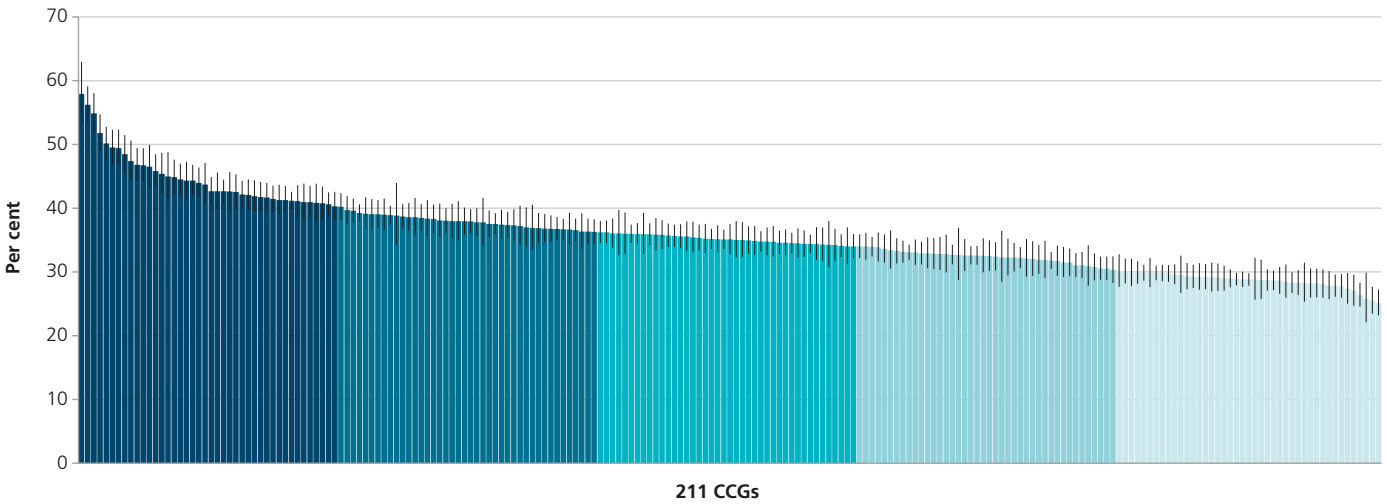
ENDOSCOPY SERVICES

Map 19B: Proportion (%) of patients undergoing gastroscopy (upper gastro-intestinal endoscopy) procedures who are aged under 55 years by CCG

2011/12

Domain 1: Preventing people from dying prematurely



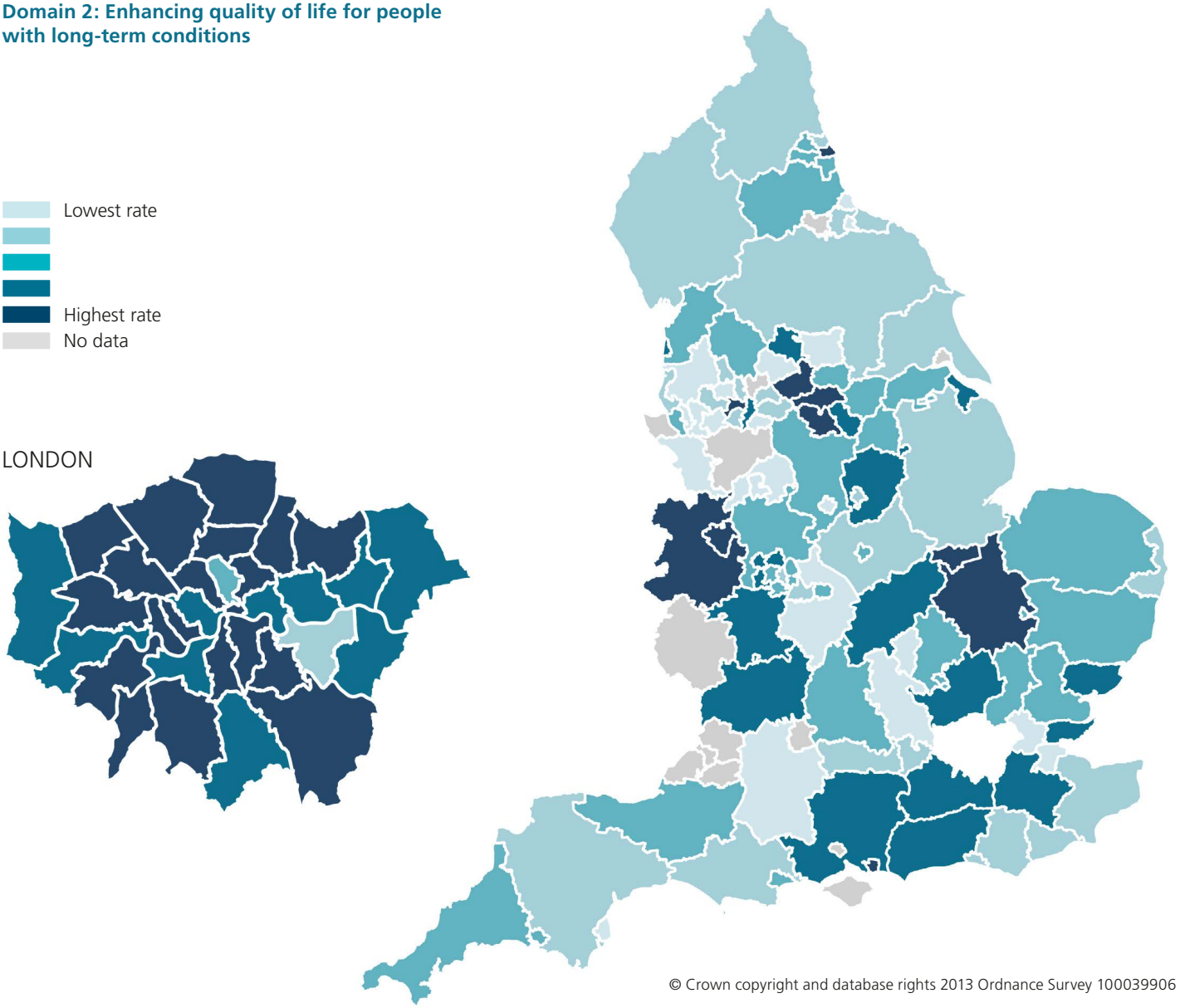


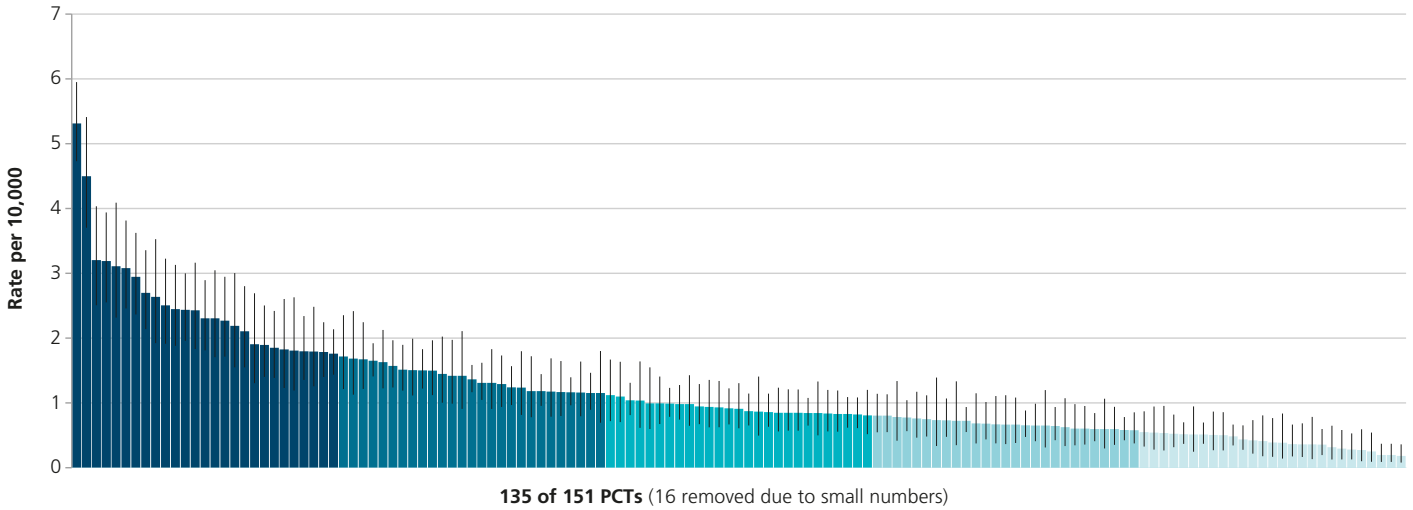
ENDOSCOPY SERVICES

Map 20A: Rate of capsule endoscopy procedures per population by PCT

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

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





135 of 151 PCTs (16 removed due to small numbers)

Context

Capsule endoscopy is a relatively new imaging technology that allows direct visualisation of the small bowel. Direct visualisation enables the diagnosis of flat lesions such as vascular abnormalities or superficial inflammation that cannot be seen by radiological methods. Capsule endoscopy is complementary to radiological imaging when studying transmural disease (disease involving all layers of the bowel, e.g. established Crohn's disease) or when mass lesions such as tumours are suspected.

Using conventional upper and lower gastro-intestinal endoscopy, it has been possible to access only the duodenum and terminal ileum, with the result that most of the small bowel has been endoscopically inaccessible. More recently, device-assisted enteroscopes have been designed specifically to examine the small bowel, but these are highly specialised instruments, and the examinations are complex and prolonged and used only in small numbers of UK centres by highly trained experts.

Capsule endoscopy is a simple and relatively safe test used to diagnose lesions, some of which may be accessed for therapy or biopsy using device-assisted enteroscopy.

Indications for capsule endoscopy are:

- obscure gastro-intestinal bleeding;
- suspected small bowel Crohn's disease;
- assessment of coeliac disease;
- screening and surveillance for polyps in familial polyposis syndromes.

The main risk associated with capsule endoscopy is capsule retention (defined as remaining in the digestive tract for two weeks or more and requiring endoscopic or surgical intervention) but this can be eliminated to a large extent by testing the patient with a dissolvable "patency" capsule before the main test in at-risk patients. Patients at higher risk of retention are people with:

- Crohn's disease;
- chronic usage of non-steroidal anti-inflammatory drugs (NSAIDs);
- abdominal radiation injury.

Capsule endoscopy is contra-indicated in patients known to have strictures (narrowings; also referred to as a stenosis) or swallowing disorders.

Capsule endoscopy is accepted worldwide as a first-line small bowel investigative modality. Since its introduction over a decade ago, the demand for capsule endoscopy has increased. In a survey of British Society of Gastroenterology (BSG) members in 2011, 91% of respondents referred patients for capsule endoscopy.[1]

Capsule endoscopy is cost-effective[2] because it prevents unnecessary cycles of investigation in patients with obscure gastro-intestinal bleeding and inflammatory bowel disease. In addition, the test is acceptable to patients when compared with conventional endoscopy.

This indicator has been mapped to two geographies:

- PCT (Map 20A);
- CCG (Map 20B).

Magnitude of variation

For PCTs in England, the rate of capsule endoscopy procedures ranged from 0.18 to 5.3 per 100,000 population (29-fold variation).[3] When the four PCTs with the highest rates and the four PCTs with the lowest rates are excluded, the range is 0.27–3.1 per 100,000 population, and the variation is 11-fold.

For CCGs in England, the rate of capsule endoscopy procedures ranged from 0.18 to 5.3 per 100,000 population (29-fold variation).[4] When the six CCGs with the highest rates and the six CCGs with the lowest rates are excluded, the range is 0.32–3.1 per 100,000 population, and the variation is 10-fold.

The magnitudes of variation for the rate of capsule endoscopy procedures per 10,000 population by both PCT and CCG are shown in Table 20.1; see also Maps 20A and 20B, respectively.

The degree of variation observed is unlikely to be due to differences in the local population in the prevalence of the conditions for which capsule endoscopy is indicated.

1 McAlindon ME, Parker CE, Hendy P et al (2012) Provision of service and training for small bowel endoscopy in the UK. *Frontline Gastroenterology* 3; 98-103. doi: 10.1136/flgastro-2011-100044. http://fg.bmj.com/content/3/2/98

2 Marmo R, Rotondano G, Rondonotti E et al (2007|) Capsule enteroscopy vs. other diagnostic procedures in diagnosing obscure gastrointestinal bleeding: a cost-effectiveness study. *Eur J Gastroenterol Hepatol* 19: 535-542.

3 Data from 16 PCTs have been removed due to small numbers.

4 Data from 35 CCGs have been removed due to small numbers.

Table 20.1: Rate of capsule endoscopy procedures per 10,000 population by PCT and CCG 2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	0.18–5.3	29	0.27–3.1	11
CCG	0.18–5.3	29	0.32–3.1	10

One reason for the degree of variation could be differences in the level of access to capsule endoscopy. Access to capsule endoscopy can be affected by several factors, including:

- historical levels of the tariff for the procedure, and consequent restrictions on use[1];
- willingness to invest in a new procedure[1];
- the perceived barriers to setting up a new service, including cost and potential workload[1];
- the availability of trained staff to interpret the results of capsule endoscopy;
- early adopters of capsule endoscopy may have a lower threshold for its use than other Trusts where it is not provided or its use is limited.

Options for action

To reduce the degree of unwarranted variation in the level of activity for capsule endoscopy, commissioners, clinicians and service providers need:

- to review the level of provision in relation to need in the local population;
- to audit the service at regular intervals;
- to ensure that formal training and accreditation programmes in the use and interpretation of capsule endoscopy are developed and made available for relevant healthcare professionals.

RESOURCES

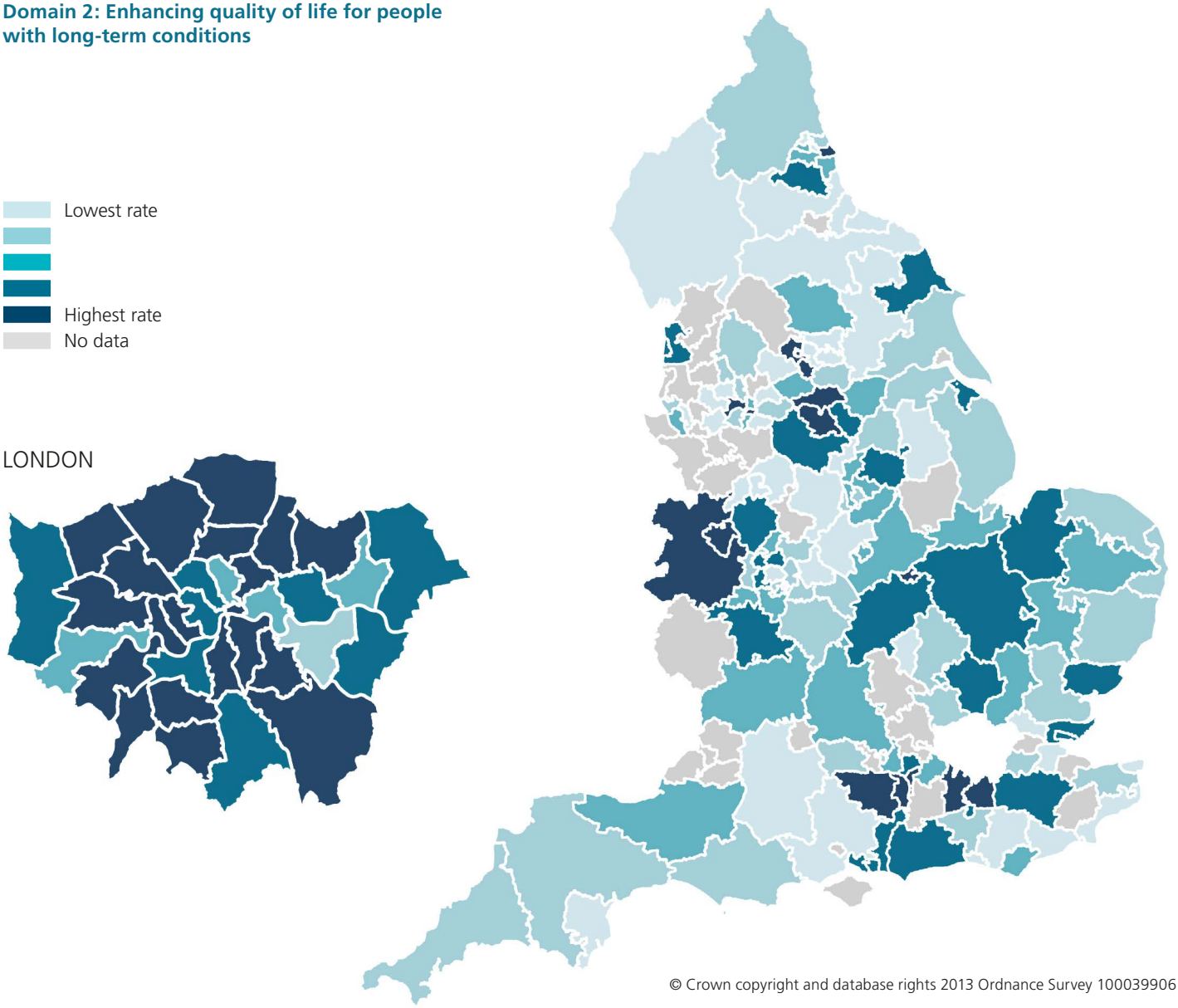
- NICE (2004) Wireless capsule endoscopy for investigation of the small bowel (IPG101). http://guidance.nice.org.uk/IPG101
- Sidhu R, Sanders DS, Morris AJ, McAlindon ME (2008) Guidelines on small bowel enteroscopy capsule endoscopy in adults. *Gut* 57; 124-136. doi: 10.1136/gut.2007.129999 http://www.bsg.org.uk/pdf_word_docs/capsule.pdf

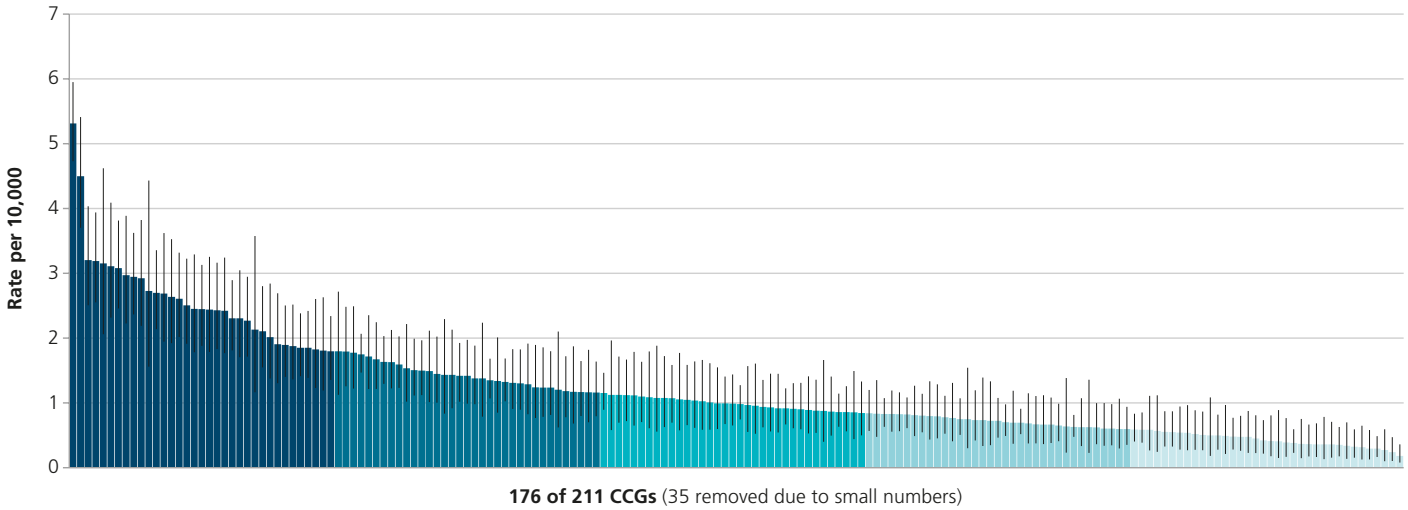
ENDOSCOPY SERVICES

Map 20B: Rate of capsule endoscopy procedures per population by CCG

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

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





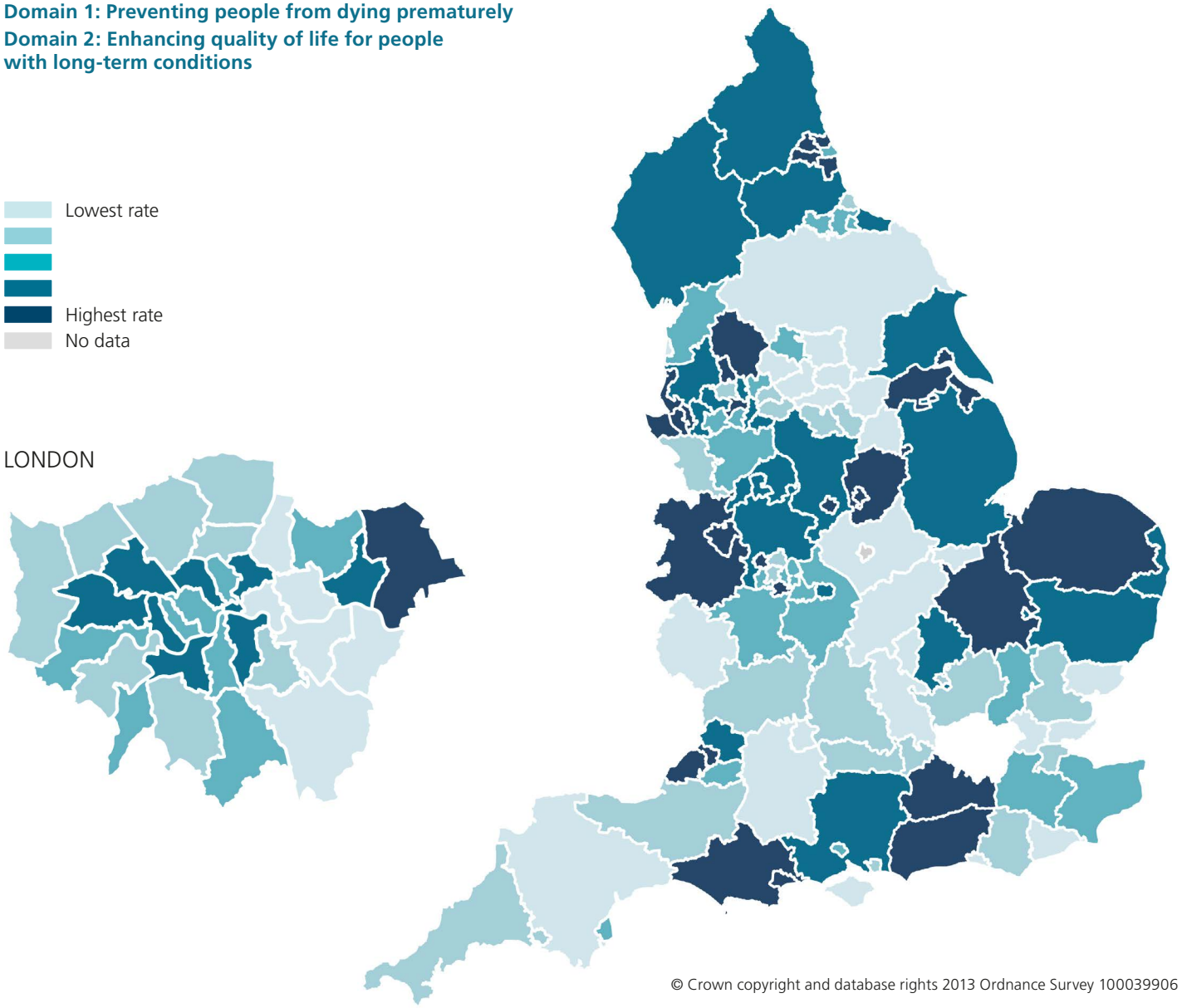
176 of 211 CCGs (35 removed due to small numbers)

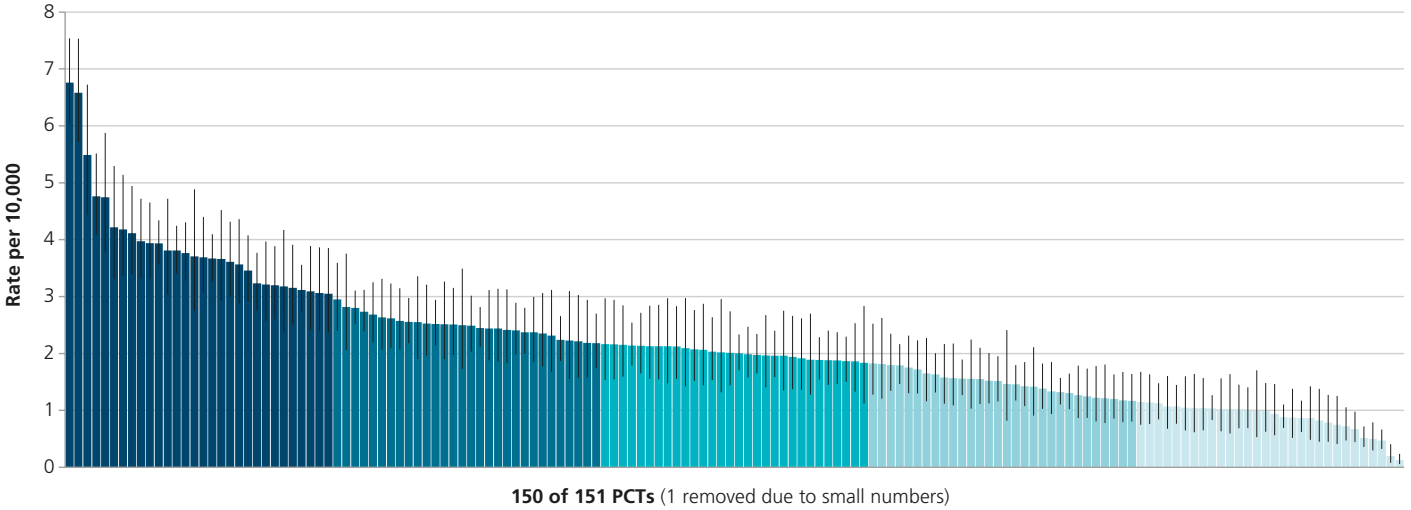
ENDOSCOPY SERVICES

Map 21A: Rate of endoscopic ultrasound procedures per population by PCT

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





150 of 151 PCTs (1 removed due to small numbers)

Context

An endoscopic ultrasound scan combines the features of endoscopy and ultrasonography. A high-resolution ultrasound probe is incorporated into the tip of an endoscope, which is introduced into the GI tract via mouth or anus. If the ultrasound probe is immediately adjacent to the area of interest, the images are much clearer, and targeted biopsy is more accurate and more likely to show a positive diagnosis.

- From entry via the oesophagus, the device can image and allow sampling from the mediastinum and chest, and from the stomach, the pancreas, adrenal glands, spleen, liver and adjacent nodes.
- From entry via the rectum, the device can image and allow sampling from adjacent pelvic structures.

There is a variety of conditions endoscopic ultrasound can be used for:

- the diagnosis of benign pancreato-biliary disease, including unsuspected gallstones;
- the diagnosis and staging of a number of gastro-intestinal malignancies, including those of the pancreas, stomach, and oesophagus;
- the diagnosis and staging of lung cancer and other chest malignancies;
- the diagnosis and staging of lymphoma;
- the diagnosis of masses of unknown origin.

Complications during endoscopic ultrasound are rare. As with any endoscopic procedure, the patient should be warned of the risk of perforation. Post-procedure pain, bleeding and infection are all rare.

This indicator has been mapped to two geographies:

- PCT (Map 21A);
- CCG (Map 21B).

Magnitude of variation

For PCTs in England, the rate of endoscopic ultrasound procedures ranged from 0.12 to 6.8 per 10,000 population (55-fold variation).[1] When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.67–4.2 per 10,000 population, and the variation is 6-fold.

For CCGs in England, the rate of endoscopic ultrasound procedures ranged from 0.20 to 9.9 per 10,000 population (50-fold variation).[2] When the seven CCGs with the highest rates and the seven CCGs with the lowest rates are excluded, the range is 0.65–4.7 per 10,000 population, and the variation is 7-fold.

The magnitudes of variation for the rate of endoscopic ultrasound procedures per 10,000 population by both PCT and CCG are shown in Table 21.1; see also Maps 21A and 21B, respectively.

The degree of variation observed is unlikely to be due to differences in the local population of the prevalence of the conditions for which endoscopic ultrasound is indicated, except perhaps for differences in the prevalence of acute pancreatitis.

Reasons for unwarranted variation could include differences in:

- the level of access to endoscopic ultrasound;
- the availability of trained operators and/or endosonographers.

Table 21.1: Rate of endoscopic ultrasound procedures per 10,000 population by PCT and CCG 2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	0.12–6.8	55	0.67–4.2	6
CCG	0.20–9.9	50	0.65–4.7	7

1 Data from one PCT have been removed due to small numbers.
2 Data from 7 CCGs have been removed due to small numbers.

Options for action

To reduce the degree of unwarranted variation in the level of activity for endoscopic ultrasound, commissioners, clinicians and service providers need:

- to review the level of provision in relation to need in the local population;
- to audit the service at regular intervals;
- to ensure appropriate training and skills development are available for endosonographers;
- to ensure the peer-review of diagnostic and staging pathways in order to demonstrate compliance with available guidance on the use of endoscopic ultrasound (see "Resources").

RESOURCES

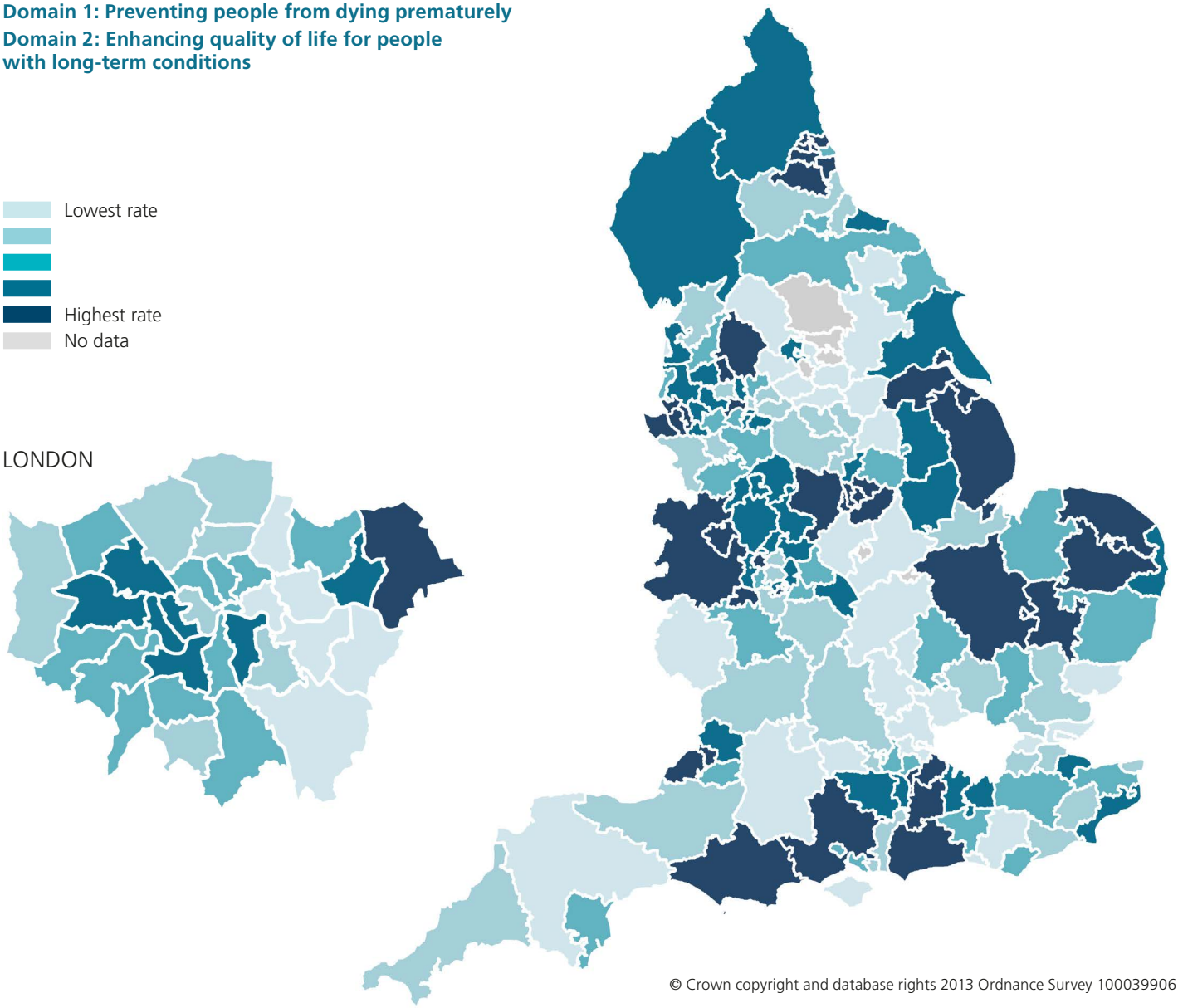
- Meenan J, Harris K, Oppong K et al (2011) Service provision and training for endoscopic ultrasound in the UK. *Frontline Gastroenterology* 2; 188-194. Published Online First: 8 April 2011 doi:10.1136/fg.2010.004101. http://fg.bmj.com/content/2/3/188.abstract
- Carroll N, Penman I (2004) UK EUS Users Group. Recommendations for training in endosonography (EUS) Draft 1.0 October 2004. http://www.bsg.org.uk/pdf_word_docs/eus_train.doc

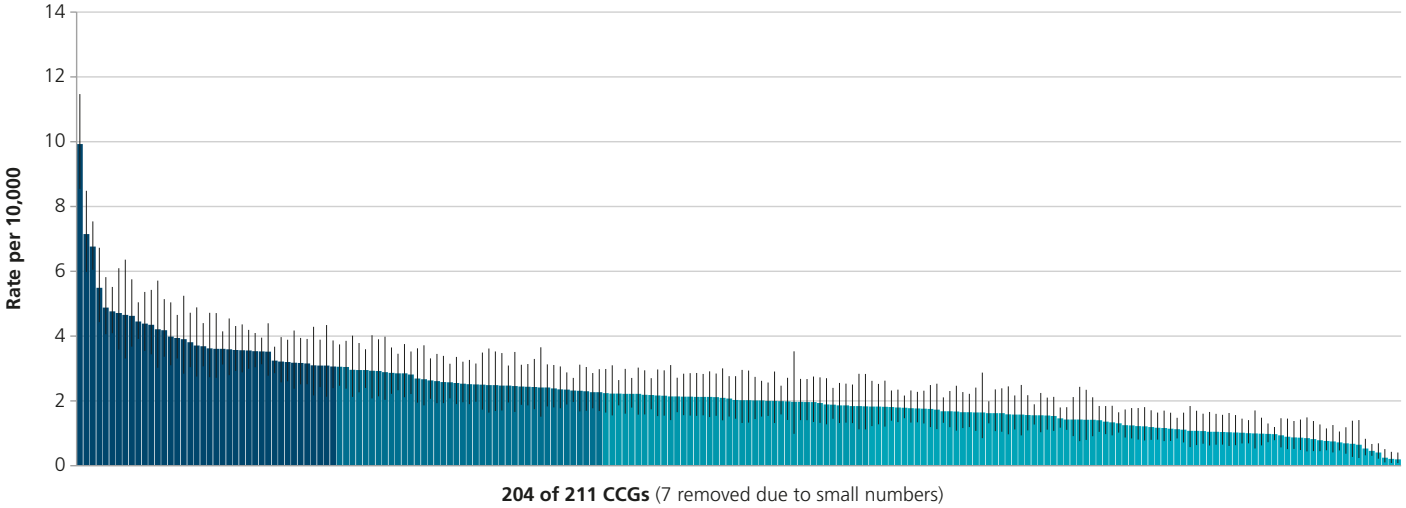
ENDOSCOPY SERVICES

Map 21B: Rate of endoscopic ultrasound procedures per population by CCG

Indirectly standardised rate, adjusted for age, sex and deprivation 2011/12

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





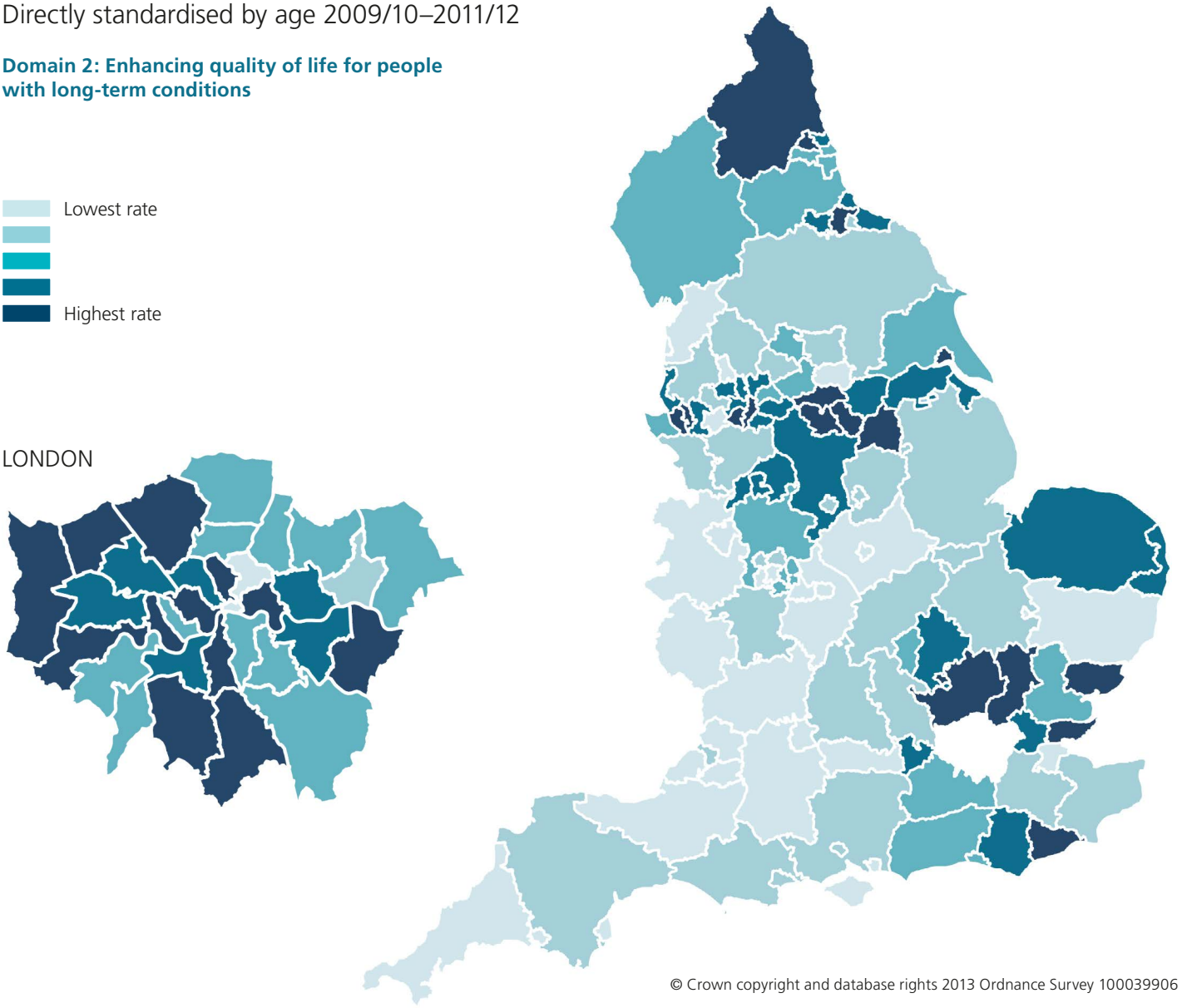
204 of 211 CCGs (7 removed due to small numbers)

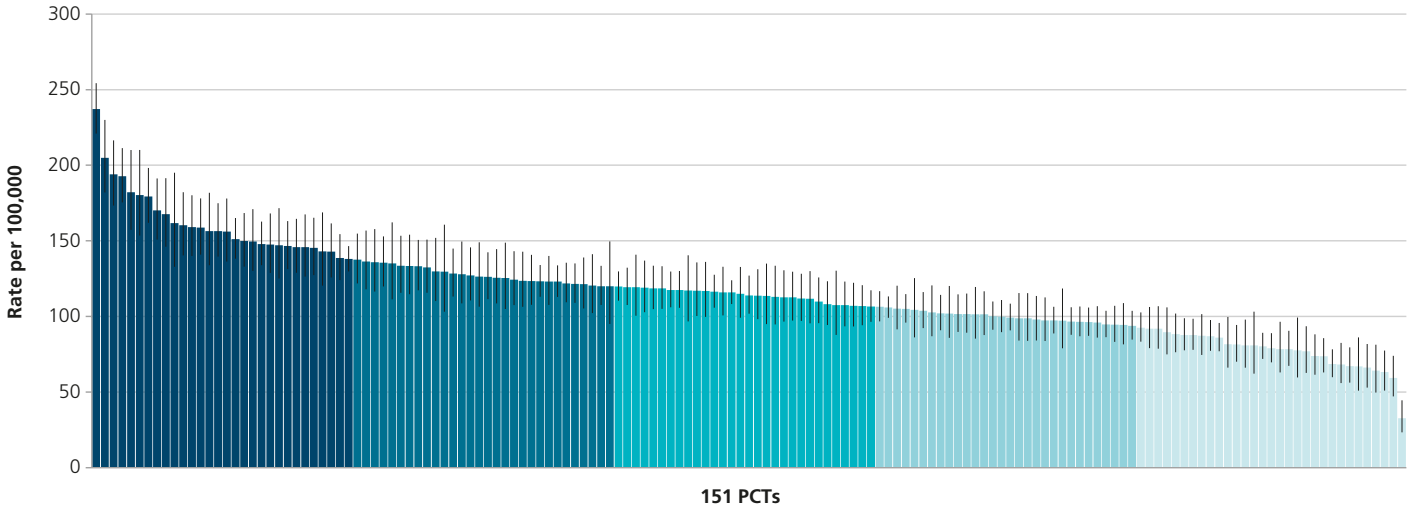
ENDOSCOPY SERVICES

Map 22A: Admission rate for children for upper and/or lower gastro-intestinal endoscopy per population aged 0–17 years by PCT

Directly standardised by age 2009/10–2011/12

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





Context

Diagnostic gastro-intestinal (GI) endoscopy enables the GI tract to be visualised directly, and for biopsies to be carried out to aid diagnosis. Endoscopy is undertaken in children to diagnose or exclude serious GI disease, such as inflammatory bowel disease,[1] coeliac disease, enteropathy and gastro-oesophageal reflux disease.

Symptoms most commonly resulting in referral for diagnostic GI endoscopy are abdominal pain, faltering growth, recurrent vomiting and diarrhoea and/or blood per rectum. Where investigations (including GI endoscopy) fail to find an organic cause for these symptoms, a diagnosis of functional GI disorder (GI symptoms without structural or physical abnormalities) is considered.

Over the past decade, the rates of diagnostic GI endoscopy have greatly increased in the UK, associated with a trend for earlier and more accurate diagnosis of severe GI disease. There are, however, no data available on the "appropriate" number of endoscopies per population to improve clinical outcomes.

Magnitude of variation

For PCTs in England, the admission rate for children for upper and/or lower GI endoscopy ranged from 32.7 to 237.1 per 100,000 population aged 0–17 years (7-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 66.9–180.2 per 100,000 population aged 0–17 years, and the variation is 2.7-fold.

For CCGs in England, the admission rate for children for upper and/or lower GI endoscopy ranged from 43.5 to 207.0 per 100,000 population aged 0–17 years (4.8-fold variation). When the seven CGs with the highest rates and the seven CCGs with the lowest rates are excluded, the range is 65.3–163.2 per 100,000 population aged 0-17 years, and the variation is 2.5-fold.

The magnitudes of variation for the admission rate for children for upper and/or lower GI endoscopy per 100,000 population aged 0–17 years by both PCT and CCG are shown in Table 22.1; see also Maps 22A and 22B, respectively.

The degree of variation observed is unlikely to be explained by differences in the number of children with symptoms or the incidence of serious organic GI disease. Low rates of GI endoscopy may reflect inadequate provision or poor access, leading to delayed or missed diagnosis in the local population of children. High rates may reflect:

- the ready availability of, and lower thresholds for, paediatric endoscopy at some centres;
- relative lack of access to alternative diagnostic or management strategies, such as psychological support for children with functional disorders.

For PCTs in England, the admission rate for children for upper and/or lower GI endoscopy per 100,000 population aged 0–17 years over three time-periods is shown in Table 22.2.

The degree of variation after exclusions seems relatively stable, suggesting that the variation in practice and the thresholds for investigation are settled or established. The geographical clustering of high intervention rates reinforces this view. Gastro-intestinal endoscopy in children seems to be an example of preference-sensitive care (see "Introduction", page 18, and "Glossary of Essential Terms", page 205).

Table 22.1: Admission rate for children for upper and/or lower gastro-intestinal endoscopy per 100,000 population aged 0–17 years by PCT and CCG 2009/10–2011/12

Geography	Range	Fold difference	Range after exclusions	Fold difference after exclusions
PCT	32.7–237.1	7	66.9–180.2	2.7
CCG	43.5–207.0	4.8	65.3–163.2	2.5

1 This term is mainly used to describe two diseases – Crohn's disease and ulcerative colitis.

Table 22.2: Admission rate for children for upper and/or lower gastro-intestinal endoscopy per 100,000 population aged 0–17 years by PCT over three time-periods

Time-period	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2007/08–2009/10	39.9–226.3	6	62.5–168.4	2.7	Map 42, Atlas 2.0 (2011); Map 23, Child Health Atlas
2008/09–2010/11	55.0–219.7	4	64.3–163.9	2.5	
2009/10–2011/12	32.7–237.1	7	66.9–180.2	2.7	

Options for action

To maximise yield and reduce unnecessary risks to patients, guidance is needed on the selection of children most likely to benefit from diagnostic GI endoscopy. It is important to develop clinical guidance, based on best evidence rather than clinical consensus, particularly as thresholds for endoscopy are refined through advances in medical practice (e.g. for coeliac disease), and from the emergence of newer conditions for which endoscopy is a pre-requisite, such as eosinophilic oesophagitis.

In the absence of national guidance, commissioners and clinicians need to agree local criteria for diagnostic GI endoscopies in children based on best available evidence, and the criteria need to be outcome- as well as process-based. It is important to benchmark criteria against agreements made in other localities to ensure equity of access and high-quality outcomes.

A networked system of delivering paediatric endoscopy will help to rationalise the criteria for endoscopy, ensuring:

- sustainable levels of activity that relate to local population needs;
- comparison of outcomes within and among networks;
- support for training and quality assurance;
- equity of access through common thresholds for intervention;
- rare but life-saving provision of out-of-hours interventional endoscopy in children.

The formalisation of paediatric networks, based on existing informal networks for the delivery of specialist children's gastro-enterology services, is anticipated under the aegis of NHS England.

RESOURCES

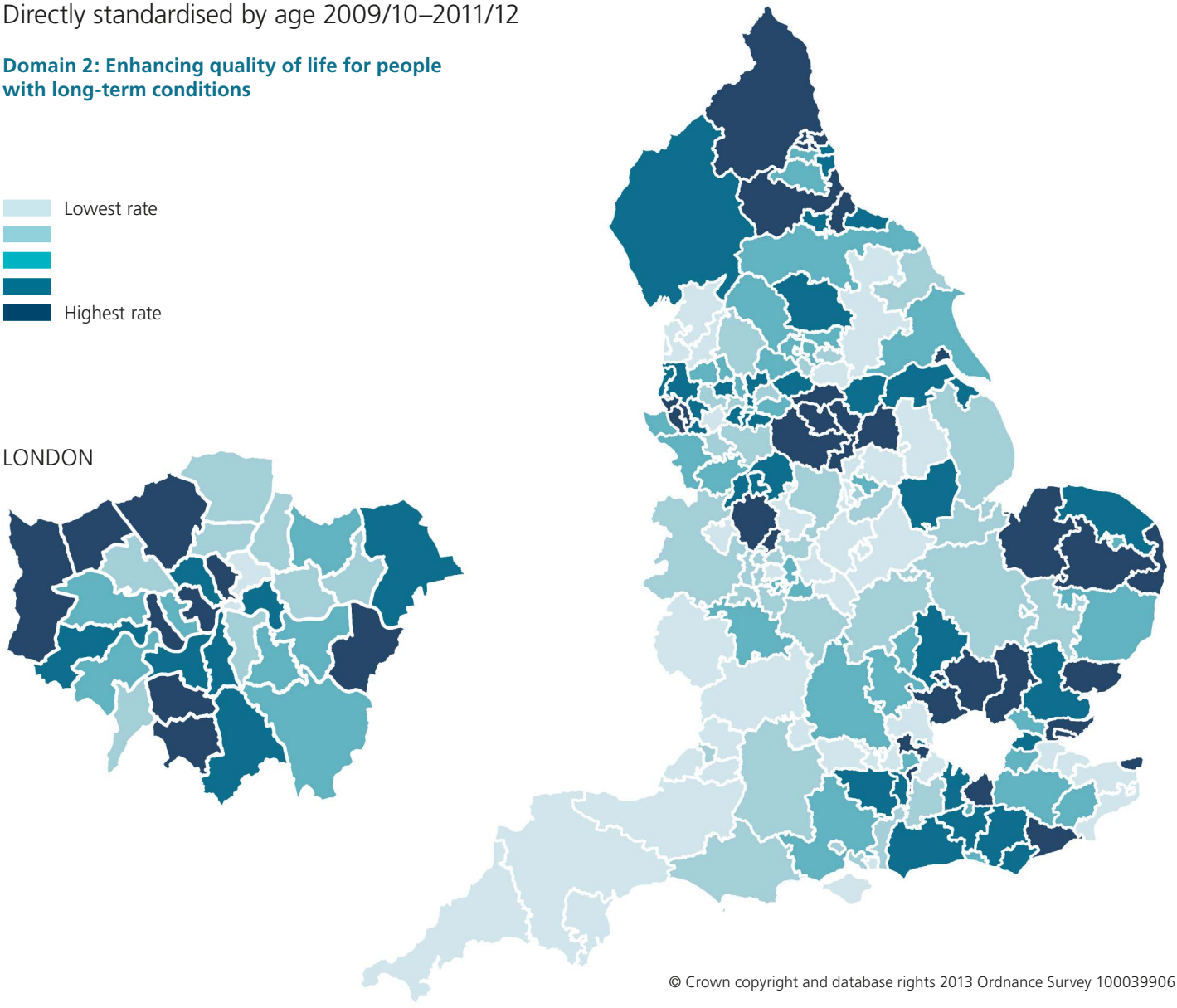
- BSPGHAN. Guide for Purchasers of PGHN Services. http://www.bspghan.org.uk/information/guides.shtml
- NICE (2007) Upper GI endoscopy service commissioning guide. http://www.nice.org.uk/usingguidance/commissioningguides/uppergiendoscopyservices/uppergiendoscopyservices.jsp
- BSPGHAN (2008) Guidelines for the management of inflammatory bowel disease in Children. http://www.bspghan.org.uk/documents/IBDGuidelines.pdf
- Coeliac Working Group of BSPGHAN (2012) Guideline for the diagnosis and management of coeliac disease in children. http://www.coeliac.org.uk/sites/files/coeliac/bspghan_guidelines.pdf
- Royal College of Physicians. Inflammatory Bowel Disease Quality Improvement Project. http://www.ibdqip.co.uk
- Specialised Services commissioning specification E3c Paediatric Gastroenterology, Hepatology and Nutrition. https://www.engage.england.nhs.uk/consultation/ssc-area-e/supporting_documents/e3cservicespec.pdf
- Joint Advisory Group (JAG) for GI endoscopy. JAG defines and maintains the standards by which endoscopy is practised in the UK. Website has a section on "Commissioning". http://www.thejag.org.uk/
- Endoscopy Global Rating Scale (GRS). The Productivity and Planning Assessment Tool (PPAT) "is live on the GRS tab", and can be completed online to enable benchmarking. https://www.jagaccreditation.org/Page.aspx?ID=5
- Child and Maternal Health Intelligence Network provides information and intelligence to improve decision-making for high-quality, cost-effective services, thereby supporting policy-makers, commissioners, managers, regulators, and other health stakeholders working on children's, young people's and maternal health. The knowledge hub provides easy access to a wide range of information and knowledge relating to the health of children, young people and maternal health, and there is a suite of online tools for presenting key data and indicators, undertaking needs assessment, capacity planning and more. http://www.chimat.org.uk/

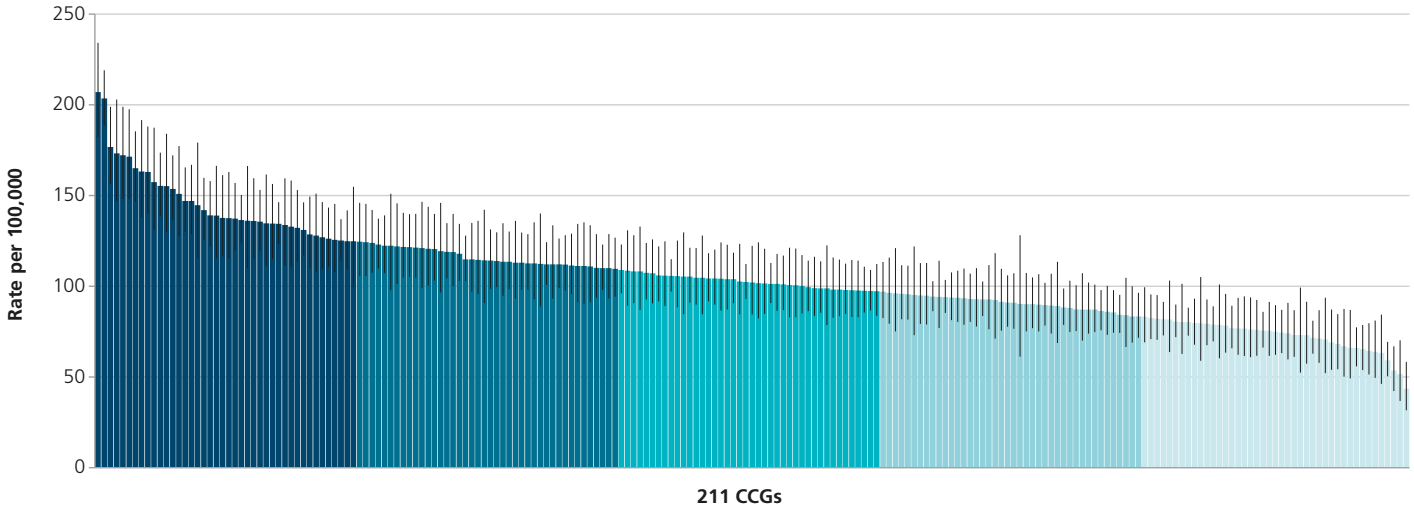
ENDOSCOPY SERVICES

Map 22B: Admission rate for children for upper and/or lower gastro-intestinal endoscopy per population aged 0–17 years by CCG

Directly standardised by age 2009/10–2011/12

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



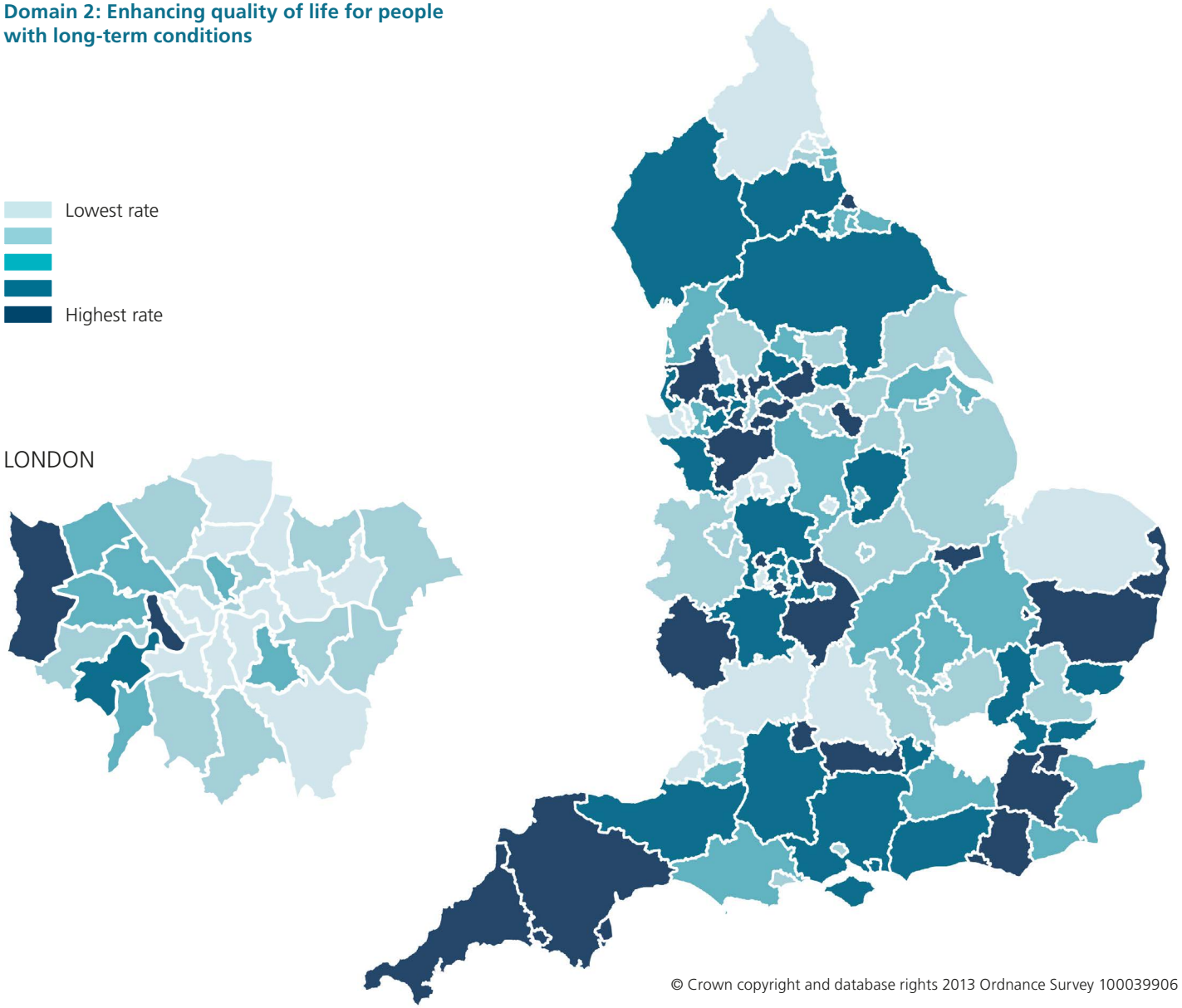


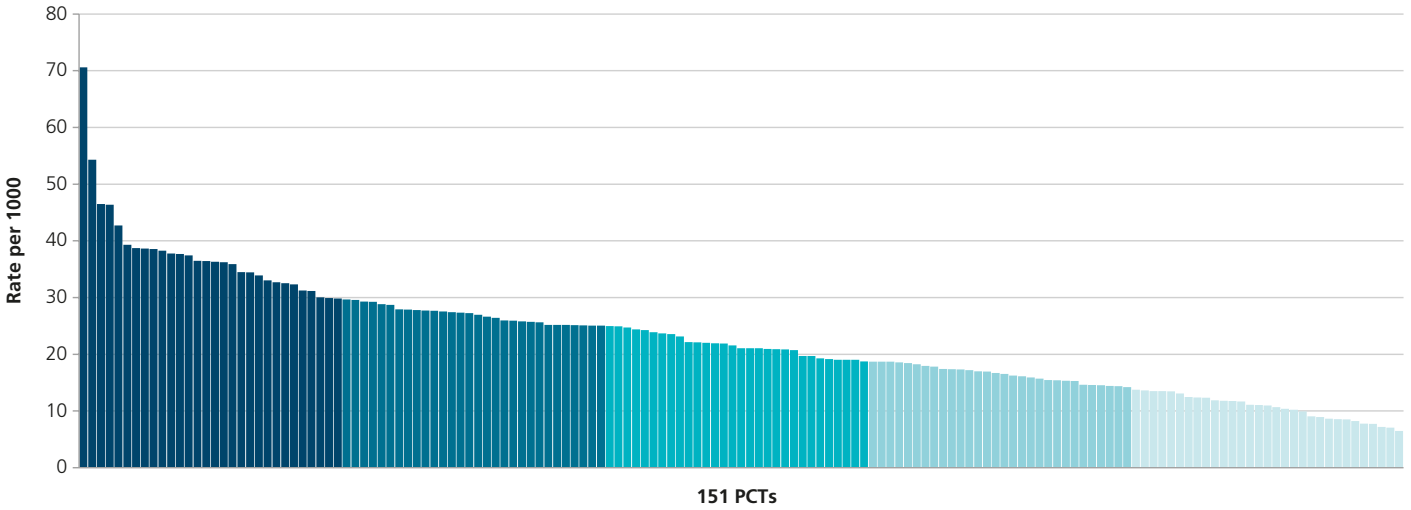
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 23: Rate of audiology assessments undertaken per weighted population by PCT

2012/13

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





Context

Ten million young people and adults and 35,000 children across England are affected by hearing loss. Hearing problems can impact on the development of language in children, reduce chances of employment, restrict aspirations and life chances, increase the risk of mental health problems and interfere with people's ability to care for their own and their families' long-term health conditions.

In the Global Burden of Disease study, it was found that across the UK, in people of 70 years and over, age-related hearing loss is the eighth most important contribution to the years lived with disability (YLDs). This burden has remained the same for the last 20 years with 3.16% of the total YLDs attributable to hearing loss.[1]

Half of the 10 million people have a hearing loss that can be managed effectively by a care package including hearing aids and other environmental aids to reduce economic, social and personal impacts across their life-course.

Audiology assessments cover a range of investigations of hearing and balance. The assessments determine functional ability, possible pathologies, and impact on the individual's daily activities. Following assessment, an appropriate treatment and support pathway is selected, which can include:

- surgery for cochlear implant;
- rehabilitation support including programmed digital signal processing (digital) hearing aids;
- counselling;
- frequency modulation (FM) systems and assistive listening devices (ALDs).

Referrals for assessment of age-related progressive hearing loss comprise the largest proportion of hearing assessments.

Over the last six years there has been an increase of 7.3% in the numbers of audiology assessments commissioned (Figure 23.1, page 190). Although 35,000 children and 1.6 million adults with hearing loss are being managed and supported by public sector services, population surveys estimate 8 million adults live with un-reported and un-managed loss of whom 4 million have a hearing loss that confers great difficulty in understanding speech, even in a quiet environment.

Over the next 20 years, the impact of hearing loss will increase:

- as the population ages;
- with increasing exposure to social noise (from MP3 players, club music and mobile phones);
- in military personnel exposed to weapons-related noise.

By 2031, it is estimated that over 14.5 million people across England will have a hearing loss.

Magnitude of variation

For PCTs in England, the rate of audiology assessments undertaken ranged from 6.5 to 70.6 per 1000 weighted population (11-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 8.2–39.3 per 1000 weighted population, and the variation is 4.8-fold [see Table 23.1 for 2011/12 data; data for 2010 are presented in Map 23, Atlas 2.0 (2011) but they are not per weighted population].

In 2012/13, there was an increase in the variation observed after exclusions when compared with that in 2011/12. The degree of variation should be highly related to population demography, but intervention rates for people over 65 years in 2011/12 showed a similar degree of variation to that in the general population both before and after exclusions. In a third of PCTs, the rate of provision is 20 per 1000 weighted population or less, which cannot be explained by local demography.

Options for action

Commissioners need to review service capacity and assess long-term plans for capacity development:

- to address any gap between met and unmet need;
- to meet increasing need due to an ageing population, increasing exposure to social noise, and exposure to weapons noise in military personnel.

Building capacity will ensure that hearing loss in local populations is appropriately diagnosed and treated in a timely manner to minimise its broader social and physical impact. To do this, commissioners need to understand:

- the current rate of audiology assessments in relation to local demography in order to estimate the gap between current provision and unmet need;
- the current annual increase in audiology assessments and the expected rate of increase.

Commissioners also need to:

- to raise awareness of hearing loss, its implications in primary care, and the cost-effectiveness of providing good-quality hearing-aid services;
- to ensure that triage and referral arrangements to support earlier management are in place;
- to use commissioning levers to improve quality [through, for example, Improving Quality in Physiological diagnostic Services (IQIPS) see "Resources"].

RESOURCES

- Shaping the Future: Strengthening the Evidence to Transform Audiology Services. NHS Improvement, 2010. http://www.improvement.nhs.uk/audiology/documents/Shaping_the_Future.pdf
- Pushing the Boundaries: Evidence to support the delivery of good practice in audiology. NHS Improvement 2010. http://www.improvement.nhs.uk/LinkClick.aspx?fileticket=zRsxjLXTeCw%3D&tabid=56
- IQIPS. https://www.iqips.org.uk/

Table 23.1: Rate of audiology assessments undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	4.4–67.0	15	9.9–41.0	4.2
2012/13	6.5–70.6	11	8.2–39.3	4.8

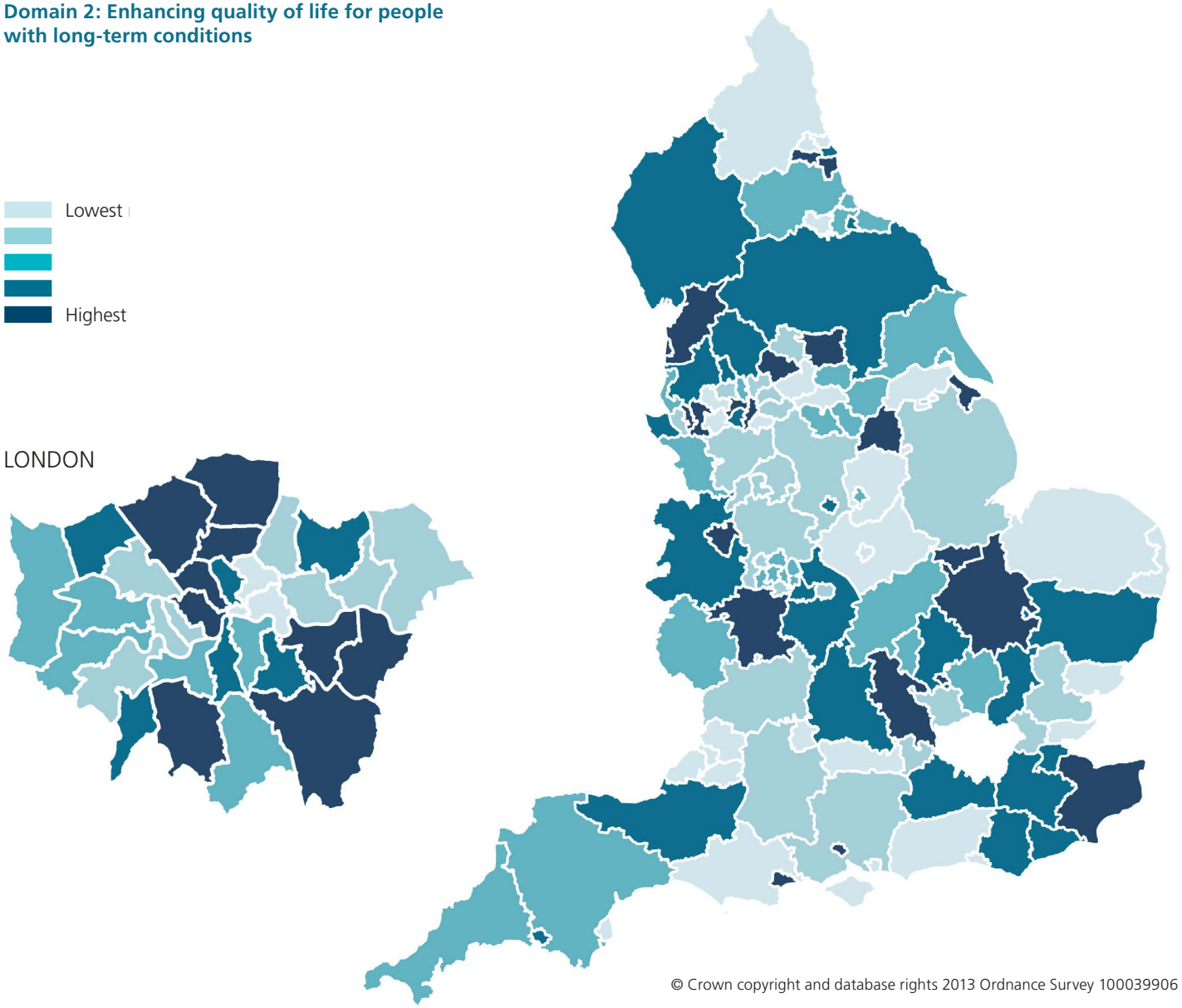
1 The Global Burden of Disease Study (2010) *The Lancet* 380; 2053-2260.

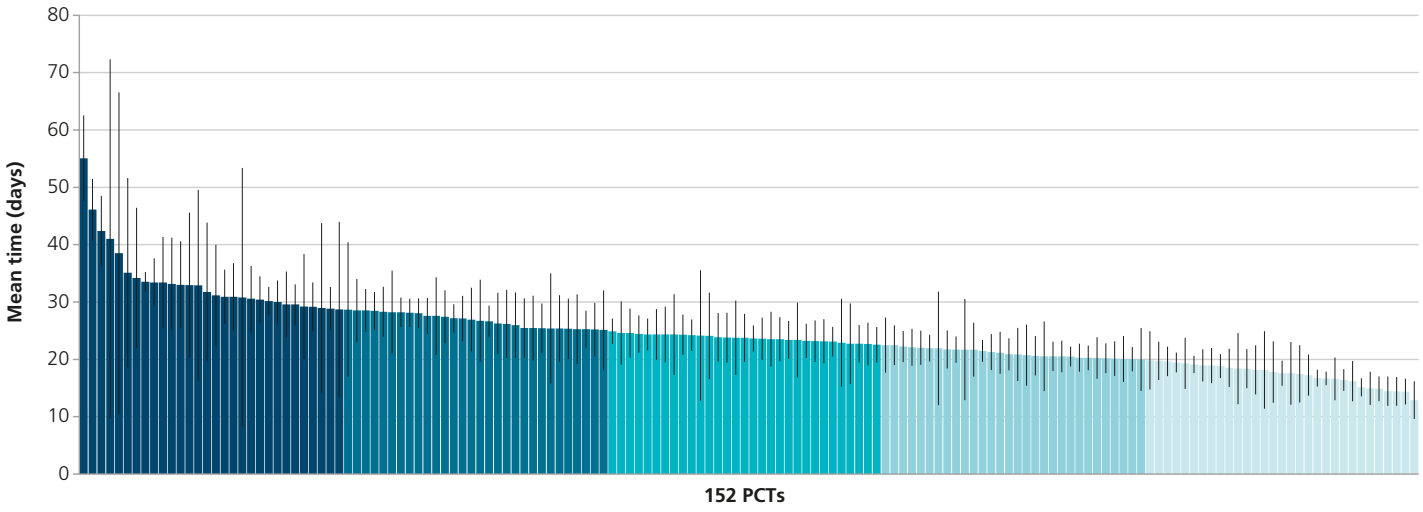
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 24: Mean time (days) from referral to assessment for hearing tests in newborns by PCT

2012

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





Context

Each year, around 1000 babies are born with permanent childhood hearing impairment. In England, 35,000 children are affected by hearing loss, and receive treatment, care and support services from the NHS, social care and education services. About £250 million per year is spent on paediatric audiology and education services for children, and on related family support services. Early identification by the NHS Newborn Hearing Screening Programme (NHSP) has dramatically improved early diagnosis and promoted early intervention to reduce the impact of hearing loss.

Through the NHSP, children are referred to paediatric diagnostic audiology services if they have a poor response in either one ear or both ears at screening. The average referral rate to paediatric diagnostic audiology services is 2.1%: for about 0.5% of referrals, babies do not have a clear response in both ears; for 1.6% of referrals, babies do not have a clear response in one ear.

Each year in England, between 13,000 and 14,000 children are referred from NHSP for electrophysiological audiological assessment. Following assessment, children are diagnosed as:

- permanently deaf;
- in need of further diagnostic testing;
- hearing within normal limits.

Of the 1000 children identified as deaf by the NHSP in a year, 750 will have bilateral deafness; of those 750 children, 170 will be profoundly deaf.

The NHSP has quality standards and service specifications (see "Resources"). The key performance indicator relating to referral for audiological assessment is:

> *"All parents of babies that refer from the screen and wish to continue should be offered an appointment that is within 4 weeks of screen completion."*

This indicator focuses on the interface between the NHSP and NHS paediatric audiology services. The data show mean time to confirmatory assessment after referral from the NHSP.

Reducing the degree of variation in the mean time from referral to assessment for hearing tests in England will reduce the level of inequity for newborns and their parents, who are offered hearing screening, and enable better outcomes to be achieved.

Magnitude of variation

For PCTs in England, the mean time from referral to assessment for hearing tests in newborns ranged from 12.9 to 55.1 days (4.3-fold variation). When the five PCTs with the highest mean times and the five PCTs with the lowest mean times are excluded, the range is 14.9–35.1 days, and the variation is 2.4-fold (for 2010 data, see Table 24.1).

Reasons for warranted variation include differences in the levels of risk, multi-morbidity and genetic aetiologies in different localities.

Possible reasons for unwarranted variation include differences in:

- capacity;
- peer-to-peer network support;
- prioritisation of services;
- arrangements for cover;
- availability of staff from education services with whom to work;
- quality of management of audiology assessment services.

Between 2010 and 2012, the degree of variation observed in mean time from referral to assessment decreased, although it is important to consider the degree of variation from screening to intervention via diagnosis to ensure that the whole pathway to intervention is not subject to unwarranted variation.

Options for action

In localities where the mean time from referral to assessment for hearing tests is 25 days or more, commissioners and service providers need to work in partnership to explore why the times are longer than those in the middle part of the distribution (see column chart), including looking at the interface between local screening services, paediatric audiology services and education services. Commissioners need to explore, with service networks, arrangements for peer-review of performance and other quality indicators in the 2012/13 Quality Assurance reports made available to the responsible officers in local services, commissioning and public health.

With the Map of Medicine®, the UK National Screening Committee (NSC) produced pathways for all the English non-cancer screening programmes for which it is responsible. The Map of Medicine care pathways for newborn hearing screening (including diagnostic assessment and habilitation) can be localised by commissioners and providers to promote standards in newborn hearing screening, including improving the time from referral to assessment (see "Resources").

RESOURCES

- NHS Newborn Hearing Screening Programme (NHSP). Standards and Protocols. http://hearing.screening.nhs.uk/standardsandprotocols
- NHS Newborn Hearing Screening Programme (NHSP). NHSP Map of Medicine care pathways. http://hearing.screening.nhs.uk/cms.php?folder=3788
- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/

Table 24.1: Mean time (days) from referral to assessment for hearing tests in newborns by PCT for two calendar years

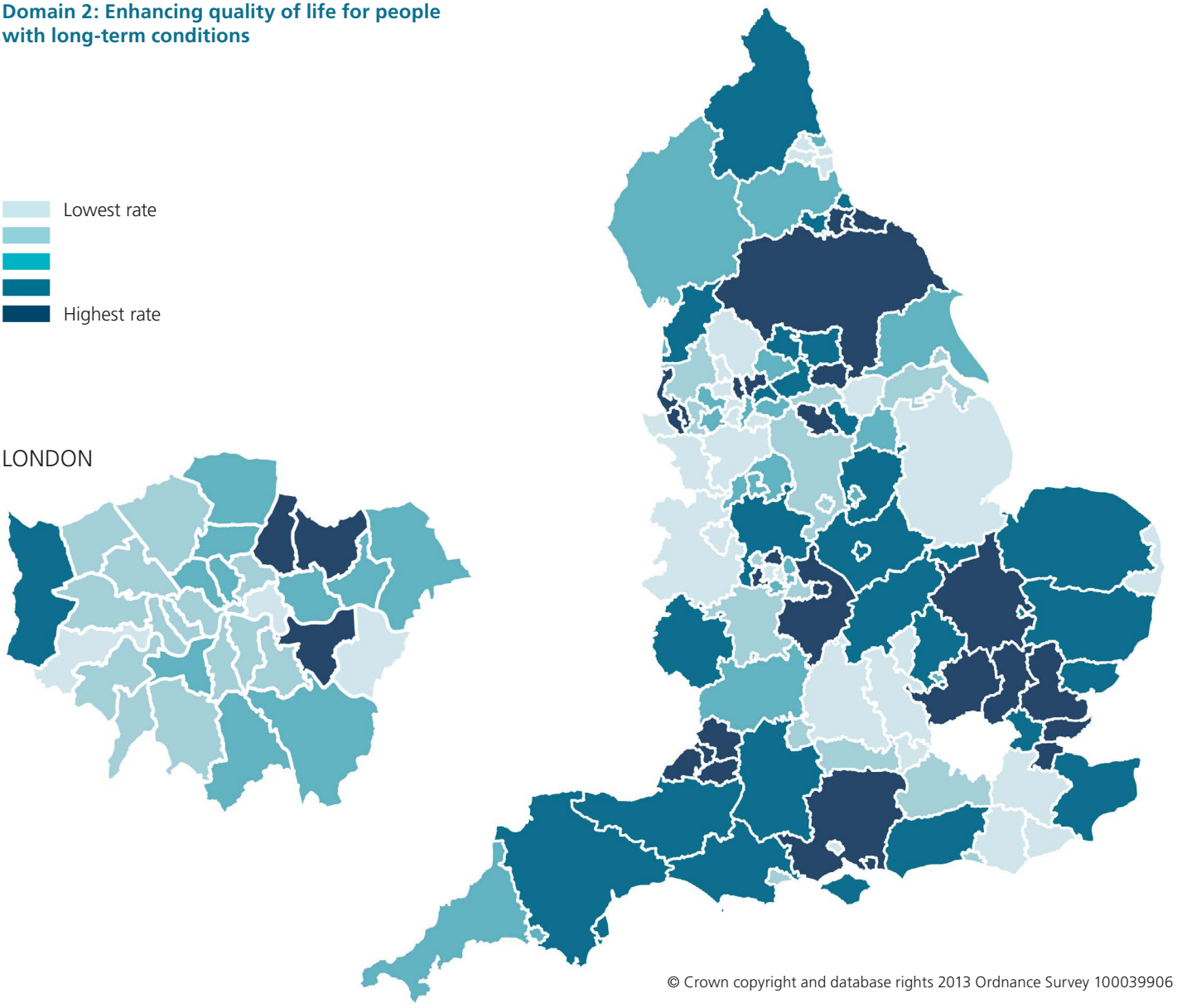
Calendar year	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Notes
2010	10.5–57.2	5	13.3–43.6	3.3	Map 24, Atlas 2.0 (2011)
2012	12.9–55.1	4.3	14.9–35.1	2.4	

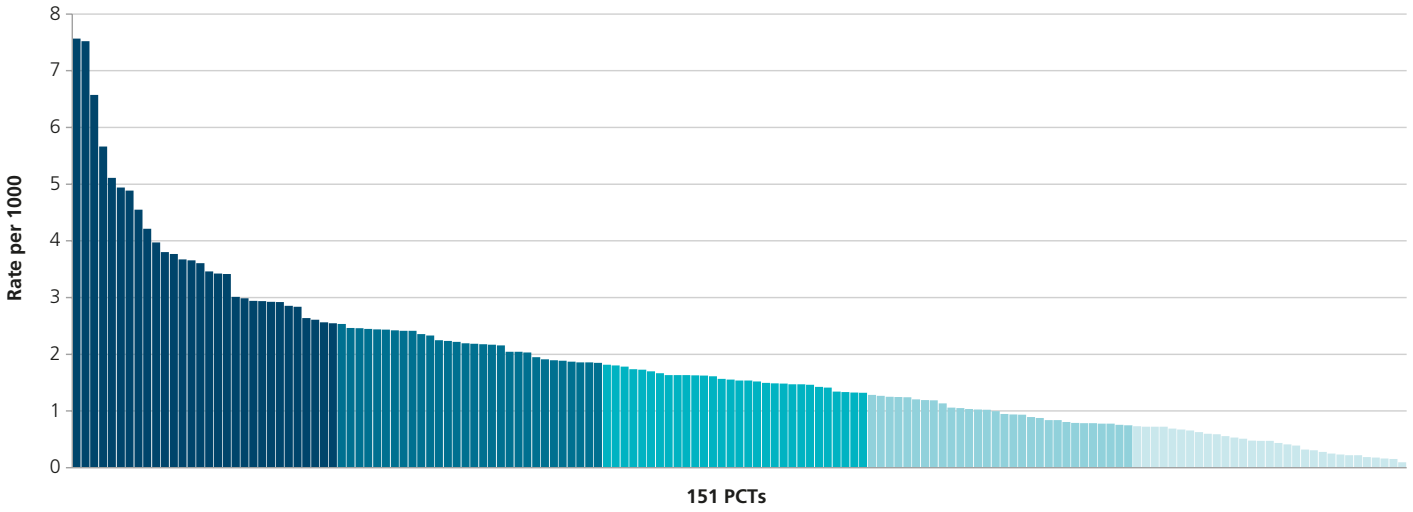
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 25: Rate of sleep studies undertaken per weighted population by PCT

2012/13

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





Context

Sleep studies are conducted to identify abnormal sleep patterns and pathologies, and to assess and provide therapeutic intervention. There are more than 80 recognised sleep disorders, which may affect the timing, quality and quantity of sleep. Sleep disorders can vary from mild to life-threatening. Common sleep disorders are insomnia, sleep apnoea, restless leg syndrome, narcolepsy, and sleep problems associated with Parkinson's disease, autism and many other conditions. Obstructive sleep apnoea (OSA) is the most common, affecting up to 5% of the population. During sleep, muscles in the upper airway relax to a greater degree than normal or parts of the airway become blocked for one of several reasons, resulting in apnoeas or pauses in breathing lasting from 10 seconds to two minutes. Apnoeas can cause sleep disruption and poor-quality sleep, leading to daytime sleepiness with an increased risk of serious road traffic accidents. If left untreated, OSA can be a risk factor for stroke, cardiovascular problems or diabetes.

Obstructive sleep apnoea is more common in men than women, and becomes increasingly more common in men with age. There is also a link between OSA and obesity.

There are two referral routes for sleep studies:

- Respiratory;
- Neurological – in clinical neurophysiology departments, which have a higher mean cost but lower activity rates when compared with studies undertaken via the respiratory referral route.

There has been an increase of 54.2% in the commissioning of sleep studies over the last six years (see Figure 25.1, page 190). Reasons for this increase may be the clearance of backlogs in accordance with the interim diagnostic waiting time targets and the maximum waiting time constitutional right. Other factors may increase the demand for sleep studies, e.g. the OSA Project of The British Lung Foundation, which could also raise the profile of sleep-related problems and result in additional referrals.

As the real prevalence of sleep apnoea is up to 4% in middle-aged men, current rates of provision of sleep studies may be too low. When the rates of polysomnography (PSG) sleep tests were compared in five countries, the UK's rate of provision was significantly lower than that in other countries. In future, therefore, the number of sleep studies undertaken in England is likely to continue to increase.

Magnitude of variation

For PCTs in England, the rate of sleep studies undertaken ranged from 0.10 to 7.6 per 1000 weighted population (79-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.22–4.9 per 1000 weighted population, and the variation is 23-fold [see Table 25.1 for 2011/12 data; although data for 2010 are presented in Map 35, Atlas 2.0 (2011), they are not per weighted population].

In 2012/13, there has been a decrease in the variation observed when compared with 2011/12, but the level of variation is still high at 23-fold.

Reasons for the degree of variation observed are differences in:

- availability of the service;
- prevalence of related conditions such as obesity;
- symptom recognition and appropriate referral in primary care.

In localities with large sleep centres, which take many tertiary referrals, the rates of testing for sleep-related conditions tend to be higher.

Options for action

Commissioners need to review referral and delivery models for sleep services to help reduce unwarranted variation. Other options for action for commissioners are:

- refining their understanding of expected and observed prevalence of related conditions;
- reviewing funding models (e.g. block contract versus payment by results) to ensure there are no perverse financial incentives to commission inappropriately;
- assessing the demand and available capacity for local sleep services;
- reviewing models for initial diagnostic testing and triage approaches to referral management;
- encouraging local providers to participate in the national accreditation scheme, Improving Quality in Physiological diagnostic Services (IQIPS; see "Resources") to assess quality and productivity.

RESOURCES

- Transforming Respiratory and Sleep Diagnostic Services. A Good Practice Guide. Department of Health, Feb 2009. http://www.improvement.nhs.uk/physiologydiagnostics/documents/RespiratoryGoodPractice_060209.pdf
- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/

Table 25.1: Rate of sleep studies undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	0.13–7.7	61	0.22–6.4	29
2012/13	0.10–7.6	79	0.22–4.9	23

1 British Lung Foundation (2013) Obstructive sleep apnoea Project. Year 2 Report. http://www.blf.org.uk/Page/Obstructive-Sleep-Apnoea

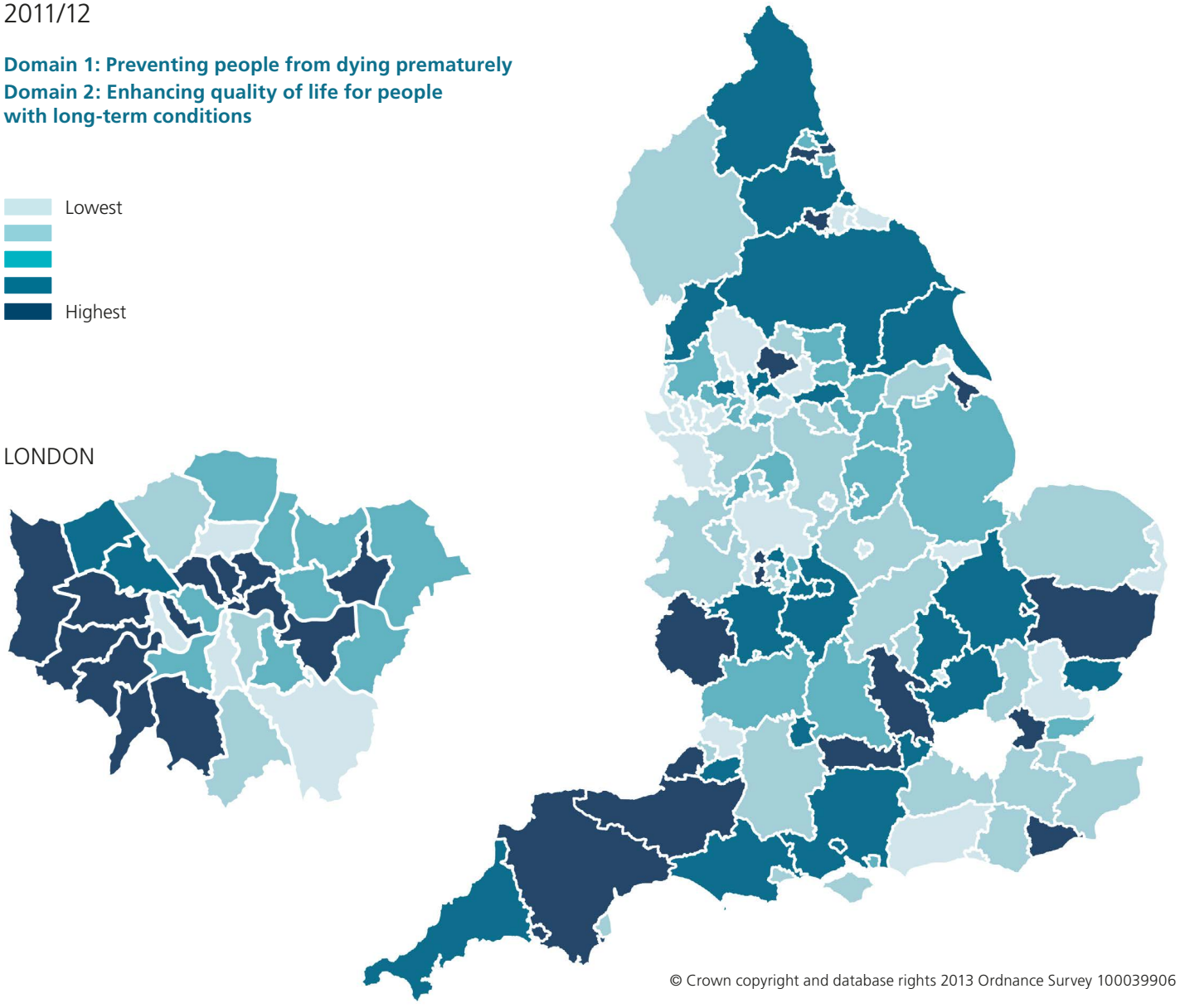
2 Flemons WW, Douglas NJ, Kuna ST et al (2004) Access to Diagnosis and Treatment of Patients with Suspected Sleep Apnea. *American Journal of Respiratory and Critical Care Medicine* 169; 668-672. doi: 10.1164/rccm200308-1124PP. http://www.atsjournals.org/doi/pdf/10.1164/rccm.200308-1124PP

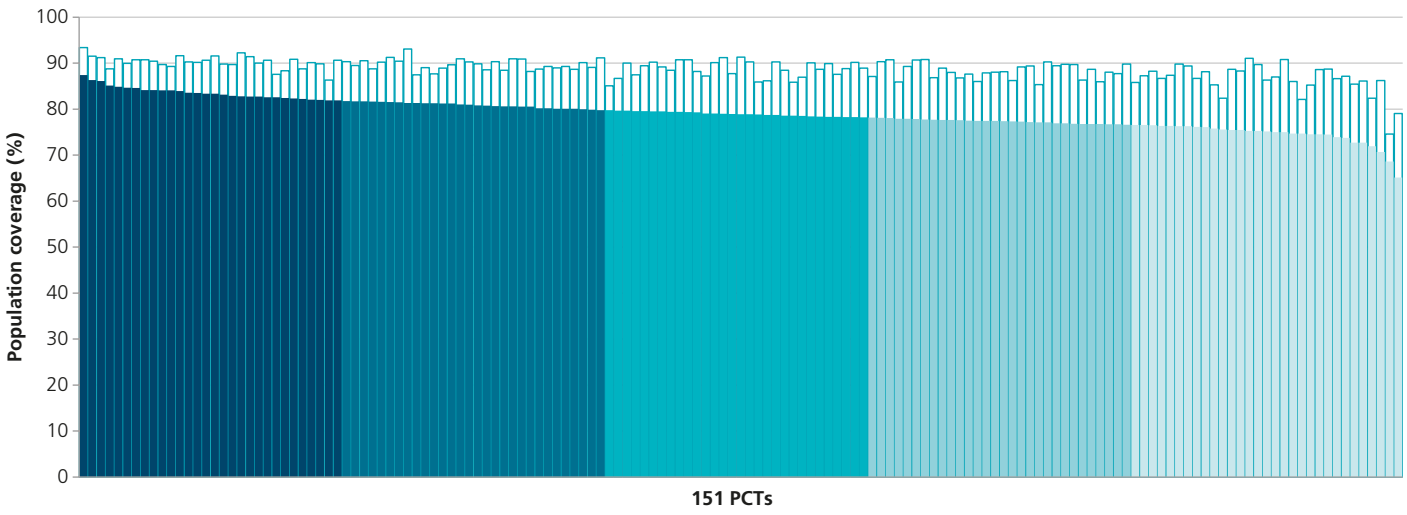
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 26: Percentage of patients with COPD with a record of FeV_1 in the previous 15 months by PCT (QOF COPD10 with exception-reported patients included)

2011/12

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





Context

NICE recommends spirometry as the objective test to identify abnormalities in lung volumes and air flow.[1] It is the standardised measurement of a forced expiration (FE) into a calibrated measuring device or spirometer. In conjunction with physical assessment, history-taking, blood tests and X-rays, spirometry is used to exclude or confirm particular types of lung disease, including COPD.

Most of the management for people with COPD is provided in the primary care sector. The chronic disease management delivered by GPs and nurses is likely to have a considerable impact on patient outcomes such as symptom control, quality of life, physical and social activity, admission to hospital, and mortality.

This indicator – COPD10 in the Quality and Outcomes Framework (QOF) 2011/12[2] – reflects one aspect of the chronic disease management of COPD in primary care.[3] Under the QOF scheme, GPs are rewarded for achieving an agreed level of population coverage for each indicator. In calculating coverage, practices are allowed to except appropriate patients from the target population to avoid being penalised for factors beyond the GPs' control, e.g. when patients do not attend for review despite repeated invitations, or if a medication cannot be prescribed due to a contra-indication or side-effect. It is this exception-adjusted population coverage that is reported annually.

Patients not seen for review, however, are at high risk of not receiving appropriate pro-active chronic disease management and, therefore, of experiencing worse outcomes than patients who do receive a review.

For this indicator, QOF 2011/12 data have been used:

- the map and the coloured columns in the chart on page 108 show the ***actual*** population coverage for each PCT in which excepted patients have been ***included*** in the denominator;
- the open columns in the chart on page 108 show the published ***QOF achievement***, which does ***not include*** excepted patients in the denominator.

Magnitude of variation

For PCTs in England, the percentage of patients with COPD with a record of FeV_1 in the previous 15 months (QOF COPD10 with exception-reported patients included) ranged from 65.1% to 87.4% (1.3-fold variation). When the five PCTs with the highest percentages and the five PCTs with the lowest percentages are excluded, the range is 72.7–84.7%, and the variation is 1.2-fold (for 2010/11 data, see Table 26.1).

Table 26.1: Percentage of patients with COPD with a record of FeV_1 in the previous 15 months by PCT – actual coverage and the published QOF achievement – for two financial years

		Range	Fold difference	Range after exclusions	Fold difference after exclusions
2010/11	Actual coverage	65.8–86.6%	1.3	72.9–83.8%	1.2
	Published QOF achievement	80.6–93.7%	1.2	83.4–91.9%	1.1
2011/12	Actual coverage	65.1–87.4%	1.3	72.7–84.7%	1.2
	Published QOF achievement	74.6–93.4%	1.3	85.1–91.5%	1.1

1 NICE (2010) Chronic obstructive pulmonary disease (updated) (CG101) Management of chronic obstructive pulmonary disease in adults in primary and secondary care. http://guidance.nice.org.uk/CG101

2 BMA and NHS Employers (2011) Quality and Outcomes Framework guidance for GMS contract 2011/12. Delivering investment in general practice. April 2011. http://www.nhsemployers.org/Aboutus/Publications/Documents/QOF_guidance_GMS_contract_2011_12.pdf

3 This indicator was identical in the Quality and Outcomes Framework for 2012/13. Guidance for PCOs and practices. http://www.nhsemployers.org/Aboutus/Publications/Documents/QOF_2012-13.pdf but in the 2013/14 general medical services (GMS) contract quality and outcomes framework (QOF). Guidance for GMS contract 2013/14. http://www.nhsemployers.org/Aboutus/Publications/Documents/qof-2013-14.pdf the indicator number has been changed from "COPD10" to "COPD indicator 004" and the time-frame has been changed from "in the preceding 15 months" to "in the preceding 12 months".

Apart from a slight increase in the values at the upper end of the range, the degree of variation observed in 2011/12 is the same as that in 2010/11.

Although there are legitimate reasons for exception-reporting, the column chart shows that the difference between the published QOF achievement and actual coverage varied substantially at PCT level. Within PCTs, the degree of variation in exception-reporting among practices tended to be much greater. This suggests that some practices are more effective than others at reaching the local COPD population and thereby at influencing patient outcomes.

In addition, spirometry is often performed inaccurately; consequently, around one-quarter of patients on GP COPD registers have been incorrectly diagnosed. In the NICE COPD Quality Standard (see "Resources"), it is recommended that diagnostic spirometry should be carried out on calibrated equipment by healthcare professionals competent in its performance and interpretation. Primary care staff, however, are often inadequately trained or use poor-quality equipment. Patients wrongly included in, or excluded from, the COPD register on the basis of poor-quality spirometry may be receiving inappropriate and potentially harmful treatment. There is a considerable opportunity cost associated with this level of mis-diagnosis: the Department of Health has estimated that up to £29 million is mis-spent on COPD medication in people who may not have COPD.

Options for action

Actual population coverage for systematic chronic disease management in people with COPD is lower than the published QOF achievement suggests. It is possible that many of the people not attending for regular review are among the high-risk patients in whom control is poor. Novel and creative strategies are necessary to reach patients previously not reached in order to optimise their COPD control.

To increase local population coverage of chronic disease management in COPD, commissioners could consider the interventions to help more local practices become effective at reaching the entire local population with COPD through regular review by:

- calculating the actual chronic disease management coverage of registered COPD patients by including excepted patients in the denominator;
- benchmarking and sharing local exception-reporting data;
- identifying the systems to maximise patient-reach used in the best-performing practices;
- supporting local practices with high exception rates to implement best-practice systems and improve patient outcomes through systematic chronic disease management.

To ensure that COPD is diagnosed and treated appropriately within the local population, commissioners need:

- to commission quality-assured spirometry services with an agreed local pathway for referral from primary care, and ensure access to appropriate expertise in local lung function laboratories;
- to support local spirometry services to apply for IQIPS accreditation;
- to ensure that diagnostic spirometry in all local settings is only performed by professionals trained and certified as competent to Association for Respiratory Technology and Physiology (ARTP), or equivalent, standards.

In addition, clinicians in primary care need to review the diagnosis of patients currently on the COPD register to identify those who may not have COPD.

RESOURCES

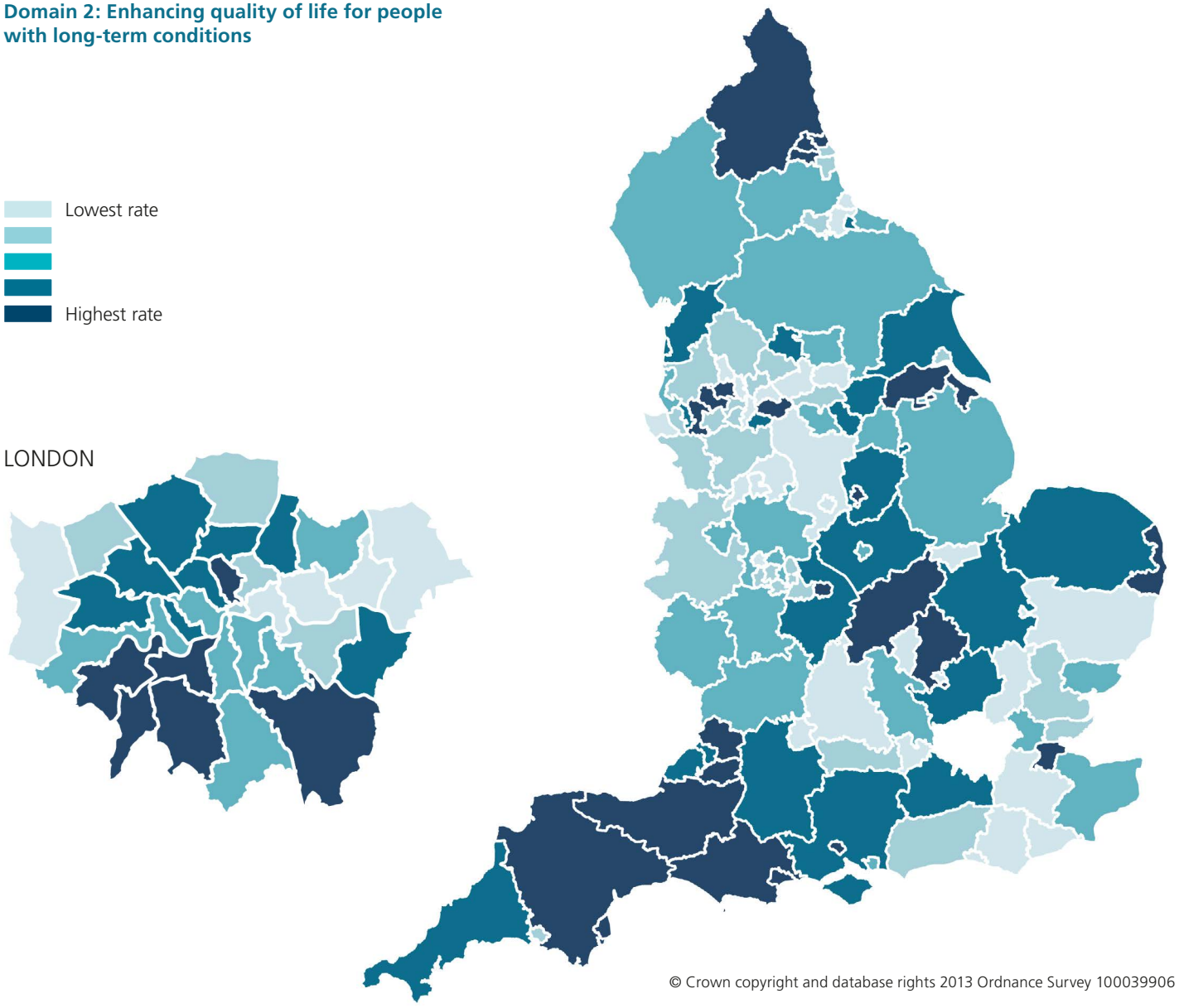
- Department of Health (2011) An outcomes strategy for people with chronic obstructive pulmonary disease (COPD) and Asthma in England. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_127974
- Department of Health (2012) An Outcomes Strategy for COPD and Asthma: NHS Companion Document. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_134000
- NHS Medical Directorate (2012) COPD Commissioning Toolkit. A Resource for Commissioners. https://www.wp.dh.gov.uk/publications/files/2012/08/chronic-obstructive-pulmonary-disease-COPD-commissioning-toolkit.pdf
- Primary Care Commissioning (2013) A Guide to Performing Quality Assured Diagnostic Spirometry. http://cdn.pcc-cic.org.uk/sites/default/files/articles/attachments/spirometry_e-guide_1-5-13_0.pdf
- NICE (2010) Chronic obstructive pulmonary disease (updated) (CG101) Management of chronic obstructive pulmonary disease in adults in primary and secondary care. http://guidance.nice.org.uk/CG101
- NICE (2011) Chronic obstructive pulmonary disease quality standard. http://www.nice.org.uk/guidance/qualitystandards/chronicobstructivepulmonarydisease/copdqualitystandard.jsp
- Public Health England. INHALE – Interactive Health Atlas for Lung conditions in England. http://www.inhale.nhs.uk/
- The Primary Care Respiratory Society. http://www.pcrs-uk.org/

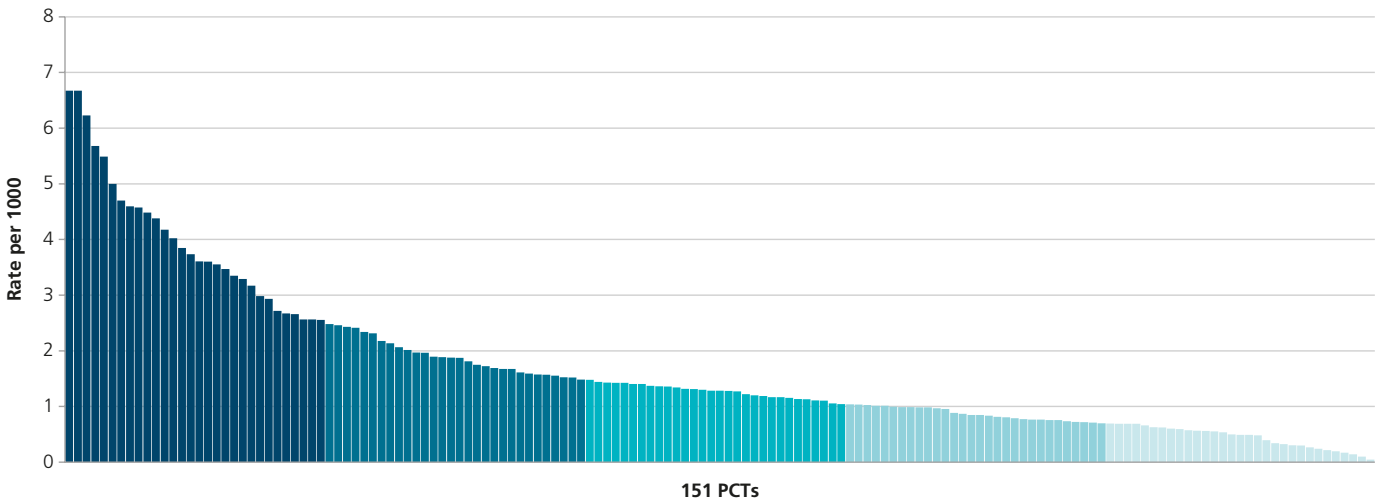
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 27: Rate of urodynamic (pressures and flows) tests undertaken per weighted population by PCT

2012/13

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





Context

Urodynamic testing is an umbrella term, which predominantly involves the measurement of pressure and flow. It enables the clinician to determine what physical factors are involved in bladder disorders. This is important, for example, in the diagnosis of different types of incontinence for which there are different indicated treatments. Urodynamic testing allows the patient to be offered the optimal therapy. The largest groups of patients undergoing urodynamic tests are:

- men with bladder outlet obstruction;
- women with incontinence.

The underlying conditions that require urodynamic tests are more prevalent in older people.

There has been a small decrease of 0.28% in the rate of urodynamic (pressures and flows) testing over the last six years (see Figure 27.1, page 191). This indicates no substantial trend in the short to medium term, with the current average rate of testing of 1.75 tests per 1000 weighted population. This rate may need to increase in future to reflect an increase in the prevalence and incidence of key conditions as the population ages. Thus, increased need may lead to increased demand for testing over the long term, broadly in line with the proportion of the population over 60 years of age. Within the next 10 years, it is expected that the number of people over 60 years of age will have increased by around 17%.[1]

Data for this indicator are from DM01, which collects data only on standard urodynamic tests (cystometrograms, video-cystometrograms and ambulatory urodynamics) and not on a less specialised test known as uroflowmetry (free flow rate).

Magnitude of variation

For PCTs in England, the rate of urodynamic tests undertaken ranged from 0.05 to 6.7 per 1000 weighted population (144-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.21–5.0 per 1000 weighted population, and the variation is 23-fold [see Table 27.1 for 2011/12 data; although data for 2010 are presented in Map 54, Atlas 2.0 (2011), they are not per weighted population].

The degree of variation observed is large. In 2012/13, there was an increase in variation after exclusions when compared with 2011/12.

Reasons for the degree of variation include differences in:

- demography – localities with a higher proportion of older people will have higher rates of testing;
- presence of a large spinal injury unit – localities with or near such units have high rates of testing;
- presence of a tertiary centre for continence – localities with or near such centres have rates of testing above average;
- availability of departments and appropriate staff – the number of tests performed each month in some services can often be explained by the presence of key members of staff;
- lack of national guidelines about which diagnostic tests need to be performed in patients with bladder outlet obstruction and incontinence.

Options for action

At present, there are few guidelines about where and how the urodynamic (pressures and flows) tests should be used. There is an urgent need to develop improved professional guidelines and/or agreements on local pathways and models of care.

The focus for commissioners is to ensure equity of access to services. If basic urodynamic tests could be easily and more conveniently carried out in primary care, commissioners need to investigate this option where it has the potential to increase access and reduce unwarranted variation.

Commissioners and service providers need to consider developing local models and pathways for how urodynamic tests are used in key diagnostic and treatment pathways.

Providers need to address quality and productivity in local services via participation in the national accreditation scheme, Improving Quality in Physiological diagnostic Services (IQIPS; see "Resources").

RESOURCES

- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/
- Joint statement on minimum standards for urodynamic practice in the UK. Report of the urodynamic training and accreditation steering group: April 2009. http://www.ukcs.uk.net/docs/joint_statement.pdf

Table 27.1: Rate of urodynamic tests undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	0.09–10.8	122	0.25–4.9	20
2012/13	0.05–6.7	144	0.21–5.0	23

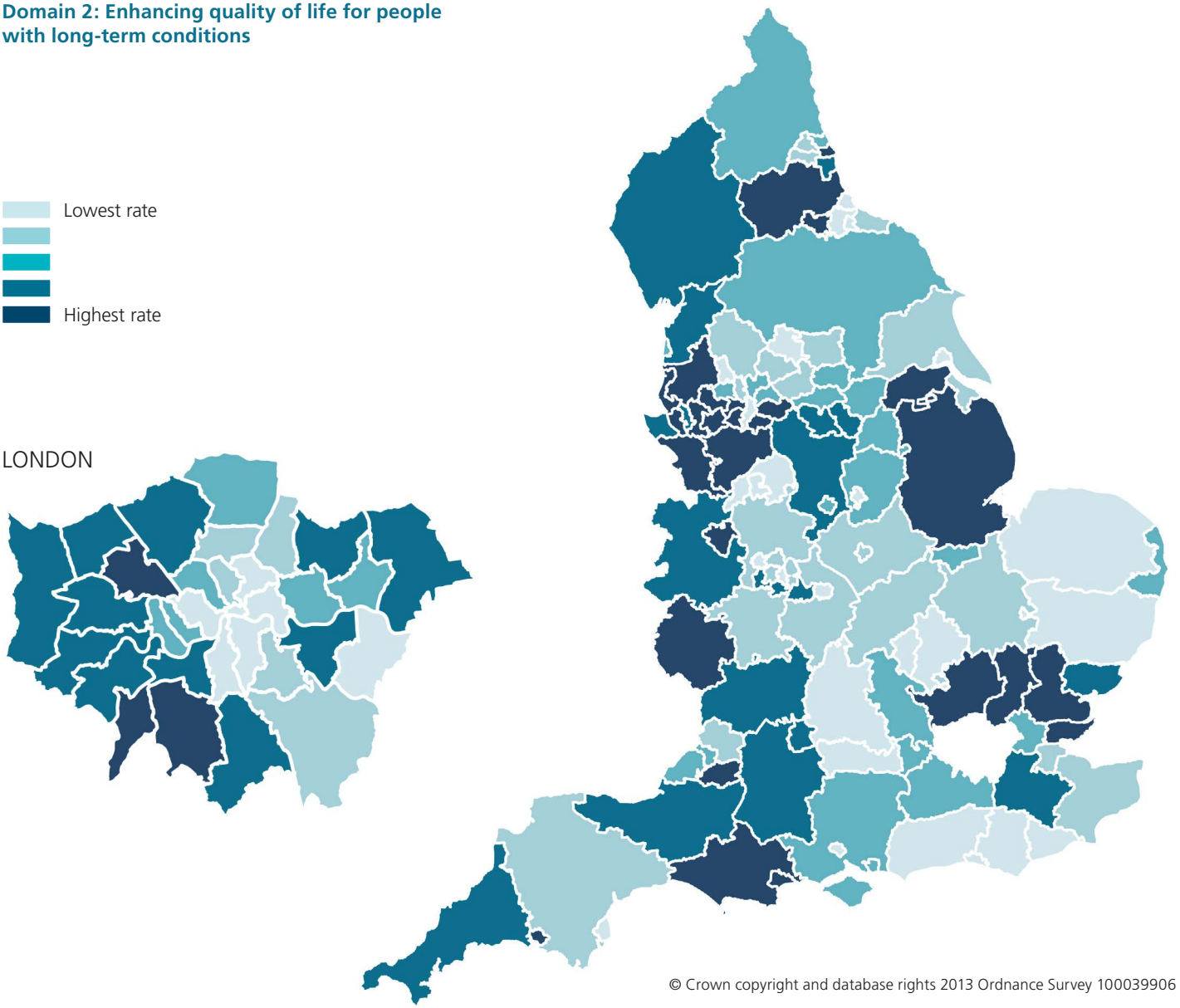
1 Data provided by the Government Actuarial Department.

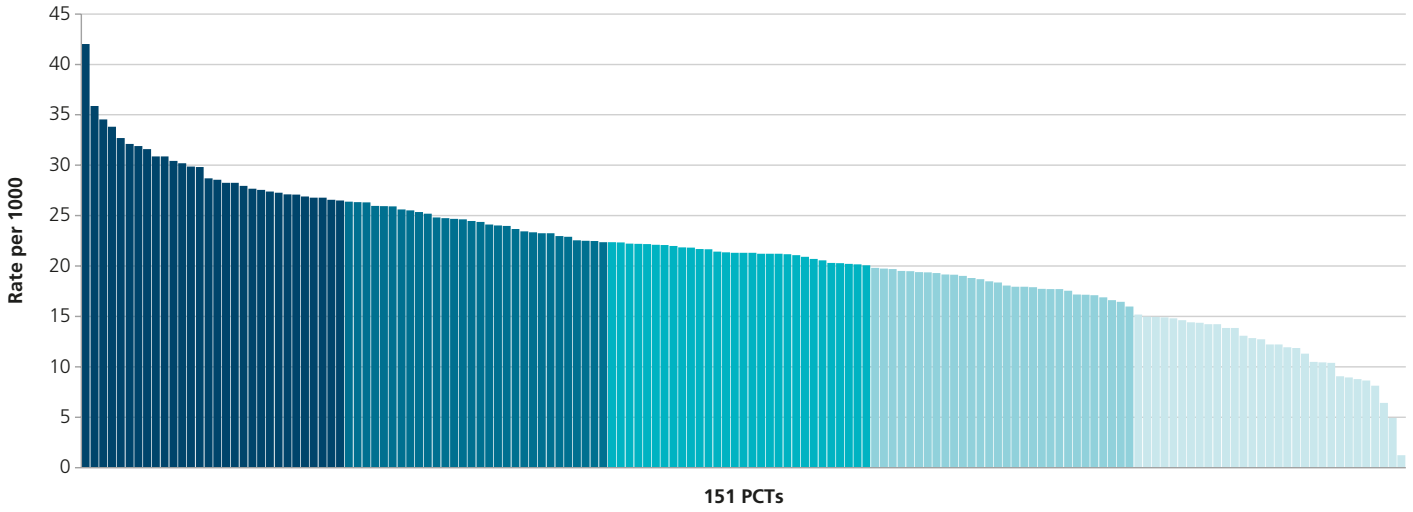
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 28: Rate of echocardiography activity undertaken per weighted population by PCT

2012/13

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





Context

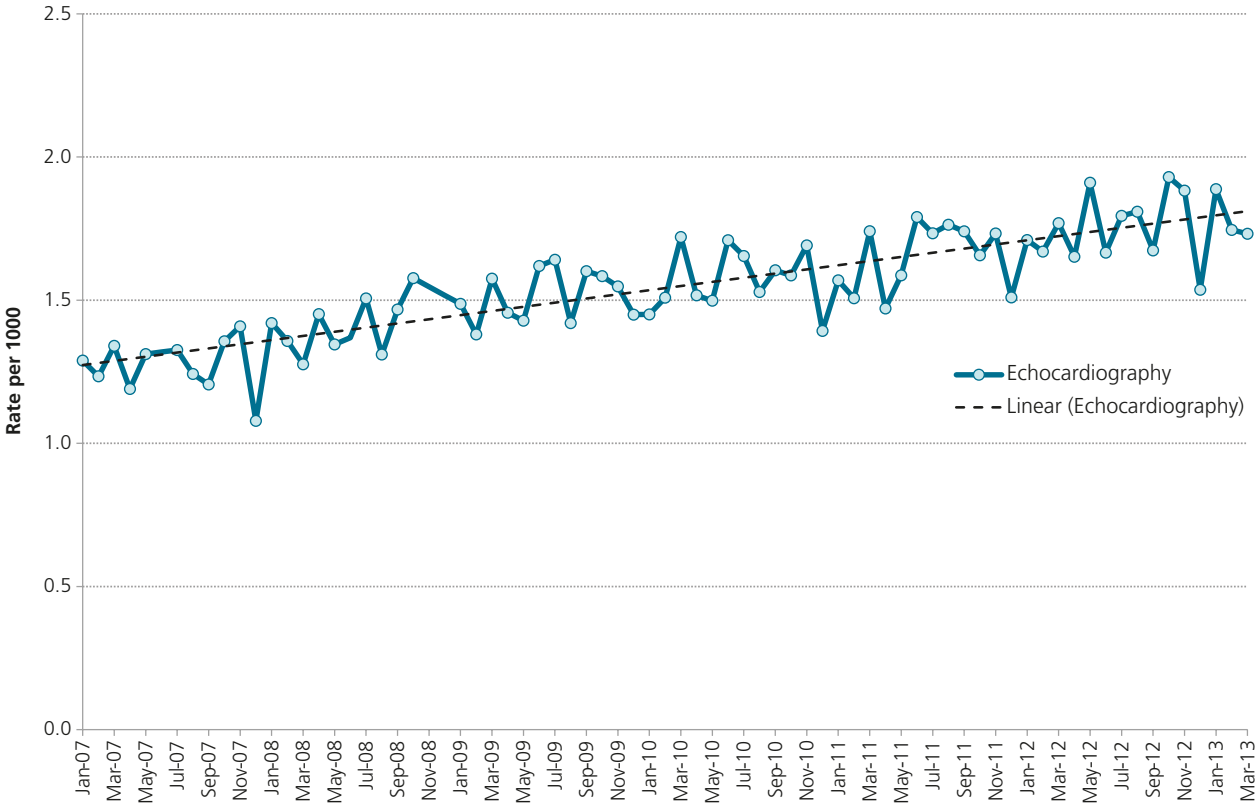
Echocardiography uses ultrasound to produce images of the heart to detect structural and/or functional abnormalities. In trans-thoracic echocardiography (TTE), a probe is placed on the chest. Trans-oesophageal echocardiography (TOE) is more invasive where the probe is passed into the oesophagus. Both techniques provide visual information about the function of the heart, enable inspection of the heart valves to check whether they are opening and closing properly, and allow for measurement of the heart's chambers, major blood vessels, the thickness of the heart walls, and to detect and delineate any congenital cardiac anomaly.

Currently, nearly all echocardiograms are performed in hospital although provision in primary care is increasing.

There has been an increase of 43.0% in the commissioning of echocardiography tests over the last six years (see Figure 28.1). Future demand is expected to rise for the following reasons:

- population ageing: (i) the incidence of heart failure increases with age, with the average age of onset being 73 years – according to estimates, there are approximately 70,000 new cases of heart failure in the UK per year,[1] and NICE guidance requires greater use of echocardiography in detection and treatment of heart failure;[2] (ii) valvular heart disease also increases with age and echocardiography is the principal test for its detection – there is evidence of under-diagnosis of valvular heart disease, and thus with increased detection demand for echocardiography will rise;
- increased requirement to monitor the side-effects of new drugs, for instance, the increase in demand for echocardiography to monitor the effects of Herceptin treatment for breast cancer is projected to be 1%;

Figure 28.1: Rate of echocardiography activity commissioned per 1000 population from January 2007 to March 2013[3]



1 British Heart Foundation (2008) Modelling the UK Burden of Cardiovascular Disease to 2020. http://www.bhf.org.uk/publications/view-publication.aspx?ps=1000626

2 NICE (2011) Chronic heart failure (QS9). http://guidance.nice.org.uk/QS9

3 Source: Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01); data from June 2007, November 2008 and December 2008 have been removed due to data quality.

Table 28.1: Rate of echocardiography activity undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	1.1–42.7	40	6.6–31.5	4.8
2012/13	1.2–42.0	34	8.8–32.1	3.7

- increasing life-expectancy of patients with congenital heart disease who need ongoing monitoring;
- stress echocardiography is increasingly used to investigate and manage coronary heart disease;[3]
- developments in cardiac pathways, such as rapid access heart failure clinics, have promoted direct and open access to echocardiography from primary care.

The use of echocardiography to investigate heart failure appears to be lower in the UK than in other European countries. In the Euro Heart Survey,[4] around 35% of UK patients with acute heart failure were investigated by echocardiography compared with an average of 55% of patients across Europe.[5]

In the NICE guidelines, it is suggested that a brain natriuretic peptide (BNP) test (see Map 51, pages 155–157) can be used to rule out heart failure.[6] The availability of BNP tests, however, has not reduced the demand for echocardiography investigations for several reasons:

- NICE guidance mandates an echocardiography test when the BNP test result is abnormal;
- as the number of BNP tests conducted increases, the demand for echocardiography tests will rise to investigate abnormal BNP test results;
- although the sensitivity of BNP means that it is a useful investigation to rule out heart failure, its level of specificity means that it does not replace echocardiography.

Magnitude of variation

For PCTs in England, the rate of echocardiography activity undertaken ranged from 1.2 to 42.0 per 1000 weighted population (34-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 8.8–32.1 per 1000 weighted population, and the variation is 3.7-fold (see Table 28.1 for 2011/12 data).

In 2012/13, there has been a decrease in the variation observed after exclusions when compared with 2011/12, although variation is still 3.7-fold.

The degree of variation observed can be explained by differences in:

- the service models and pathways for the use of echocardiography tests in key diagnostic and treatment pathways;
- the size and structure of local and regional echocardiography departments;
- the criteria/policies adopted for triage thresholds or the appropriateness of a test;
- the community provision of echocardiography;
- the availability of appropriately trained staff.

3 NICE (2010) Chest pain of recent onset: assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin (CG95). http://www.nice.org.uk/CG95

4 http://www.escardio.org/guidelines-surveys/ehs/Pages/welcome.aspx

5 The EuroHeart Failure survey programme – a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis (2003) *European Heart Journal* 24: 442–463. http://eurheartj.oxfordjournals.org/content/24/5/442.long

6 NICE (2010) Chronic heart failure: management of chronic heart failure in adults in primary and secondary care (CG108). http://guidance.nice.org.uk/CG108

Options for action

To reduce unwarranted variation in echocardiography activity, commissioners need:

- to review referral and delivery models for echocardiography services;
- to consider commissioning echocardiography services in community settings, with appropriate clinical governance, which may be more convenient to patients, and cost-effective;
- to develop robust data collection systems to improve understanding of the incidence and prevalence of cardiovascular disease in the local community;
- to model demand for echocardiography services in the locality and review capacity, thereby promoting innovative delivery models;
- to review funding models to reduce potential perverse incentives (e.g. block contract versus payment by results);
- to use commissioning levers to improve quality, for example, by encouraging participation in the national accreditation scheme, Improving Quality in Physiological diagnostic Services (IQIPS; see "Resources").

RESOURCES

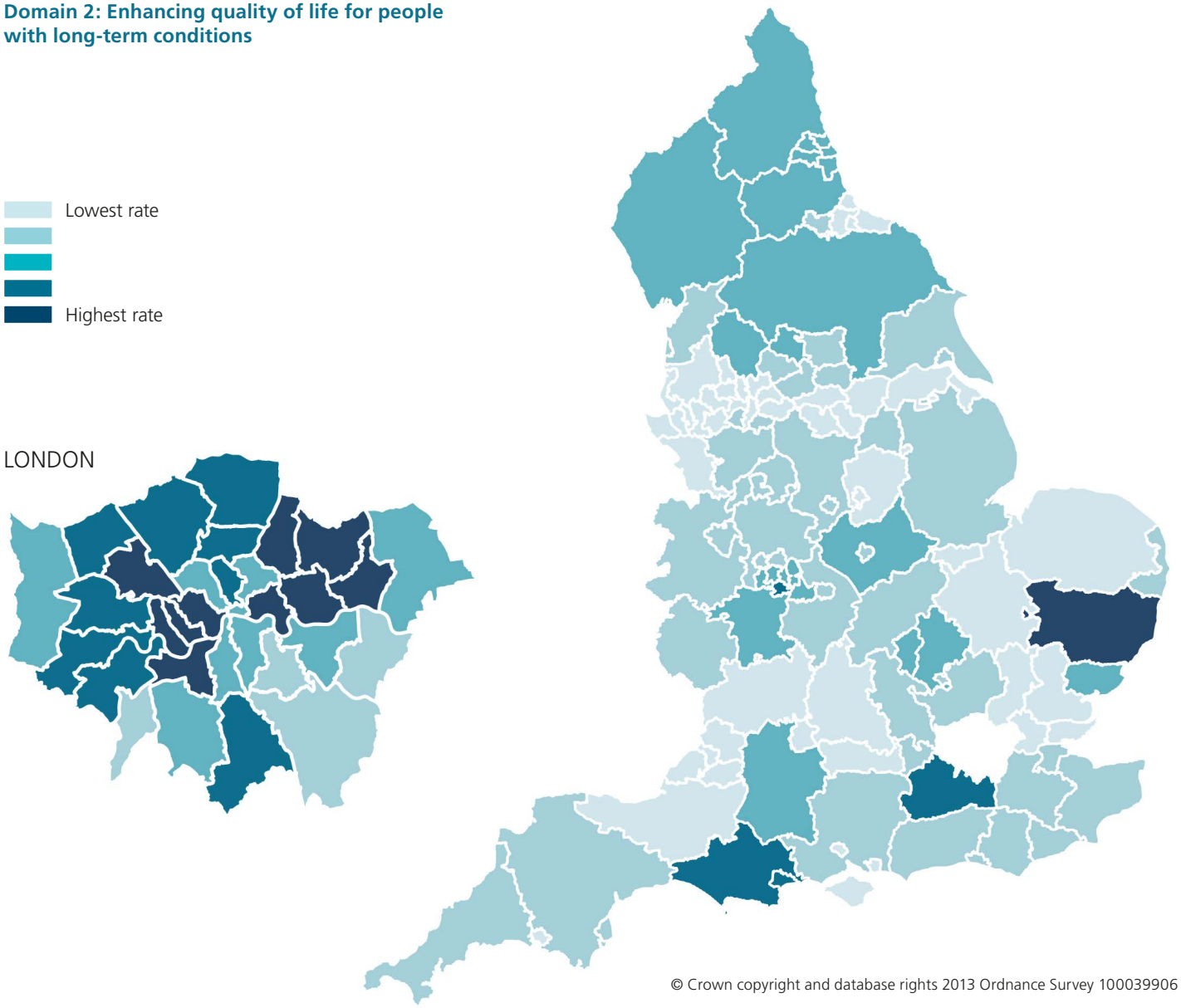
- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/

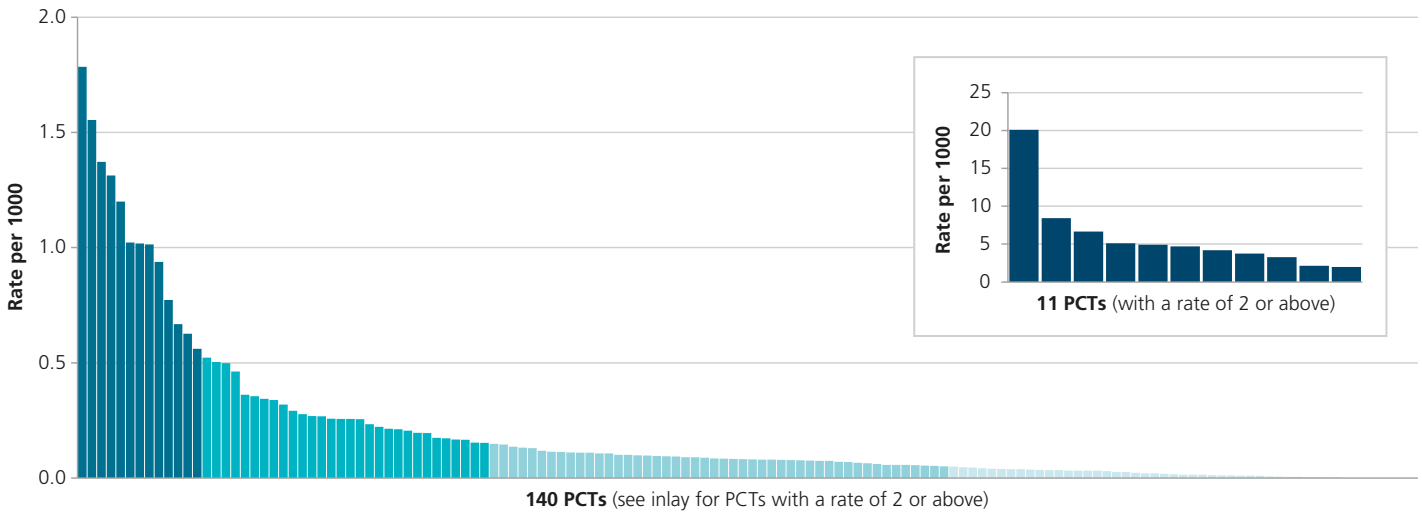
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 29: Rate of diagnostic invasive electrophysiology activity undertaken per weighted population by PCT

2012/13

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





Context

Cardiac electrophysiology is the science of understanding, diagnosing and treating abnormalities of the heart's electrical activity (arrhythmias), and electrophysiology studies have enabled the clarification of the mechanism of normal and abnormal rhythms. Diagnostic electrophysiologic studies allow electrical activity of the heart to be analysed in detail.

Electrophysiology studies involve an invasive procedure in the cardiac catheterisation laboratory. An electrophysiology investigation provides a detailed analysis of the electrical conduction system of the heart: to assess whether it functions correctly, to locate the site of any abnormalities, and to inform treatment.

To establish a diagnosis, the cardiologist, supported by cardiac physiologists and other members of the team, will use electrical stimuli to induce rhythm disturbances deliberately. The interpretation of the test results and treatment are often undertaken at the same time. Treatment involves ablation (destroying the areas inside the heart causing the abnormal rhythm), or the insertion of a device such as a pacemaker or implantable cardiovertor defibrillator.

Heart Rhythm UK (HRUK) recommends that:

> *"…all centres and cardiologists performing (diagnostic) electrophysiological studies should also have competency to proceed to catheter ablation if necessary. There are very few clinical indications for a patient to undergo an electrophysiological study alone and in the vast majority of cases it is more appropriate to proceed to a catheter ablation at the same procedure".*[1]

There has been an increase of 157.6% in the commissioning of diagnostic electrophysiology investigations over the last six years (see Figure 29.1, page 191) because the clinical indications for its use have increased. The overall reported rate of isolated diagnostic electrophysiologic testing, however, remains small. Apparently low rates and regional variation may reflect the fact that reporting to the national databases has not hitherto been mandatory (although it will be from 1/4/2014). The diagnosis of atrial fibrillation depends on non-invasive tests (ECG and Holter recording) rather than invasive diagnostic electrophysiologic study. As atrial fibrillation is the largest preventable cause of stroke, and is currently under-detected, the need for these non-invasive tests is likely to increase greatly.

Magnitude of variation

For PCTs in England, the rate of diagnostic invasive electrophysiology activity undertaken ranged from 0.0 to 21.5 per 1000 weighted population. When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.01–5.3 per 1000 weighted population, and the variation is 826-fold (see Table 29.1 for 2011/12 data).

Apart from under-reporting, the degree of variation observed may be explained by differences in:

- the prevalence of arrhythmias in the local population;
- local policies for the management of arrhythmias;
- the development of local clinical pathways and referral criteria – in localities where there are large tertiary centres, with well-developed specialist electrophysiology services, the rates of referral and of electrophysiology testing tend to be higher;
- cardiac centre clinical policies – if a patient proceeds directly to treatment ablation, the diagnostic electrophysiology study will not be recorded separately and therefore is invisible to data collection systems;
- the availability of a specialist cardiac physiologist to perform these investigations.

Options for action

To reduce unwarranted variation in invasive electrophysiology activity, commissioners need:

- to review access to diagnostic electrophysiologic studies and electrophysiology/catheter ablation treatment for the local population;
- to ensure that local clinical pathways and referral criteria reflect guidance from Heart Rhythm UK (see "Resources");
- to consider making the submission of data to the national Heart Rhythm UK audit a contract condition for local services implanting devices or undertaking electrophysiology studies.

RESOURCES

- Department of Health (2005) National Service Framework. Coronary Heart Disease. Chapter 8. Arrhythmias and Sudden Cardiac Deaths (March 2005). http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4105280.pdf
- Heart Rhythm UK (2010) Standards for electrophysiological studies and catheter ablation. September 2010. http://heartrhythmuk.org.uk/files/file/Docs/Guidelines/Heart%20Rhythm%20UK%20competency%20standards%20for%20EP%20and%20ablation%20-%20Sept%202010%20FINAL.pdf
- Heart Rhythm UK. UK & International Guidelines. http://heartrhythmuk.org.uk/guidelines
- NICOR/UCL (2013) Cardiac Rhythm Management UK National Clinical Audit Report. David Cunningham, Richard Charles, Morag Cunningham, Tracey Whittaker (NICOR, January 18, 2013). https://nicor5.nicor.org.uk/CRM/device.nsf/65153b7e3756850e80256aff003a2c78/$FILE/CRM%20National%20Annual%20Report%202011%20final%20release%20revised.pdf
- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/

Table 29.1: Rate of diagnostic invasive electrophysiology activity undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	0.0–20.1	Not applicable	0.0–4.7	Not applicable
2012/13	0.0–21.5	Not applicable	0.01–5.3	826

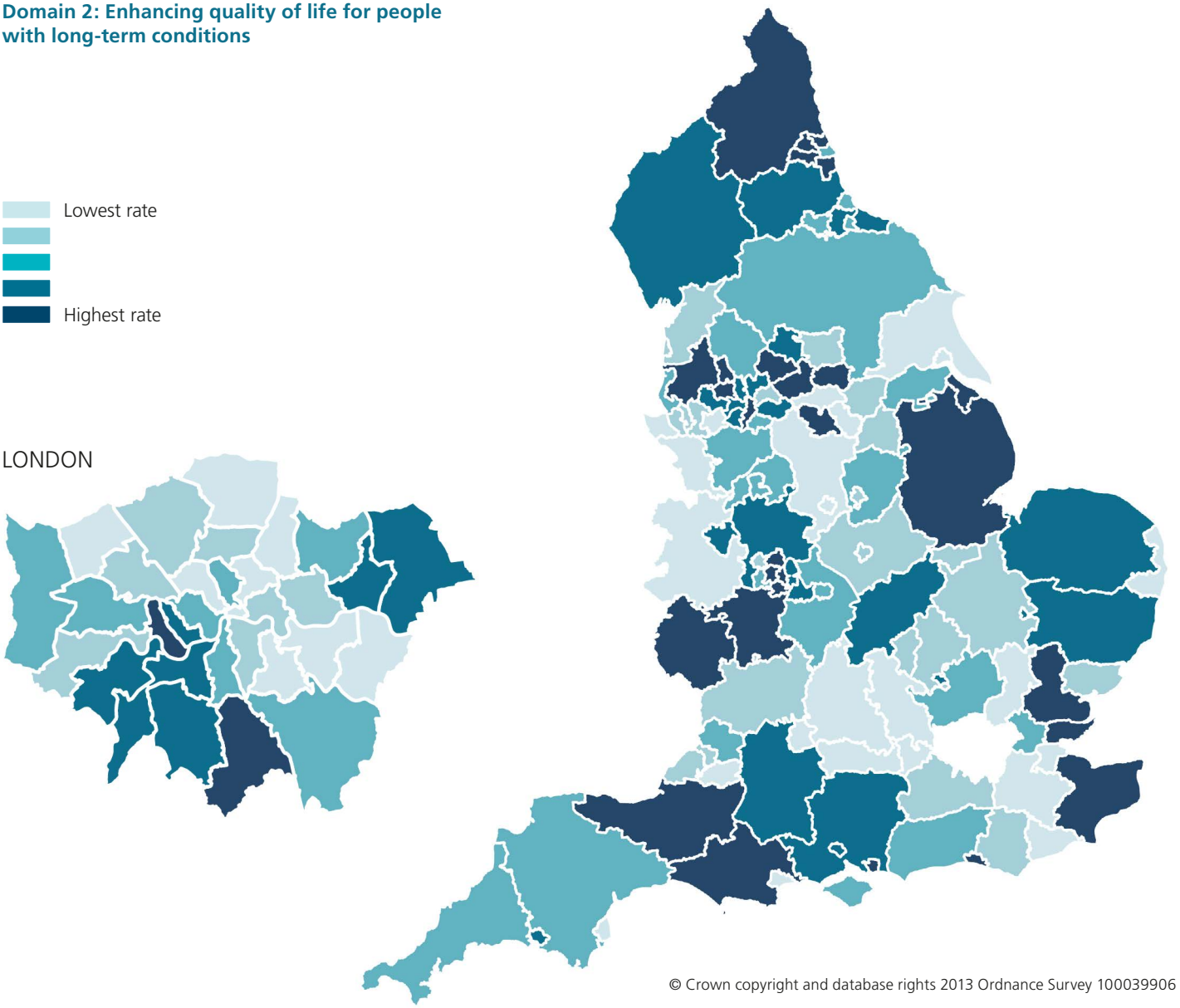
1 Heart Rhythm UK Standards for electrophysiological studies and catheter ablation. HRUK, September 2010 (page 3, para.1)

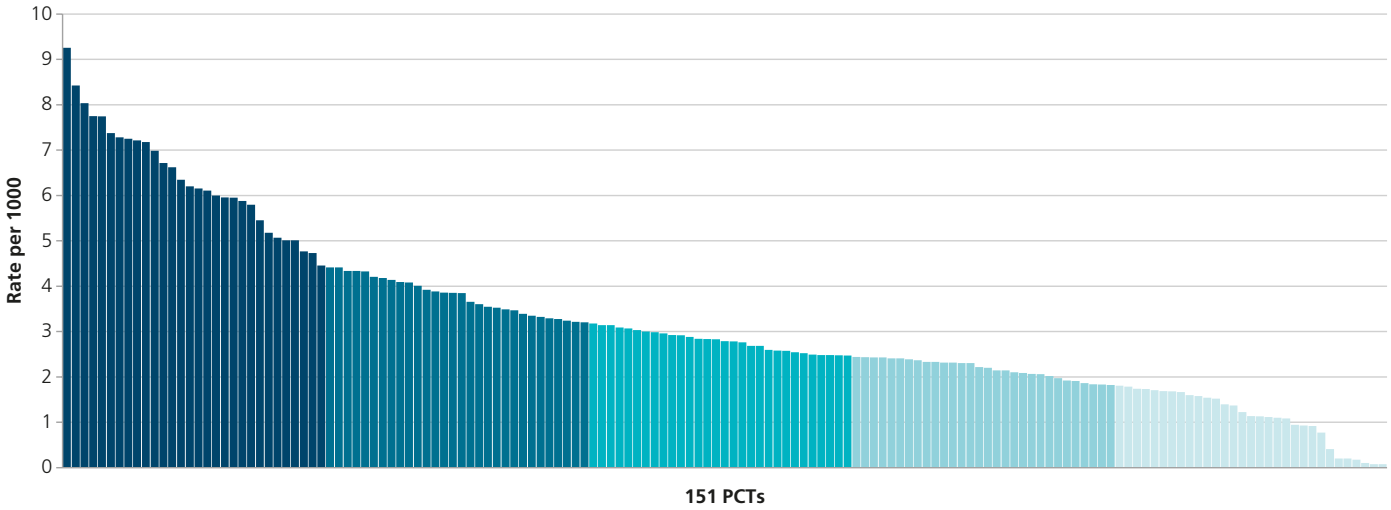
PHYSIOLOGICAL DIAGNOSTICS SERVICES

Map 30: Rate of peripheral neurophysiology tests undertaken per weighted population by PCT

2012/13

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





Context

Peripheral neurophysiology is concerned with the peripheral nervous system only. The core tests provided by clinical neurophysiology departments in peripheral neurophysiology are:

- nerve conduction studies (NCS);
- electromyography (EMG).

Nerve conduction studies involve electrical stimulation of peripheral nerves with recording of responses from nerves or muscles. It is used to investigate a range of peripheral nerve disorders, the most common of which is carpal tunnel syndrome, the entrapment of the median nerve as it passes through the carpal tunnel in the wrist.[1] The incidence of carpal tunnel syndrome is around 1–3 presentations per 1000 population per year in England, and the problem affects up to 3.5% of the general population. Overall, around 50% of nerve conduction studies are related to carpal tunnel syndrome, 10% to ulnar nerve testing, and the remainder are not related to surgical intervention.

Electromyography is an invasive procedure, involving the insertion of a needle into muscle, which investigates the causes of muscle weakness and a variety of disorders affecting the peripheral nervous system.

There has been an increase of 2.7% in the commissioning of peripheral neurophysiology testing over the last six years (see Figure 30.1, page 192); in some localities, where there is good availability of the service, there has been a much greater increase in the rate of provision.

Magnitude of variation

For PCTs in England, the rate of peripheral neurophysiology tests undertaken ranged from 0.07 to 9.3 per 1000 weighted population (124-fold variation). When the five PCTs with the highest rates and the five PCTs with the lowest rates are excluded, the range is 0.20–7.4 per 1000 weighted population, and the variation is 37-fold (see Table 30.1 for 2011/12 data).

In 2012/13, there has been an increase in the variation observed after exclusions when compared with 2011/12.

Reasons for the degree of variation observed are differences in:

- access via local pathways – in localities where there is no access or where the pathway does not include clinical neurophysiology, patients are often sent to an orthopaedic surgeon; in a study of a small group of patients, the surgical success rate for orthopaedic carpal tunnel decompression was 77%, whereas that for patients managed with nerve conduction studies was 84%;[2]
- service models and pathways for the use of clinical neurophysiology in key diagnostic pathways, the most important being the management of carpal tunnel syndrome – some localities always manage carpal tunnel syndrome using peripheral neurophysiology whereas other localities never use peripheral neurophysiology to manage carpal tunnel syndrome;
- clinical practice – both consultant clinical neurophysiologists and clinical physiologists can perform and report investigations, which affects level of access to, and cost of, the service;
- the availability of clinical neurophysiology departments and appropriate staff – localities with or near a large department have higher rates of testing (variation in the rates of EEG testing is likely to mirror the variation in peripheral neurophysiology testing);
- the balance between the public and private provision of services – in localities where the provision of clinical neurophysiology services is low, there is likely to be a private sector service available.

Options for action

Commissioners need to review referral and delivery models across neurophysiology services. To reduce unwarranted variation in peripheral neurophysiology test activity, commissioners could consider:

- developing robust data collection systems to improve understanding of the incidence and prevalence of conditions of the peripheral nervous system in the local population;
- reviewing funding models (e.g. block contract versus payment by results) to ensure there are no perverse financial incentives to appropriate service delivery;
- assessing future demand and available capacity for local neurophysiology services;
- investigating new service models with appropriate governance and/or audit arrangements in place to ensure a high quality of service is maintained, for example, undertaking most carpal tunnel syndrome activity through clinical physiologist-led clinics;
- using commissioning levers to improve quality, e.g. through schemes such as Improving Quality in Physiological diagnostic Services (IQIPS; see "Resources").

RESOURCES

- Improving Quality in Physiological diagnostic Services (IQIPS). https://www.iqips.org.uk/

Table 30.1: Rate of peripheral neurophysiology tests undertaken per 1000 weighted population by PCT over two financial years

Financial year	Range	Fold difference	Range after exclusions	Fold difference after exclusions
2011/12	0.09–9.5	107	0.73–7.7	11
2012/13	0.07–9.3	124	0.20–7.4	37

1 Browning P. Carpal Tunnel Syndrome Imaging. http://www.emedicine.com/radio/topic135.htm

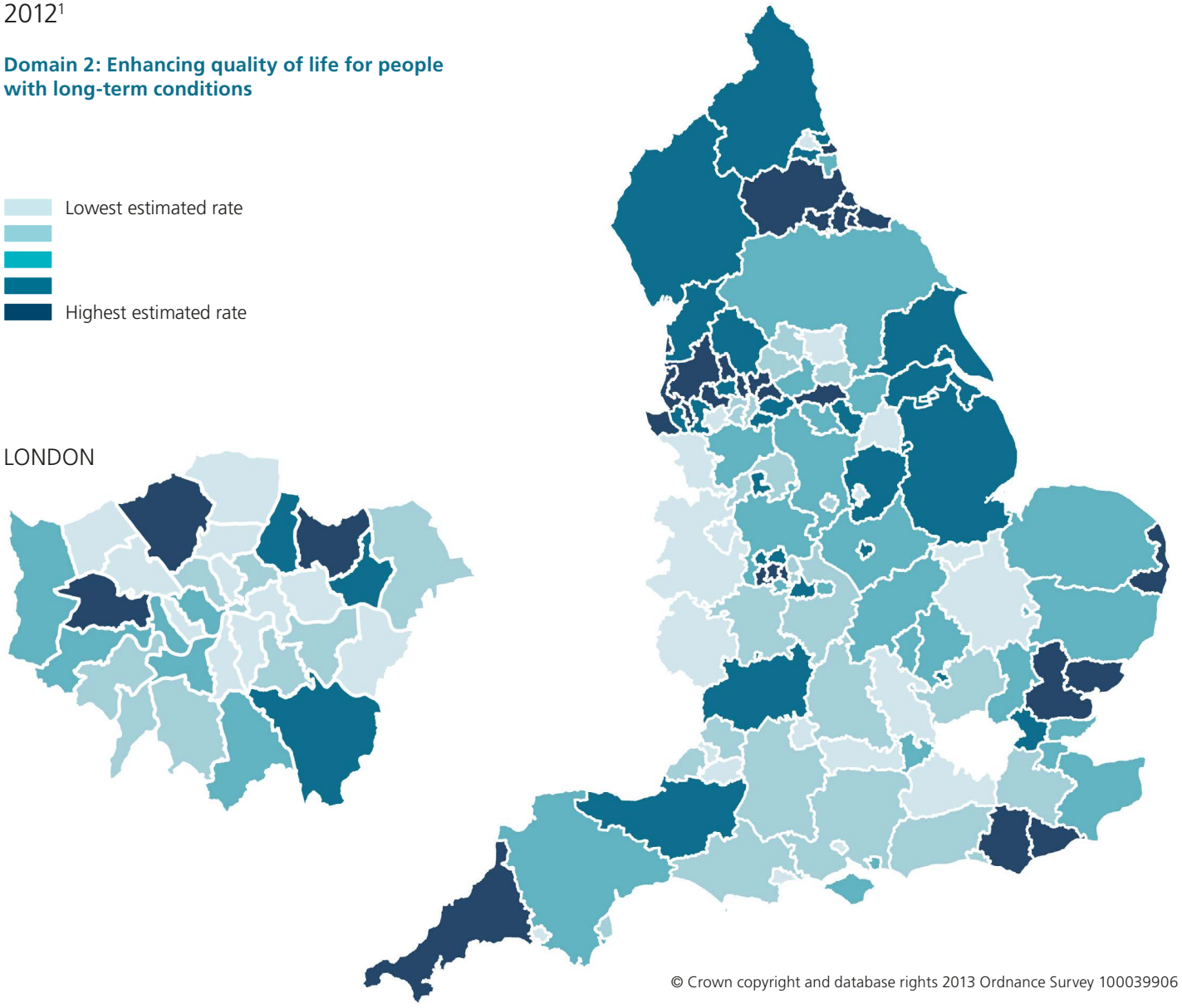
2 Information provided by Jeremy Bland, East Kent NHS Foundation Trust.

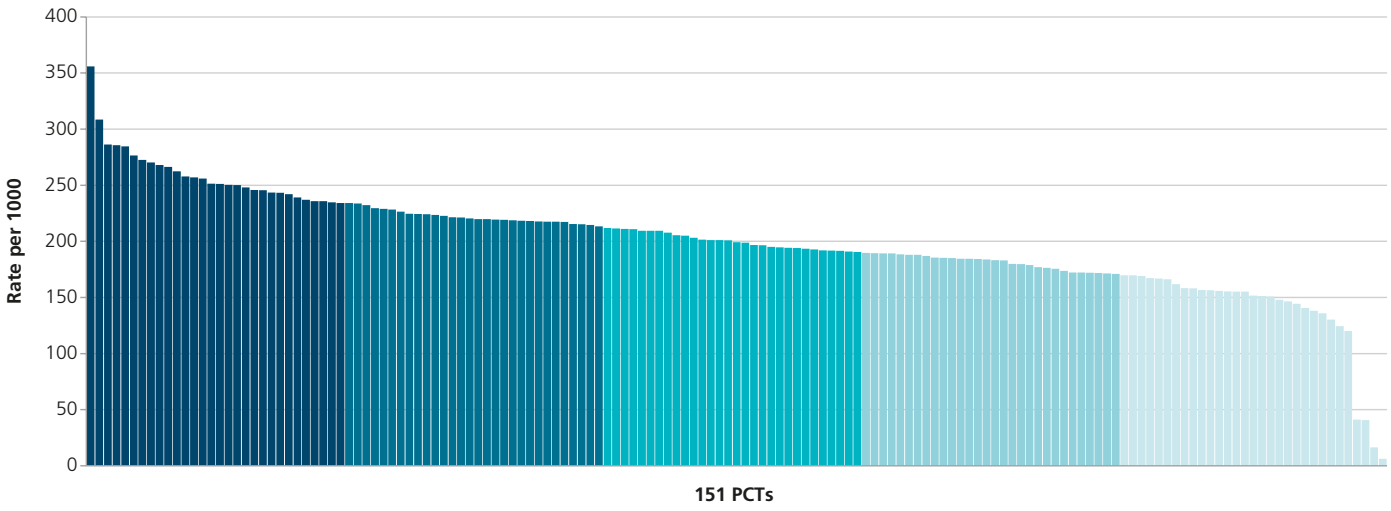
PATHOLOGY SERVICES

Map 31: Estimated annual rate of use for thyroid stimulating hormone (TSH) tests ordered by GPs per practice population by PCT

2012[1]

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





Context

The thyroid gland operates through a feedback loop with the pituitary gland. The thyroid secretes the hormones, thyroxine and tri-iodothyronine (T4 and T3, respectively) in response to thyroid stimulating hormone (TSH) from the pituitary. Diseases of the thyroid usually present as over-activity (hyperthyroidism) or under-activity (hypothyroidism). Thyroid disorders are relatively common and may have a slow onset with relatively few symptoms. General population screening is not recommended although the high incidence of thyroid disease in children with Type 1 diabetes and older people with Type 2 diabetes justifies routine testing in these groups.

Thyroid function tests are used:

- to detect hyperthyroidism, hypothyroidism and thyroiditis;
- to monitor therapy with thyroxine replacement in hypothyroidism or carbimazole in hyperthyroidism;
- to monitor thyroid function when it is affected by other drug therapies, such as lithium, amiodarone and interferon.

The classical patterns of hyperthyroidism and hypothyroidism are readily recognised; however, differentiating between the pattern of thyroid function tests in pituitary failure and patients with severe intercurrent illness or anorexia is complex and requires the analysis of additional pituitary hormones.

The reference values of thyroid function tests in pregnancy are different from those in the non-pregnant state.

There is diurnal variation in TSH: TSH values are higher during the night when compared with those during the day.

Most of the circulating thyroid hormones are bound to plasma proteins. Modern analytical techniques estimate the unbound biologically active portion, hence, the most common test in use is free T4 (fT4).

A normal physiological state can be assessed by measuring TSH and fT4 simultaneously. Disorders of the thyroid can be diagnosed when one or both hormones diverge from a narrow concentration range.

Analysis of free T3 (fT3) is usually a confirmatory test for excessive thyroid activity (hyperthyroidism) with raised serum concentrations of both fT4 and fT3. Occasionally, hyperthyroidism may be due to a T3-secreting thyroid nodule with a low or normal fT4 level but elevated fT3 level and suppressed levels of TSH. Hence, the lower rate of requesting for fT3 than that for fT4 and TSH.

Thyroid peroxisomal (TPO) antibody levels are used to predict whether TSH levels that are borderline high are likely to progress to overt hypothyroidism; elevated values indicate a high probability of progression.

Magnitude of variation

Map 31: TSH

For PCTs in England, the estimated annual rate of use for TSH tests ordered by GPs ranged from 6.2 to 355.8 per 1000 practice population (57-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 124.4–276.5 per 1000 practice population, and the variation is 2.2-fold.

Map 32: fT4

For PCTs in England, the estimated annual rate of use for fT4 tests ordered by GPs ranged from 4.9 to 256.8 per 1000 practice population (52-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 14.6–231.1 per 1000 practice population, and the variation is 16-fold.

Map 33: fT3

For PCTs in England, the estimated annual rate of use for fT3 tests ordered by GPs ranged from 0.05 to 53.4 per 1000 practice population (999-fold variation).[2] When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 0.42–17.0 per 1000 practice population, and the variation is 40-fold.

Map 34: TPO antibodies

For PCTs in England, the estimated annual rate of use for TPO tests ordered by GPs ranged from 0.04 to 7.0 per 1000 practice population (165-fold variation).[3] When the four PCTs with the highest estimated annual rates and

1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 2 PCTs.
3 There are no data from 15 PCTs.

the four PCTs with the lowest estimated annual rates are excluded, the range is 0.11–5.0 per 1000 practice population, and the variation is 45-fold.

Reasons for the degree of variation observed include differences in:

- the age profile of the local population – the incidence of hypothyroidism increases with age;
- the extent of surveillance of people with diabetes or of people who are taking drugs that affect thyroid function.

There has been much debate about the need to measure both fT4 and TSH for reasons of cost and diagnostic efficiency. Each laboratory has adopted its own policy:

- some use a parallel test, in which both TSH and fT4 are measured for every thyroid test request;
- others take a sequential approach, with a first-line TSH, then an fT4 if there is an abnormality or if a clinical need for a paired test is indicated on the request form.

The British Thyroid Association recommends the measurement of both TSH and fT4 (i.e. the parallel test) on the basis that the laboratories do not necessarily know the reason why a test has been requested, and there is a risk of missing pituitary failure.

The degree of variation observed in the use of TPO antibody assays may reflect differences in local laboratory policies on:

- reflex testing of antibodies;
- control of repeat testing;
- use of shared records of existing tests;
- the use of existing tests by endocrinologists in secondary care.

Options for action

Developing a common approach to thyroid function testing requires clinical consensus. Commissioners, clinicians and service providers need:

- to review the reasons for the degree of variation observed;
- to help develop a standardised approach to testing for, and monitoring of, thyroid disease;
- to assess the value of the level of testing undertaken for the local population (i.e. number of patients tested and frequency of testing), especially in the light of any increase in the number of referrals to hospital;
- to assess the potential of shared records between primary and secondary care to provide longitudinal views of tests undertaken.

One approach to rationalisation is to require clinicians requesting a test to state the reason for the test; then simple algorithms can be applied to ensure an appropriate response with the minimum number of tests.

Commissioners, clinicians and service providers need to consider wider use of TPO antibody testing in patients with a borderline high value for TSH to distinguish between patients who have a high risk of progression to hypothyroidism and patients at low risk (see guidelines under "Resources").

It is important for commissioners to discuss with service providers the laboratory's strategies for thyroid function testing.

Laboratories need to develop user interfaces linked to the purpose of the test, thereby enabling the targeting of tests with increased specificity in order to solve a given clinical circumstance at a reduced cost but with considerable gains in efficiency.

RESOURCES

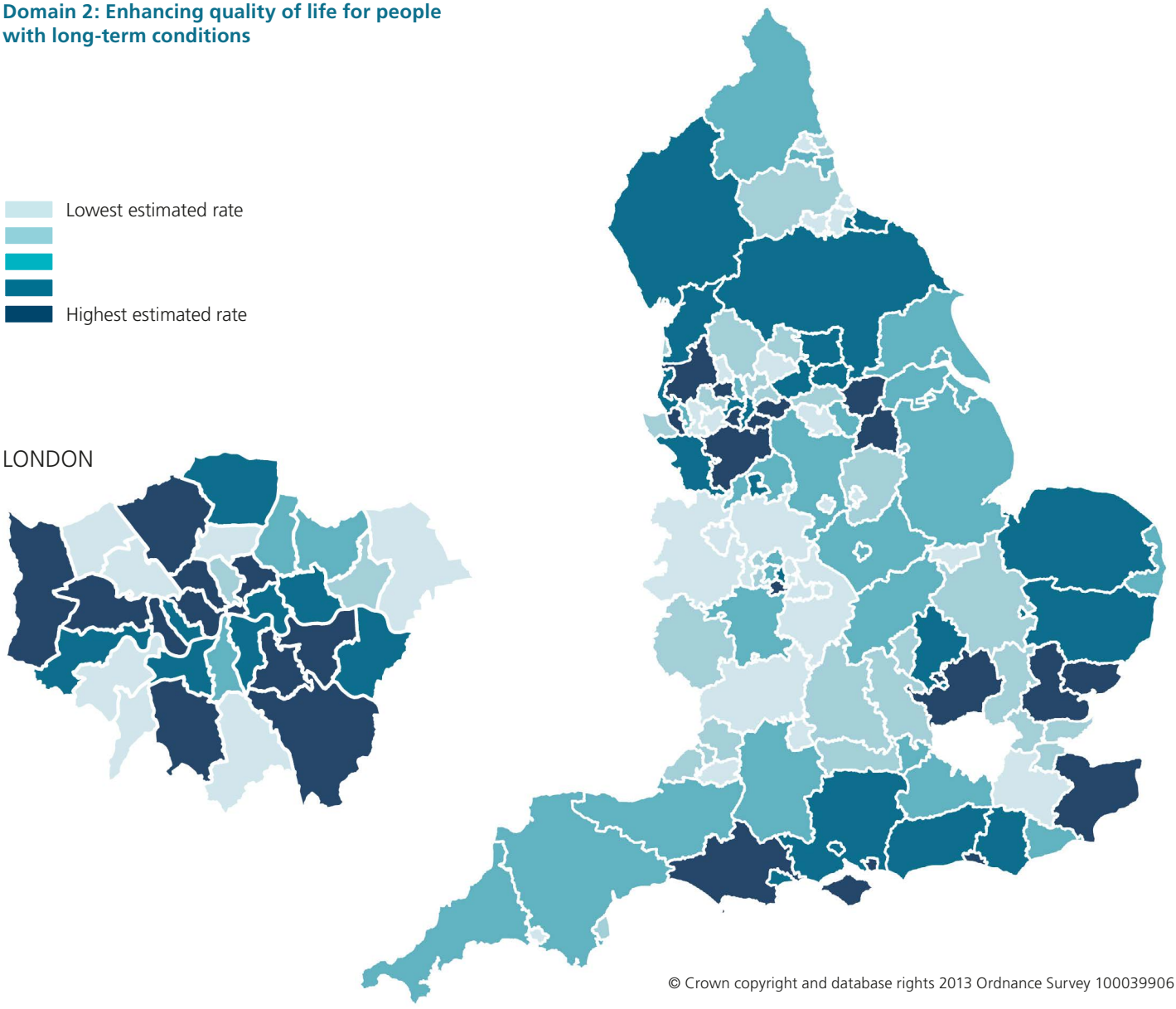
- The Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation (2006) UK Guidelines for the Use of Thyroid Function Tests. http://www.british-thyroid-association.org/info-for-patients/Docs/TFT_guideline_final_version_July_2006.pdf
- Beckett G, Toft T, O'Kane M (not dated) Thyroid Function Tests in the UK. http://www.acb.org.uk/docs/default-source/test-profiles/TFTprofile.pdf?sfvrsn=0

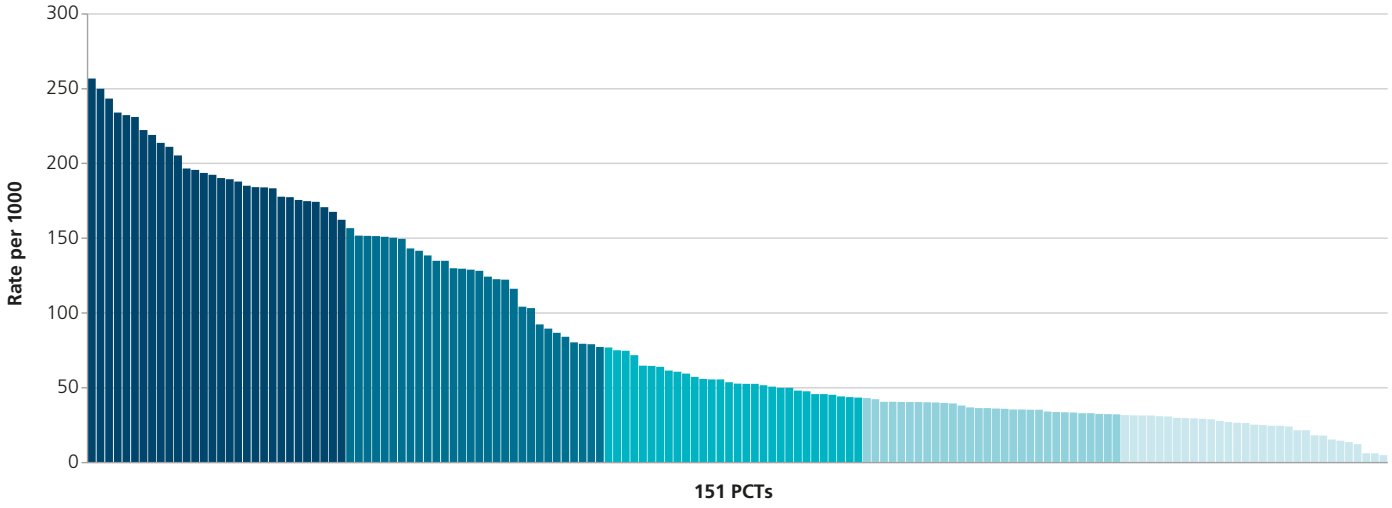
PATHOLOGY SERVICES

Map 32: Estimated annual rate of use for free thyroxine (fT4) tests ordered by GPs per practice population by PCT

2012[1]

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



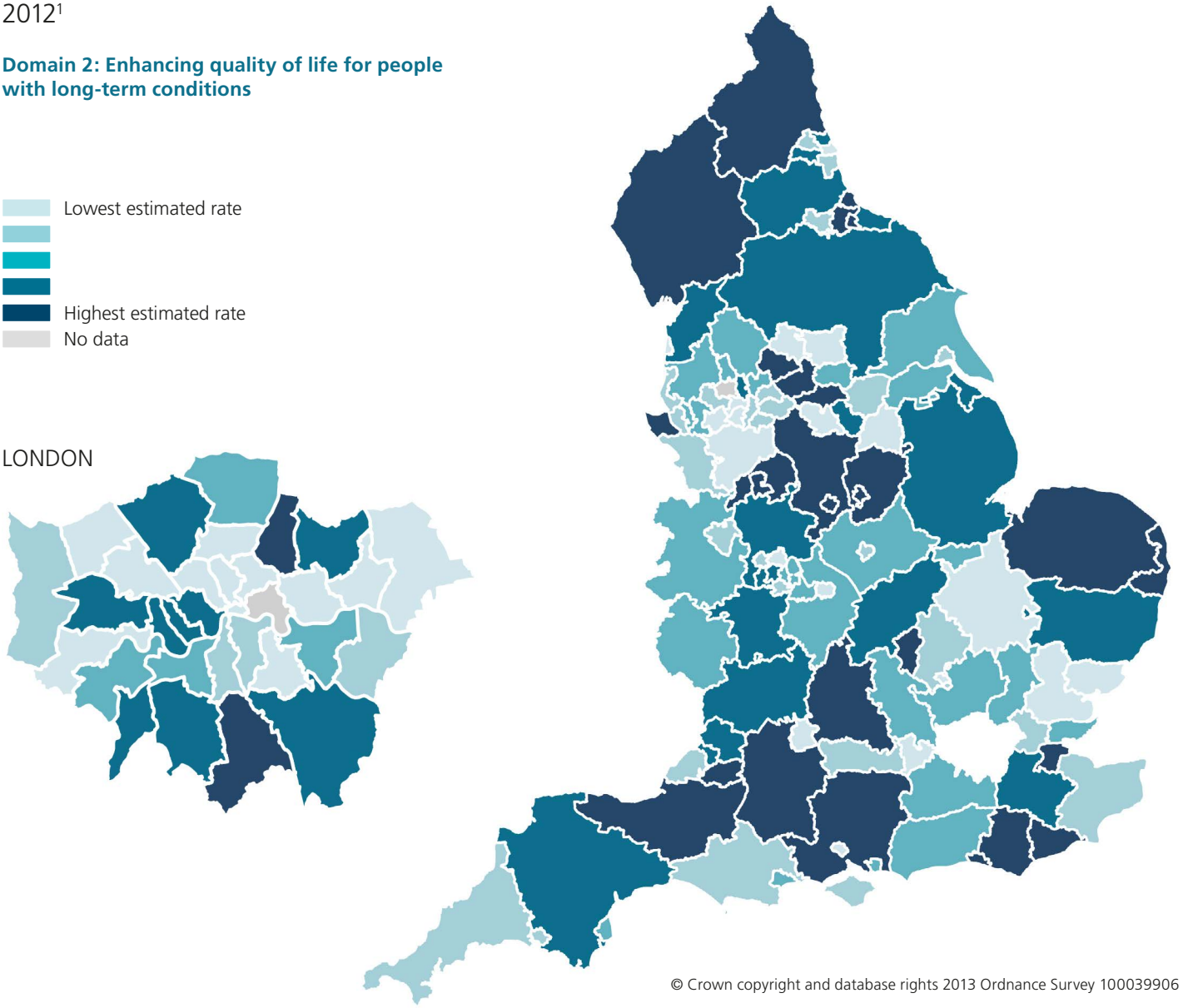


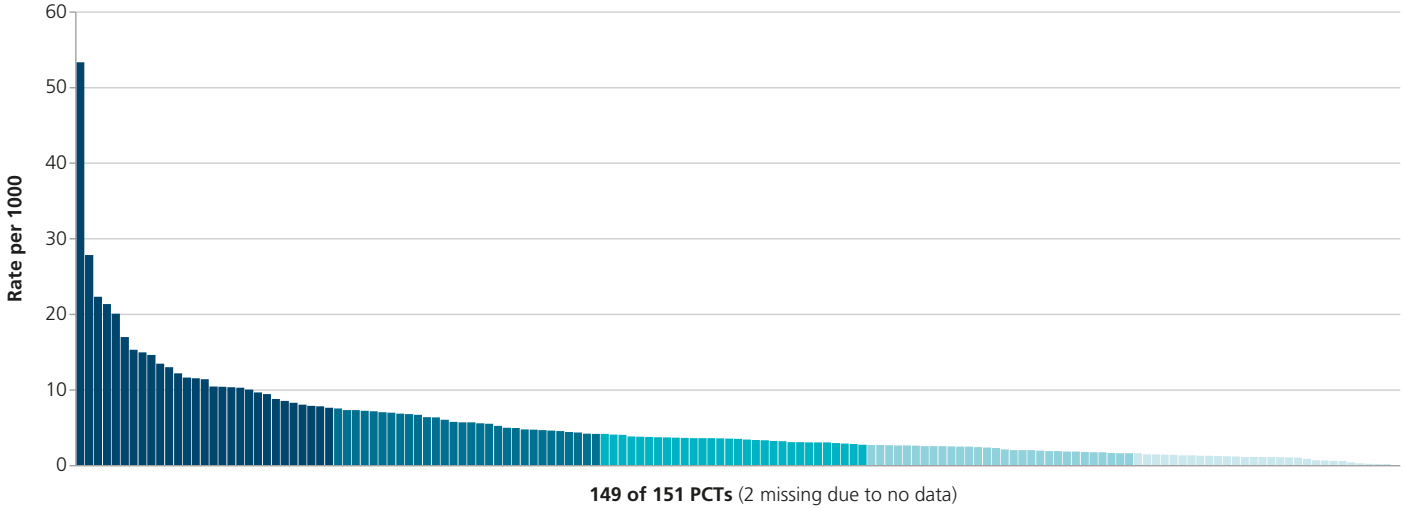
PATHOLOGY SERVICES

Map 33: Estimated annual rate of use for free tri-iodothyronine (fT3) tests ordered by GPs per practice population by PCT

2012[1]

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



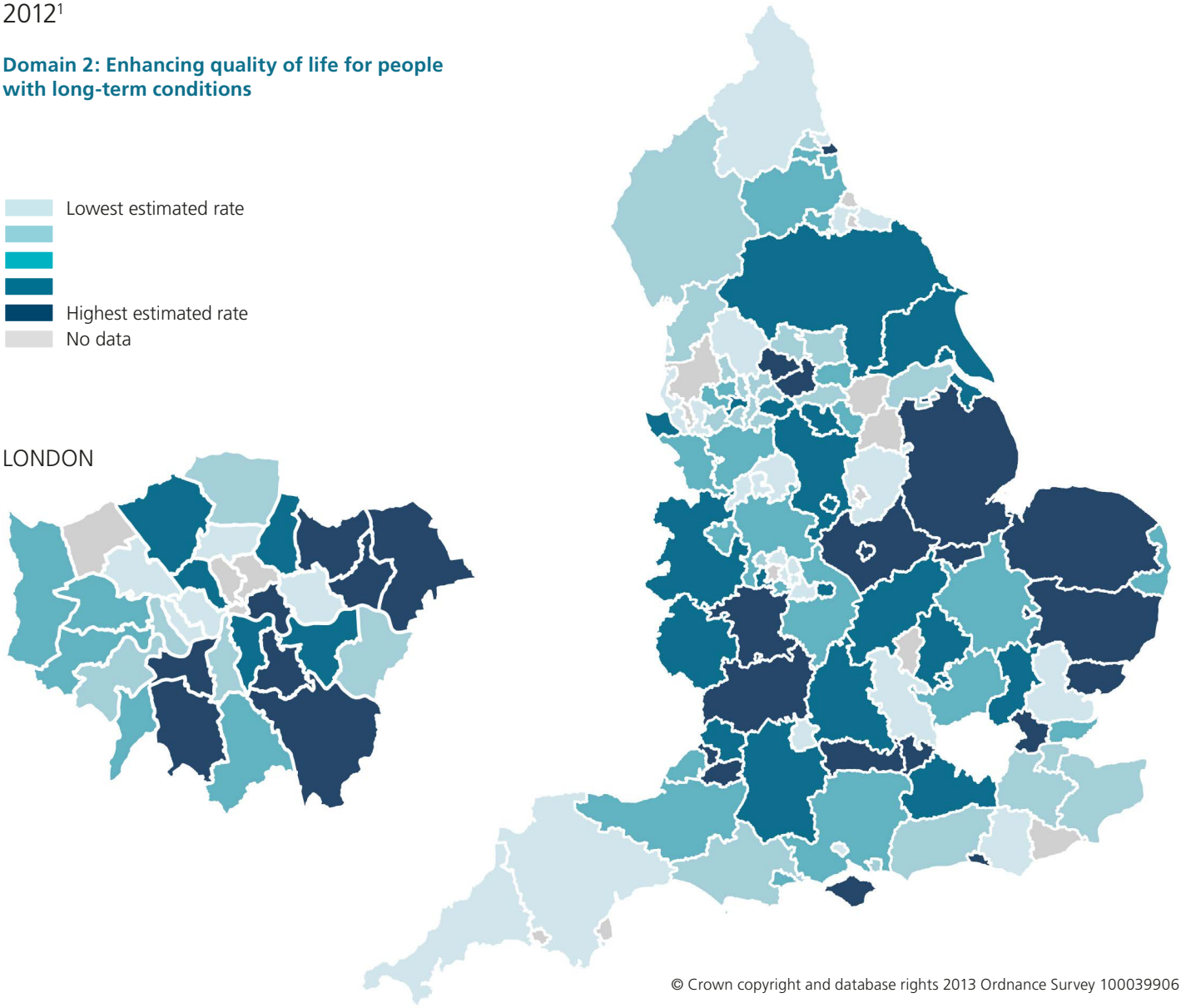


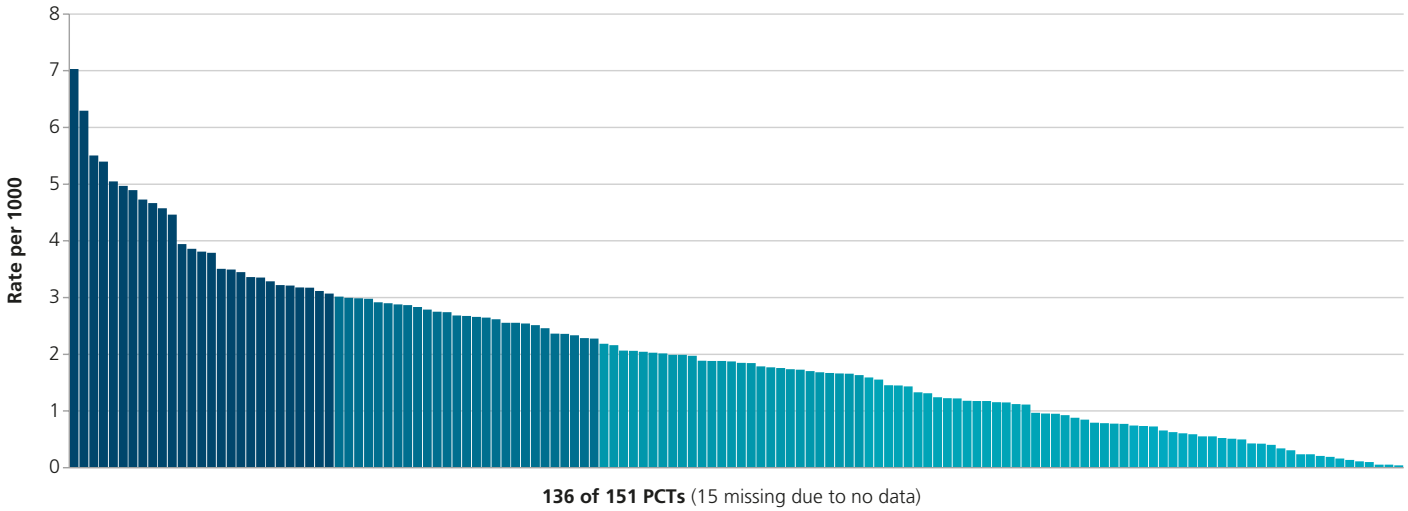
PATHOLOGY SERVICES

Map 34: Estimated annual rate of use for free thyroid peroxisomal (TPO) antibody tests ordered by GPs per practice population by PCT

2012[1]

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





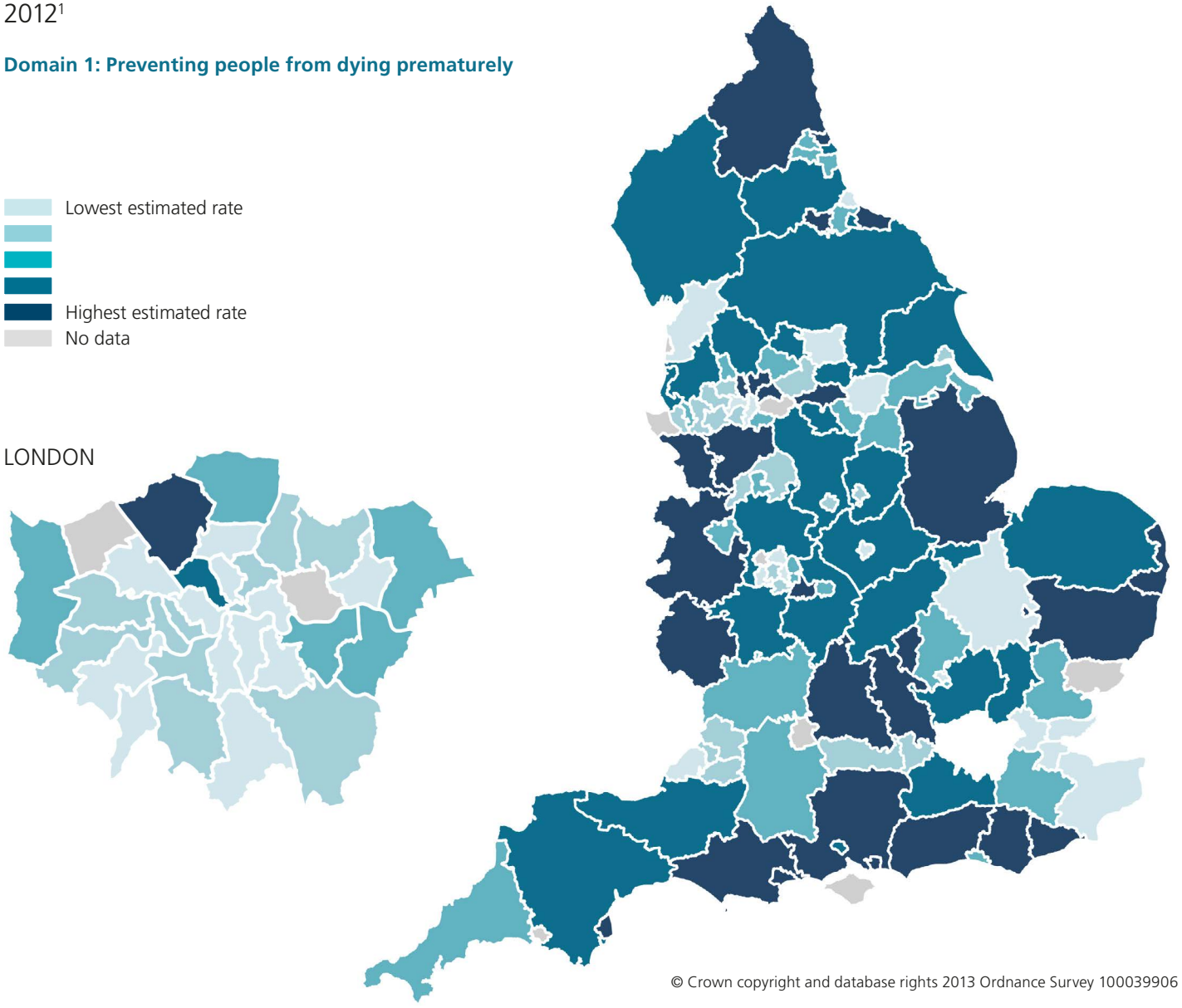
136 of 151 PCTs (15 missing due to no data)

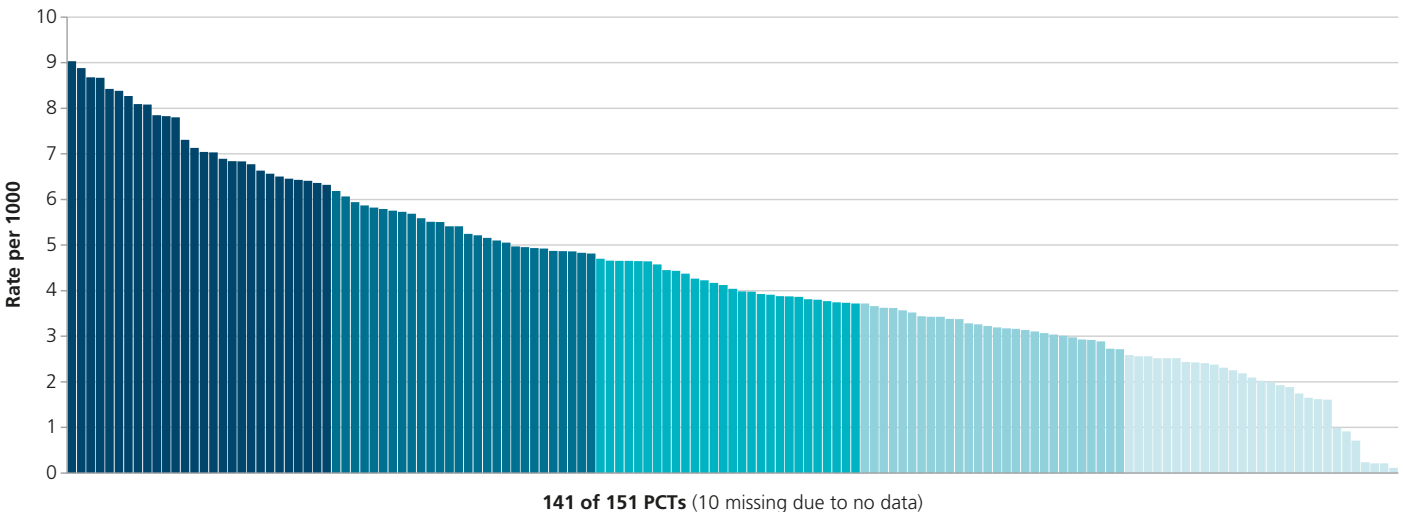
PATHOLOGY SERVICES

Map 35: Estimated annual rate of use for carbohydrate antigen 125 (CA 125) tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely





141 of 151 PCTs (10 missing due to no data)

Context

Many tumours secrete biological products, such as proteins (e.g. carbohydrate antigen 125, prostate-specific antigen) or hormones [e.g. cortisol, adrenocorticotropic hormone (ACTH), catecholamines], which can be used in the diagnosis or monitoring of disease.

- Carbohydrate antigen 125 (CA 125) is a protein found on the surface of ovarian cancer cells, and in some normal tissues; it is a tumour marker for ovarian cancer. Traditionally, the CA 125 test has been used to monitor treatment for ovarian cancer; it can also be used to detect whether cancer has returned after treatment has been completed. Cancer antigen 125 is also elevated in association with other ovarian pathologies.
- Prostate-specific antigen (PSA) is a protein produced mainly by cells in the prostate gland; it can be an indicator of prostate cancer, and is used as a tumour marker for prostate cancer. Serum concentrations of PSA increase with age, reflecting increases in the volume of the prostate. Prostate-specific antigen may also be elevated in prostatitis, and following procedures involving prostatic massage. For the diagnosis of prostate cancer, the test showing the percentage of free PSA is preferred: low percentages of free PSA are associated with an increased risk of cancer.

Most of the use for both of these tests is in:

- the confirmation of a suspected diagnosis;
- the monitoring of the response to treatment.

Specialist units are the main users of these tests, but an increasing amount of testing is taking place in primary care, especially following the publication of guidelines by NICE and the Department of Health.

In 2011, a new policy for the use of CA 125 for the early detection of suspected ovarian cancer in general practice was published (see "Resources"). It encourages the use of CA 125 in women if the following symptoms are persistent or frequent (e.g. >12 times/month):

- persistent abdominal distension or bloating;
- feeling full (early satiety) and/or loss of appetite;
- pelvic or abdominal pain;
- increased urinary urgency and/or frequency.

There is little evidence to support the use of these markers in screening for cancer due to the poor sensitivity and, particularly, specificity of the tests. Although there is no evidence to support the use of PSA testing in population-wide screening for prostate cancer, the Department of Health has agreed that men concerned about their risk of prostate cancer can have a PSA test provided they are given information about the risks of testing. Some men with prostate cancer have a type that does not progress, but receiving a positive test result will change their life.

Magnitude of variation

Map 35: CA 125

For PCTs in England, the estimated annual rate of use for CA 125 tests ordered by GPs ranged from 0.11 to 9.0 per 1000 practice population (80-fold variation).[2] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.92–8.4 per 1000 practice population and the variation is 9-fold.

The degree of variation observed in the use of CA 125 testing is unlikely to be accounted for by differences in the prevalence of ovarian cancer. Some of the variation probably reflects differences in:

- professional practice and commissioning prioritisation;
- the rate of diffusion of innovation since the publication of updated guidance in 2011.

Map 36: PSA

For PCTs in England, the estimated annual rate of use for PSA tests ordered by GPs ranged from 0.64 to 46.1 per 1000 practice population (72-fold variation). When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 8.5–40.1 per 1000 practice population and the variation is 4.7-fold.

The degree of variation observed in the use of PSA testing is relatively high at almost fivefold, and may reflect differences in:

- men's needs and preferences for testing – warranted variation;
- professional attitudes to PSA testing – unwarranted variation.

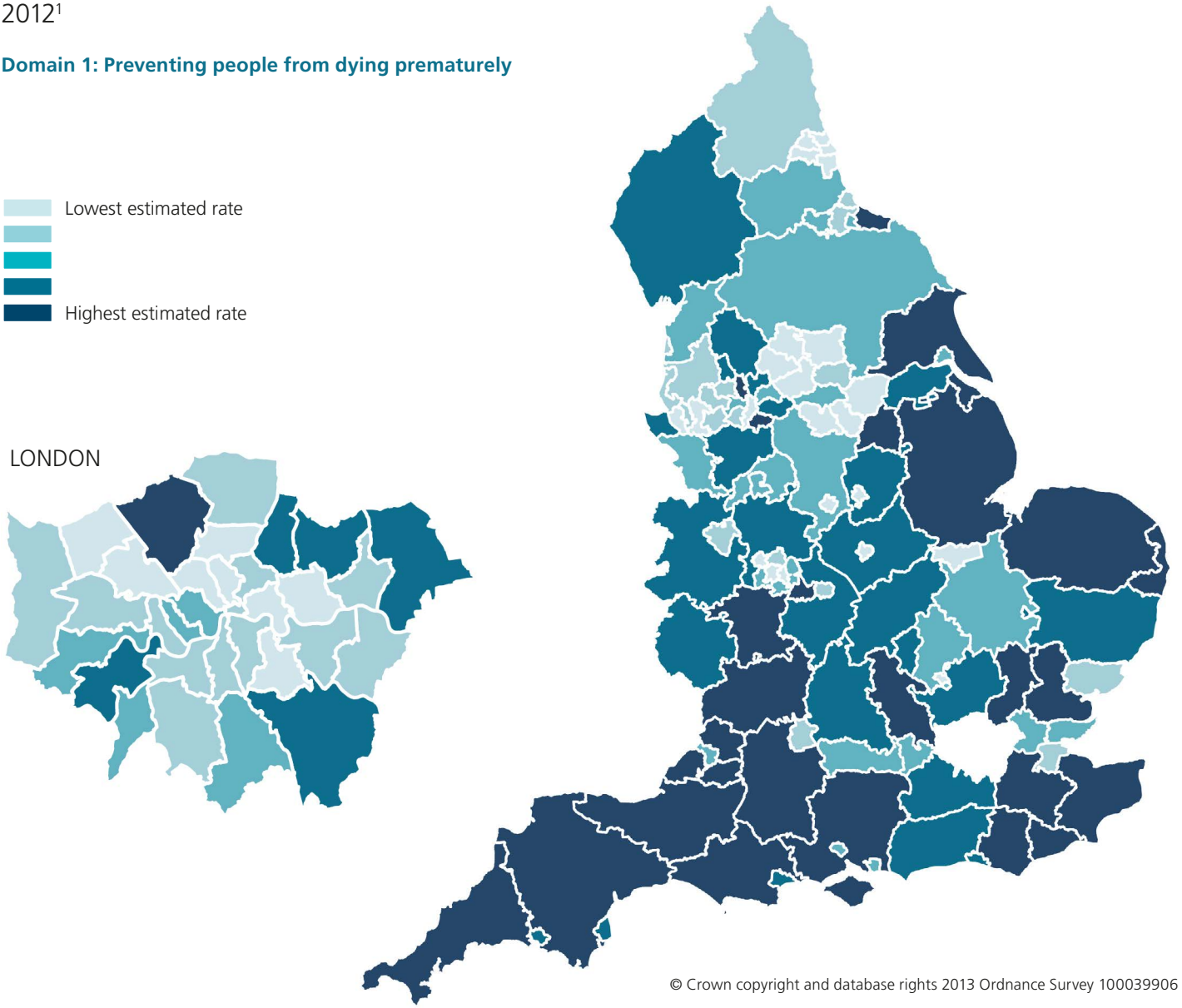
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 10 PCTs.

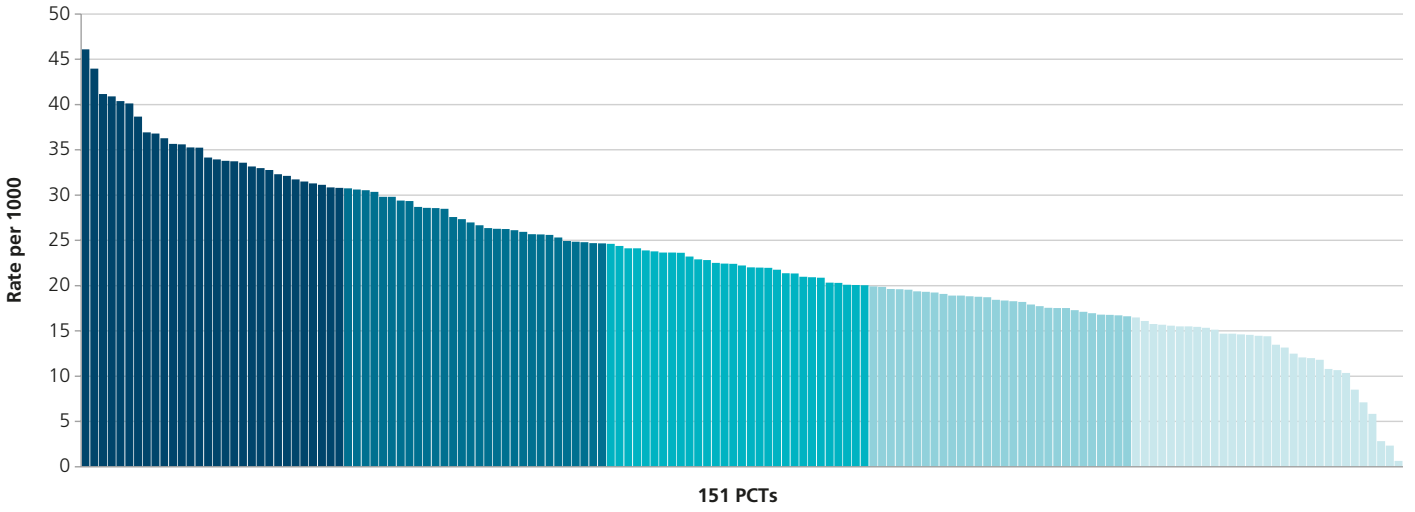
PATHOLOGY SERVICES

Map 36: Estimated annual rate of use for prostate-specific antigen (PSA) tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely





Options for action

To reduce unwarranted variation in the use of testing for tumour markers, commissioners need:

- to provide feedback to general practices and GPs on their use of CA 125 and PSA in order to assist the calibration of clinician suspicion of tumours in their clinical context;
- to implement the policy on the use of CA 125 testing in women whose symptoms are persistent or frequent, and ensure CA 125 testing is available within the programme budget for cancer services – resources may need to be shifted from lower-value activities to fund this. As this policy is adopted across primary care, it is expected that more uniform testing of CA 125 will develop over time.

RESOURCES

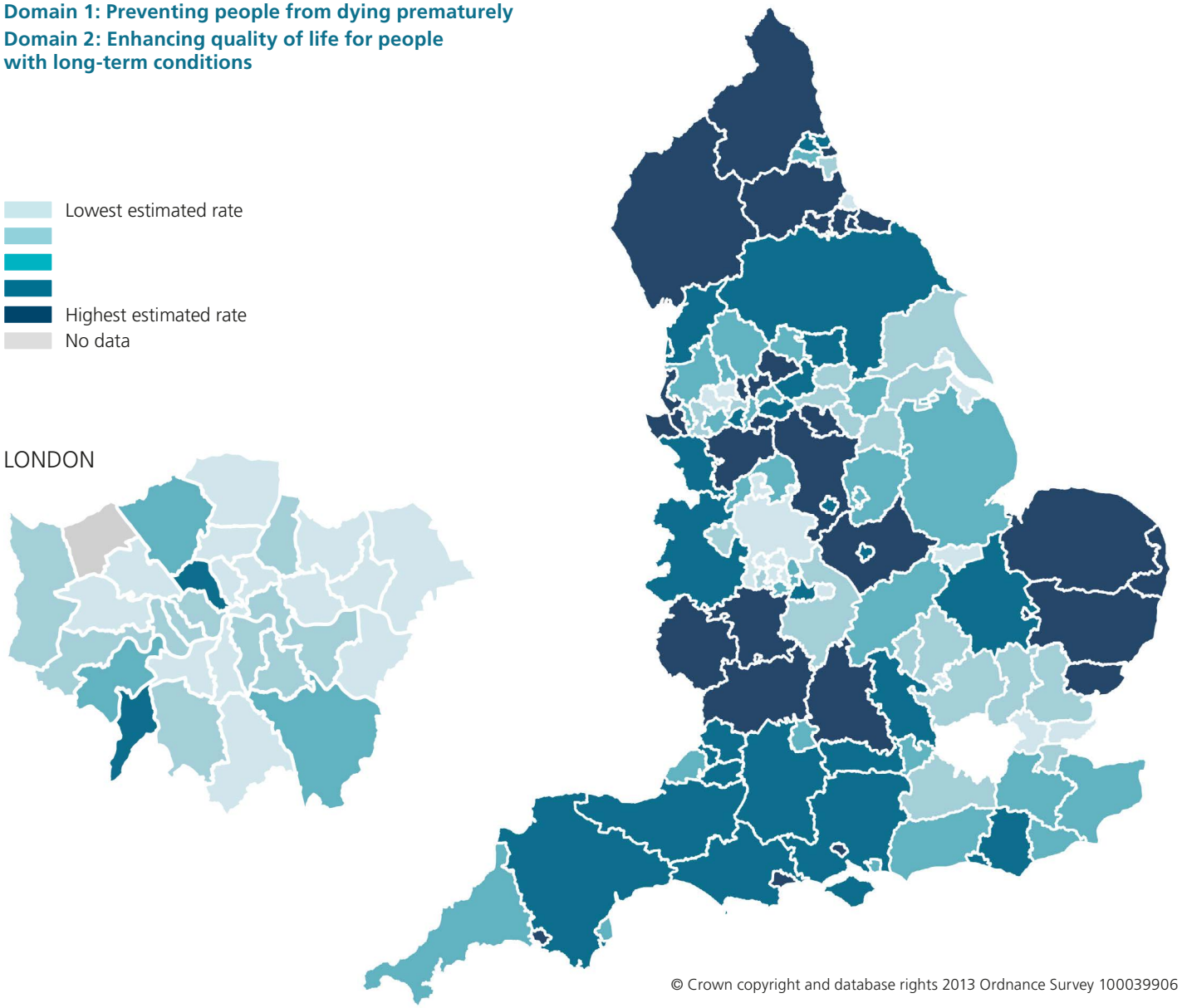
- NICE (2011) Ovarian cancer. The recognition and initial management of ovarian cancer (CG122). http://guidance.nice.org.uk/CG122
- NHS Cancer Screening Programmes. Prostate Cancer Risk Management Programme: UK Information Pack. http://www.cancerscreening.nhs.uk/prostate/informationpack.html

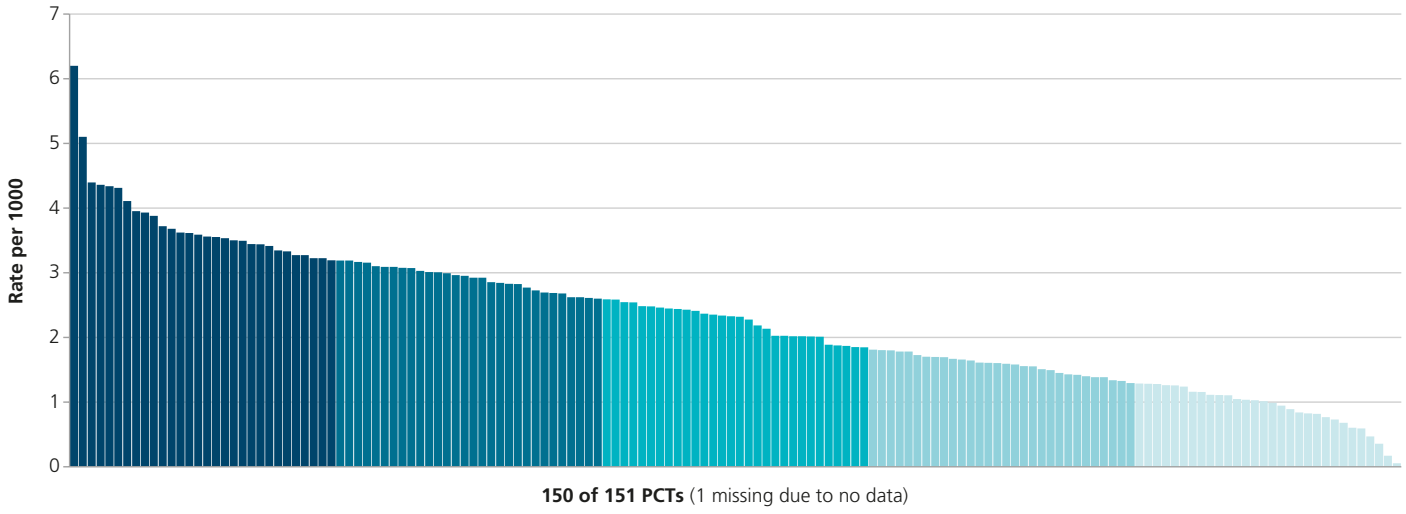
PATHOLOGY SERVICES

Map 37: Estimated annual rate of use for lithium tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





150 of 151 PCTs (1 missing due to no data)

Context

In Maps 37–41, the indicators are examples of the use of the laboratory in therapeutic drug monitoring. Each map represents a different relationship between the drug and the disease state.

Lithium (Map 37) is a drug used to treat people with bipolar disorder, a mental condition characterised by cycles of depression and mania. Sometimes, lithium is also used to treat people with depression who are not responding to other drugs. The effect of lithium is to moderate a person's mood, although it can take several weeks or months for the drug to have an effect.

To be effective, levels of lithium need to be maintained within a narrow therapeutic range:

- too little, and the drug is not effective;
- too much, and patient experiences lithium toxicity.

Doses of the drug need to be adjusted until a steady concentration is achieved. The amount of the drug needed to achieve steady state varies among individuals, and can be affected by age, health status, and whether other drugs are being taken.[2] Thus, the test is used to measure and monitor the amount of lithium in the blood to determine whether the concentration is within the therapeutic range. At the beginning of lithium treatment, tests are requested frequently (every few days) so that the dose can be adjusted to reach the therapeutic range. Once the lithium concentration has reached the therapeutic range and is stable, levels are monitored every 3–12 months to ensure they remain within that range (see also Maps 31–34, pages 122–127, regarding thyroid function tests for lithium and hypothyroidism).

Given that lithium is cleared from the circulation and secreted only by the kidney, it is important to assess kidney function for signs of deterioration during long-term lithium therapy. Extremely high levels of lithium are toxic, and can lead to kidney failure, loss of consciousness and/or seizures, and death. The NICE standard is one blood-level measurement every 3 months (see "Resources").

The test may also be requested if a patient's condition does not appear to be responding to lithium treatment, or if toxicity is suspected.

Carbamazepine (Map 38) is used primarily in the treatment of epilepsy. Low serum concentrations may indicate a risk of failure to control fits, whereas elevated values may indicate toxicity. In addition, carbamazepine is used in the treatment of bipolar disorders.

Valproate testing (Map 39) has largely been discontinued: there is little correlation between blood concentrations and the control of epilepsy. The assay has value only in determining non-compliance with therapy.

Digoxin (Map 40) is used in the treatment of atrial fibrillation and cardiac failure, although it is not a first-line treatment for either of these conditions. The drug has a narrow therapeutic range, hence, adverse events are common. Hospitalisation for toxicity occurs in 1.5–2% of patients receiving digoxin. The major route of elimination of digoxin is via the kidney; any deterioration of renal function, as judged by a falling eGFR, risks the development of toxicity. NICE does not recommend routine monitoring of serum digoxin concentrations; however, a digoxin concentration may be useful to confirm a clinical impression of toxicity or non-compliance.

Phenytoin (Map 41) is used as a second-line treatment for epilepsy. Although it is an effective treatment, it carries the risk of side-effects. Phenytoin has a narrow therapeutic range: there is a very small difference between doses that control fits and those that cause toxic effects. The drug induces several enzymes resulting in abnormal liver function tests, and impaired vitamin D metabolism, which can lead to disorders of calcium metabolism that adversely increase the tendency to fitting.

Concentrations of both lithium and carbamazepine are dependent on patient compliance with dosage together with prescribing related to blood-test findings. For all five drugs, there are specific recommendations for the timing of blood tests.

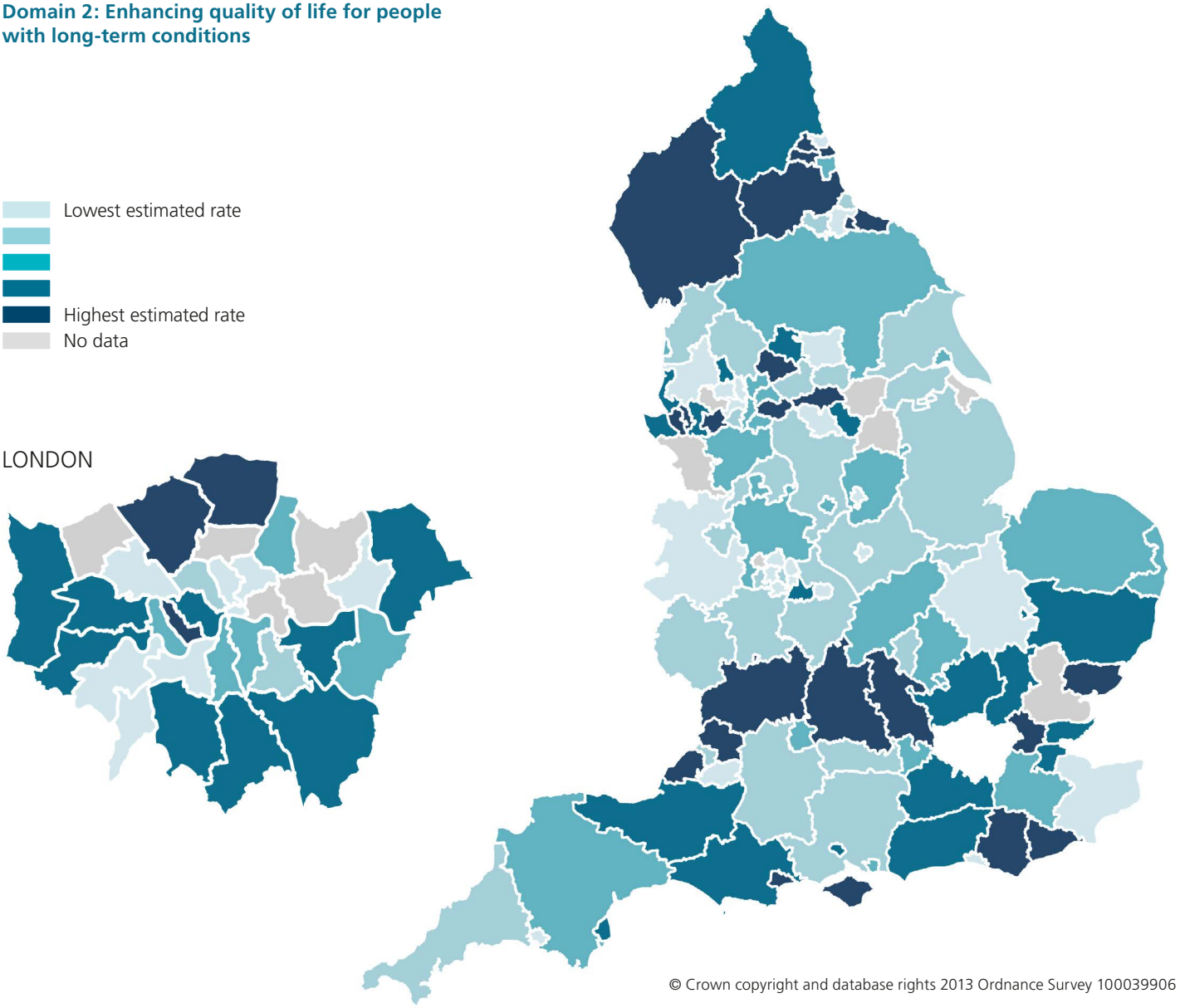
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 http://www.labtestsonline.org.uk/understanding/analytes/lithium/test.html

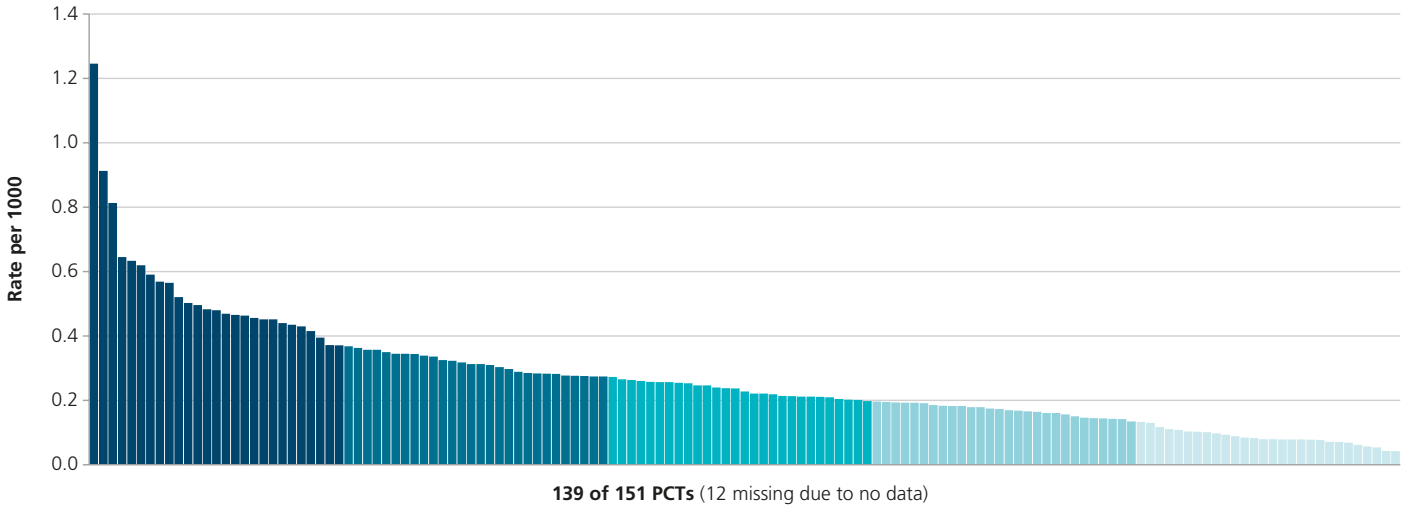
PATHOLOGY SERVICES

Map 38: Estimated annual rate of use for carbamazepine tests ordered by GPs per practice population by PCT

2012[1]

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





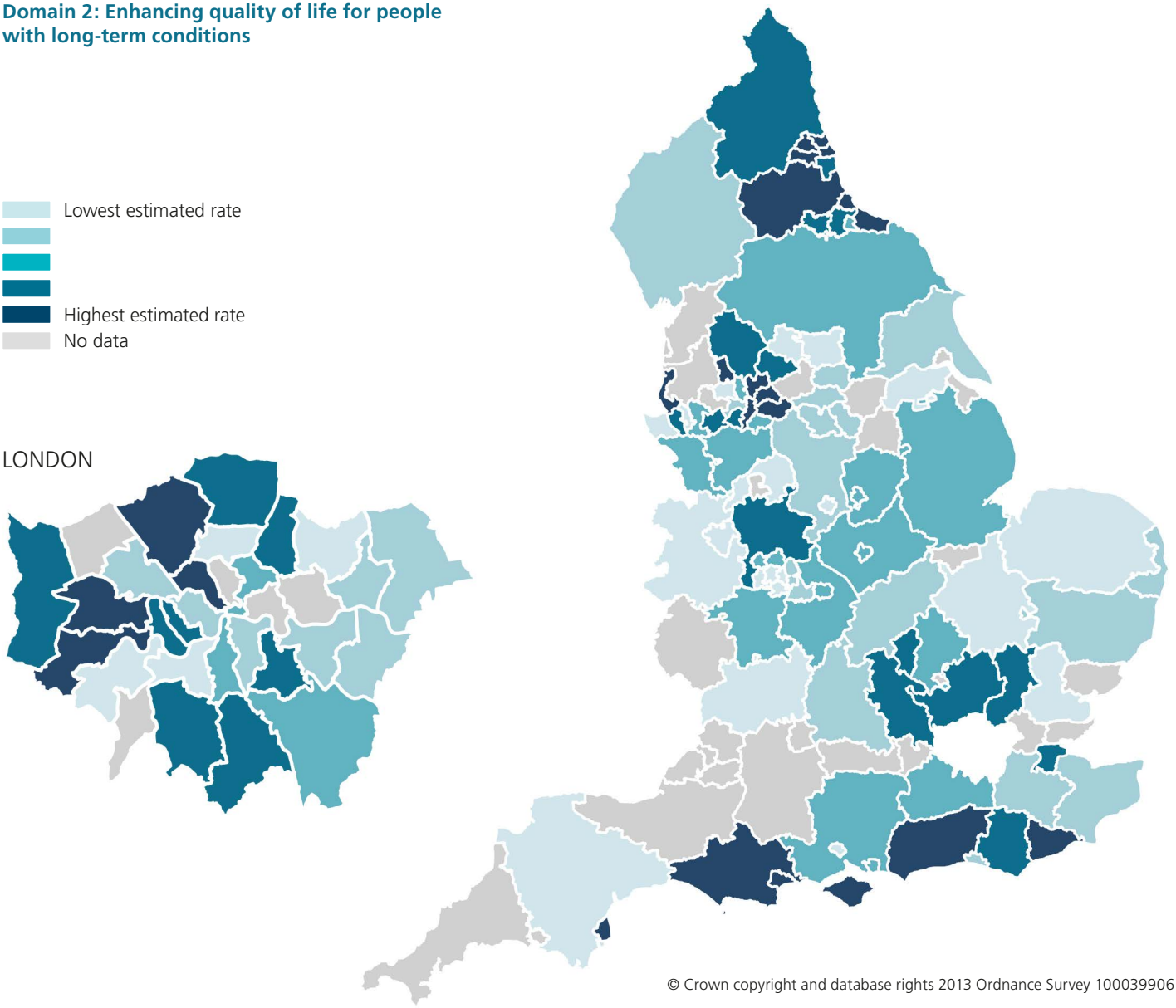
139 of 151 PCTs (12 missing due to no data)

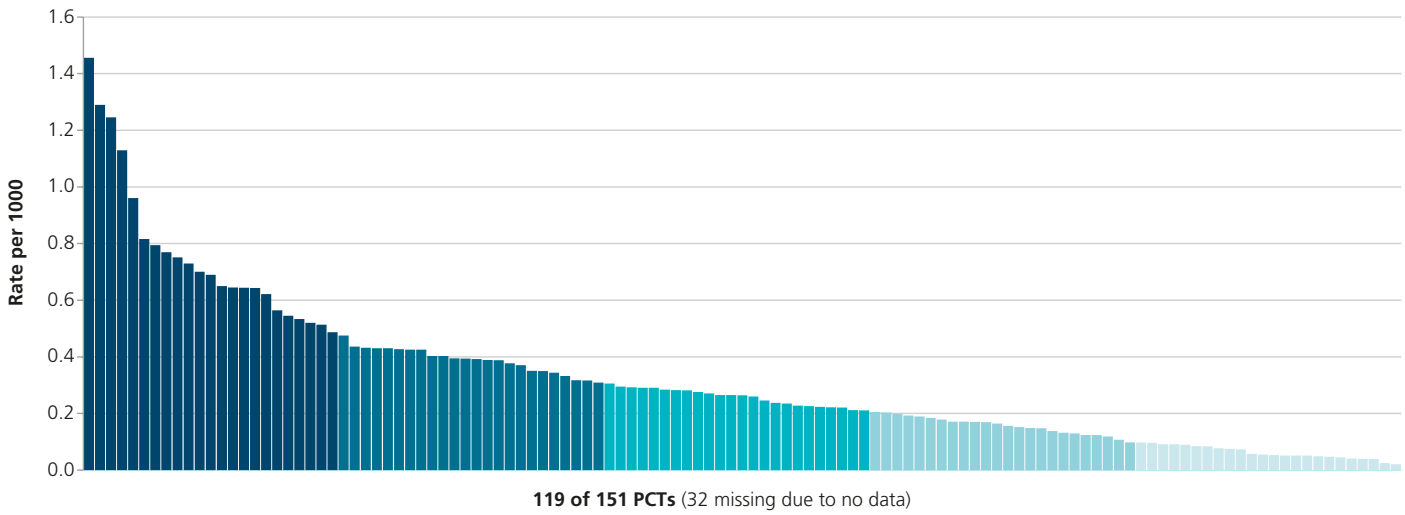
PATHOLOGY SERVICES

Map 39: Estimated annual rate of use for valproate tests ordered by GPs per practice population by PCT

2012[1]

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





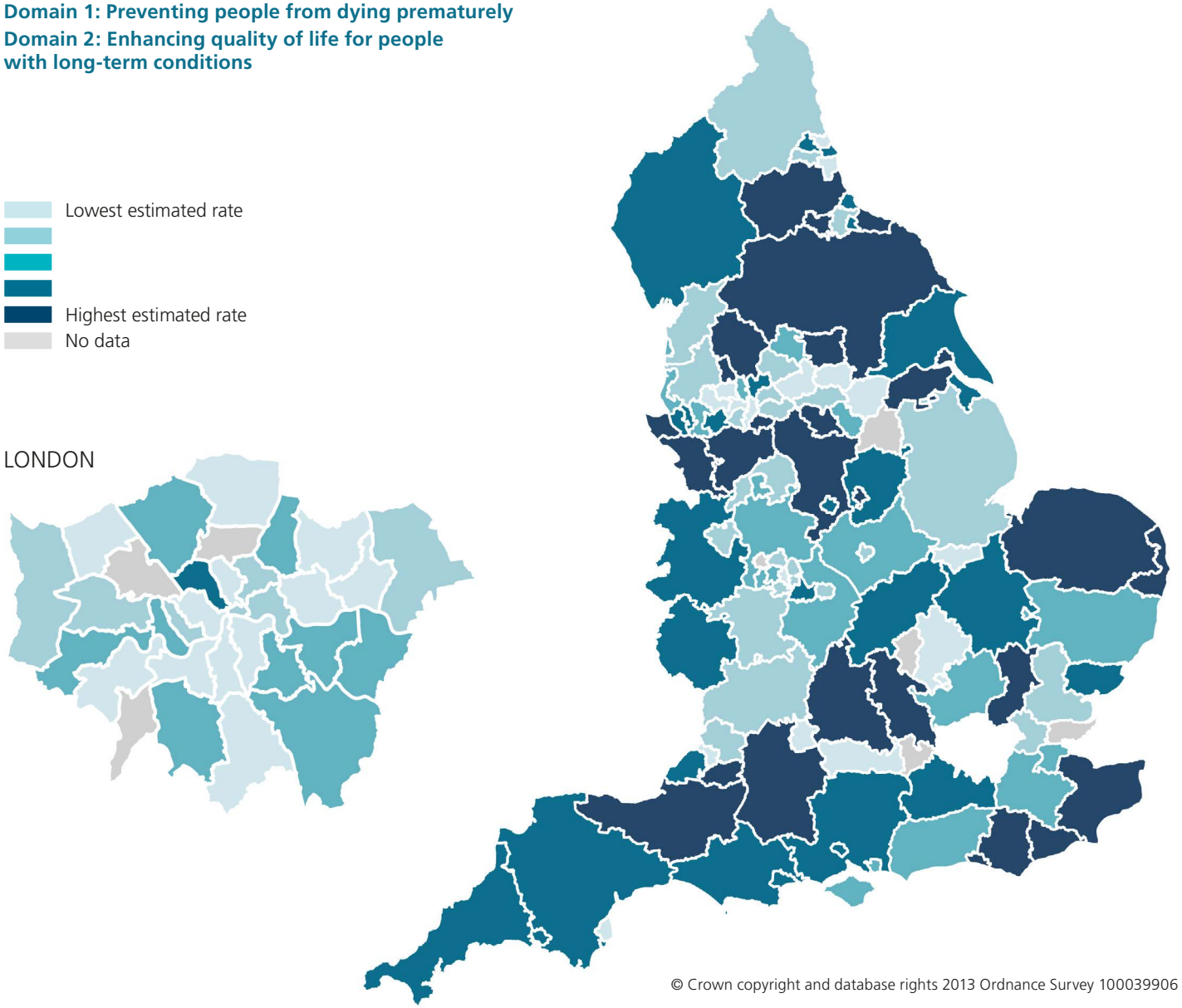
119 of 151 PCTs (32 missing due to no data)

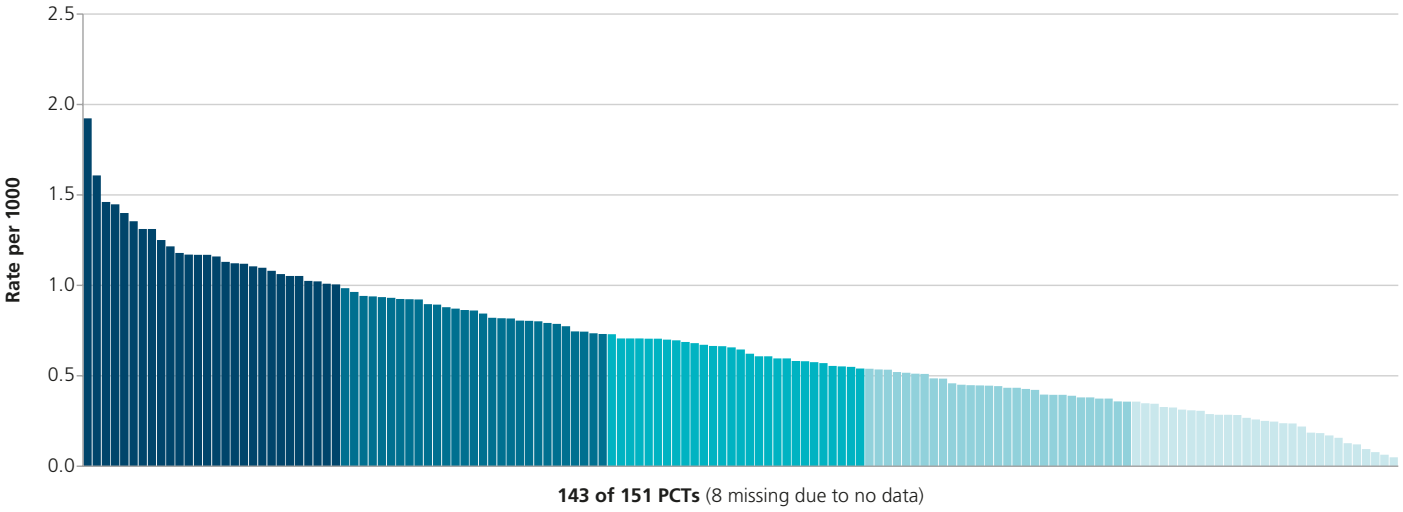
PATHOLOGY SERVICES

Map 40: Estimated annual rate of use for digoxin tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





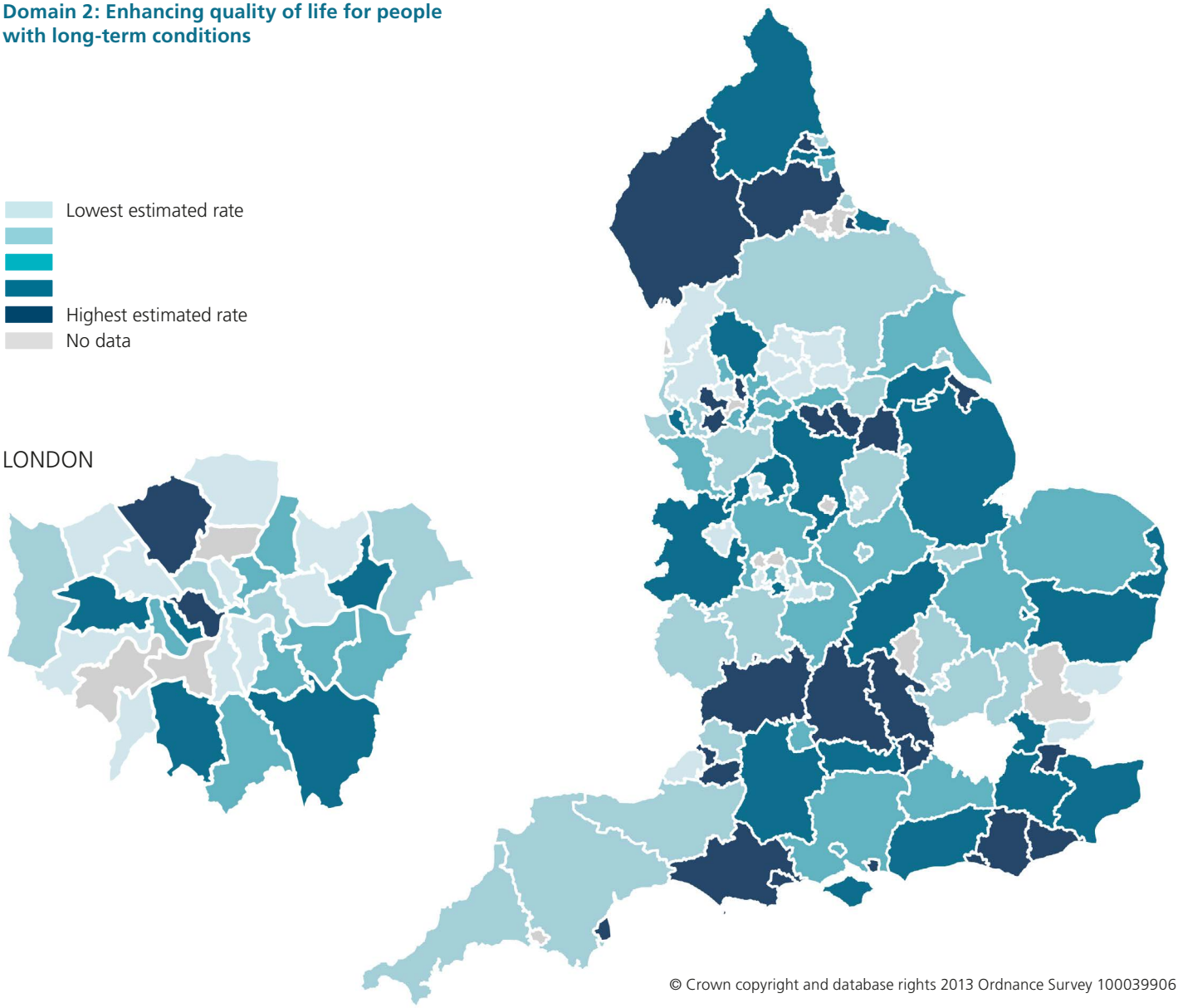
143 of 151 PCTs (8 missing due to no data)

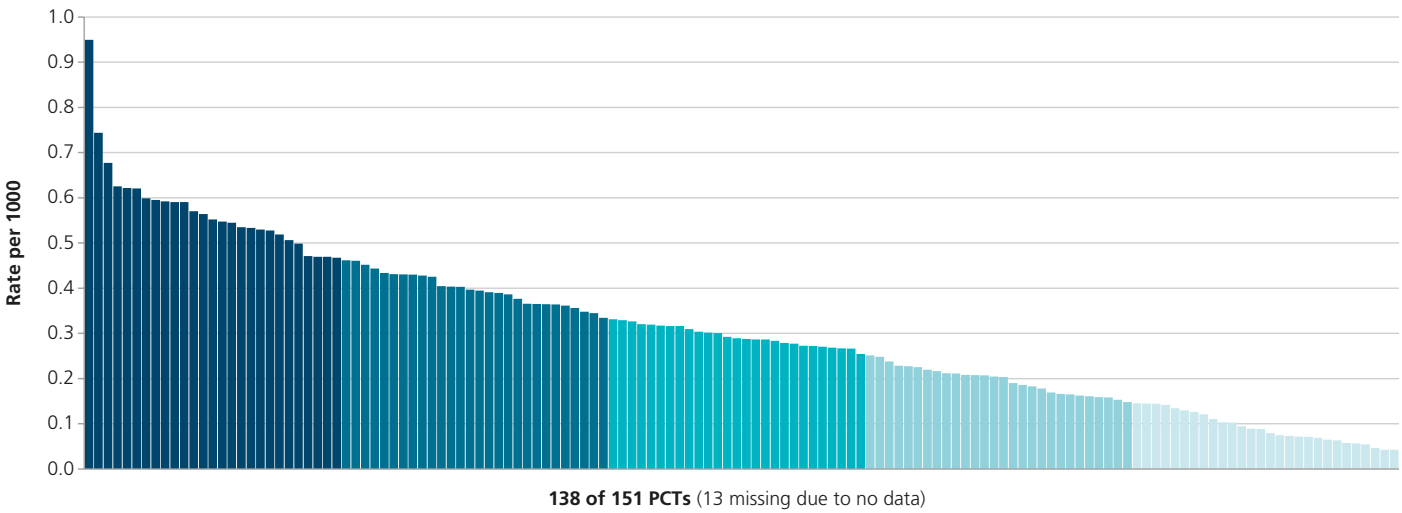
PATHOLOGY SERVICES

Map 41: Estimated annual rate of use for phenytoin tests ordered by GPs per practice population by PCT

2012[1]

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





138 of 151 PCTs (13 missing due to no data)

Magnitude of variation

Map 37: Lithium

For PCTs in England, the estimated annual rate of use for lithium tests ordered by GPs ranged from 0.05 to 6.2 per 1000 practice population (116-fold variation).[3] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.60–4.3 per 1000 practice population, and the variation is 7-fold.

The degree of variation observed in the use of lithium testing is unlikely to be accounted for by differences in the incidence and prevalence of bipolar disorder.

Map 38: Carbamazepine

For PCTs in England, the estimated annual rate of use for carbamazepine tests ordered by GPs ranged from 0.04 to 1.2 per 1000 practice population (30-fold variation).[4] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.07–0.6 per 1000 practice population, and the variation is 9-fold.

Map 39: Valproate

For PCTs in England, the estimated annual rate of use for valproate tests ordered by GPs ranged from 0.02 to 1.5 per 1000 practice population (72-fold variation).[5] When the four PCTs with the highest estimated rates and the four PCTs with the lowest estimated rates are excluded, the range is 0.04–1.0 per 1000 practice population, and the variation is 24-fold.

The utilisation rate for valproate testing is very low, which indicates that the test is probably being used only to check non-compliance with drug therapy.

Map 40: Digoxin

For PCTs in England, the estimated annual rate of use for digoxin tests ordered by GPs ranged from 0.05 to 1.9 per 1000 practice population (39-fold variation).[6] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.13–1.4 per 1000 practice population, and the variation is 11-fold.

Map 41: Phenytoin

For PCTs in England, the estimated annual rate of use for phenytoin tests ordered by GPs ranged from 0.04 to 0.9 per 1000 practice population (22-fold variation).[7] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.06–0.6 per 1000 practice population, and the variation is 11-fold.

The degree of variation observed in estimated annual rates of testing for all five drugs probably reflects differences in what Wennberg[8] called the "signature" of services, that is, differences in the beliefs and attitudes of particular clinicians and clinical teams, which become manifest as differences in practices and behaviour. More research is needed on the scientific merit of therapeutic drug monitoring.

Research is also needed to identify the degree to which differences in prescribing reflect differences in diagnostic thresholds.

3 There are no data from one PCT.
4 There are no data from 12 PCTs.
5 There are no data from 32 PCTs.
6 There are no data from 8 PCTs.
7 There are no data from 13 PCTs.
8 Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Healthcare.* Oxford University Press. See also: http://www.dartmouthatlas.org/

Options for action

Lithium

For commissioners responsible for populations where the rates of lithium testing are higher or lower than the national average, it is advisable to undertake an audit to identify the proportion of patients locally who have stopped taking lithium, or who may need to be admitted to hospital due to lithium toxicity.

Laboratory services need to work with commissioners, and provide information on patients in the local population who are on file as having their lithium levels monitored; this information needs to be reviewed against those patients known to local mental health services as having a bipolar disorder.

Carbamazepine

Commissioners need to review local policies on the use of drug monitoring of carbamazepine levels in local populations.

Valproate

Commissioners need to ensure that valproate assays are used only to determine non-compliance with therapy in patients in the local population, and that samples are taken at an appropriate time in relation to dose.

Digoxin

Commissioners need:

- to review local policies on the use of digoxin;
- to review local data on hospital admissions for digoxin toxicity and compare them with local digoxin assay rates;
- to audit the frequency of checks of renal function on patients in the local population taking digoxin.

Phenytoin

Commissioners need:

- to review local policies for the role of phenytoin in the control of epilepsy;
- to audit the frequency of checks of calcium metabolism in patients in the local population who are being treated with phenytoin and compare it with recommendations in NICE guidance.

RESOURCES

- NICE (2006) Bipolar disorder: The management of bipolar disorder in adults, children and adolescents, in primary and secondary care (CG38). http://guidance.nice.org.uk/CG38
- National Patient Safety Agency (2009) Patient Safety Alert. NPSA/2009/PSA005. 1 December 2009. Safer lithium therapy. http://www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=65428&...
- Hiemke C et al (2009) AGNP Consensus Guidelines for Therapeutic Drug Monitoring in Psychiatry: Update 2011. *Pharmacopsychiatry* 44; 195-235. http://www.ncbi.nlm.nih.gov/pubmed/21969060
- Patsalos PN, Berry DJ, Bourgeois BF et al (2008) Antiepileptic drugs - best practice guidelines for therapeutic drug monitoring: a position paper by the subcommission on therapeutic drug monitoring, ILAE Commission on Therapeutic Strategies. *Epilepsia* 49; 1239-1276. http://www.ncbi.nlm.nih.gov/pubmed/18397299
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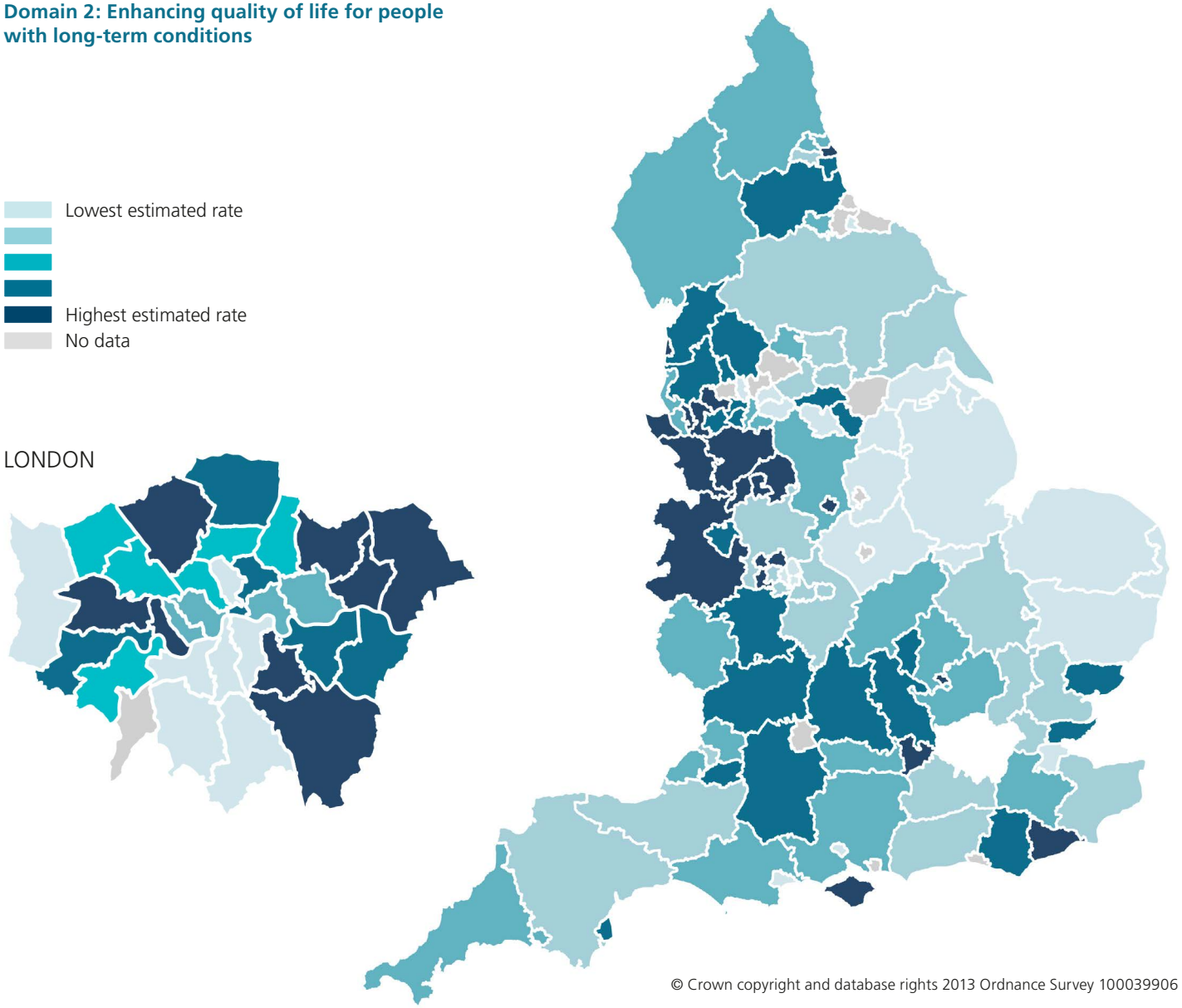
- NICE (2012) The epilepsies: the diagnosis and management of the epilepsies in adults and children in primary and secondary care (CG137). http://guidance.nice.org.uk/CG137

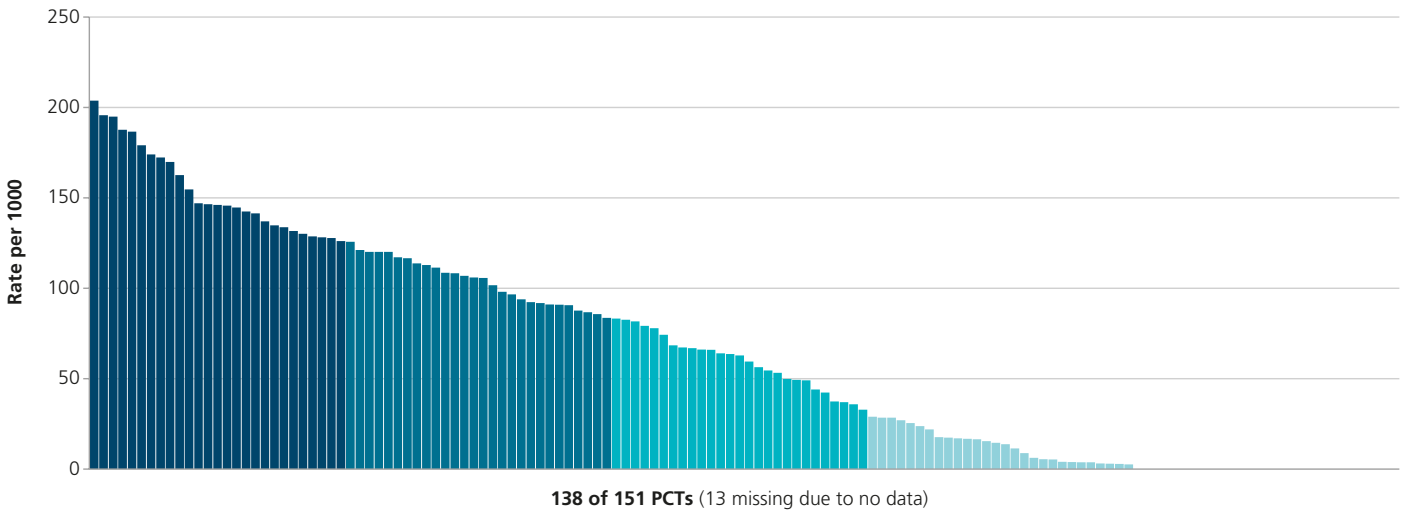
PATHOLOGY SERVICES

Map 42: Estimated annual rate of use for blood glucose (fasting) tests ordered by GPs per practice population by PCT

2012[1]

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





138 of 151 PCTs (13 missing due to no data)

Context

Fasting plasma glucose measurements (Map 42) may be used to assess the risk of a patient having diabetes, for instance, as part of a screen for cardiovascular risk, or in the monitoring of diabetic control of blood glucose. Elevated fasting glucose values may indicate the presence of diabetes if the level is ≥7.0 mmol/L, or impaired fasting glycaemia if the level is between 6.1 and 6.9 mmol/L. In addition, a fasting glucose of >5.6 mmol/L is a criterion for the diagnosis of metabolic syndrome.

Blood glucose (2 hours post glucose load) tests (Map 43) are undertaken as part of an oral glucose tolerance test, the definitive diagnostic test for diabetes. Two-hour plasma glucose values after a glucose load indicate a diagnosis of diabetes if they are ≥11.1 mmol/L, and impaired glucose tolerance if between 7.8 and 11.0 mmol/L.

Glycated haemoglobin (Map 44) is used as a long-term assessment of the quality of glucose control. The glycated haemoglobin, haemoglobin A1c (HbA1c), test is used to monitor an individual's diabetes. Glucose in the blood binds to haemoglobin to form HbA1c, and the amount of HbA1c is directly related to the average level of glucose in the blood. If an individual's diabetes is not well controlled, blood glucose levels will be high, as will levels of HbA1c.

Testing for HbA1c is undertaken when people are first diagnosed with diabetes, and then at least twice a year thereafter according to Department of Health recommendations. The test may be undertaken more frequently if:

- blood glucose levels remain too high;
- HbA1c values remain too high
- an individual's treatment plan changes.

For HbA1c:

- the non-diabetic reference range is 20-42 mmol/mol;
- values of 42-48 mmol/mol are above normal, but indicate good or acceptable control of diabetes;
- values >53 mmol/mol are considered an indication for further lifestyle and/or therapeutic interventions.

Magnitude of variation

Map 42: Fasting glucose

For PCTs in England, the estimated annual rate of use for blood glucose (fasting) tests ordered by GPs ranged from 0.05 to 203.7 per 1000 practice population (>1000-fold variation).[2] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.08–179.1 per 1000 practice population, and the variation is >1000-fold.

Map 43: Blood glucose (2 hours post glucose load)

For PCTs in England, the estimated annual rate of use for blood glucose (2 hours post glucose load) tests ordered by GPs ranged from 0.04 to 14.6 per 1000 practice population (386-fold variation).[3] When the three PCTs with the highest estimated rates and the three PCTs with the lowest estimated rates are excluded, the range is 0.06–11.0 per 1000 practice population, and the variation is 184-fold.

Map 44: HbA1c (IFCC test)

For PCTs in England, the estimated annual rate of use for HbA1c tests (IFCC) ordered by GPs ranged from 4.6 to 252.4 per 1000 practice population (55-fold variation).[4] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 34.1–131.6 per 1000 practice population, and the variation is 3.9-fold.

It is unlikely that the degrees of variation observed in fasting glucose tests, blood glucose (2 hours post glucose load) tests and HbA1c tests mirror differences in the prevalence of diabetes across the country.

Part of the variation in the use of HbA1c testing may reflect the increasing use of the test in primary care for the diagnosis of diabetes – the HbA1c test is simpler to perform when compared with a glucose tolerance test.

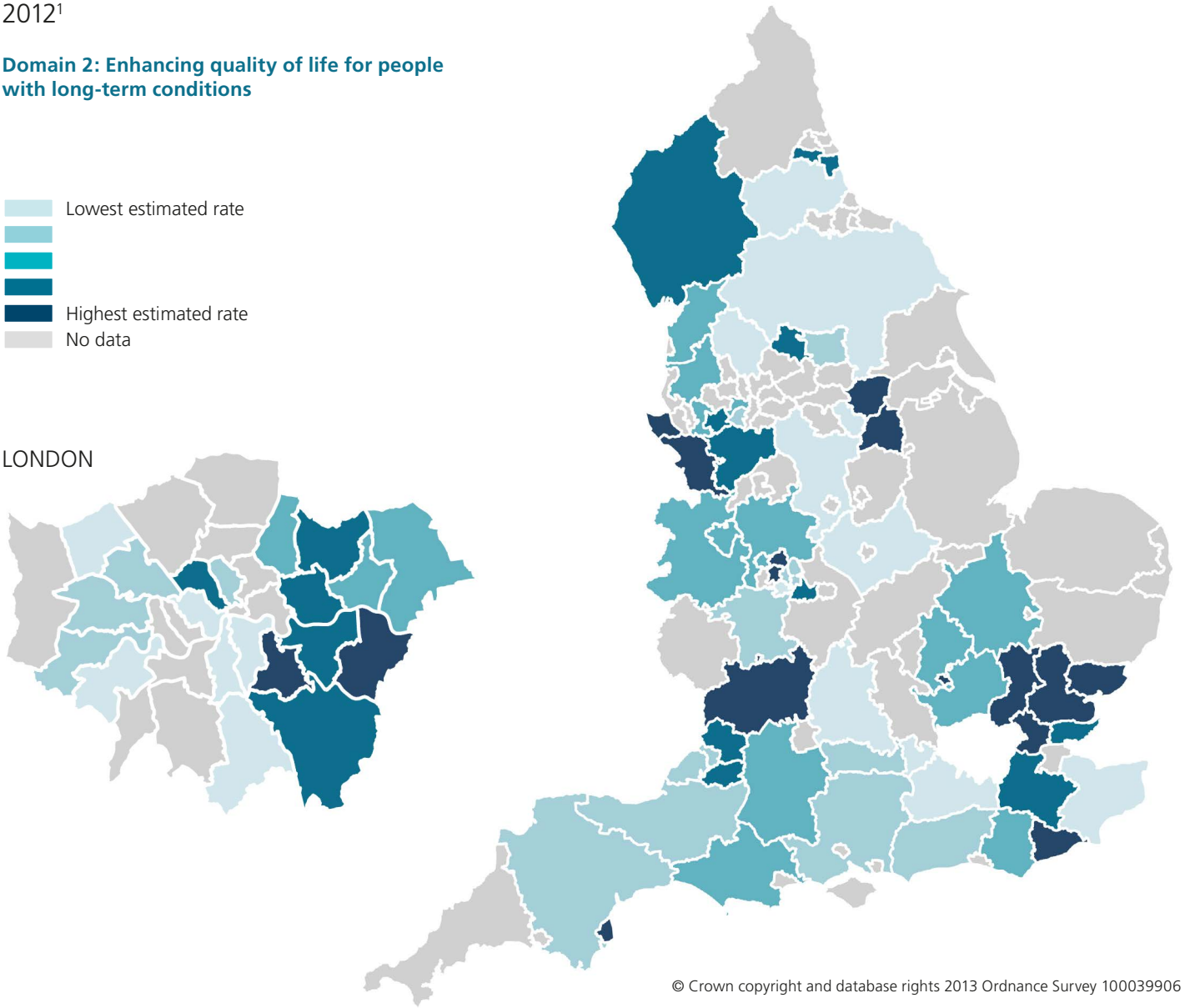
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 13 PCTs.
3 There are no data from 69 PCTs.
4 There are no data from 2 PCTs.

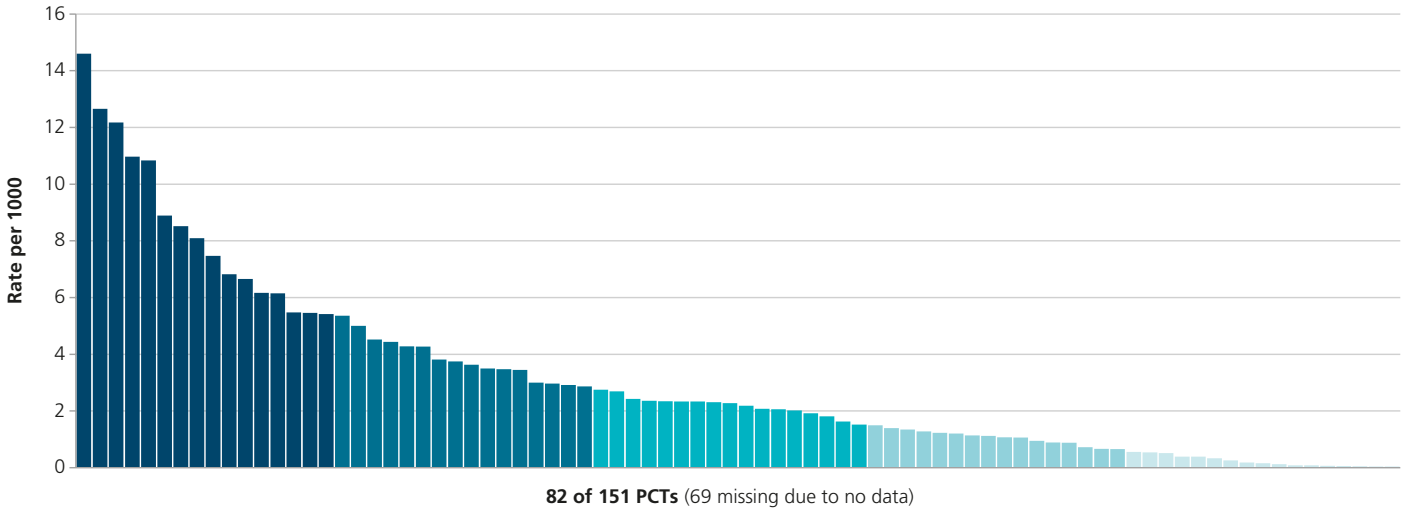
PATHOLOGY SERVICES

Map 43: Estimated annual rate of use for blood glucose (2 hours post glucose load) tests ordered by GPs per practice population by PCT

2012[1]

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





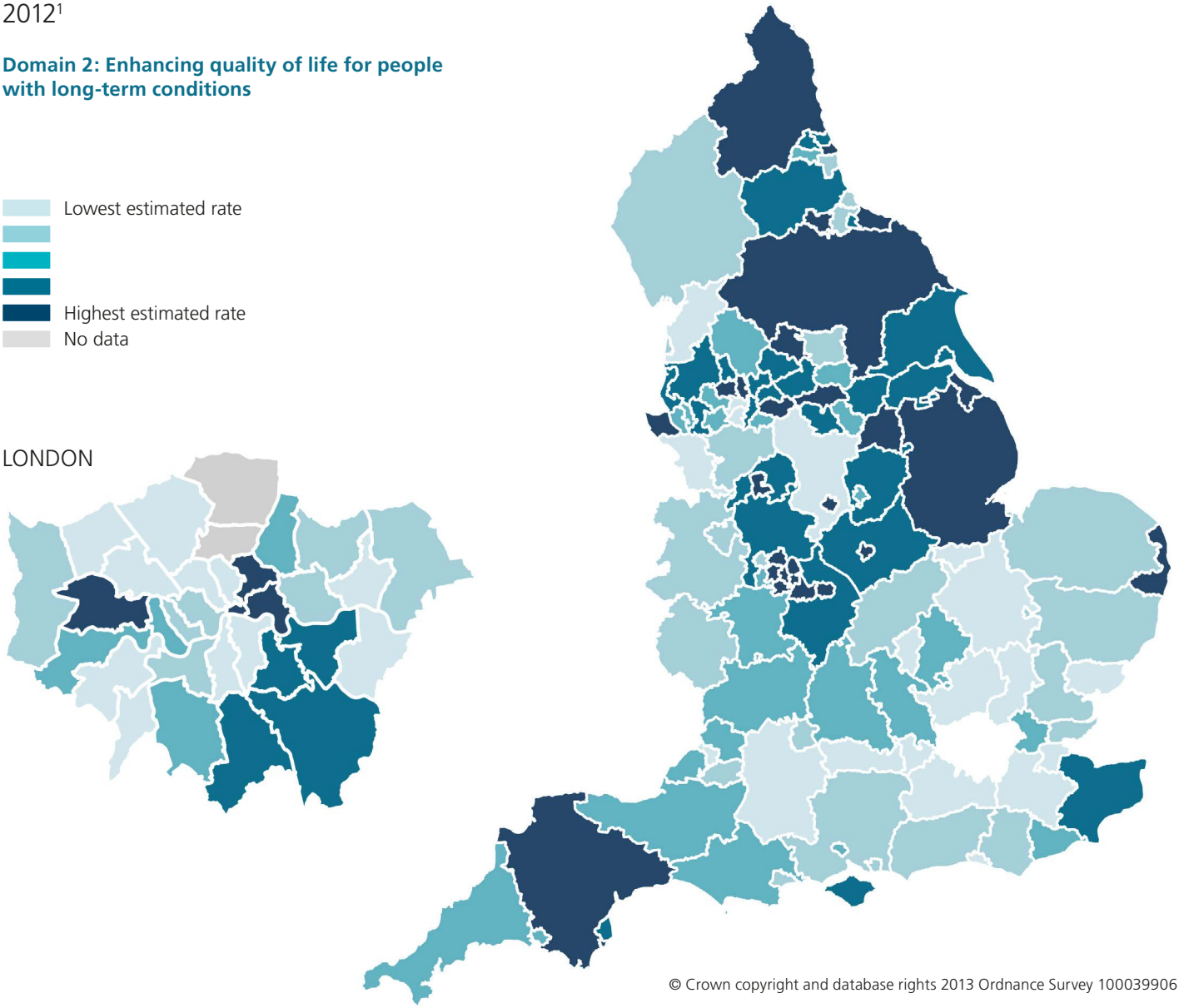
82 of 151 PCTs (69 missing due to no data)

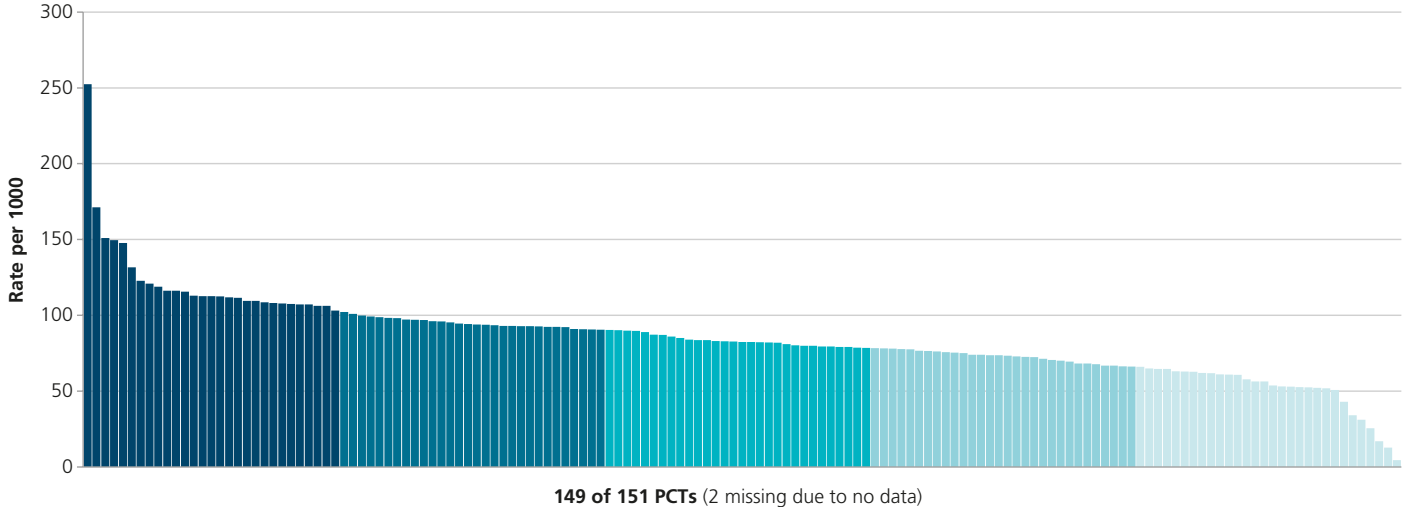
PATHOLOGY SERVICES

Map 44: Estimated annual rate of use for blood glycated haemoglobin (HbA1c) tests (IFCC) ordered by GPs per practice population by PCT

2012[1]

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





149 of 151 PCTs (2 missing due to no data)

Options for action

Commissioners need to audit the frequency of measurement of HbA1c because, from the Keele benchmarking data[2], there is evidence not only of excessive use but also of infrequent use. For a greater depth of analysis, the audit could include a comparison of average level of HbA1c by general practice against the frequency of testing.

On an anecdotal level, many laboratories have noticed a reduction in the use of glucose tolerance testing and an increase in the use of HbA1c testing to diagnose diabetes. Commissioners need to be alert to and aware of any change in practice. In localities where a change in practice is taking place, commissioners need to stipulate that the laboratory method has the necessary analytical total error to ensure the accuracy of diagnosis.

RESOURCES

- Diabetes UK Cymru (2009) HbA1c standardisation for clinical healthcare professionals. http://www.wales.nhs.uk/sitesplus/documents/861/HbA1c%20HCPs1.pdf
- World Health Organization (WHO) (2006) Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia. Report of a WHO/IDF consultation. http://whqlibdoc.who.int/publications/2006/9241594934_eng.pdf
- WHO (2011) Use of Glycated Haemoglobin (HbA1c) in the Diagnosis of Diabetes Mellitus. Abbreviated Report of a WHO Consultation. WHO/NMH/CHP/CPM/11.1. http://www.who.int/diabetes/publications/report-hba1c_2011.pdf
- International Diabetes Federation (2006) The IDFconsensus worldwide definition of the Metabolic Syndrome. http://www.idf.org/webdata/docs/IDF_Meta_def_final.pdf
- Driskell OJ, Holland D, Hanna FW et al (2012) Inappropriate requesting of glycated hemoglobin (Hb A1c) is widespread: assessment of prevalence, impact of national guidance, and practice-to-practice variability. Clin Chem 58; 906-915. http://www.clinchem.org/content/58/5/906.full

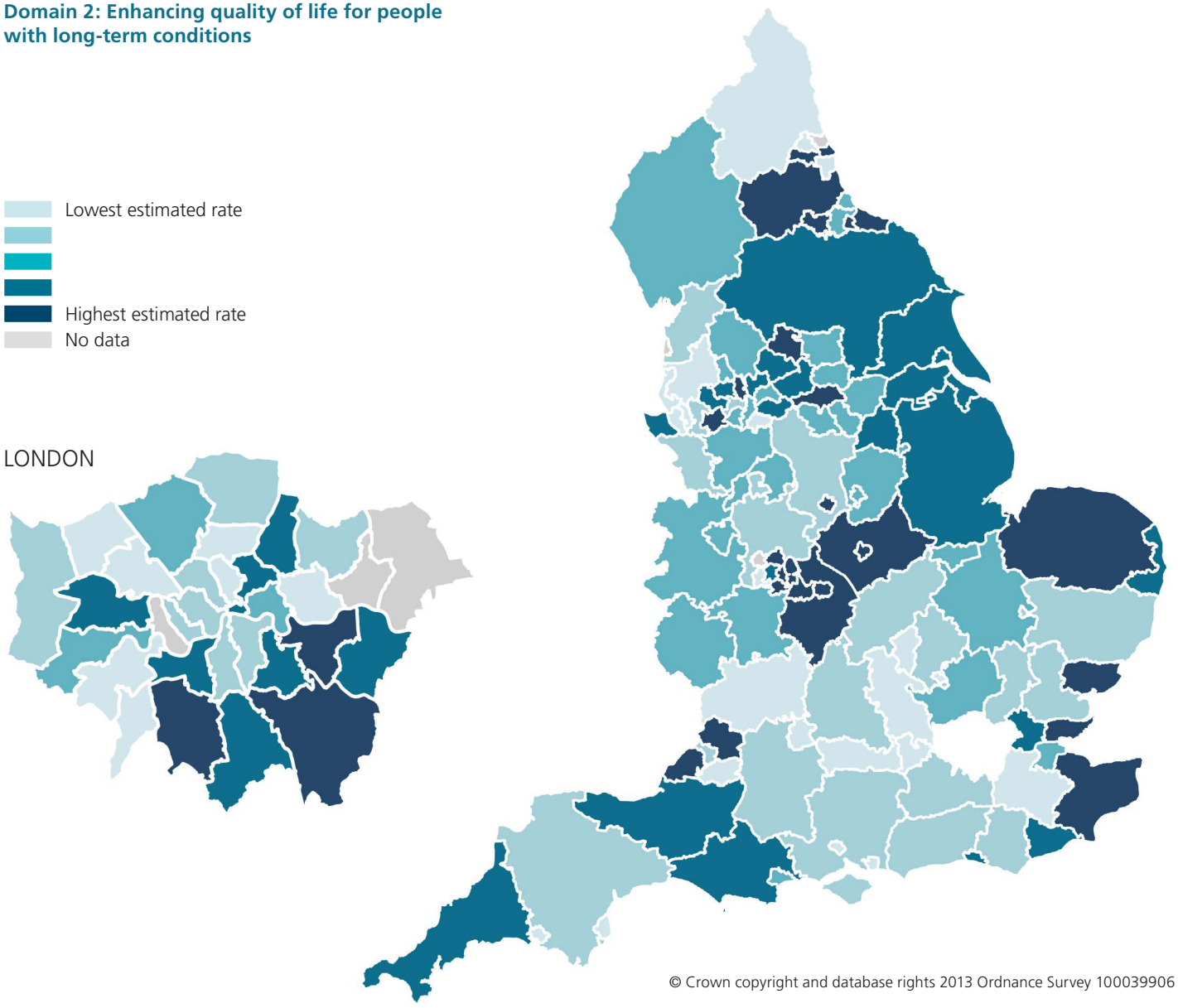
2 Driskell OJ, Holland D, Hanna FW et al (2012) Inappropriate requesting of glycated hemoglobin (Hb A1c) is widespread: assessment of prevalence, impact of national guidance, and practice-to-practice variability. *Clin Chem* 58; 906-915. http://www.clinchem.org/content/58/5/906.full

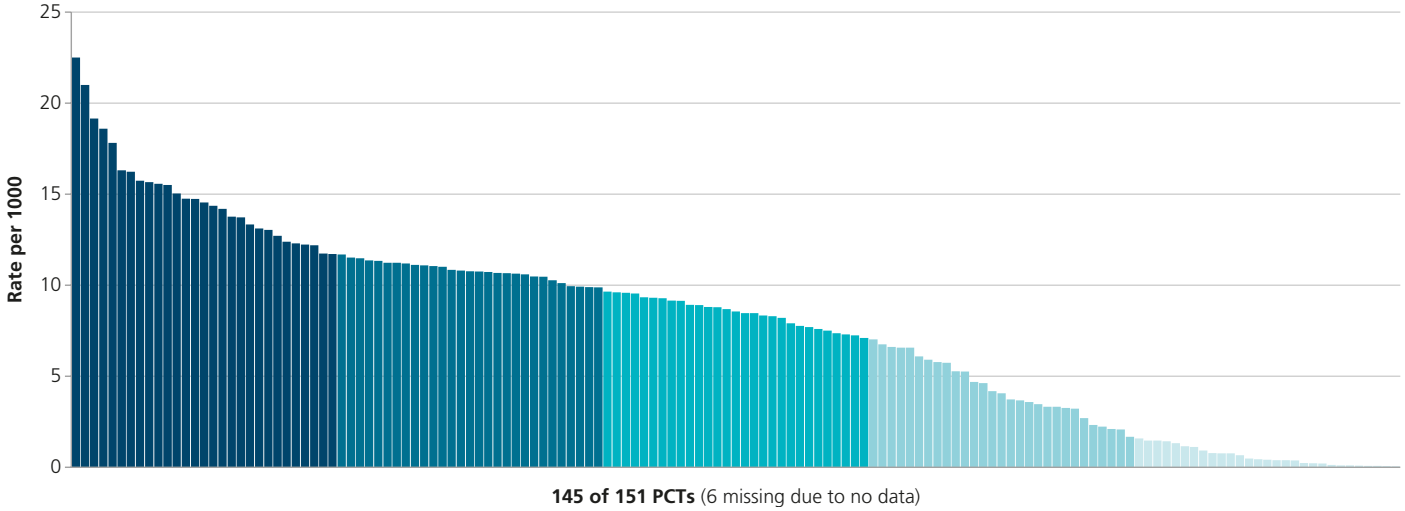
PATHOLOGY SERVICES

Map 45: Estimated annual rate of use for rheumatoid factor tests ordered by GPs per practice population by PCT

2012[1]

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





145 of 151 PCTs (6 missing due to no data)

Context

Rheumatoid factor is an auto-antibody, i.e. an antibody directed against an individual's own tissues; it is an antibody specifically directed against the Fc portion of immunoglobulin G (IgG). Elevated values of this auto-antibody are associated with rheumatoid arthritis. Rheumatoid factor and IgG combine to form immune complexes that contribute to the disease process.

It is important to distinguish rheumatoid arthritis from other forms of arthritis and other conditions that cause similar symptoms of joint pain, inflammation and stiffness to ensure that the appropriate therapy is provided. Rheumatoid factor may be negative in rheumatoid arthritis. The test may be positive in a range of conditions including Sjögren's syndrome, chronic hepatitis, primary biliary cirrhosis, any chronic viral infection, bacterial endocarditis, leukaemia, dermatomyositis, and systemic lupus erythematosus.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for rheumatoid factor tests ordered by GPs ranged from 0.05 to 22.5 per 1000 practice population (416-fold variation).[2] When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 0.10–16.3 per 1000 practice population, and the variation is 170-fold.

As the rheumatoid factor test is not the only test used to help diagnose rheumatoid arthritis, it is likely that some of the degree of variation observed reflects differences in the use of different tests in different localities.

Options for action

Commissioners, clinicians and service providers need to consider whether to select tests that are more specific for rheumatoid arthritis than the rheumatoid test: for instance, the anti-cyclic citrullinated peptide (anti-CCP) antibody test has a higher predictive value when positive.

Despite the superiority of anti-CCP testing in the diagnosis of rheumatoid arthritis, the higher cost of this test has slowed its uptake at some centres. Rheumatoid factor tests have some value in the diagnosis and monitoring of other rheumatic conditions where there is no access to anti-CCP tests.

C-Reactive protein (CRP) testing is regarded as a poor prognostic indicator of rheumatoid diseases.

Commissioners need to work with laboratory services and their users to review the protocols and range and sequence of tests used to diagnose and monitor rheumatoid diseases.

RESOURCES

› Clinical Knowledge Summaries. Rheumatoid Arthritis. Investigations supporting diagnosis. June 2009. http://cks.nice.org.uk/rheumatoid-arthritis. Click on *Evidence* > *Supporting evidence* > *Investigations supporting diagnosis*.

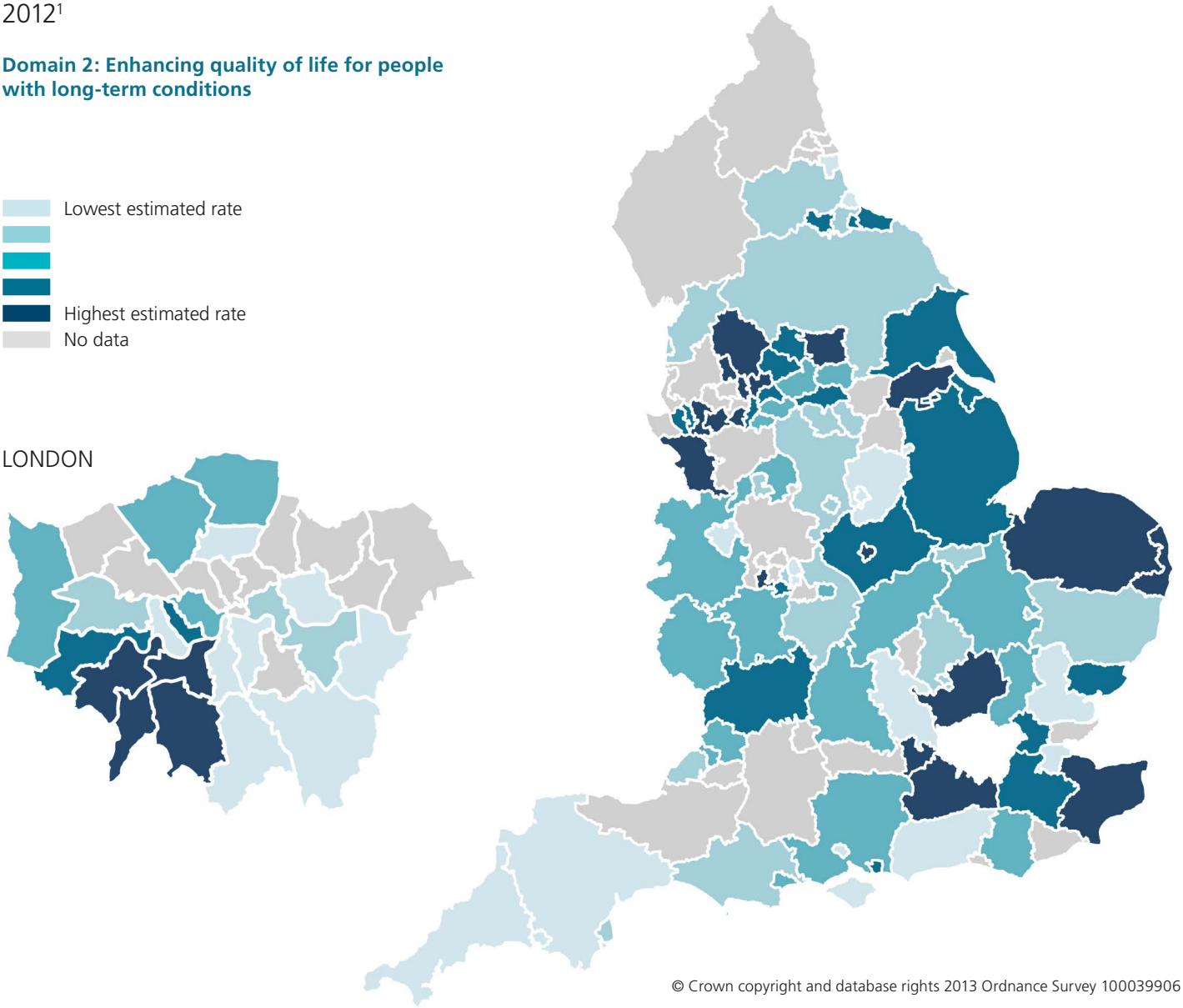
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 6 PCTs.

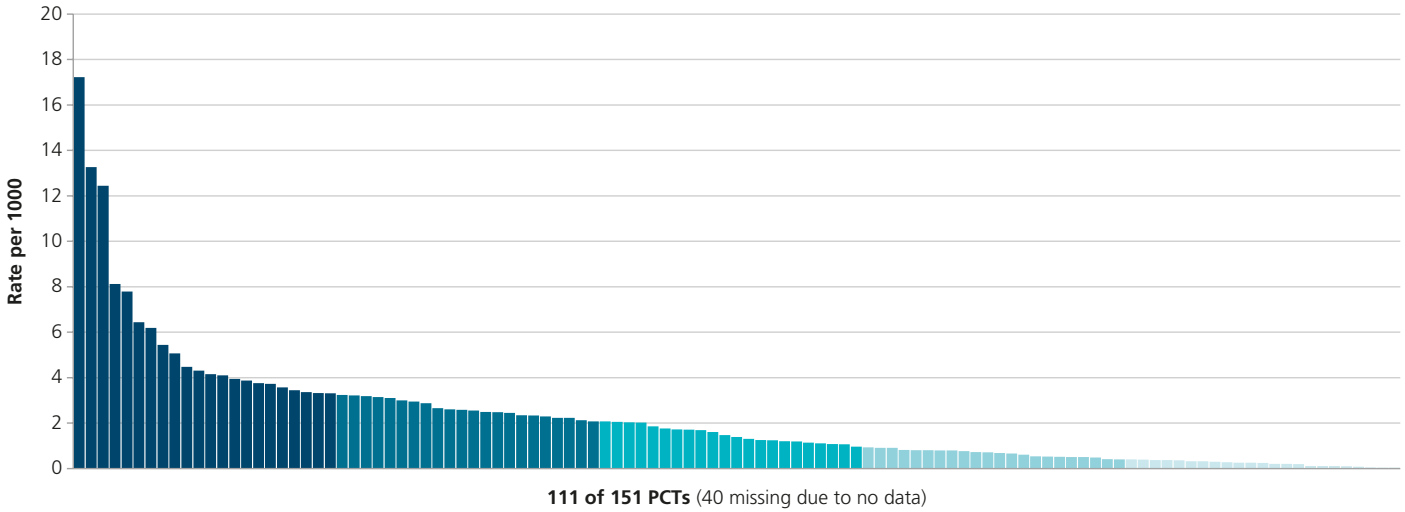
PATHOLOGY SERVICES

Map 46: Estimated annual rate of use for allergen-specific immunoglobulin E (IgE) assays (known as RAST) ordered by GPs per practice population by PCT

2012[1]

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





111 of 151 PCTs (40 missing due to no data)

Context

Colloquially, blood-based allergy assays are referred to as RAST, although technically RAST is an acronym for the radio-allergosorbent test, a proprietary brand used to measure the level of immunoglobulin E (IgE) to specific allergens. The aim of testing is to determine to which substances a person may be allergic when they suffer from asthma and/or allergic dermatitis.

Radio-allergosorbent techniques have been replaced by fluorenzymeimmunoassays such as ImmunoCap. Fluorenzymeimmunoassays are currently undergoing a transition from semi-quantitative to quantitative techniques.

These IgE assays may be to specific allergens, such as rye grass, or to a combination of allergens, for example, all grasses, or common food allergens.

Assay results cannot always be combined to give aggregate results because of cross-reaction between allergens. This can lead to confusion if reported values are used erroneously as a surrogate for the prediction of the severity of allergic reaction.

In the context of the increasing incidence of allergy in England, there is considerable debate about the benefits of allergy testing using blood samples. In general, allergen tests tend to be used more widely in other countries. Work is underway to standardise the use of blood and skin sensitisation testing across Europe.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for RASTs ordered by GPs ranged from 0.04 to 17.2 per 1000 practice population (435-fold variation).[2] When the four PCTs with the highest estimated annual rates and the four PCTs with the lowest estimated annual rates are excluded, the range is 0.11–7.8 per 1000 practice population, and the variation is 73-fold.

Reasons for the degree of variation observed could include differences in:

- the beliefs of respiratory, dermatology and allergy clinicians about the value of testing using RAST and other blood-based allergy-testing methods;
- the transition to the use of specific IgE assays in different localities.

The degree of variation observed in the use of RASTs in the English NHS is a cause for concern, reflecting:

- the lack of consistent policy and guidance on the use of these tests in the diagnosis and management of allergic disorders including asthma;
- the lack of clinical allergy services in many parts of the country.

The variation partly reflects a lack of training available to commissioners, and clinicians requesting the assays. In the absence of good-quality information about allergy testing, the number of requests for assays may reflect only the level of patient demand for testing.

Options for action

To reduce unwarranted variation in allergen testing, including RAST, commissioners, clinicians and service providers need:

- to review the demand for testing in the context of "true" need;
- to assess the current provision of allergy services in relation to unmet need;
- to assess the prevalence of allergies in the local population;
- to develop local guidance on the use of allergen tests in the diagnosis and management of allergic disorders;
- to determine with laboratory services the improved use of more modern analytical techniques.

RESOURCES

- NICE (2011) Food allergy in children and young people: Diagnosis and assessment of food allergy in children and young people in primary care and community settings (CG116). http://guidance.nice.org.uk/CG116
- Mills ENC, Mackie AR, Burney P et al (2007) The prevalence, cost and basis of food allergy across Europe. *Allergy* 62; 717–722. http://www.ncbi.nlm.nih.gov/pubmed/17573717
- Heinzerling L, Frew AJ, Bindslev-Jensen C et al (2005) Standard skin prick testing and sensitization to inhalant allergens across Europe - a survey from the GALEN network. *Allergy* 60; 1287-1300. http://www.ncbi.nlm.nih.gov/pubmed/16134996
- Heinzerling L, Mari A, Bergmann KC et al (2013) The skin prick test – European standards Clinical and Translational *Allergy* 3; 3. http://www.ctajournal.com/content/3/1/3

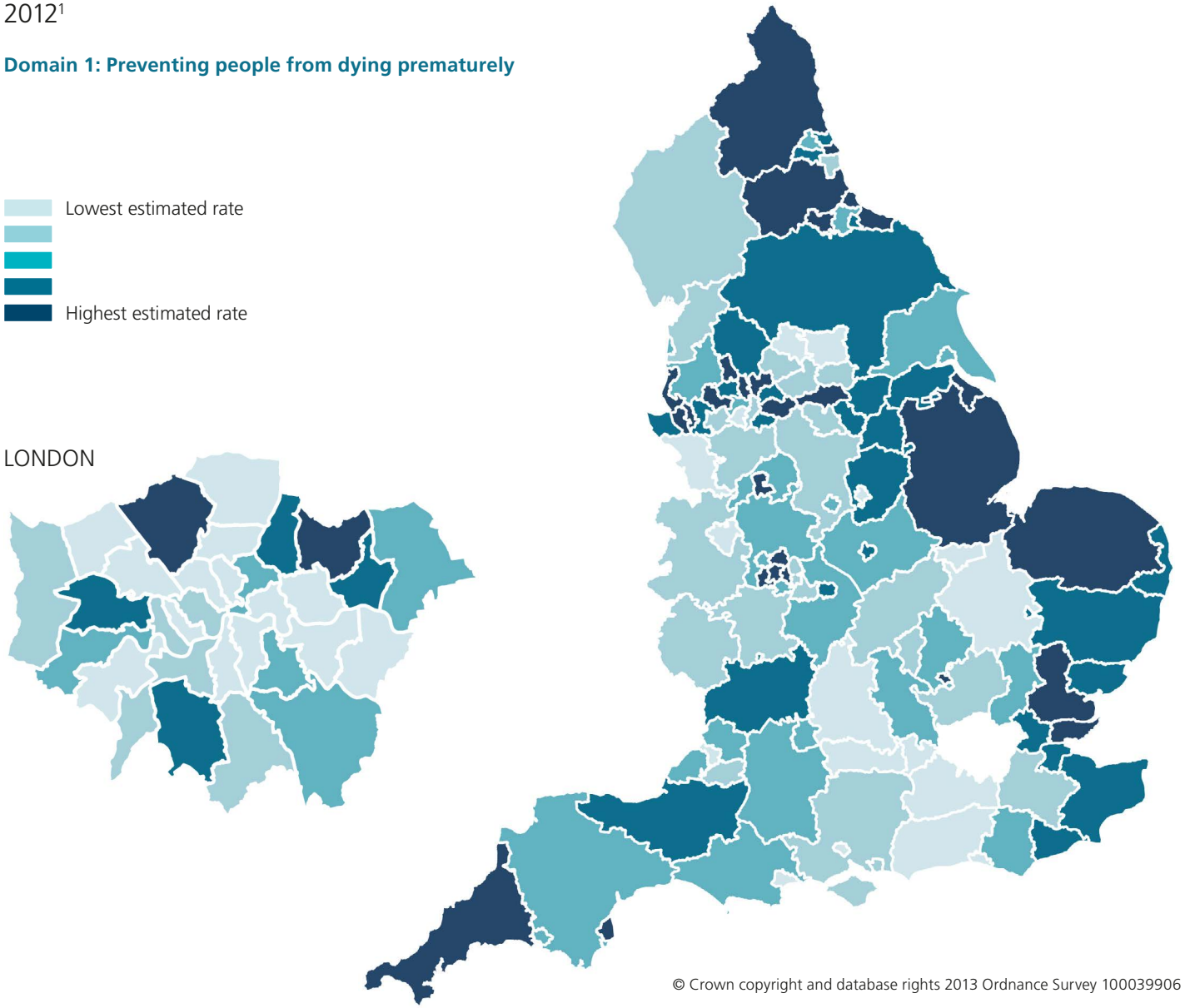
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 40 PCTs.

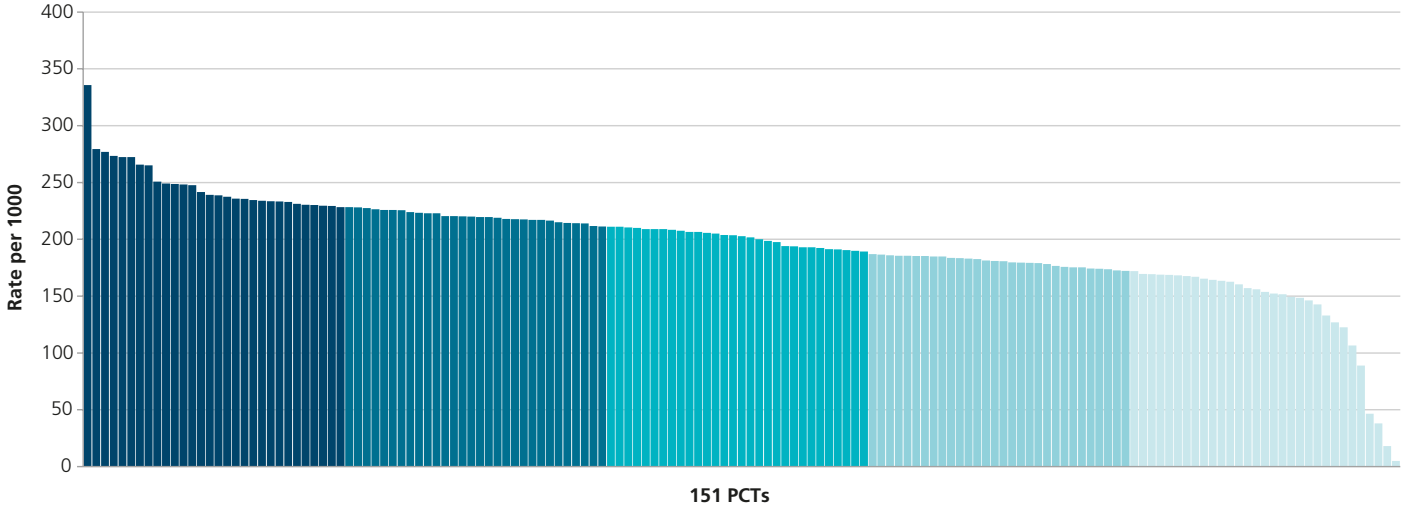
PATHOLOGY SERVICES

Map 47: Estimated annual rate of use for serum total cholesterol tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely





Context

There is a range of tests relating to cardiac diseases.

Serum total cholesterol (Map 47), triglyceride (Map 48) and high-density lipoprotein (HDL) cholesterol (Map 49) are used to determine a person's cardiovascular risk in combination with other factors such as smoking habit, blood pressure and the presence of diabetes. The analytes are also used to monitor lifestyle changes, and the impact of lipid-lowering drugs such as statins. Familial hyperlipidaemias and dyslipidaemias are associated with a high prevalence of cardiovascular disease. Of particular importance is the detection through biochemical and genetic tests of familial hypercholesterolaemia due to abnormalities in the number and function of low-density lipoprotein (LDL) cholesterol receptors.

High-density lipoprotein cholesterol is part of the cycle of removing cholesterol from peripheral tissues and transporting it to the liver for excretion. In addition, HDL cholesterol has anti-oxidant and anti-inflammatory properties that inhibit the formation of atheromatous plaques. Low serum HDL cholesterol concentrations have been associated with a high risk of vascular disease.[2] More recent data suggest it is the properties of HDL cholesterol as a protein that are important.[3]

Troponin (Map 50) is a complex of three regulatory proteins integral to muscle contraction in skeletal and cardiac muscle: troponin C, troponin I and troponin T. Troponin I and troponin T tests have been developed for diagnostic use, and are highly specific markers of cardiac damage especially that due to myocardial infarction.

Brain natriuretic peptide (BNP and NTproBNP, the hormone and co-peptide elements of the pro-hormone; Map 51) is secreted into the blood in response to excessive stretching of the ventricular wall, an early precursor to the development of heart failure. Levels of BNP/NTproBNP correlate with the severity of heart disease, and the test is used to assess the severity of heart failure. The test is employed to screen patients to determine which of them requires an echocardiogram to diagnose cardiac failure. The BNP test is a good rule-out test for heart failure; neither an ECG nor chest X-ray adds to the diagnostic accuracy.[4] NICE recommends the use of the BNP/NTproBNP test in the pathway for chronic heart failure (see "Resources"), except if the patient has a history of myocardial infarction when the patient should be sent directly for echocardiography.

Elevated levels of this group of analytes can also indicate other conditions.

- Elevated levels of serum cholesterol and high-risk lipid profiles may be associated with hypothyroidism, diabetes, and renal disease, such as nephrotic syndrome.
- Serum troponin activity may be elevated in a variety of other conditions including myocarditis, end-stage renal failure, tachyarrhythmia, sepsis, congestive cardiac failure, pulmonary embolus, cisplatin therapy, and hypothyroidism.
- Serum BNP and NTproBNP may be elevated in people with chronic renal disease.

1 Data were extracted from 23 days at end of May-beginning of June 2012.

2 Abbottt RD, Wilson PW, Kannel WB, Castelli WP (1988) High density lipoprotein cholesterol, total cholesterol screening, and myocardial infarction. The Framingham Study. *Arteriosclerosis* 8; 207-211. PMID: 3370018.

3 Barter P, Nicholls S, Rye K et al (2004) Antiinflammatory Properties of HDL. *Circulation Research* 95: 764-772. http://circres.ahajournals.org/content/95/8/764.long

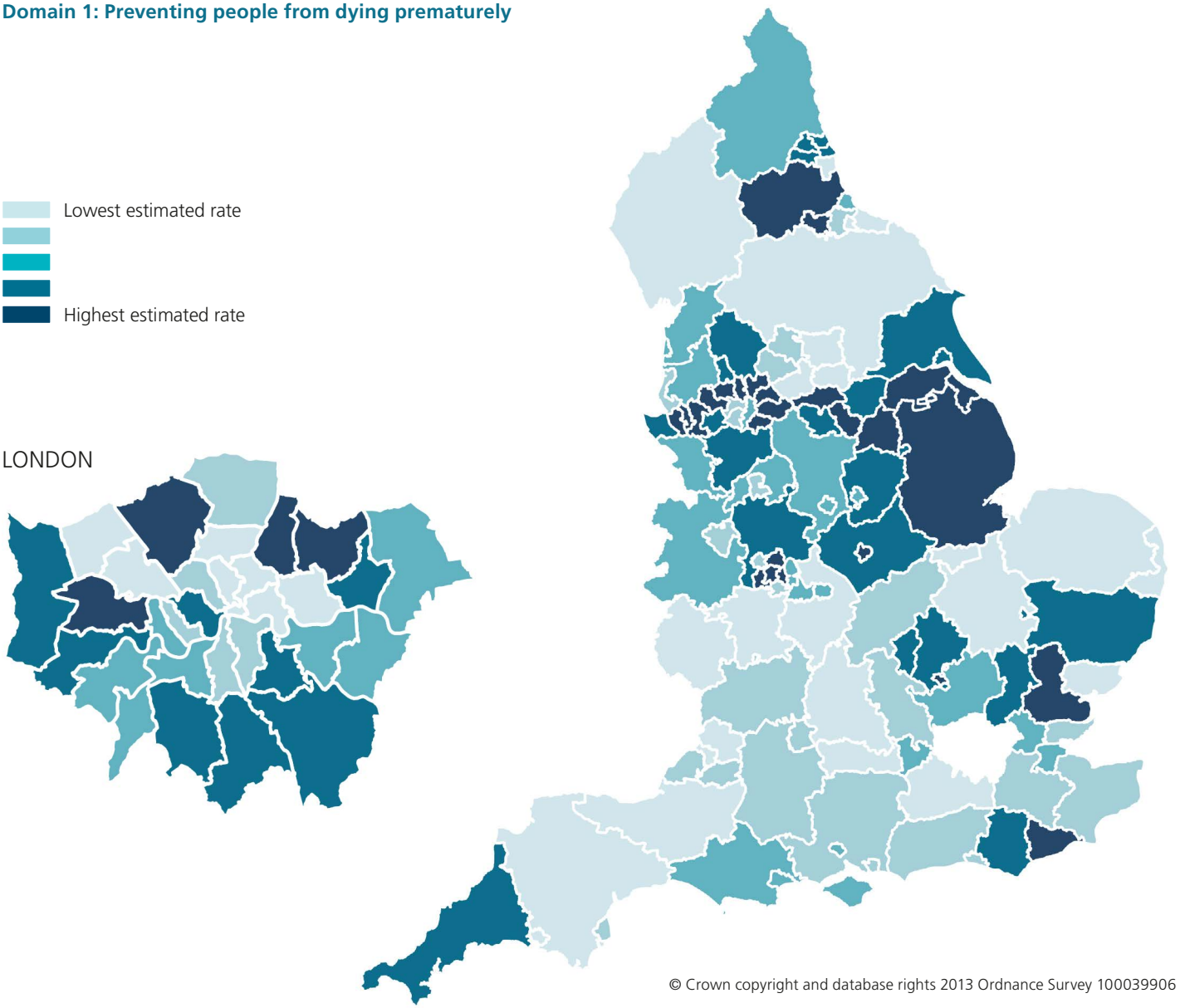
4 A Health Technology Assessment (*Systematic review and individual patient data meta-analysis of diagnosis of heart failure, with modelling of implications of different diagnostic strategies in primary care.* HTA 2009; Vol. 13: No. 32 http://www.hta.ac.uk/fullmono/mon1332.pdf) concluded that the natriuretic peptide test was a good rule out test for heart failure.

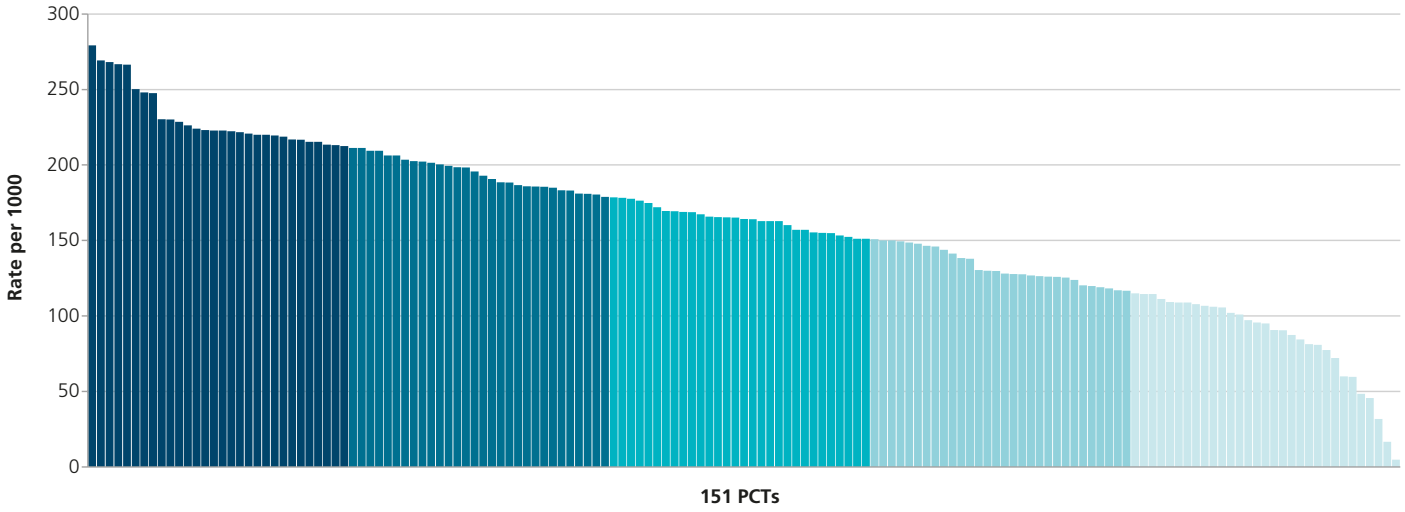
PATHOLOGY SERVICES

Map 48: Estimated annual rate of use for triglyceride tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely



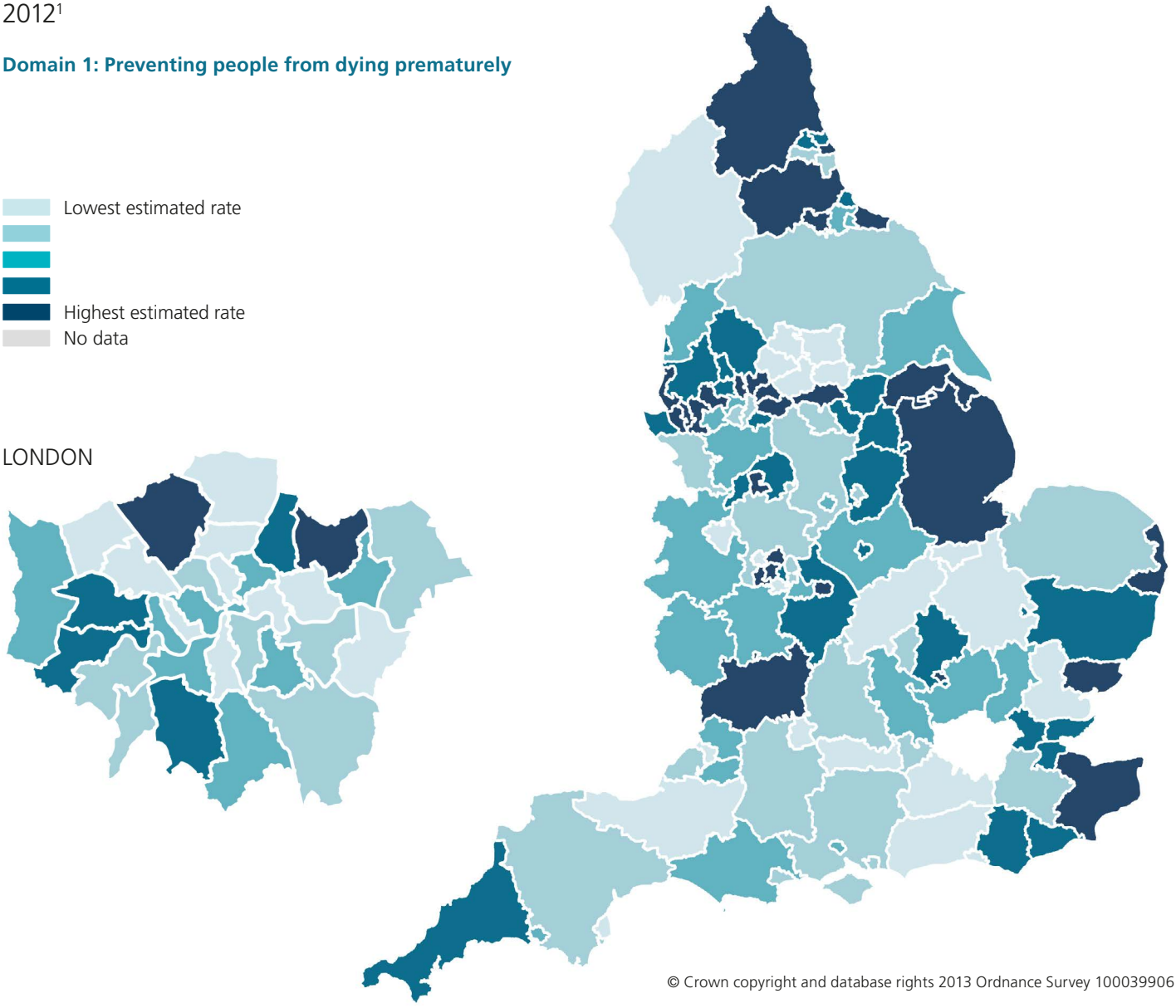


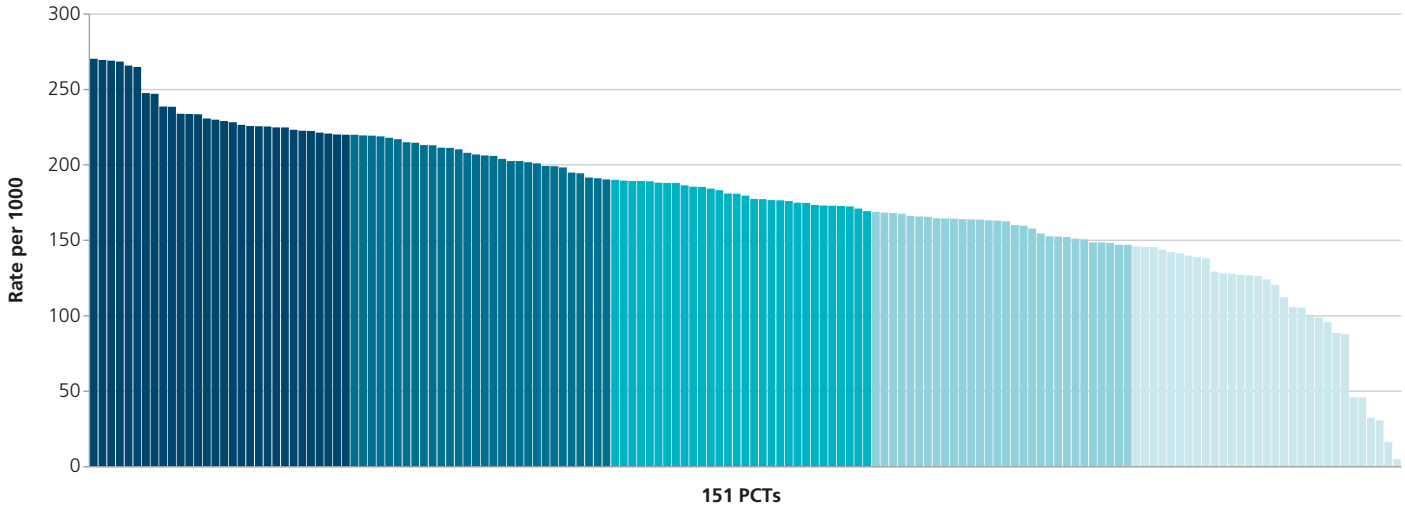
PATHOLOGY SERVICES

Map 49: Estimated annual rate of use for high-density lipoprotein (HDL) cholesterol tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely



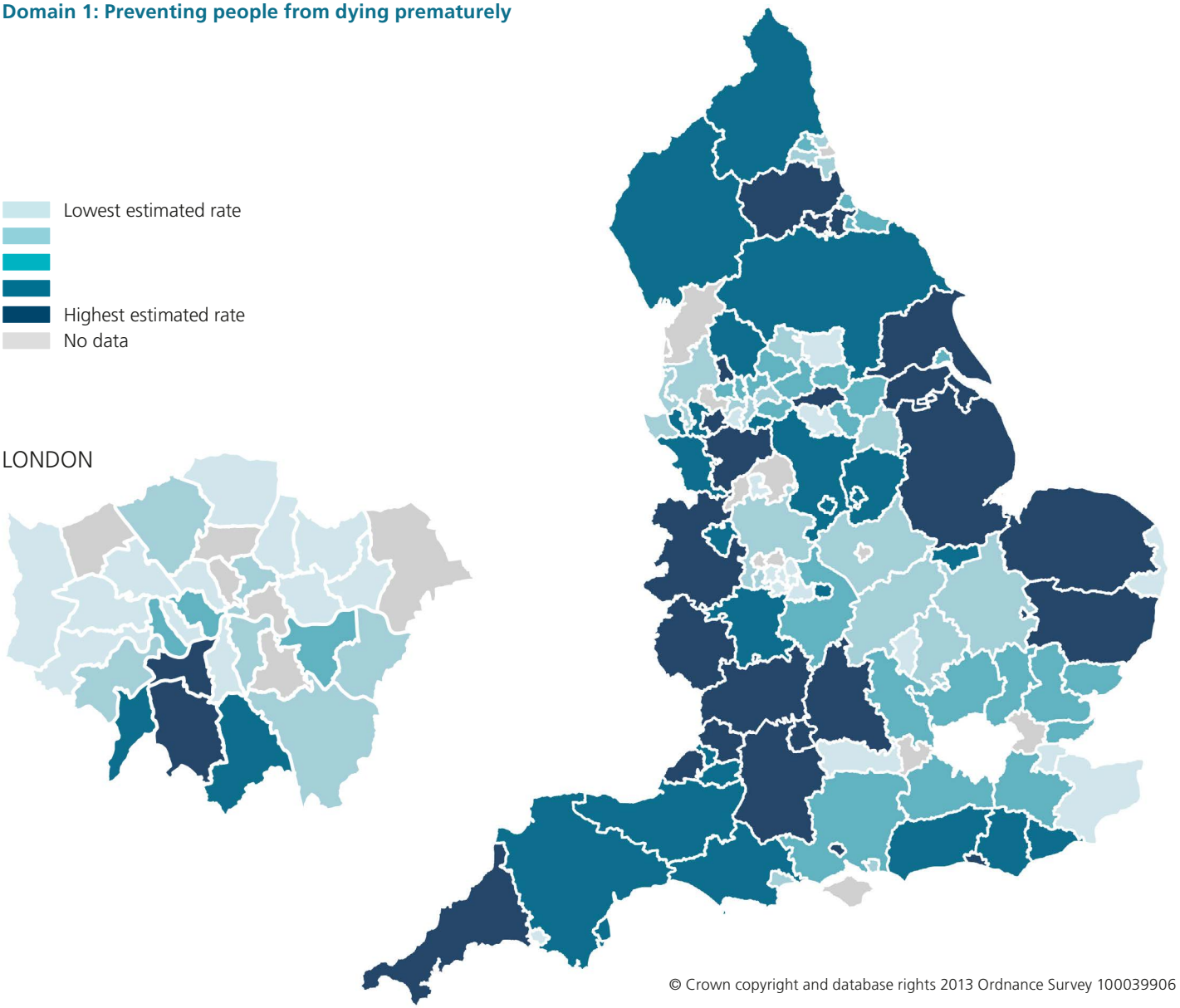


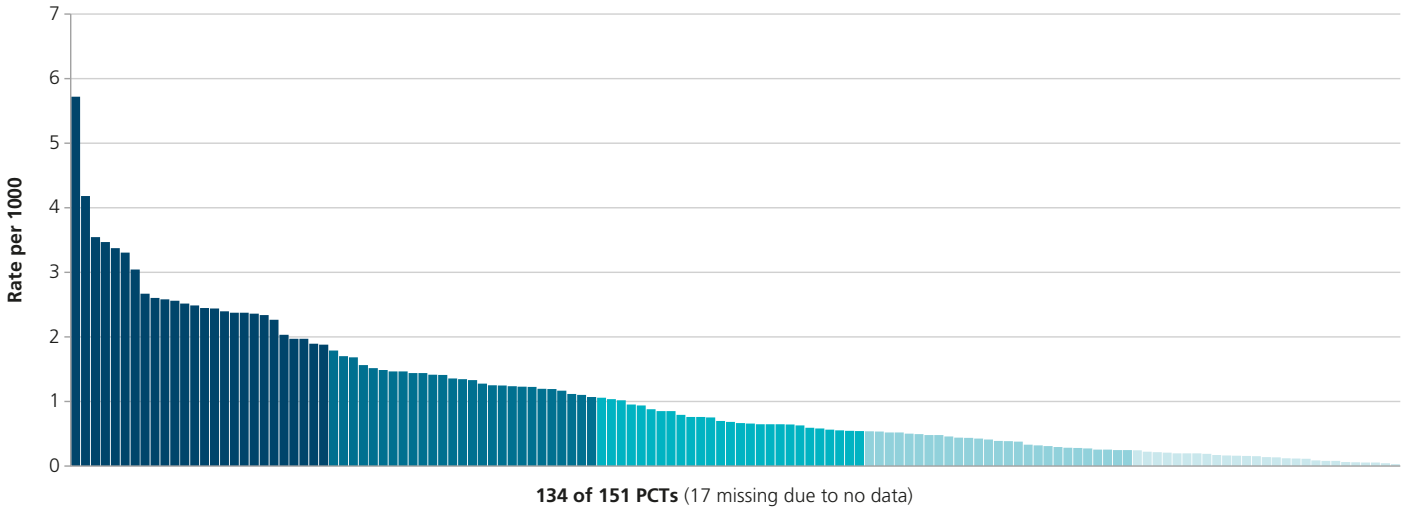
PATHOLOGY SERVICES

Map 50: Estimated annual rate of use for troponin tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely





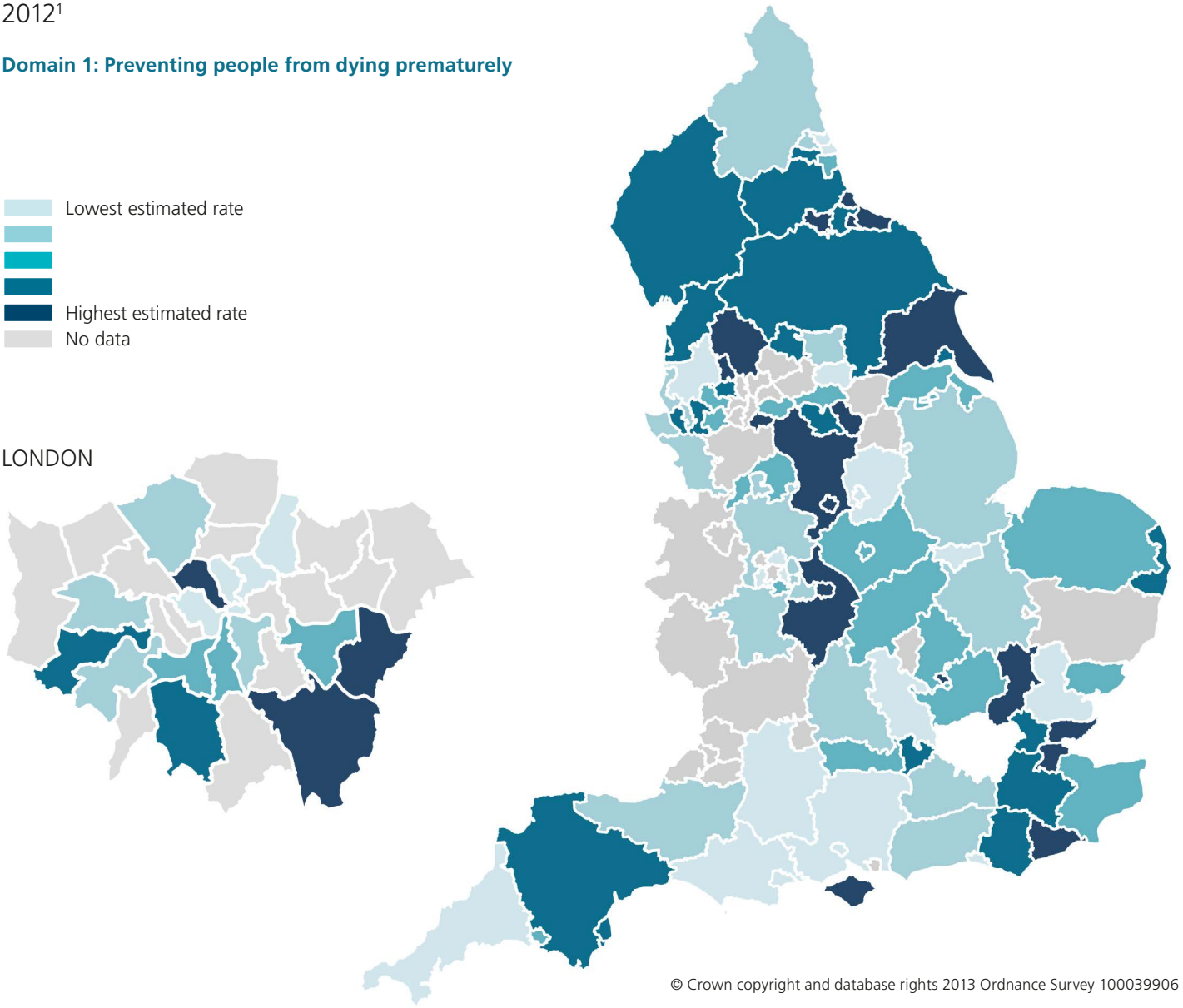
134 of 151 PCTs (17 missing due to no data)

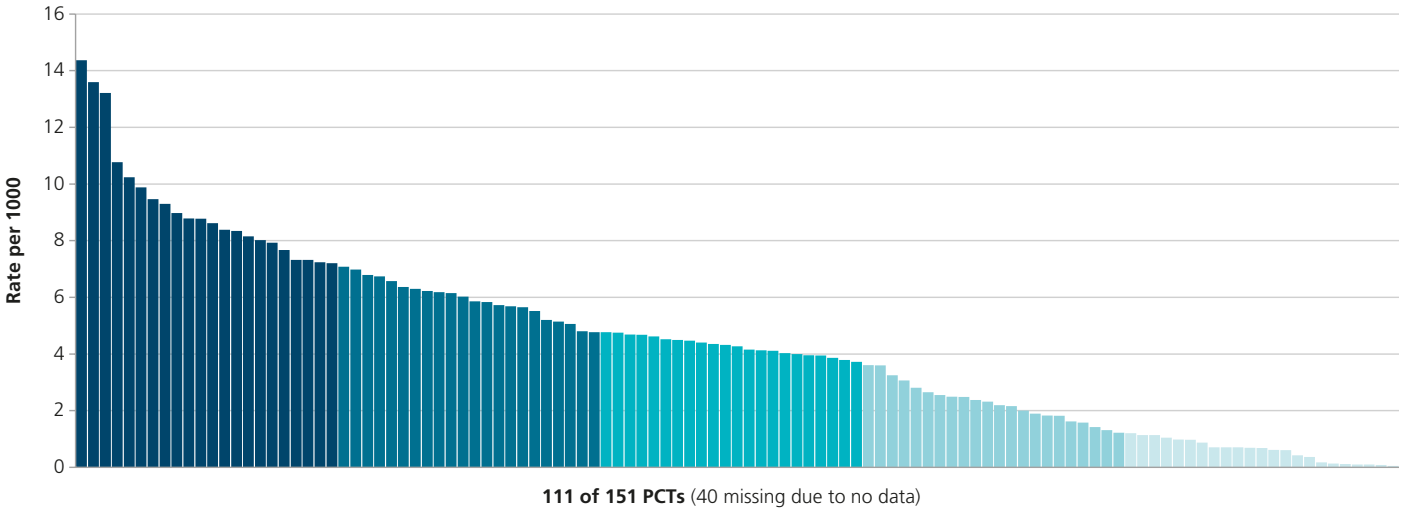
PATHOLOGY SERVICES

Map 51: Estimated annual rate of use for brain natriuretic peptide (BNP or NTproBNP) tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely





111 of 151 PCTs (40 missing due to no data)

Magnitude of variation

Map 47: Serum total cholesterol

For PCTs in England, the estimated annual rate of use for serum total cholesterol tests ordered by GPs ranged from 5.0 to 335.8 per 1000 practice population (68-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 106.6–272.3 per 1000 practice population, and the variation is 2.6-fold.

When compared with other analytes, the degree of variation observed for serum total cholesterol tests ordered by GPs could be considered to represent a relatively well-managed aspect of pathology testing. The Quality and Outcomes Framework (QOF) in primary care – a payment-by-results or pay-for-performance system, in which GPs are paid for achieving certain levels of risk management – has probably contributed towards reducing some degree of unwarranted variation in this aspect of preventive healthcare.

Map 48: Triglyceride

For PCTs in England, the estimated annual rate of use for triglyceride tests ordered by GPs ranged from 4.9 to 279.2 per 1000 practice population (57-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 59.6–250.3 per 1000 practice population, and the variation is 4.2-fold.

The degree of variation observed in triglyceride testing may reflect differences in local policies, such as the use of serum total cholesterol testing only in the monitoring of patients treated for hyperlipidaemia.

Map 49: HDL Cholesterol

For PCTs in England, the estimated annual rate of use for HDL cholesterol tests ordered by GPs ranged from 5.0 to 270.4 per 1000 practice population (54-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 46.1–264.9 per 1000 practice population, and the variation is 6-fold.

The degree of variation observed in the use of HDL cholesterol tests is unlikely to reflect the prevalence of cardiovascular disease, and more likely to reflect differences in local policies, such as in the use of HDL cholesterol for determining cardiovascular risk, and in the monitoring of interventions.

Map 50: Troponin

For PCTs in England, the estimated annual rate of use for troponin tests ordered by GPs ranged from 0.03 to 5.7 per 1000 practice population (214-fold variation).[2] When the four PCTs with the highest estimated annual rates and the four PCTs with the lowest estimated annual rates are excluded, the range is 0.06–3.4 per 1000 practice population, and the variation is 59-fold.

The use of troponin assays is usually confined to secondary care, with use in primary care being low; many PCTs reported zero utilisation. The variation observed could reflect local policies on the restriction of this assay to secondary care. Whether this degree of variation in use in primary care is justified requires further research and analysis.

Map 51: BNP

For PCTs in England, the estimated annual rate of use for BNP tests ordered by GPs ranged from 0.05 to 14.4 per 1000 practice population (297-fold variation).[3] When the four PCTs with the highest estimated annual rates and the four PCTs with the lowest estimated annual rates are excluded, the range is 0.11–10.2 per 1000 practice population, and the variation is 89-fold.

One reason for the degree of variation observed in BNP

1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 17 PCTs.
3 There are no data from 40 PCTs.

testing is differences in the uptake of this pathway by GPs and local cardiac services. In some PCTs, point-of-care testing of BNP was undertaken as part of a care pathway; as such, these tests will not be represented in the dataset for this indicator.

Following the adoption of BNP testing as part of the pathway for the diagnosis of cardiac failure, there is likely to be a disproportionate use of BNP tests if the reason for investment in the test was delays in patients accessing echocardiography services.

Options for action

Commissioners need to review local policies on testing for serum total cholesterol, triglyceride and HDL cholesterol, and ensure that clinicians and service providers recognise the importance of measuring triglyceride and HDL cholesterol. In some localities, there is a reliance on cholesterol assays alone. Assays of HDL cholesterol are essential for calculating the ratio of serum total cholesterol to HDL cholesterol in cardiovascular risk calculations.

Commissioners need to review local policies on screening for hyperlipidaemia and familial hypercholesterolaemia in particular against NICE guidelines (see "Resources"), and ensure that genetic testing and family follow-up studies are included.

To reduce unwarranted variation in the use of troponin tests, commissioners, clinicians and service providers need to consider the role of troponin assays in primary care.

To reduce unwarranted variation in the use of BNP tests, commissioners, clinicians and service providers need to consider ways to gain enhanced compliance with NICE guidelines for the diagnosis of cardiac failure.

The most likely business case for the introduction of the BNP test will have been based on a reduction in the requirement for echocardiography, e.g. a reduction in waiting times, in the need for further investment, or in the overall cost of the diagnostic pathway.

Commissioners could compare the requesting patterns and waiting times for echocardiography to determine whether the rationale for the uptake of the BNP test is reflected in routine practice. As the use of the BNP test for this function evolves, the ratio of echocardiography to BNP test requests in the context of the prevalence of heart failure in the local population could be used as a measure of appropriate uptake.

RESOURCES

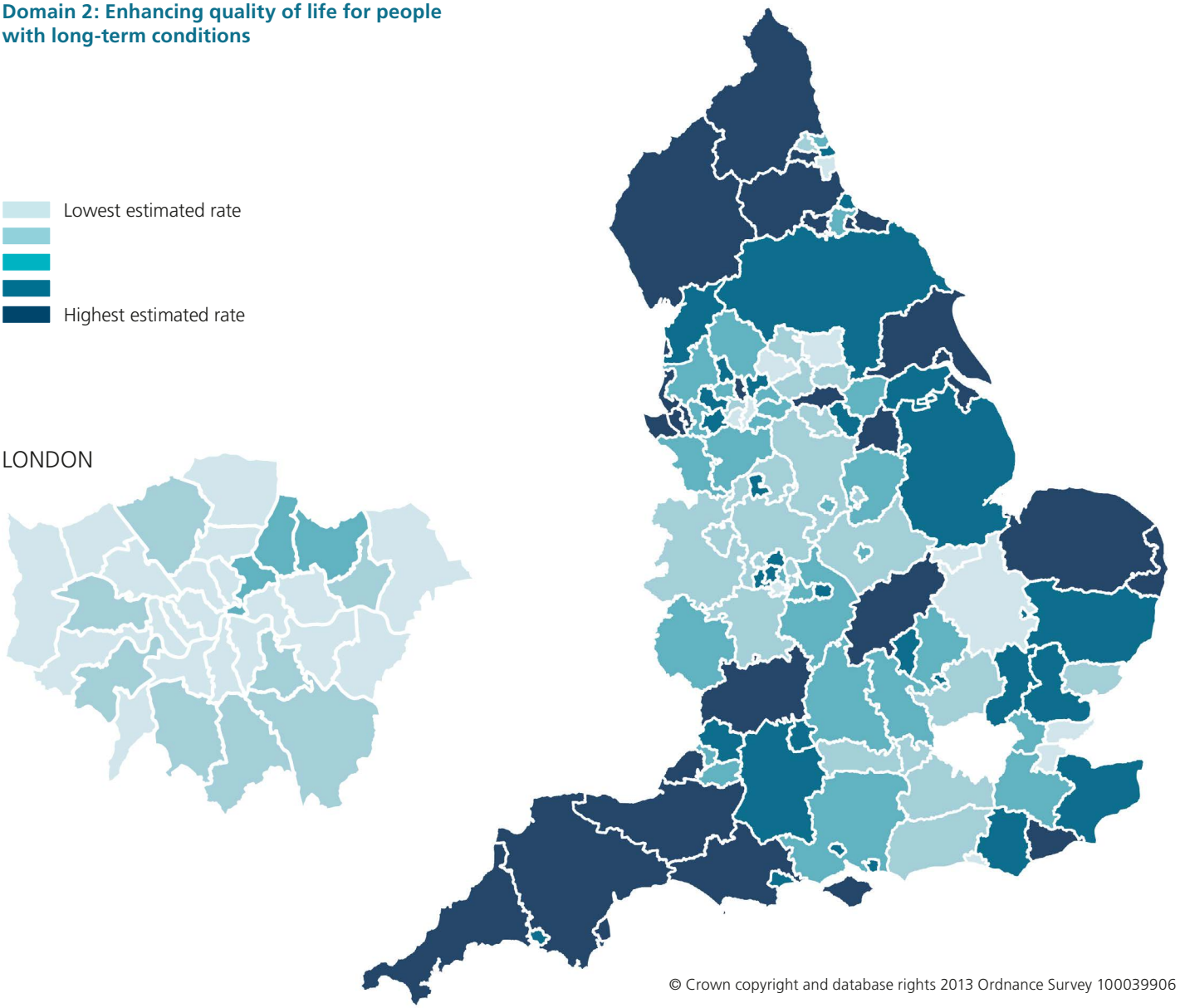
- B-Type Natriuretic Peptide Test. Labtests Online. http://www.labtestsonline.org.uk/understanding/analytes/bnp/tab/test
- NICE (2010) Chronic heart failure: Management of chronic heart failure in adults in primary and secondary care (CG 108). http://publications.nice.org.uk/chronic-heart-failure-cg108
- ClinRisk. QRISK®2-2013 risk calculator http://www.qrisk.org
- NICE (2008) Clinical Knowledge Summaries. CVD risk assessment and management. http://cks.nice.org.uk/cvd-risk-assessment-and-management

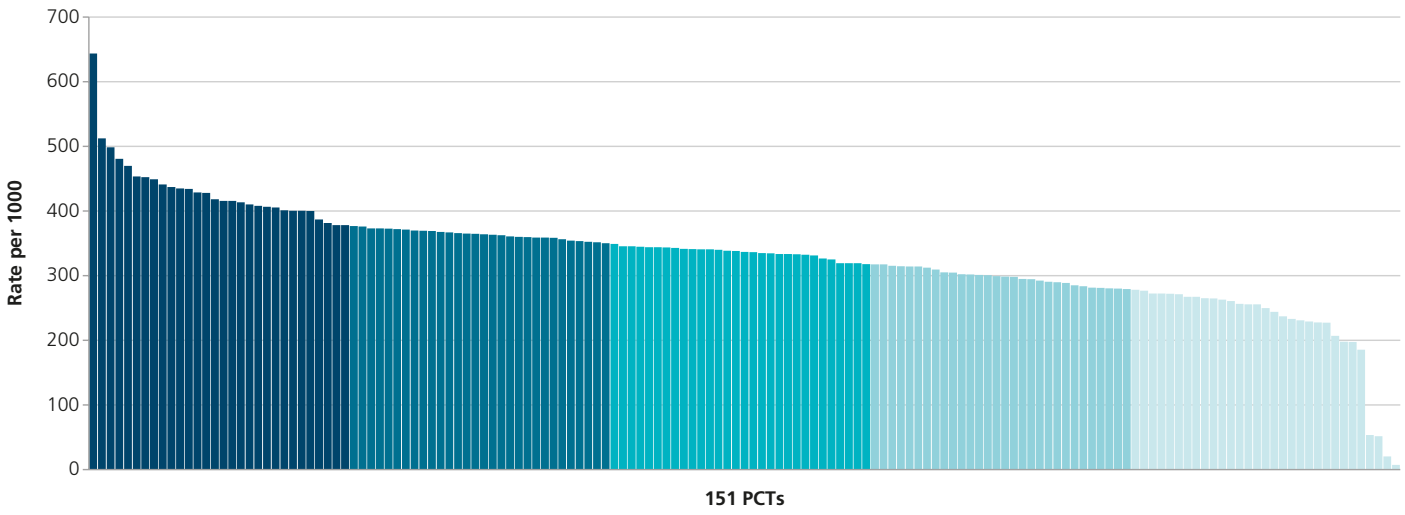
PATHOLOGY SERVICES

Map 52: Estimated annual rate of use for haemoglobin tests ordered by GPs per practice population by PCT

2012[1]

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





Context

Haematology tests include:

- a full blood count (FBC) – the profile of assays includes haemoglobin, red cell indices, white cell count and platelet count;
- specific assays for the causes of anaemia, such as serum vitamin B12, folate and ferritin assays.

Haemoglobin testing (Map 52) is undertaken as part of an FBC, and this indicator is being used as a proxy for FBC because haemoglobin is universally included in the profile of FBC assays. Thus, the number of haemoglobin assays equates to the number of FBCs.

An FBC can be requested for a variety of reasons. The haemoglobin test measures the amount of haemoglobin in the blood, and can be used:

- to detect and measure the severity of anaemia;
- to monitor the response to treatment;
- to help make decisions about blood transfusion.

White cell counts are used to recognise and monitor infections, and any malignancy associated with that cell line. Platelet counts are used to recognise and monitor disorders of platelets.

Vitamin B12 (Map 53) and folate (serum folate in Map 54; red cell folate in Map 55) are both part of the complex of vitamins important for normal red cell formation, tissue and cell repair, and DNA synthesis. In addition, vitamin B12 is important for nerve health, and folate is important for cell division, for example, in a fetus during pregnancy.

Concentrations of vitamin B12 and folate are measured:

- to help diagnose causes of anaemia or nerve damage (neuropathy);
- to evaluate an individual's nutritional status;
- to monitor effectiveness of treatment for vitamin B12 or folate deficiency.

If the analytical method undertaken by the laboratory uses intrinsic factor to bind endogenous and labelled vitamin B12, in patients with pernicious anaemia, there is a risk of interference by intrinsic factor antibodies, giving falsely high results.

Serum ferritin (Map 56) analysis is the best measure of iron stores and, hence, of the risk of iron deficiency. The assay is also the best initial measure of iron overload. In many clinical contexts, serum iron and transferrin analyses are difficult to interpret because they respond to infections, and the interpretation of test results is complicated by the presence of a malignancy. Ferritin is also an acute phase protein, and levels increase during bacterial infections.

Serum ferritin values may be increased in people who have liver disease, haemochromatosis, a high alcohol intake, iron overload, a high body mass index (BMI), and metabolic syndrome. In addition, reference values are higher in people from Hispanic and black African communities.

Magnitude of variation

Map 52: Haemoglobin

For PCTs in England, the estimated annual rate of use for haemoglobin tests ordered by GPs ranged from 7.1 to 643.5 per 1000 practice population (91-fold variation). When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 197.3-453.2 per 1000 practice population, and the variation is 2.3-fold.

The degree of variation observed in haemoglobin testing could reflect differences in:

- the ethnic composition of local populations;
- the socio-economic status of the various communities in a locality.

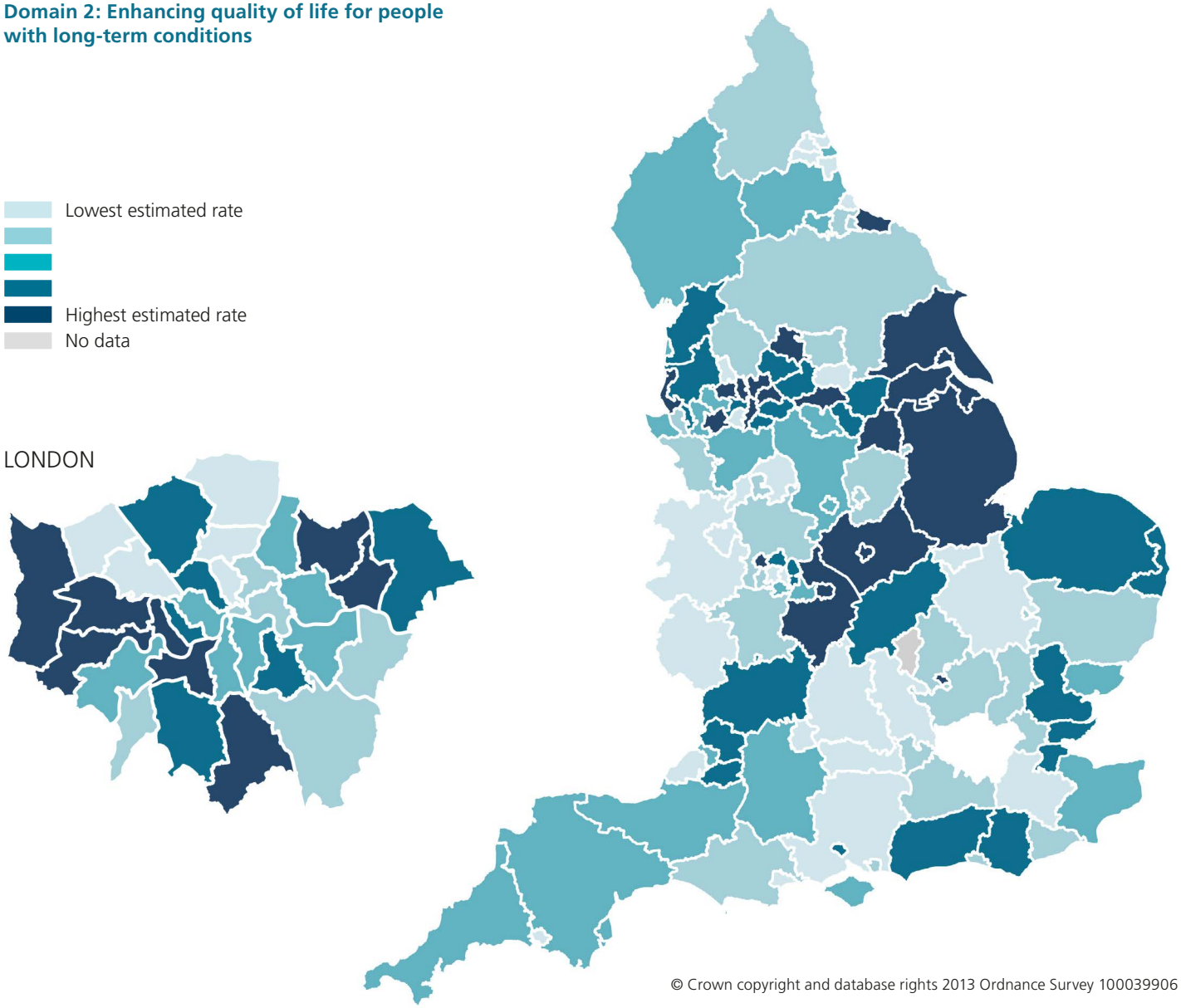
1 Data were extracted from 23 days at end of May-beginning of June 2012.

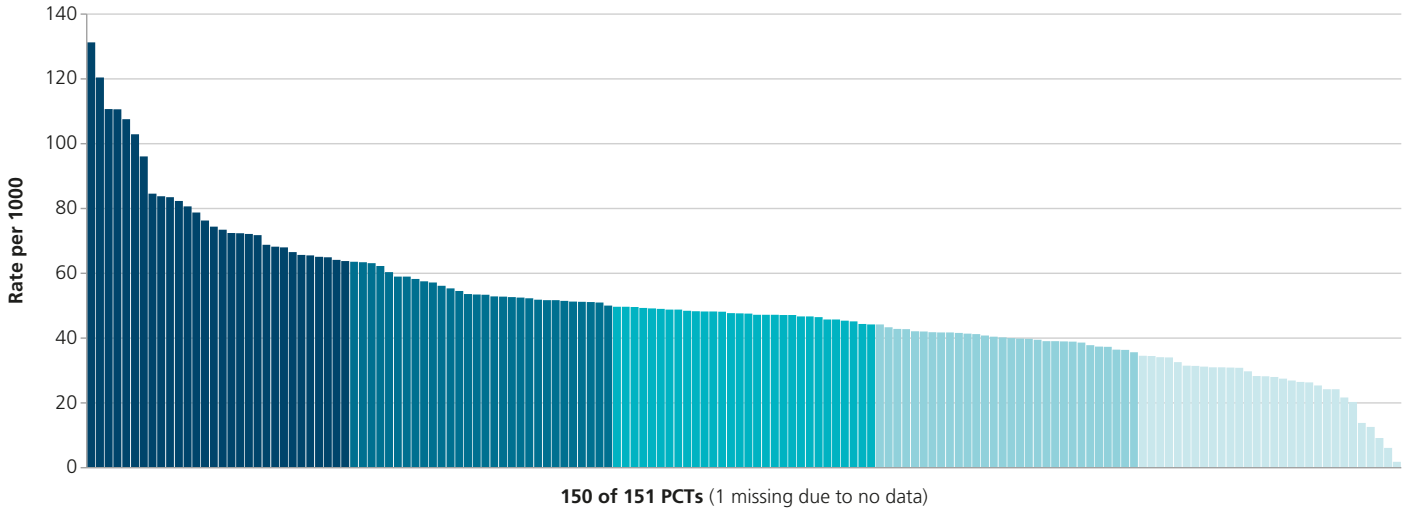
PATHOLOGY SERVICES

Map 53: Estimated annual rate of use for vitamin B12 tests ordered by GPs per practice population by PCT

2012[1]

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





150 of 151 PCTs (1 missing due to no data)

Map 53: Vitamin B12

For PCTs in England, the estimated annual rate of use for vitamin B12 tests ordered by GPs ranged from 1.8 to 131.3 per 1000 practice population (72-fold variation).[2] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 20.2–102.9 per 1000 practice population, and the variation is 5-fold.

The degree of variation observed in vitamin B12 testing appears to be greater than can be explained by differences in the prevalence of the conditions or deficiencies for which vitamin B12 tests are used. Part of the variation may relate to differences in local protocols with respect to when vitamin B12 assays are undertaken, for example, some may stipulate only when haematological indices indicate possible megaloblastic change. It is important to be aware that neurological disorder related to vitamin B12 deficiency may occur in the absence of any haematological change.

Map 54: Serum folate

For PCTs in England, the estimated annual rate of use for serum folate tests ordered by GPs ranged from 0.05 to 131.4 per 1000 practice population (>1000-fold variation).[2] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.82–96.1 per 1000 practice population, and the variation is 117-fold.

The degree of variation observed in serum folate testing may reflect differences in the provision of serum folate testing in NHS laboratory repertoires.

Map 55: Red cell folate

For PCTs in England, the estimated annual rate of use for red cell folate tests ordered by GPs ranged from 0.02 to 52.8 per 1000 practice population (>1000-fold variation).[4] When the two PCTs with the highest estimated rates and the two PCTs with the lowest estimated rates are excluded, the range is 0.03–31.4 per 1000 practice population, and the variation is >1000-fold.

The degree of variation observed in red cell folate testing appears to be greater than can be explained by differences in the prevalence of the conditions or deficiencies for which red cell folate testing is used. Part of the variation may relate to differences in local protocols with respect to when folate assays are undertaken, for example, some may stipulate an assay only when haematological indices indicate possible megaloblastic change.

Map 56: Ferritin

For PCTs in England, the estimated annual rate of use for ferritin tests ordered by GPs ranged from 3.7 to 139.5 per 1000 practice population (38-fold variation). When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 14.2–123.8 per 1000 practice population, and the variation is 9-fold.

The degree of variation observed in ferritin testing appears to be greater than can be explained by differences in the prevalence of the conditions or deficiencies for which ferritin assays are used. It is possible that the superior value of ferritin assays in the assessment of iron status is not fully recognised in primary care, and as such iron and transferrin assays are predominantly used to assess iron deficiency.

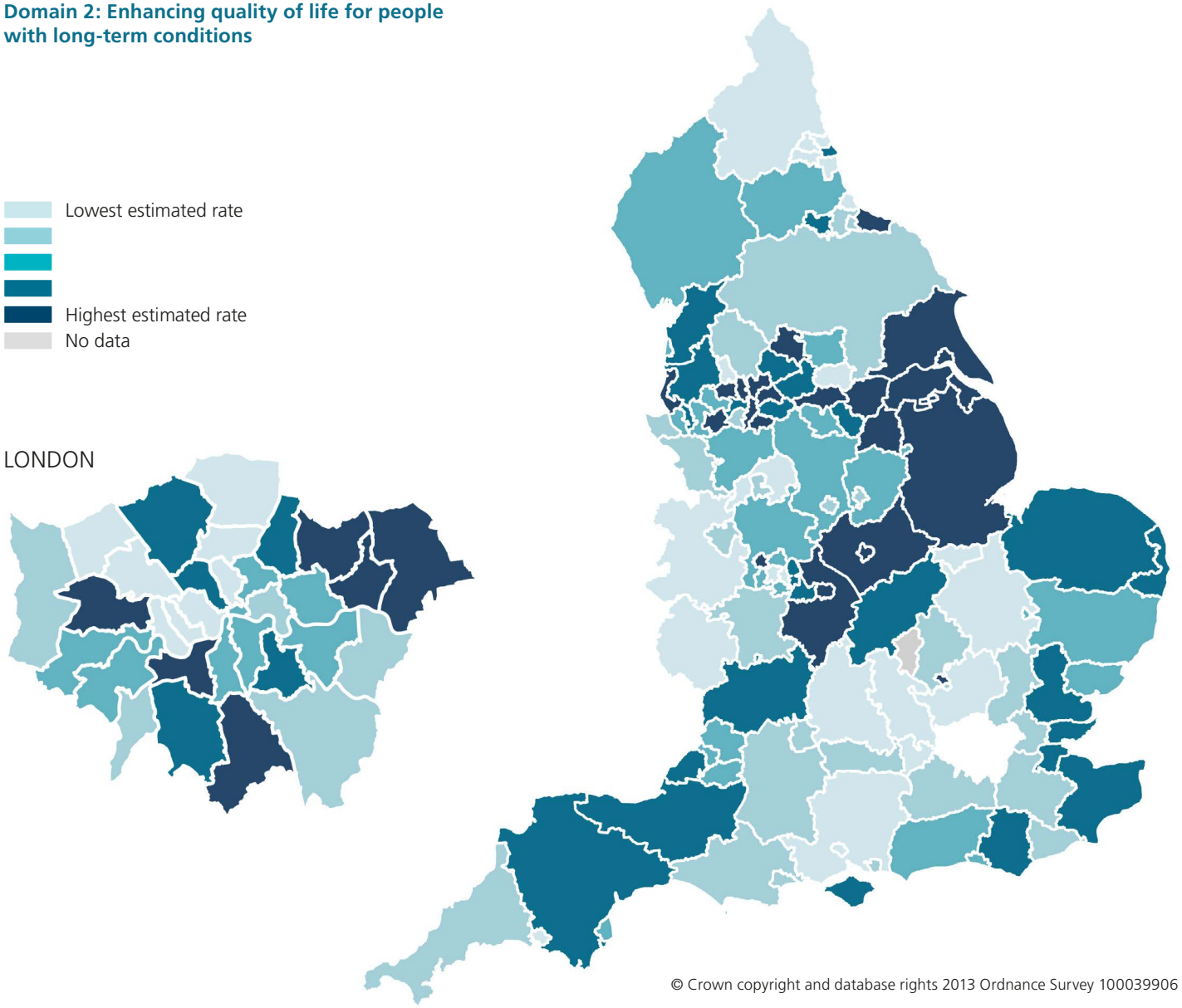
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from one PCT.
3 There are no data from 77 PCTs.

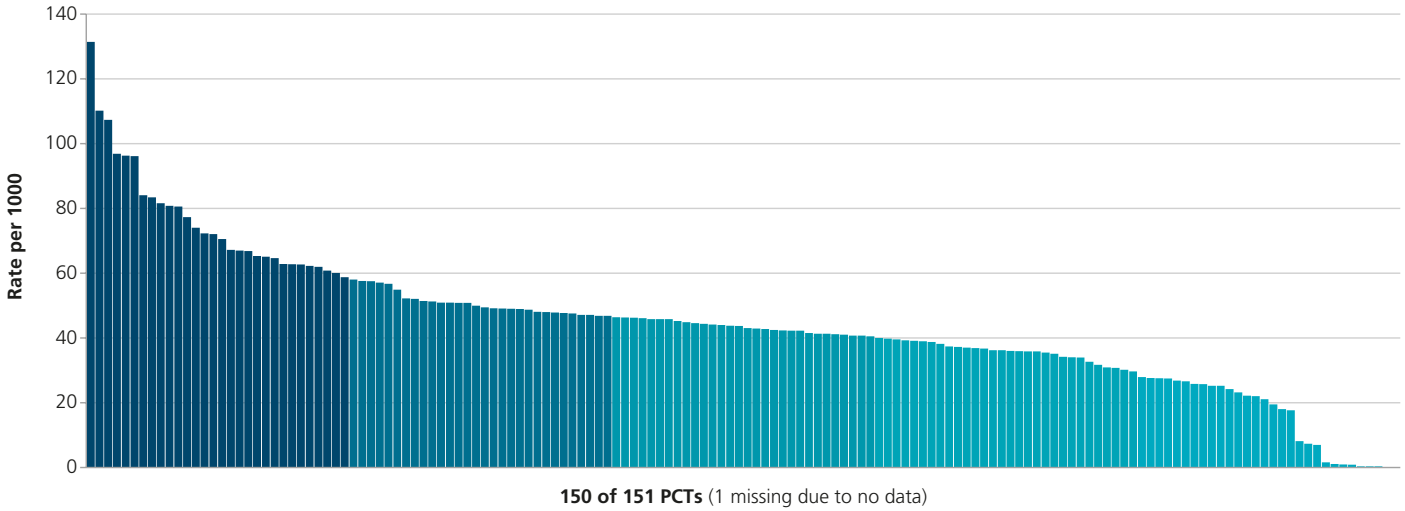
PATHOLOGY SERVICES

Map 54: Estimated annual rate of use for serum folate tests ordered by GPs per practice population by PCT

2012[1]

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



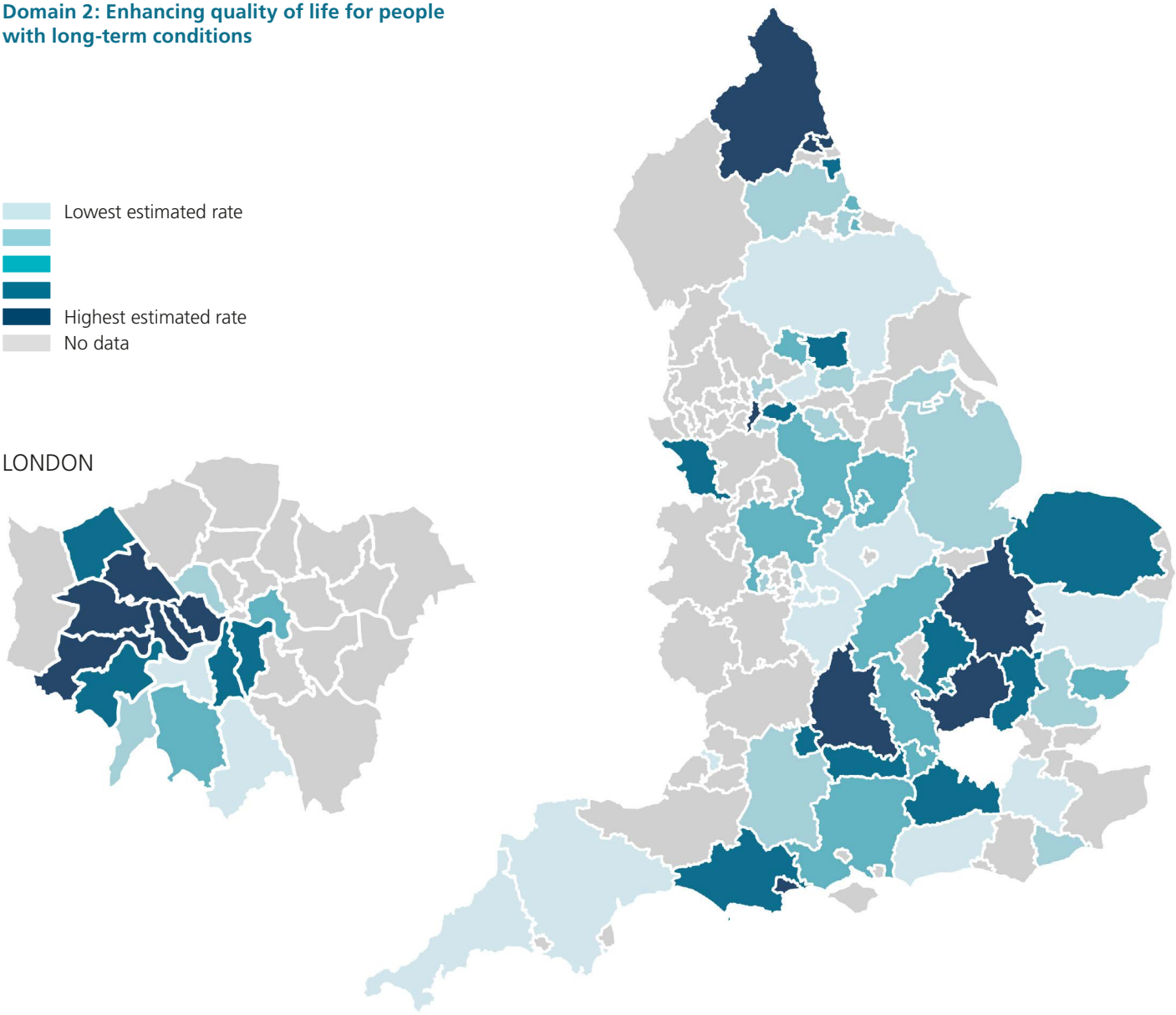


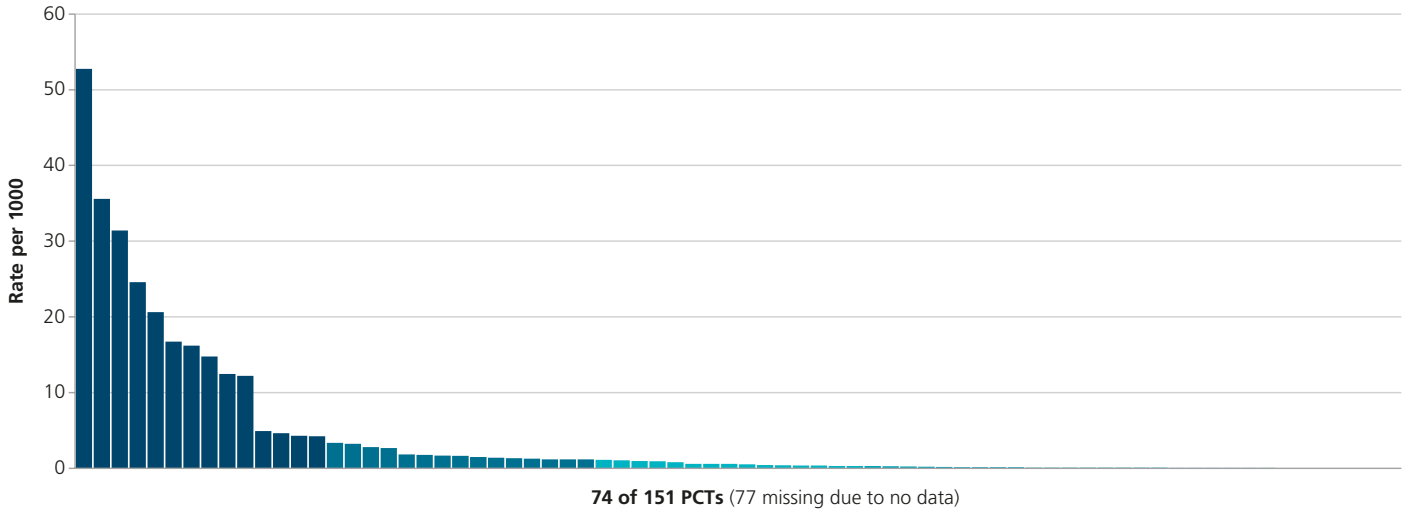
PATHOLOGY SERVICES

Map 55: Estimated annual rate of use for red cell folate tests ordered by GPs per practice population by PCT

2012[1]

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





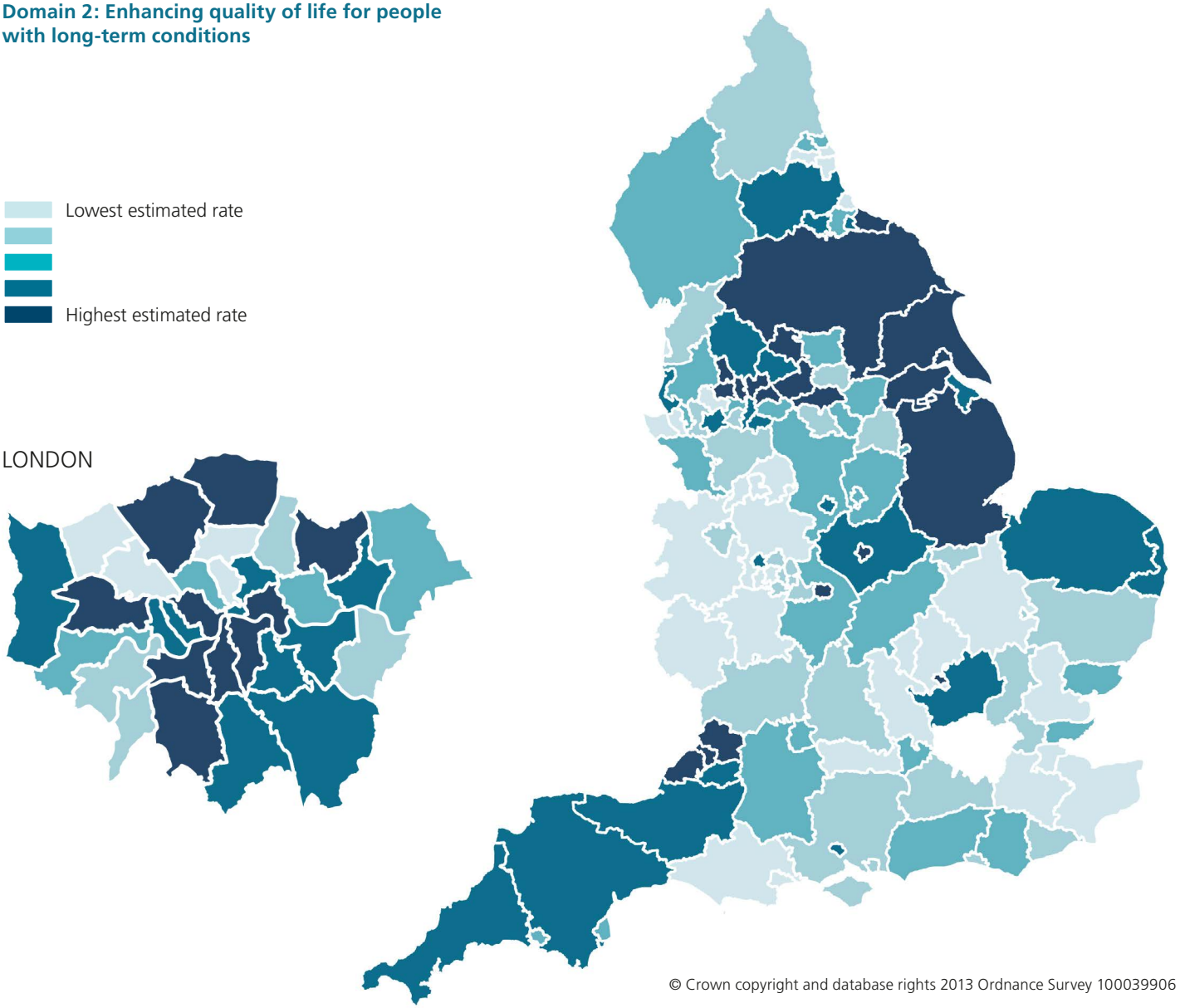
74 of 151 PCTs (77 missing due to no data)

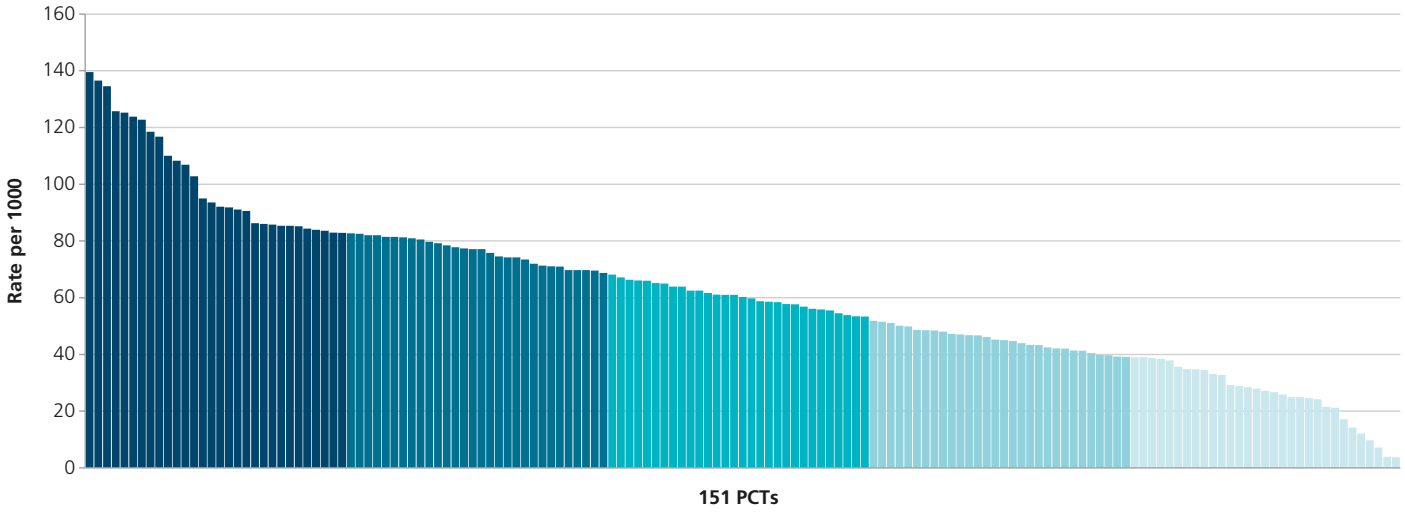
PATHOLOGY SERVICES

Map 56: Estimated annual rate of use for ferritin tests ordered by GPs per practice population by PCT

2012[1]

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





Options for action

Commissioners need to review local protocols that link vitamin B12 and folate analyses to haematological indices, because this practice may lead to failure to recognise vitamin B12 deficiency as a cause of neurological problems. In patients with pernicious anaemia in whom intrinsic factor antibodies may cause falsely high values of vitamin B12, methylmalonic acid analysis is useful for determining true vitamin B12 status.

To address unwarranted variation in folate testing, rationalisation across the NHS may be needed. Commissioners, clinicians and service providers need to collaborate to resolve the division within pathology as to whether red cell folate is a better measure of folate status than serum folate.

Pathologists need to agree the relative values of red cell versus serum folate estimations.

The investigation of anaemia in chronic kidney disease requires specialist input from renal physicians.

To address unwarranted variation in the use of ferritin tests, commissioners, clinicians and service providers need to work together to ensure that when assessing a patient's iron stores the test that is requested is the serum ferritin test, which provides a better measurement of iron stores than the serum iron assay or the transferrin assay.

RESOURCES

- NICE Clinical Knowledge Summaries. Anaemia – B12 and folate deficiency http://cks.nice.org.uk/anaemia-b12-and-folate-deficiency
- British Society of Gastroenterology (2005). Guidelines for the management of iron deficiency anaemia. http://www.bsg.org.uk/pdf_word_docs/iron_def.pdf
- NICE Clinical Knowledge Summaries. Anaemia – iron deficiency. http://cks.nice.org.uk/anaemia-iron-deficiency

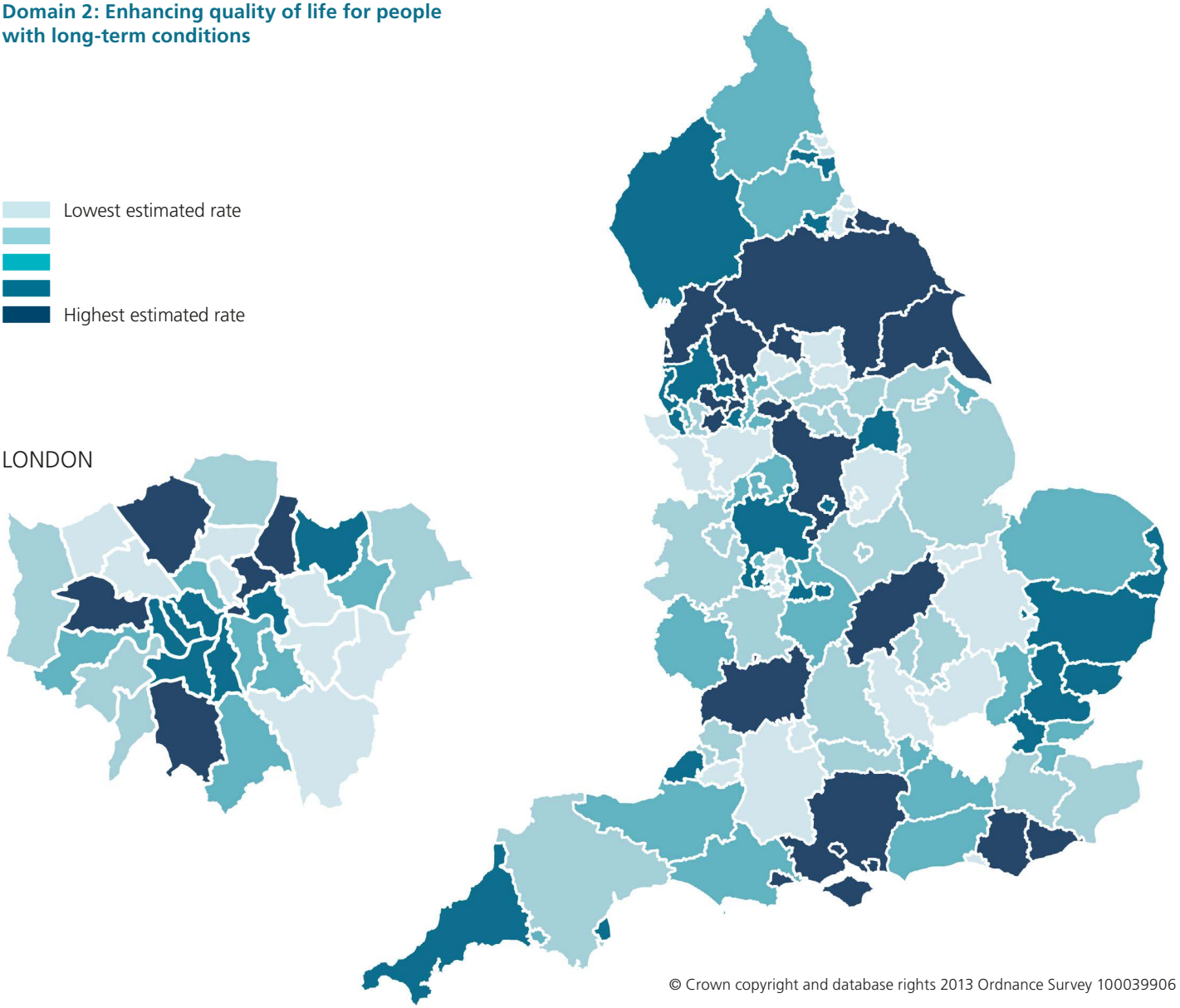
1 Data were extracted from 23 days at end of May-beginning of June 2012.

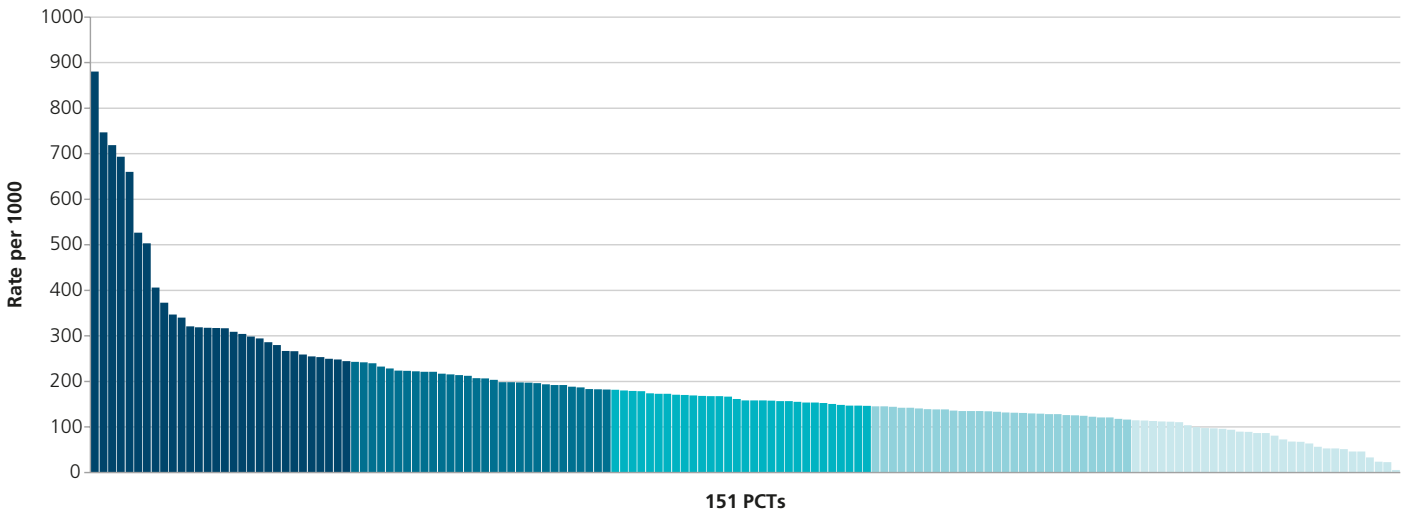
PATHOLOGY SERVICES

Map 57: Estimated annual rate of use for serum calcium tests ordered by GPs per practice population by PCT

2012[1]

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





Context

Calcium (Map 57), vitamin D (Map 58) and parathyroid hormone (PTH; Map 59) are measured in serum or plasma to detect and monitor bone disease.

Serum calcium measurements are usually undertaken with assays of albumin (about 50% of serum calcium is bound to albumin) to make allowance for variation in albumin, and provide "adjusted calcium" reports in addition to, or instead of, total calcium. Alkaline phosphatase (an enzyme associated with bone turnover) analysis is usually undertaken with calcium and phosphate analysis as a "bone profile".

Parathyroid hormone helps the body maintain stable levels of calcium in the blood. People undergo testing:

- when calcium blood levels are higher or lower than normal;
- to determine the functioning of the parathyroid gland;
- when patients are being monitored during treatment of chronic kidney disease.

Elevated concentrations of PTH are also found in kidney disease, where this is a response to phosphate accumulation or vitamin D deficiency, and when there is autonomous hyper-secretion in primary hyperparathyroidism.

Vitamin D enhances the absorption of dietary calcium from the gut. Most vitamin D is formed in the skin in response to sunlight, although some derives from people's diet. Although vitamin D deficiency is the cause of rickets, low serum concentrations are also associated with lethargy, muscle aches and weakness. For full biological function, vitamin D is modified in the liver and the kidney, hence, biological activity is reduced in chronic kidney disease. Low vitamin D concentrations are associated with diminished access to sunlight for whatever reason. People who have dark skin and limited exposure to sunlight are at highest risk of low serum vitamin D levels.

Modern laboratory analyses are undertaken on 25-hydroxyvitamin D (25-OH vitamin D) or calcidiol. Assays for the full biologically active form, known as 1,25-dihydroxyvitamin D3 (1,25-OH vitamin D3) or calcitriol, are available, but their use is limited by cost.

Vitamin D tests may also be undertaken to assess the effect of supplementation, and it is important to be aware of the specificity of analytical methods when using analyses to monitor vitamin D supplementation. The form of vitamin D naturally produced by the body is vitamin D3, whereas the most common supplement is vitamin D2. Thus, a patient receiving vitamin D2 supplements will not show a rise in vitamin D3 concentration.

Magnitude of variation

Map 57: Serum calcium

For PCTs in England, the estimated annual rate of use for serum calcium tests (i.e. the total and adjusted calcium results combined) ordered by GPs ranged from 5.8 to 880.2 per 1000 practice population (153-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 46.3–526.5 per 1000 practice population, and the variation is 11-fold.

It is unlikely that the degree of variation observed in calcium testing can be fully explained by differences in:

- the age or ethnic profiles of local populations;
- prevalence of bone disease.

There is variation in reporting: some laboratories appear to report only the "adjusted" serum calcium.

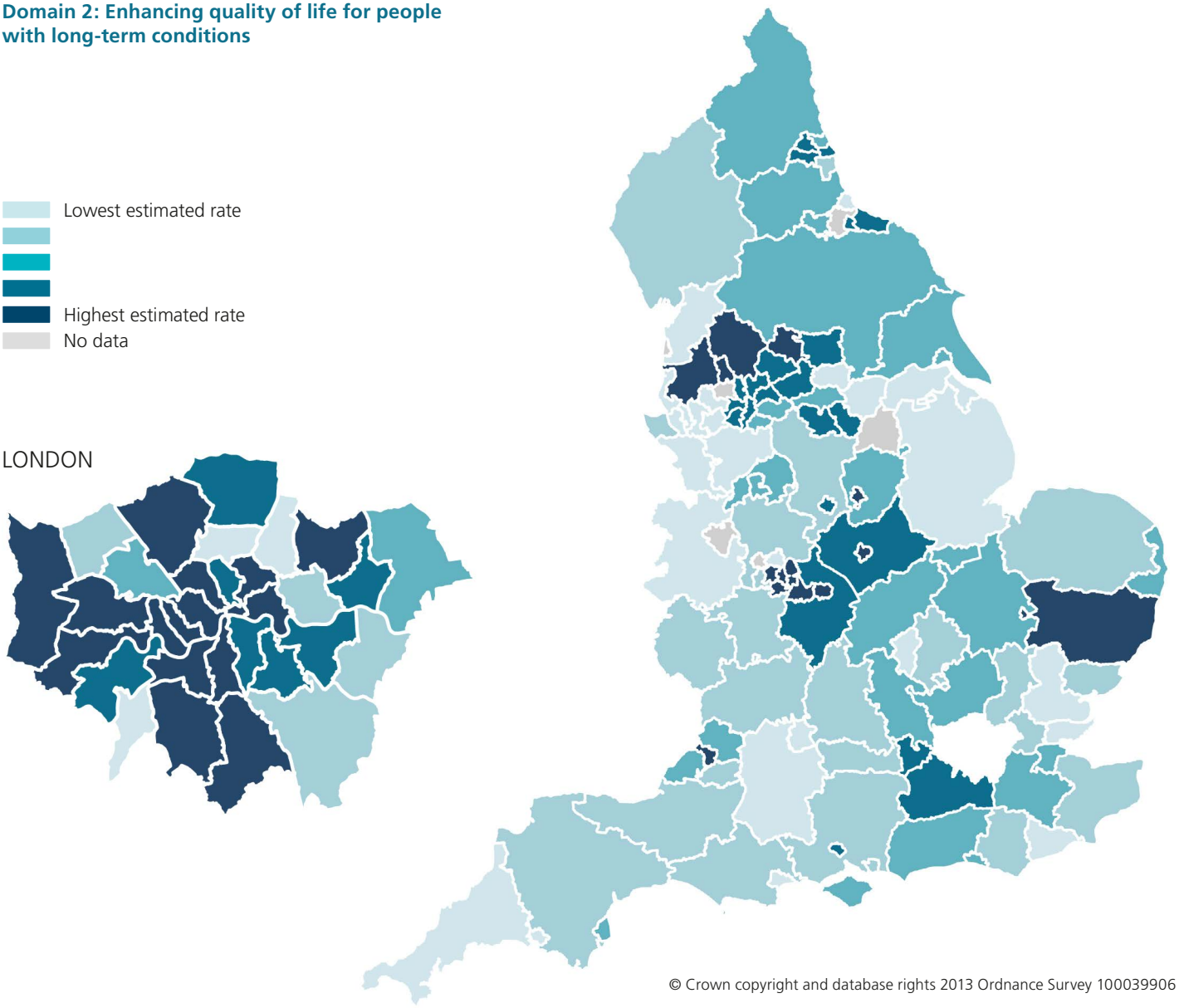
1 Data were extracted from 23 days at end of May-beginning of June 2012.

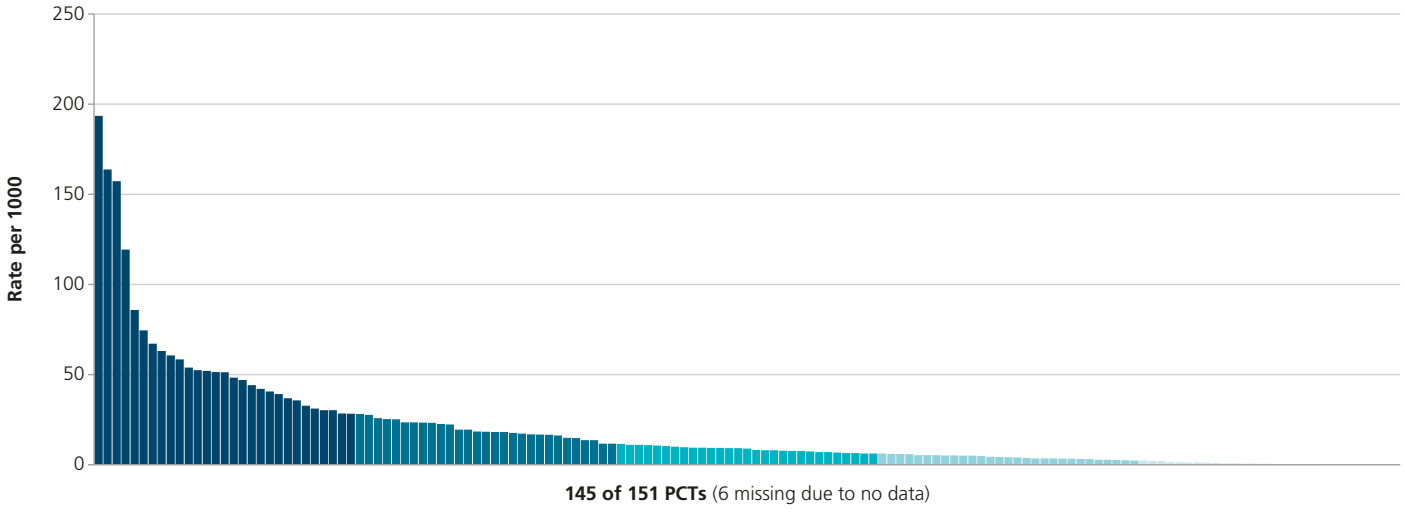
PATHOLOGY SERVICES

Map 58: Estimated annual rate of use for vitamin D tests ordered by GPs per practice population by PCT

2012[1]

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





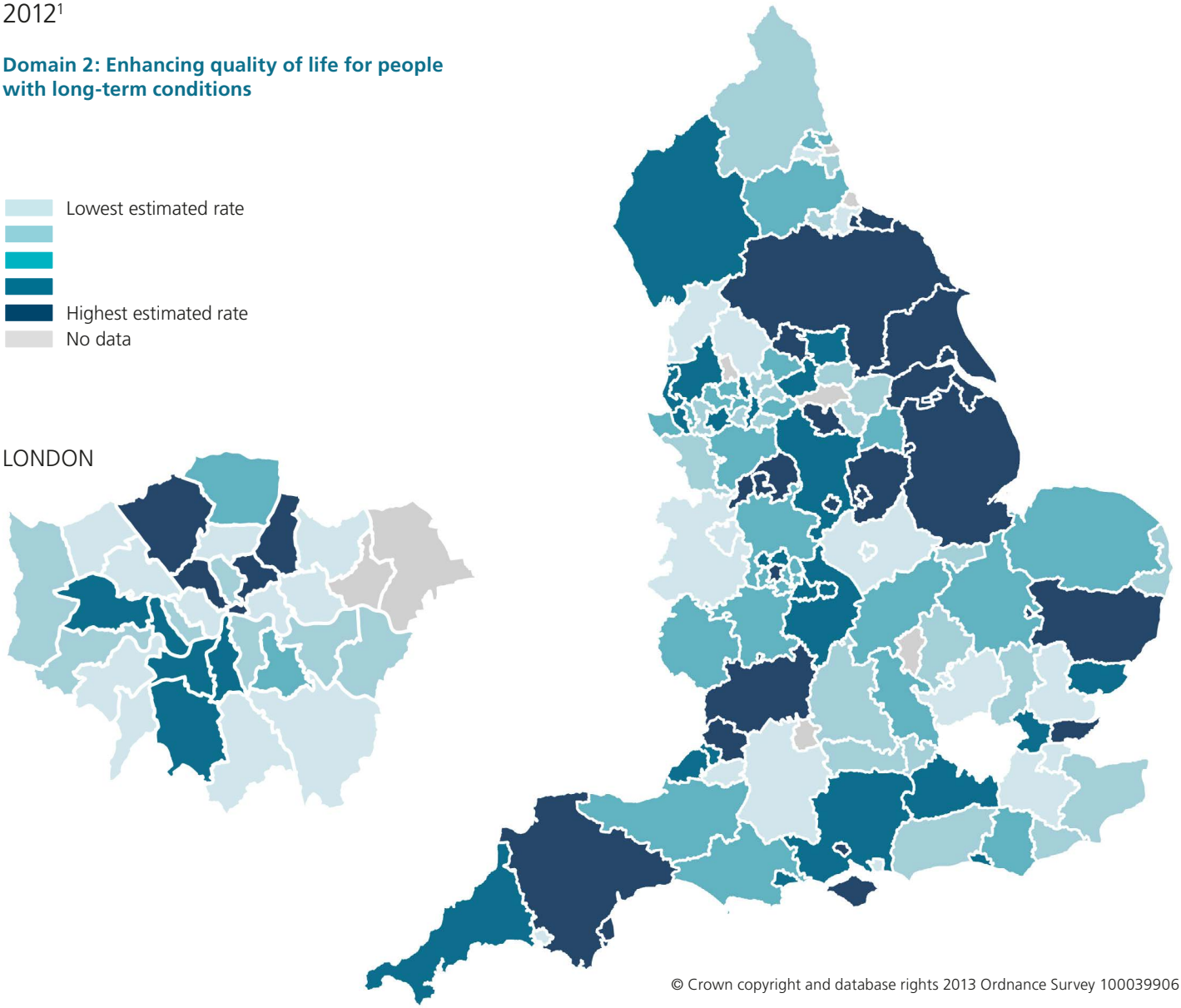
145 of 151 PCTs (6 missing due to no data)

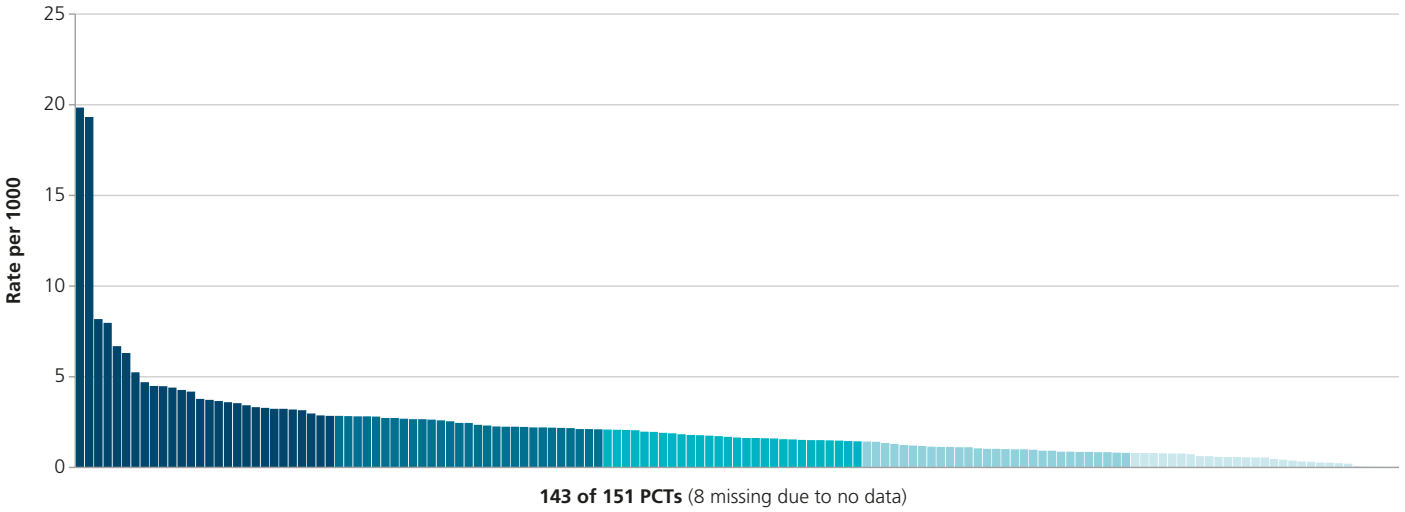
PATHOLOGY SERVICES

Map 59: Estimated annual rate of use for parathyroid hormone (PTH) tests ordered by GPs per practice population by PCT

2012[1]

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





143 of 151 PCTs (8 missing due to no data)

Map 58: Vitamin D

For PCTs in England, the estimated annual rate of use for vitamin D tests ordered by GPs ranged from 0.05 to 193.4 per 1000 practice population (>1000-fold variation).[2] When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 0.19–74.5 per 1000 practice population, and the variation is 392-fold.

Reasons for the degree of variation observed in the use of vitamin D tests may be due to differences in:

- the ethnic composition of the local population;
- the presence of other risk factors for vitamin D deficiency.

In addition, local policies may limit primary-care access to vitamin D assays, and thresholds for suspicion of deficiency may be inappropriate in primary care.

Map 59: PTH

For PCTs in England, the estimated annual rate of use for PTH tests ordered by GPs ranged from 0.04 to 19.8 per 1000 practice population (466-fold variation).[3] When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 0.20–6.3 per 1000 practice population, and the variation is 31-fold.

It is unlikely that the degree of variation observed in the use of PTH tests by GPs can be explained by differences in the prevalence of parathyroid- and non-parathyroid-related causes, or the need for monitoring the effectiveness of treatment.

Local policies may limit primary-care access to PTH assays, and recognition of the value of PTH analysis may be inappropriate. Some variation may be due to different practices in the monitoring of chronic kidney disease.

Options for action

As testing for PTH is expensive, commissioners, clinicians and service providers need to investigate the level of use for this test locally, and assess whether usage matches need. It is important for commissioners to understand the methodological variation in PTH assays and the role of the World Health Organization (WHO) standards (see "Resources").

In relation to vitamin D testing, commissioners, clinicians and service providers need:

- to consider targeting vitamin D assays at high-risk groups in the local population;
- to ensure that laboratory services offer an appropriate analytical method;
- to agree serum concentrations of vitamin D that require intervention with supplementation.

Commissioners need to ensure that laboratory services are using the correct names and Read codes for the reporting of serum calcium results.

RESOURCES

- National Osteoporosis Society (2013) Vitamin D and Bone Health: A Practical Clinical Guideline for Patient Management. http://www.nos.org.uk/document.doc?id=1352
- The UK eCKD Guide: The Renal Association (2009) http://www.renal.org/eGFR
- NICE (2008) Chronic kidney disease: early identification and management in adults in primary and secondary care (CG73). http://www.nice.org.uk/nicemedia/live/12069/42117/42117.pdf
- Feehally J, Gilmore I, Barasi S et al (2013) RCPE UK Consensus Conference on "Management of acute kidney injury: the role of fluids, ealerts and biomarkers". *J R Coll Physicians Edinb* 43; 37-38. doi: 10.4997/JRCPE.2013.19 http://www.rcpe.ac.uk/sites/default/files/files/Final_statement_0.pdf
- WHO International Standard Parathyroid Hormone 1-84, human, recombinant – NIBSC. http://www.nibsc.org/documents/ifu/95-646.pdf
- WHO International Standard Parathyroid Hormone 1-34, Recombinant, Human – NIBSC. http://www.nibsc.org/documents/ifu/04-200.pdf

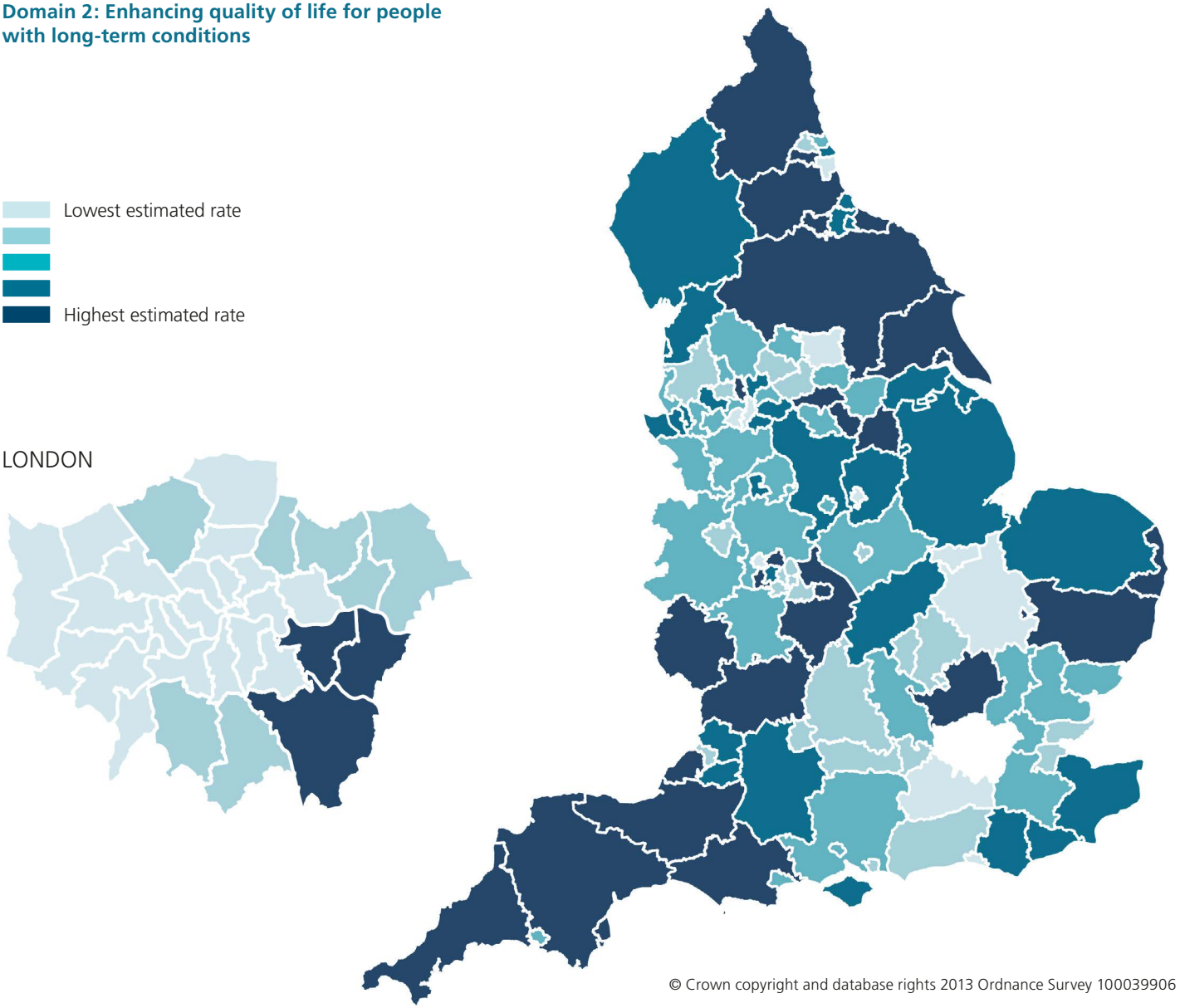
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 Six PCTs are not shown, either because there are no data or because data have been removed due to poor quality.
3 There are no data from 8 PCTs.

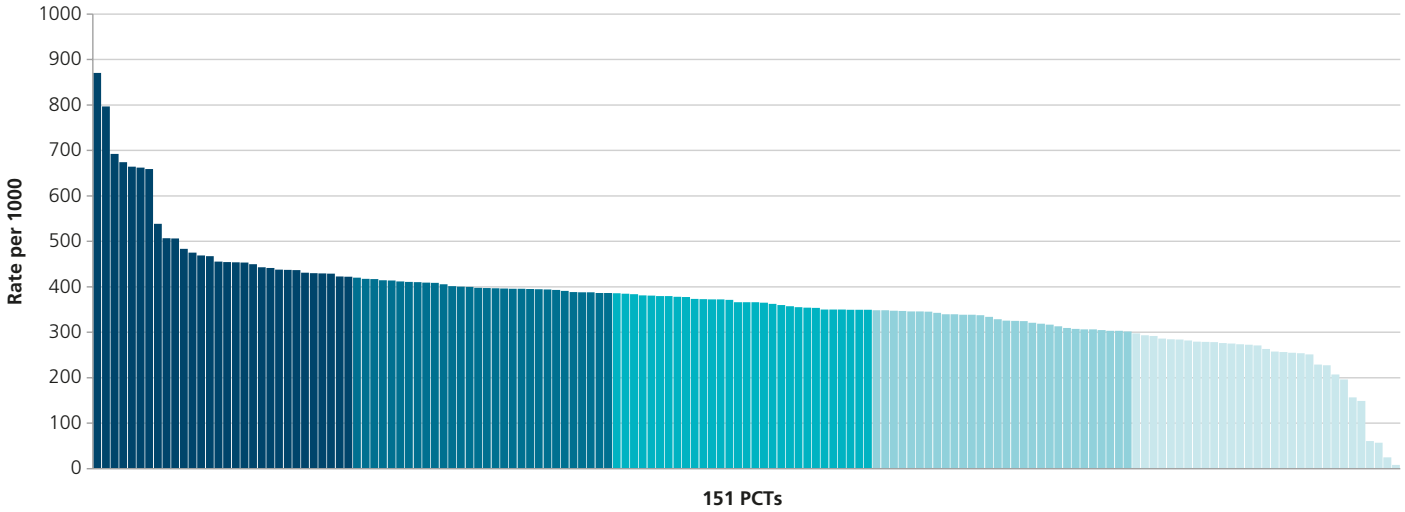
PATHOLOGY SERVICES

Map 60: Estimated annual rate of use for serum creatinine tests ordered by GPs per practice population by PCT

2012[1]

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





Context

Serum creatinine tests (Map 60) and estimated glomerular filtration rate (eGFR) tests (Map 61) are used in:

- the early detection of kidney disease;
- the monitoring of chronic kidney disease.

Creatinine clearance provides an assessment of glomerular filtration rate (GFR). The GFR is a measure of kidney function used to look for evidence of early kidney damage. Creatinine clearance can be calculated from the serum creatinine using variables such as age, weight, and gender, to give an estimated GFR (eGFR). An eGFR is provided by nearly all NHS laboratories as routine whenever creatinine or kidney function tests are requested.

Early kidney damage can be caused by high blood pressure, diabetes, some other diseases, or certain medications.

Serum creatinine is the preferred test for the detection of acute kidney injury, whereas eGFR is preferred for the diagnosis of chronic kidney disease.

Magnitude of variation

Map 60: Serum creatinine

For PCTs in England, the estimated annual rate of use for serum creatinine tests ordered by GPs ranged from 8.2 to 870.7 per 1000 practice population (106-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 157.0–662.4 per 1000 practice population, and the variation is 4.2-fold.

Map 61: eGFR

For PCTs in England, the estimated annual rate of use for eGFR tests ordered by GPs ranged from 0.31 to 774.3 per 1000 practice population (>1000-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 8.0–447.4 per 1000 practice population, and the variation is 56-fold.

Map 62: Urine protein–creatinine

For PCTs in England, the estimated annual rate of use for urine protein–creatinine ordered by GPs ranged from 0.04 to 68.0 per 1000 practice population (>1000-fold variation).[2] When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 0.13–43.3 per 1000 practice population, and the variation is 334-fold.

It is unlikely that differences in the risk factors for kidney damage explain the degree of variation observed in the rate of use for serum creatinine, eGFR and urine protein–creatinine tests.

Some of the variation in the use of eGFR may be due to erroneous Read codes and units of measurement arising from the inability of the laboratory system to provide the full representation of the unit of measurement for eGFR; as a result novel "work-arounds" are used. In addition, not all laboratories report eGFR.

Options for action

Commissioners, clinicians and service providers need to work together to promote surveillance for kidney disease in high-risk groups such as people with diabetes and people with hypertension.

Commissioners and clinicians need to ensure that eGFR is commissioned when creatinine assays are requested.

Commissioners need to ensure that:

- laboratory services provide the correct analyte name, Read code, and unit of measurement for eGFR (see http://www.ychi.leeds.ac.uk/pmipunits/);
- creatinine assays are standardised against the isotope dilution mass spectrometry (IDMS) method.

RESOURCES

- NICE (2013) Acute kidney injury: Prevention, detection and management of acute kidney injury up to the point of renal replacement therapy (CG169). http://guidance.nice.org.uk/CG169
- NICE (2008) Chronic kidney disease: Early identification of chronic kidney disease in adults in primary and secondary care (CG73). http://www.nice.org.uk/CG73
- The Renal Association. The UK eCKD Guide, Jan 2009. http://www.renal.org/whatwedo/InformationResources/CKDeGUIDE.aspx

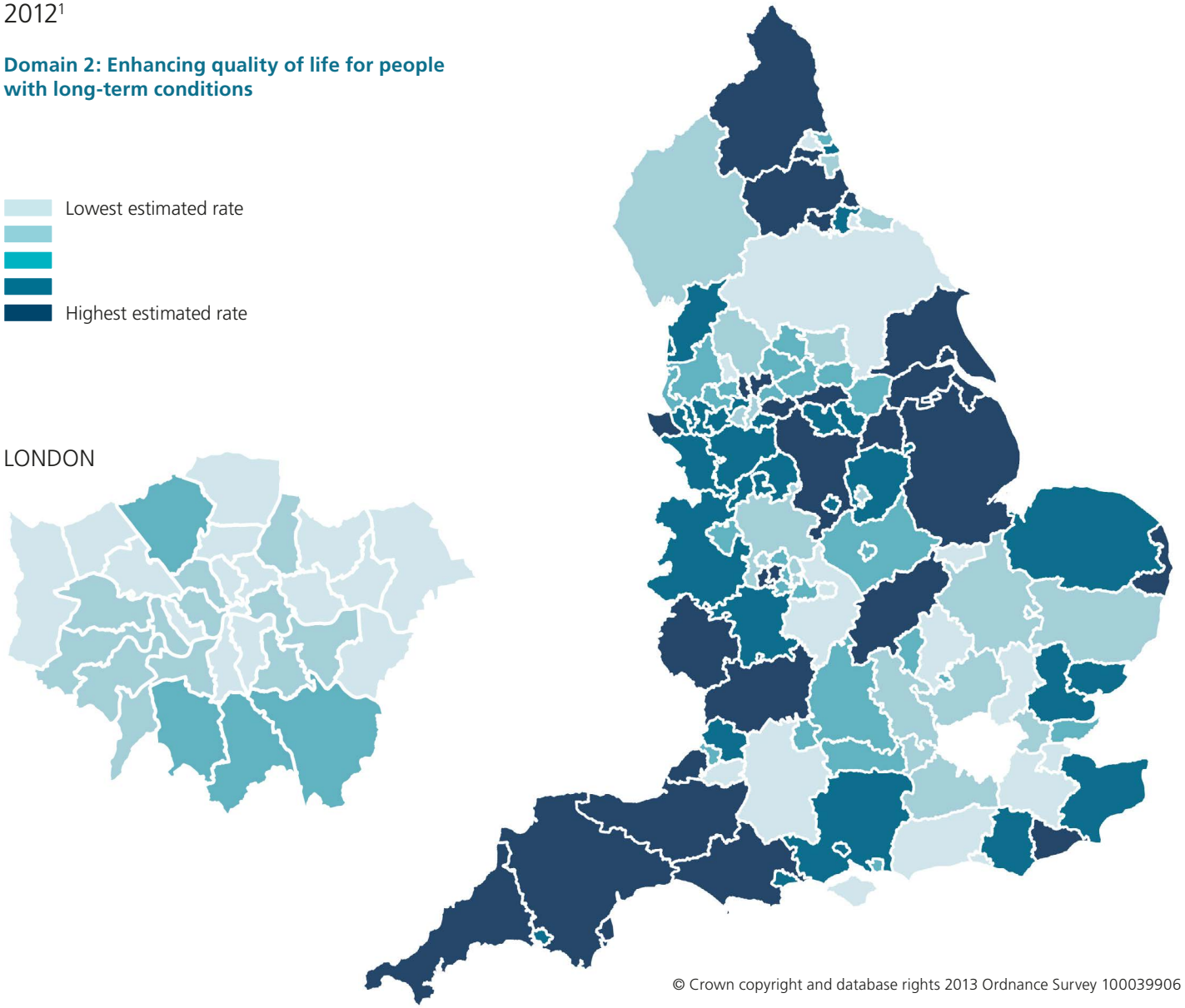
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 11 PCTs.

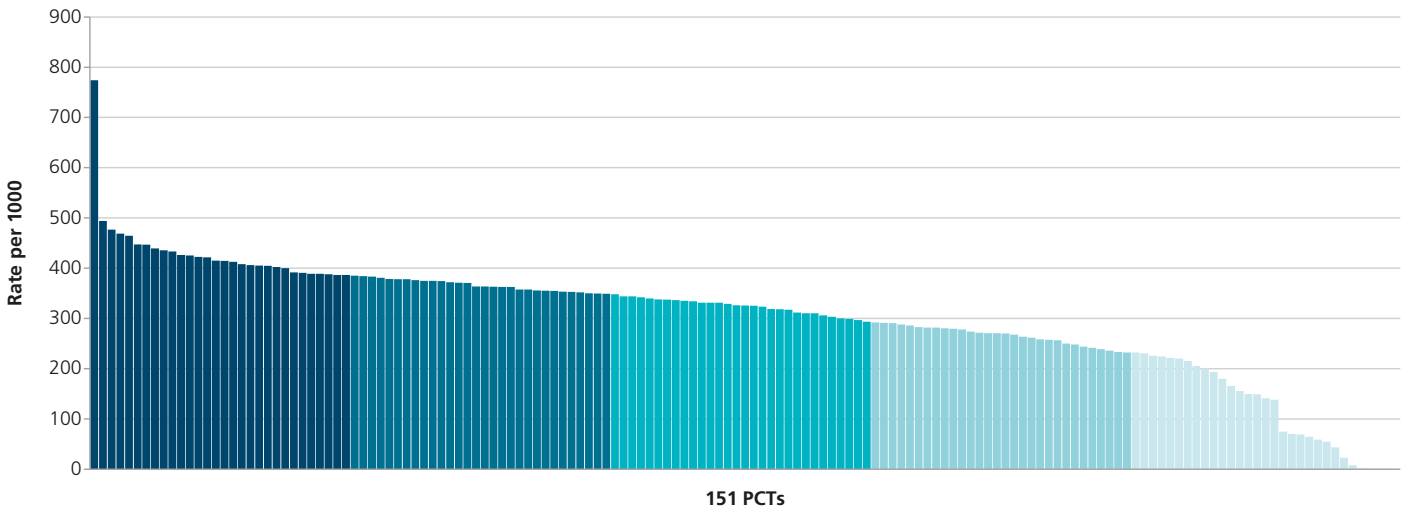
PATHOLOGY SERVICES

Map 61: Estimated annual rate of use for estimated glomerular filtration rate (eGFR) tests ordered by GPs per practice population by PCT

2012[1]

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



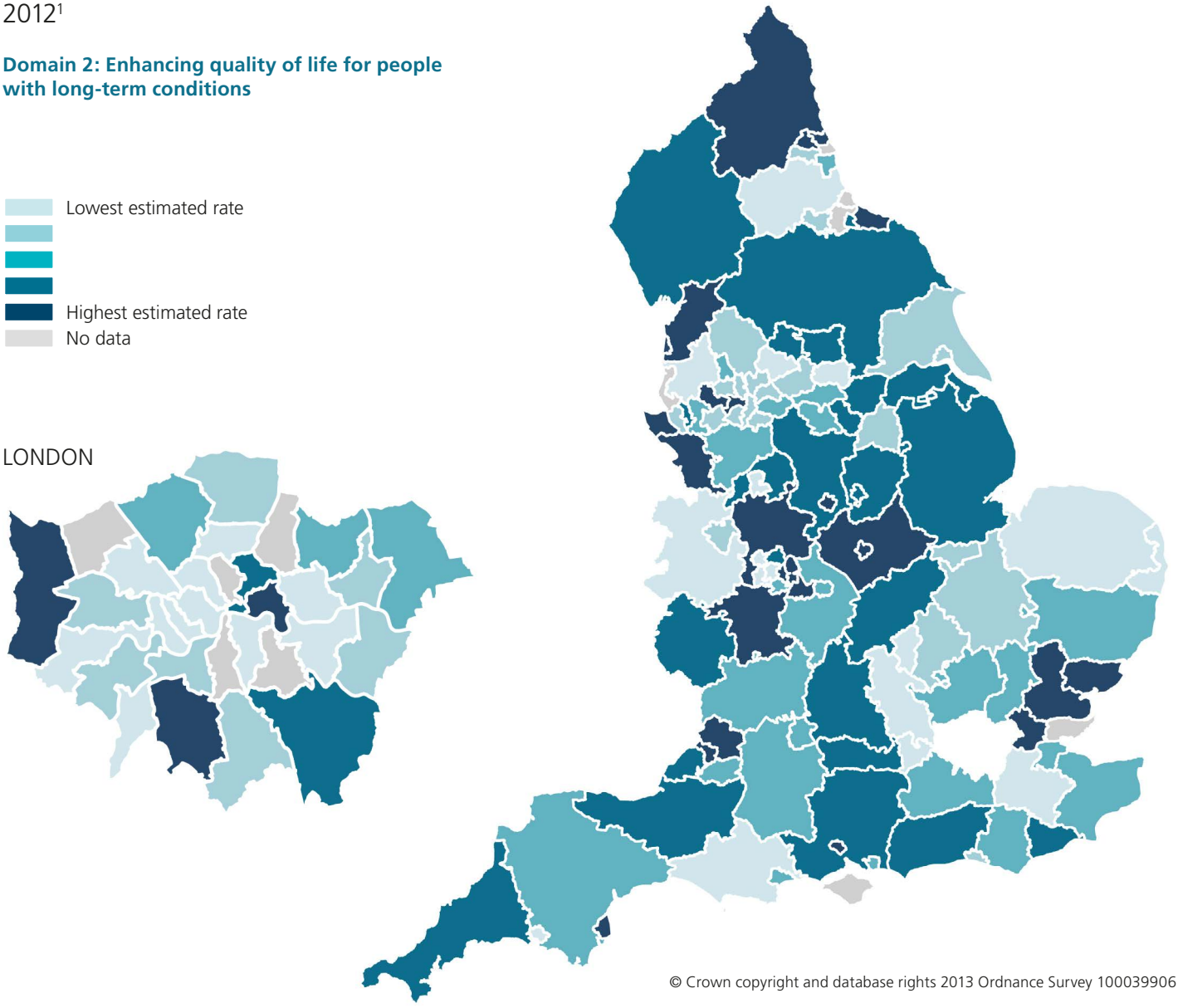


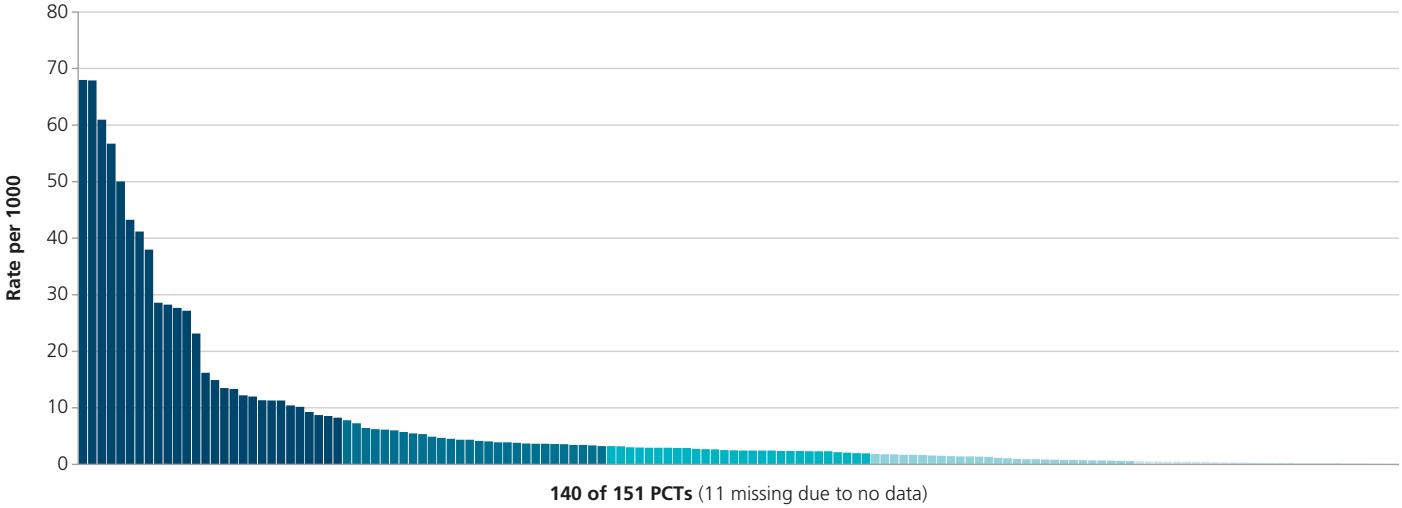
PATHOLOGY SERVICES

Map 62: Estimated annual rate of use for urine protein–creatinine tests ordered by GPs per practice population by PCT

2012[1]

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





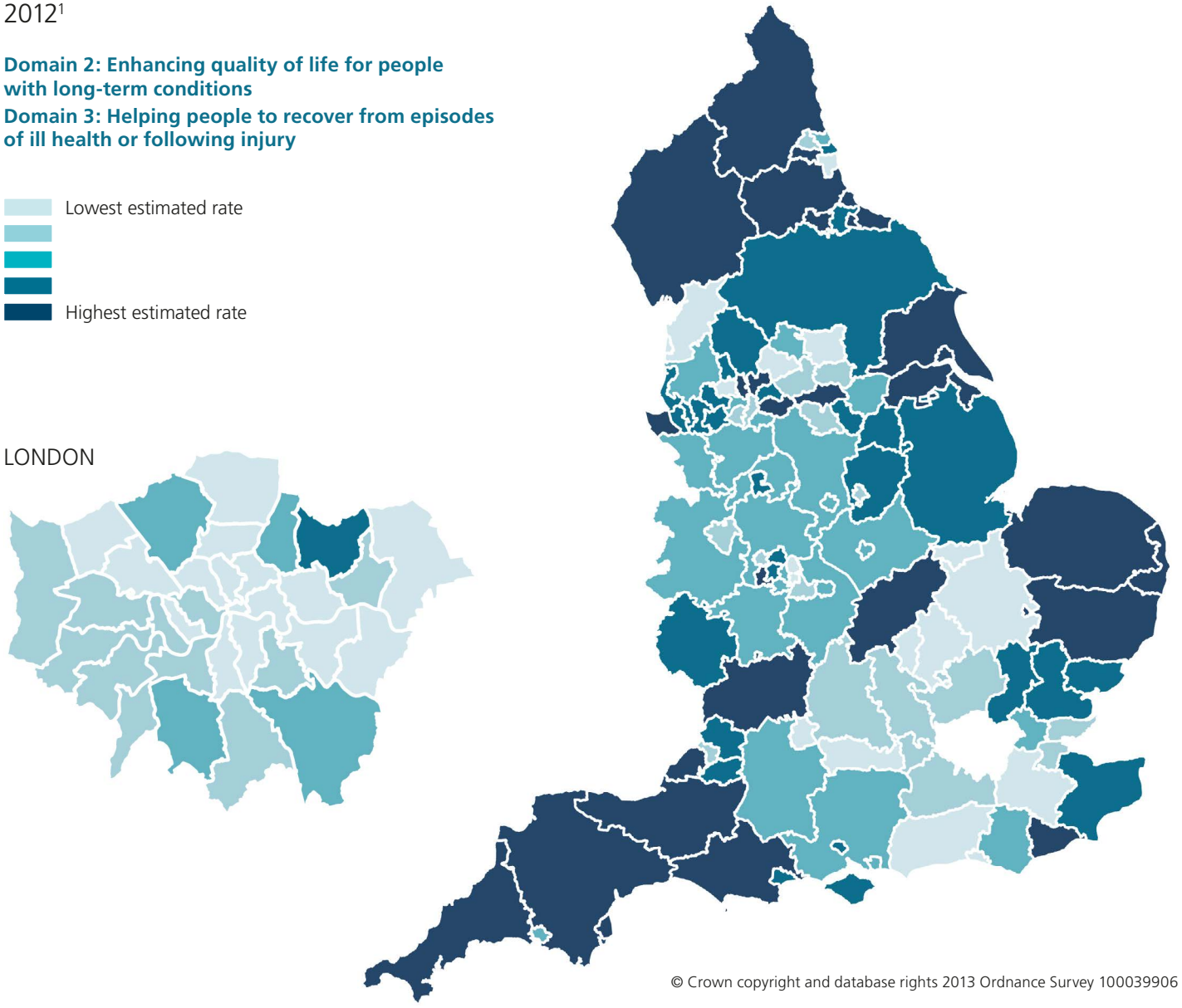
140 of 151 PCTs (11 missing due to no data)

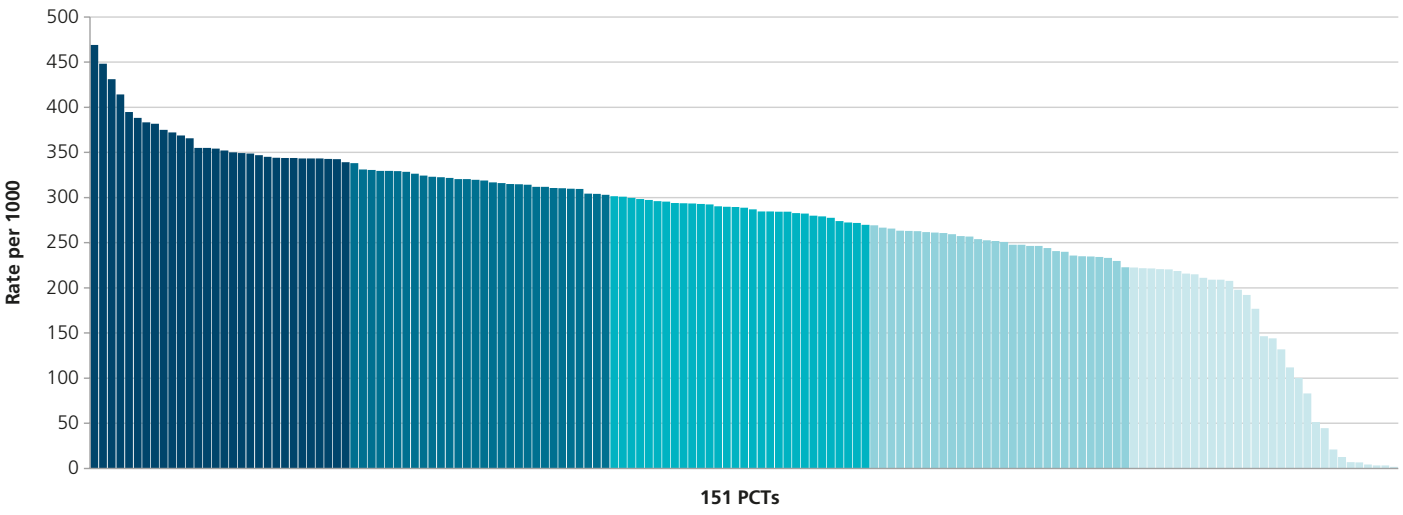
PATHOLOGY SERVICES

Map 63: Estimated annual rate of use for alanine aminotransferase (ALT) tests ordered by GPs per practice population by PCT

2012[1]

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





Context

When the liver is damaged, alanine aminotransferase (ALT) is released into the bloodstream. An ALT assay is usually requested in conjunction with other laboratory investigations such as alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT) and sometimes aspartate aminotransferase (AST) as part of a panel known as liver function tests (LFTs), which also include albumin and bilirubin: ALT, ALP, GGT and AST are liver enzymes, and elevated values imply liver damage; albumin and bilirubin reflect actual liver function.

Liver function tests are used alone, or in conjunction with other tests, for the investigation of people in whom a diagnosis is unclear. Given that liver disease is usually silent until it is at an advanced stage, these tests are often included in a "battery of tests" to explore potential diagnoses.

Measurement of ALT activity is undertaken in the following circumstances:

- liver disease is suspected because of a risk factor, e.g. excess alcohol consumption;
- liver disease is assessed in the context of known or possible exposure to hepatitis viruses;
- disease of the bile duct or pancreas is suspected because of symptoms, e.g. jaundice, dark urine or ascites;
- a patient is known to have liver disease and requires monitoring;
- some guidance for other conditions or drugs suggests the monitoring of liver function, e.g. treatment with statins;
- incidental findings point to a potential liver disease, e.g. an abnormal ultrasound scan;
- a family history of liver disease.

Interpretation of LFTs requires a high level of knowledge and skill.

There is a diurnal variation in serum ALT activity, and some evidence from animal studies that small rises may primarily reflect increased synthesis by the liver. In addition, values are higher in people from Hispanic and black African communities. Serum ALT activity is also higher in people who have a high body mass index (BMI).

Elevated ALT activity may also be found in people with congestive cardiac failure, obesity and poorly controlled diabetes.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for ALT tests ordered by GPs ranged from 1.9 to 468.9 per 1000 practice population (252-fold variation). When the five PCTs with the highest estimated rates and the five PCTs with the lowest estimated rates are excluded, the range is 6.9–388.3 per 1000 practice population, and the variation is 56-fold.

It is difficult to understand the reason for the degree of variation observed:

- early liver disease is under-diagnosed and it is important to encourage consideration of its assessment and opportunities for interventions;
- there are often multiple repeats of tests, which appear to be inappropriate, thus there is both under-use and over-use.

Several laboratories report using inappropriate codes or un-coded test reports, which may distort the data, especially at the lower end of the returns.

The data and the degree of variation observed do not give any indication of:

- why tests were done;
- the numbers of repeat tests;
- the proportion of tests that are abnormal.

On average, laboratories report 10% of results as above their range of normal. Liver enzymes are often abnormal in:

- diabetes mellitus or obesity due to fatty infiltration of the liver;
- cardiac failure because of congestion.

It is not clear, however, how LFTs are utilised in patients with these conditions.

Options for action

Commissioners, clinicians and service providers need to agree pathways for the investigation and management of liver disease in both primary and secondary care at a local level. The Map of Medicine® is a good place to start, and there are national guidelines for many of the pathways (see "Resources"). In cases where laboratory services have not adopted ALT as the key test for liver damage, commissioners need to ensure the introduction and use of this test.

Agreement also needs to be reached on the following:

- mechanisms for interpreting tests;
- to which investigations and pathways each of the tests might lead if results are not within the "normal" range;
- within the pathways, protocols for repeating tests to avoid inappropriate duplication.

Shared IT systems among service providers will also help to avoid the duplication of tests.

As there is a considerable cost associated with the battery of tests to exclude liver disease when ALT is slightly raised, there is reticence to investigate thoroughly. Commissioners may seek to minimise costs by introducing testing schemes based on an individual's behaviours.

In a review of the use of tests for viral hepatitis, reporting was not consistent: different names, analytical methods and units of measurement were used. Virology service providers need to work towards the standardisation of methods and reporting.

RESOURCES

- Lab Tests Online. ALT. http://labtestsonline.org/understanding/analytes/alt/tab/test
- British Society of Gastroenterology. Liver. Guidelines. http://www.bsg.org.uk/clinical-guidelines/liver/index.html
- Lilford RJ et al (2013) Birmingham and Lambeth Liver Evaluation Testing Strategies. Health Technology Assessment 17; No. 28.

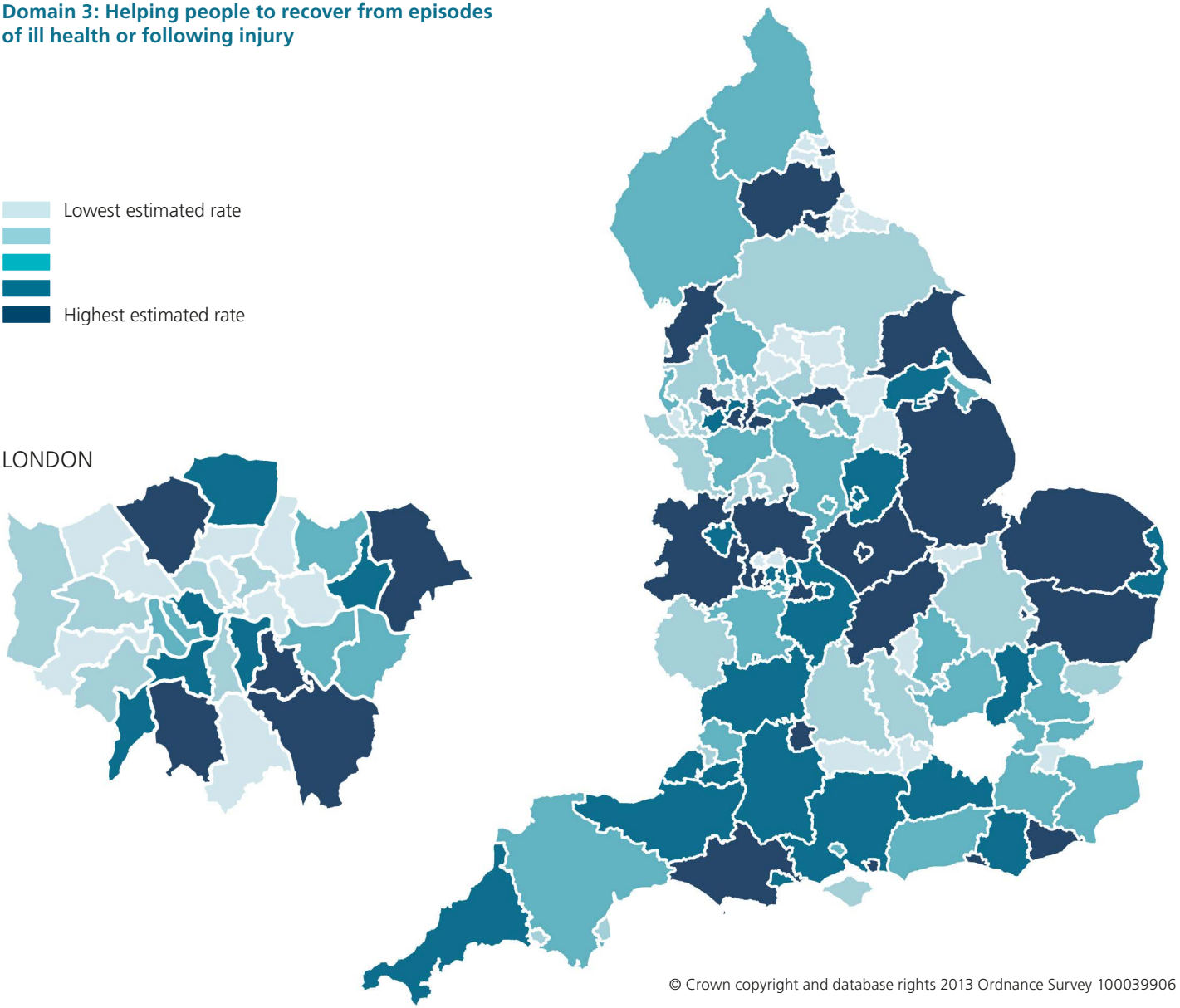
1 Data were extracted from 23 days at end of May-beginning of June 2012.

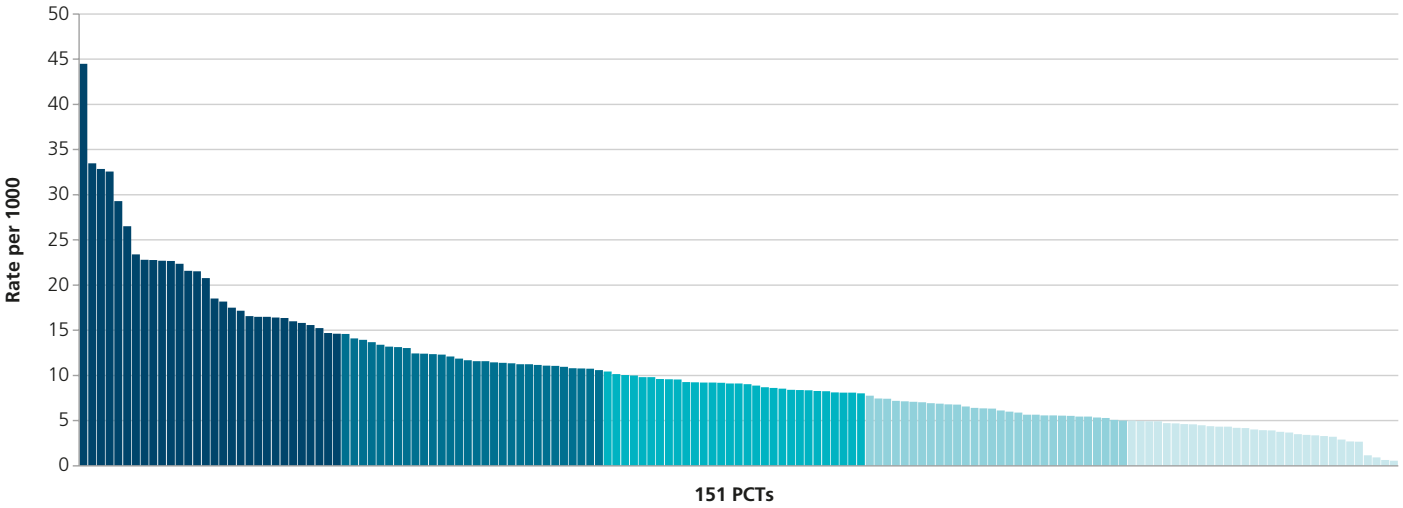
PATHOLOGY SERVICES

Map 64: Estimated annual rate of use for creatine kinase tests ordered by GPs per practice population by PCT

2012[1]

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





Context

Creatine kinase is present in the cells of cardiac and skeletal muscle, and also in the brain and smooth muscle. It is released when the muscle cells are damaged by trauma or disease. Serum creatine kinase assays are used as a measure of skeletal muscle damage, although they were used to detect cardiac disease before testing of troponins became the preferred method (see Map 50, pages 151, 154, 156 and 157).

The creatine kinase test is used:

- to differentiate myositis from polymyalgia;
- to check whether there is muscle damage in patients treated with statins;
- to assess the significance of falls in older people.

Elevated activity of creatine kinase is also associated with:

- alcoholic myopathy;
- hypothyroidism (due to reduced clearance);
- the use of certain drugs such as statins.

High values are also found in people who are bodybuilders, and people who have undertaken severe or unusual exercise.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for creatine kinase tests ordered by GPs ranged from 0.57 to 44.5 per 1000 practice population (78-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 2.7–26.5 per 1000 practice population, and the variation is 10-fold.

It is unlikely that differences in population composition or disease prevalence can account for the degree of variation observed. Variation in creatine kinase testing may be related to differences in:

- the prevalence of statin use in different localities;
- the extent of monitoring of patients who are taking statins.

There may be a lack of awareness of the value of creatine kinase testing in differentiating myalgia from myositis.

Options for action

Commissioners could consider relating the use of creatine kinase assays to the use of statins to assess the level of monitoring taking place in the population.

RESOURCES

- South London Cardiac and Stroke Networks (2009) Guidance on Prescribing Statins. http://www.slcsn.nhs.uk/files/prescribing/statins/statins-guidance-022009.pdf
- Lab Tests Online. CK. http://labtestsonline.org/understanding/analytes/ck/tab/test

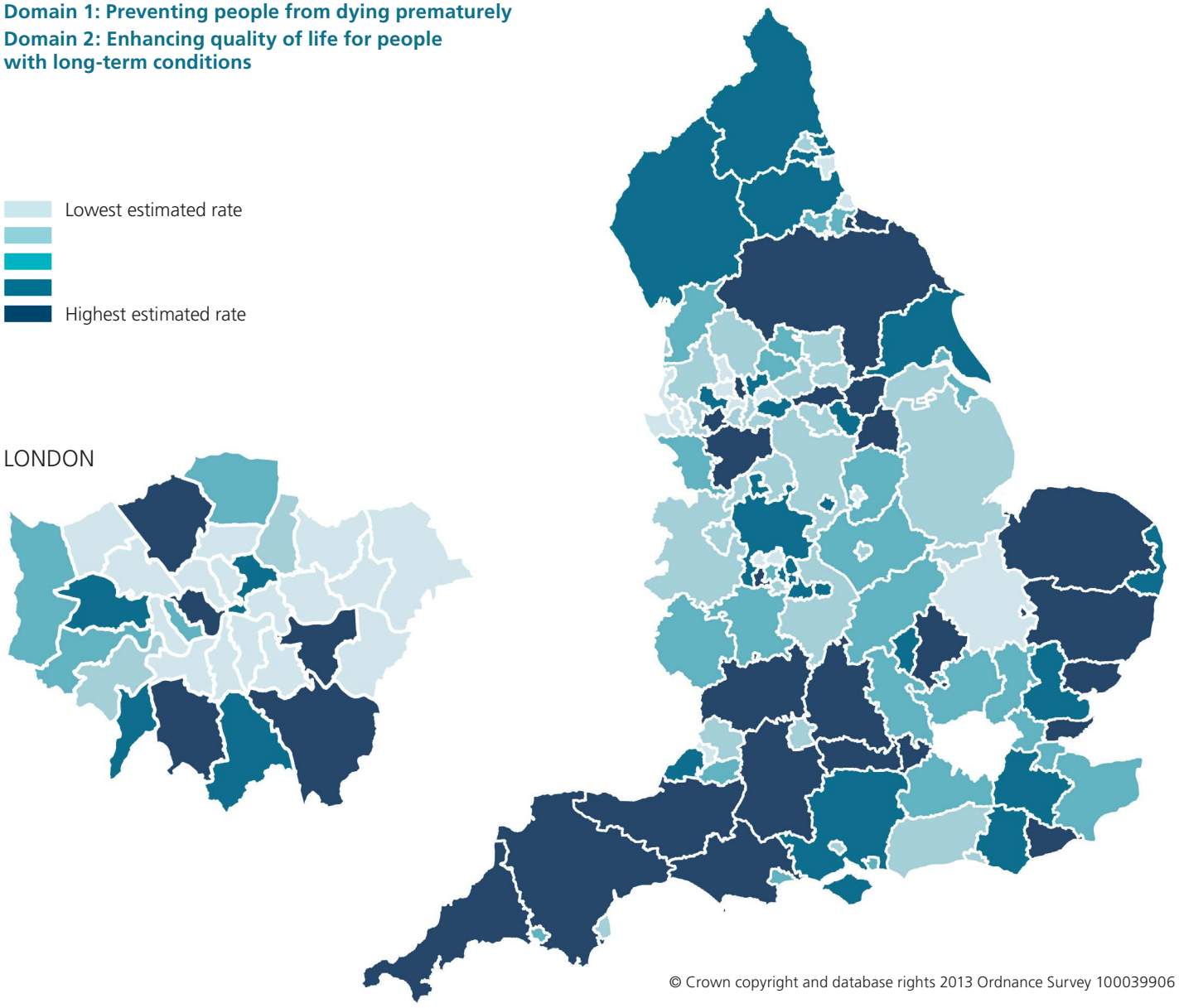
1 Data were extracted from 23 days at end of May-beginning of June 2012.

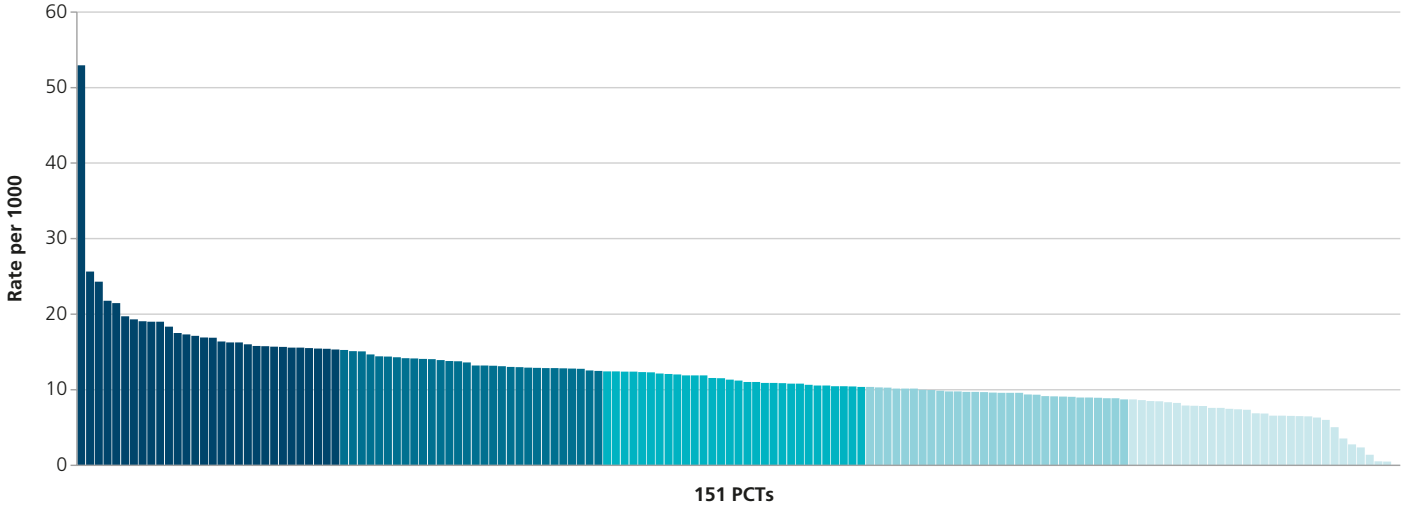
PATHOLOGY SERVICES

Map 65: Estimated annual rate of use for urate tests ordered by GPs per practice population by PCT

2012[1]

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





Context

Urate is formed from the degradation of purines found in DNA and RNA. High serum concentrations may be associated with increased cell turnover or poor renal excretion. Serum concentrations rise with age, and are higher in men than women.

Elevated serum urate can be caused by several factors including:

- rapidly growing tumours;
- chemotherapy for tumours;
- drug therapy (thiazide diuretics);
- chronic renal disease;
- high alcohol intake;
- dyslipidaemia;
- pre-eclampsia.

Some genetic conditions also cause hyperuricaemia.

Serum urate analyses are used in the diagnosis of gout, although serum urate concentrations may be normal at the time of an attack, and hyperuricaemia may not be apparent until six weeks after an attack. The definitive diagnosis of gout is the presence of urate crystals in the synovial fluid of the affected joint.

Serum urate levels are used in the differential diagnosis of mono-arthropathy and the monitoring of urate-lowering therapies in primary care. Analyses may also be undertaken in patients with chronic kidney disease, diabetes and metabolic syndrome because these conditions predispose to hyperuricaemia. Hyperuricaemia is also associated with kidney stone formation and premature vascular disease.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for serum urate tests ordered by GPs ranged from 0.06 to 53.0 per 1000 practice population (836-fold variation). When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 2.8–19.7 per practice population, and the variation is 7-fold.

It is unlikely that differences in disease prevalence can account for the degree of variation observed. A small proportion of the variation may be explained by differences in the profiles of local populations with respect to age, sex, and ethnicity. Serum urate concentrations are higher in people of black African origin.

Options for action

Commissioners could consider relating the frequency of urate testing to the prevalence of gout as indicated by the rate of use for urate-lowering drugs such as allopurinol.

RESOURCES

- NICE (2012) Clinical Knowledge Summaries. Gout. http://cks.nice.org.uk/gout
- Lab Tests Online. Uric Acid. http://labtestsonline.org/understanding/analytes/uric-acid/tab/test

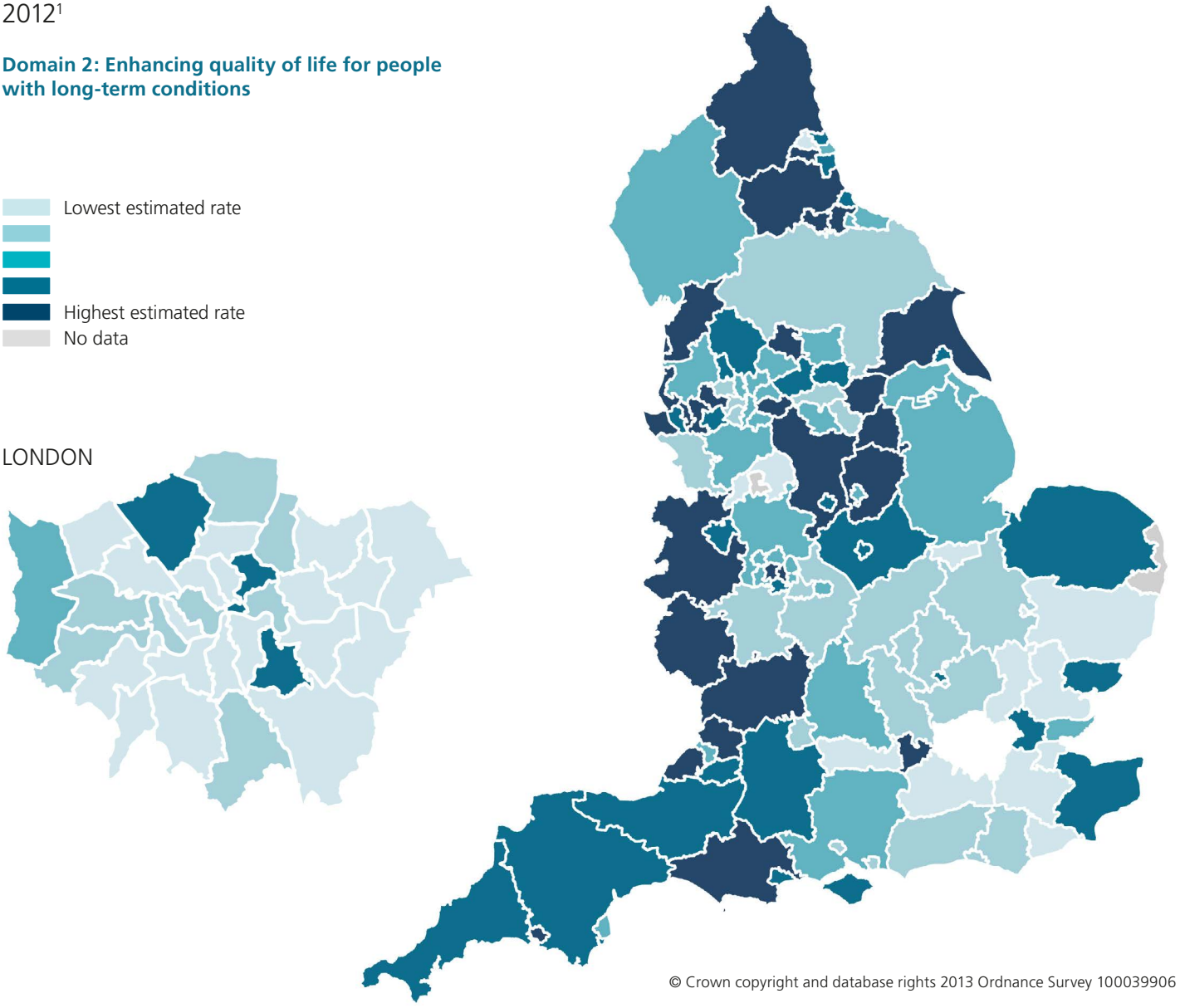
1 Data were extracted from 23 days at end of May-beginning of June 2012.

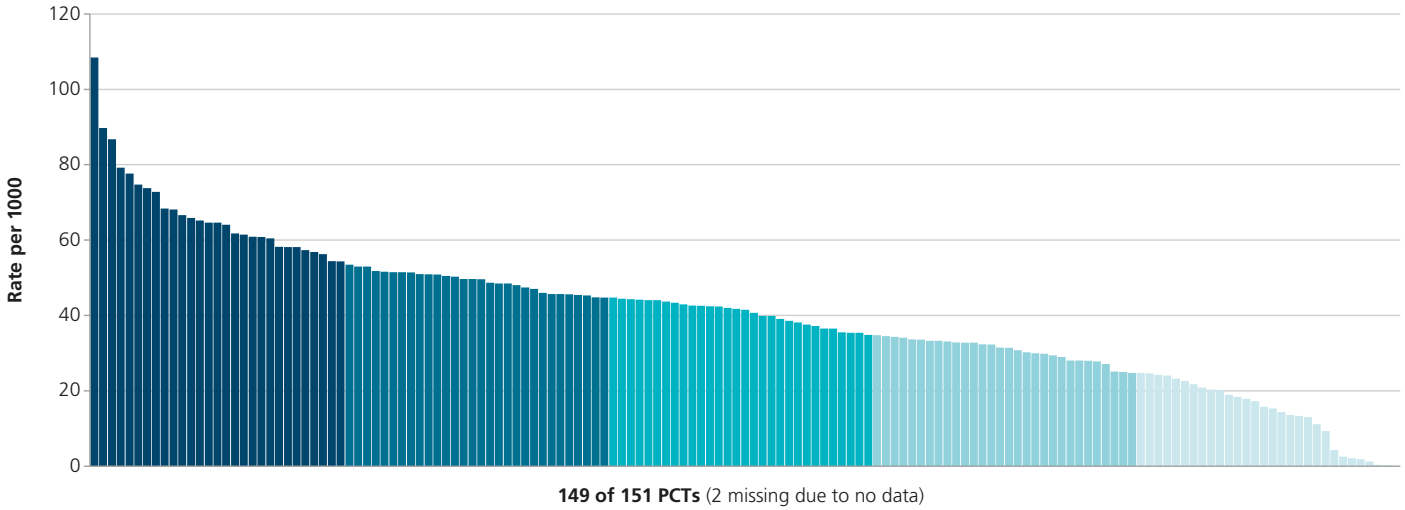
PATHOLOGY SERVICES

Map 66: Estimated annual rate of use for the urine albumin to creatinine ratio (ACR) tests ordered by GPs per practice population by PCT

2012[1]

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





149 of 151 PCTs (2 missing due to no data)

Context

Glomeruli in the kidney that are functioning normally retain albumin, which is the reason why only very small amounts are found in the urine. Any damage to the glomeruli will allow albumin to leak into the urine.

The major cause of kidney damage is early kidney disease in people with diabetes; early detection enables the commencement of drug therapy to limit the progression of kidney damage.

The urine albumin to creatinine ratio (ACR) is used:

- to monitor the risk of kidney complications in patients with diabetes;
- in the diagnosis and monitoring of some types of kidney disease.

Laboratory measurement of albumin in urine samples, whether on urine samples collected over 24 hours or those collected as a spot-check, has largely been abandoned, although it remains the basis for urine stick testing, due to the inconsistency of collection and variation in urine concentration. The ratio of albumin to creatinine, however, compensates for variations in urine concentration in spot-check samples and allows the test to be undertaken on random urine samples rather than requiring longer and inconvenient collections. In patients with relatively low albumin excretion rates, dilute urine samples will produce unreliable results.

As a term, micro-albuminuria is no longer recommended for use. Some laboratories, however, continue to use the term. In response to local clinicians' preferences, some laboratories report on both tests – ACR and micro-albuminuria.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for the urine ACR tests ordered by GPs ranged from 0.07 to 108.4 per 1000 practice population (>1000-fold variation).[2] When the five PCTs with the highest estimated annual rates and the five PCTs with the lowest estimated annual rates are excluded, the range is 2.1–74.7 per practice population, and the variation is 35-fold.

It is unlikely that differences in disease prevalence can account for the degree of variation observed. The use of this test should reflect the prevalence of diabetes in local populations, and relate to the rate of utilisation of tests used to monitor diabetes, i.e. glycated haemoglobin (HbA1c; see Map 44, pages 141, 143 and 144).

One reason for the degree of variation observed is differences in the method of reporting by laboratories:

- most laboratories report only the ACR;
- a few report only micro-albuminuria;
- some undertake dual reporting.

Other reasons for variation include:

- the difficulty in reporting on samples that are too dilute to calculate the ACR precisely;
- the degree to which the care of people with diabetes is based in the community as opposed to in hospitals.

Options for action

There is an urgent need to standardise the terminology by adopting that of the urine ACR, and discontinuing the use of other terms, such as micro-albuminuria.

Commissioners need:

- to compare the rate of use of the urine ACR with that of HbA1c (see Map 44) to ensure the appropriate use of both tests in people with diabetes;
- to audit the frequency of dilute urine samples that laboratories deem unsuitable for the calculation of the ACR, and the proportion (%) of these samples that are repeated with a suitable sample;
- to ensure that local reporting and receiving systems accurately represent the less than (<) and more than (>) symbols in ACR reports.

Pathologists need to agree a common approach to:

- the reporting of dilute specimens;
- the representation of low values in IT systems.

RESOURCES

- NICE (2009) Type 2 Diabetes - newer agents (partial update of CG66) (CG87). http://www.nice.org.uk/guidance/index.jsp?action=byID&o=12165
- NICE (2008) Chronic kidney disease: Early identification and management of chronic kidney disease in adults in primary and secondary care (CG73). http://www.nice.org.uk/guidance/index.jsp?action=byID&o=12069
- Scottish Intercollegiate Guidelines Network (SIGN) (2010) 116 Management of diabetes. A national clinical guideline. March 2010. http://www.sign.ac.uk/guidelines/fulltext/116/index.html
- National Kidney Foundation Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease. http://www.kidney.org/professionals/kdoqi/guideline_diabetes/guide1.htm
- Lab Tests Online. Urine Albumin to Creatinine Ratio or ACR. http://www.labtestsonline.org.uk/understanding/analytes/microalbumin/tab/test

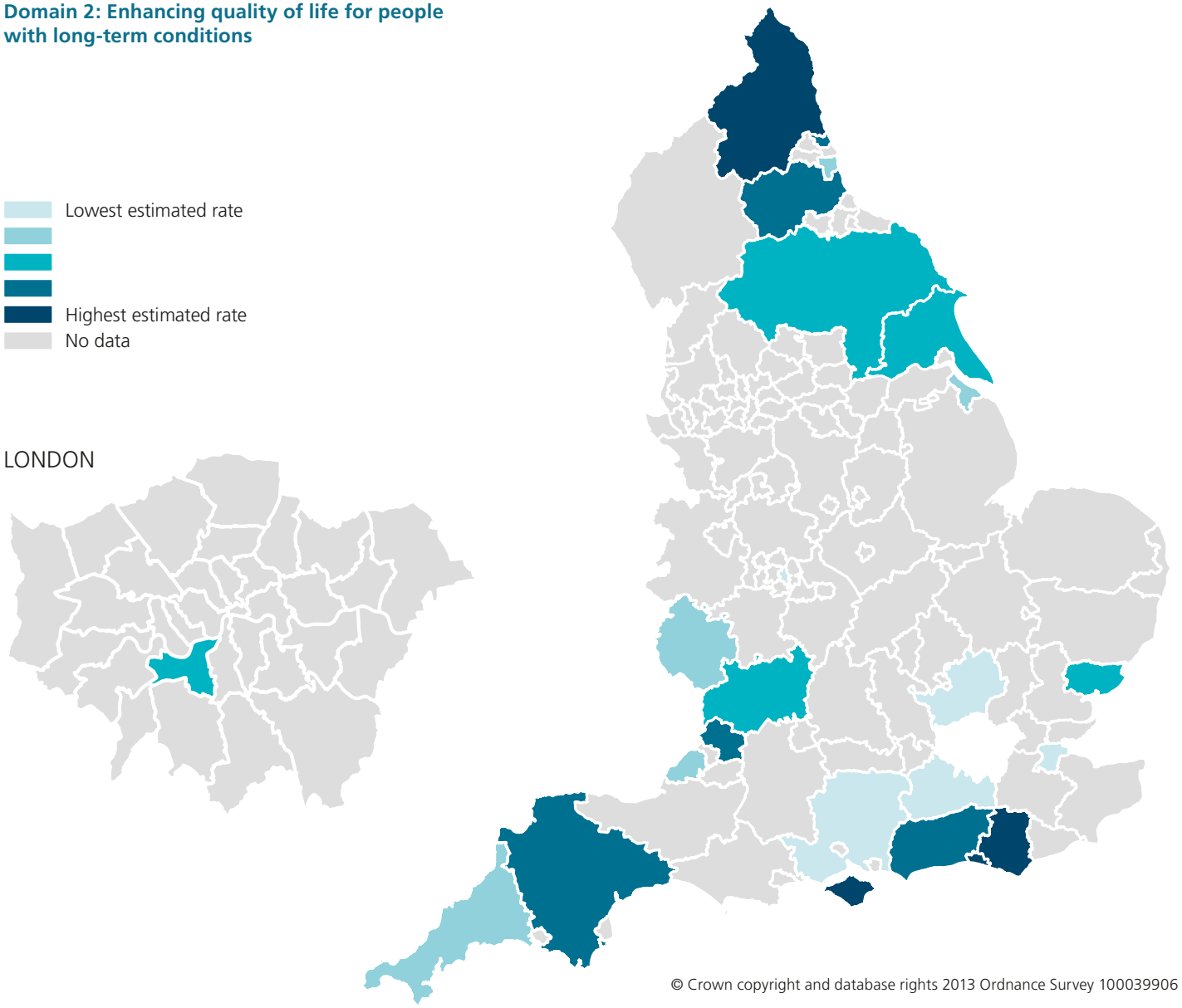
1 Data were extracted from 23 days at end of May-beginning of June 2012.
2 There are no data from 2 PCTs

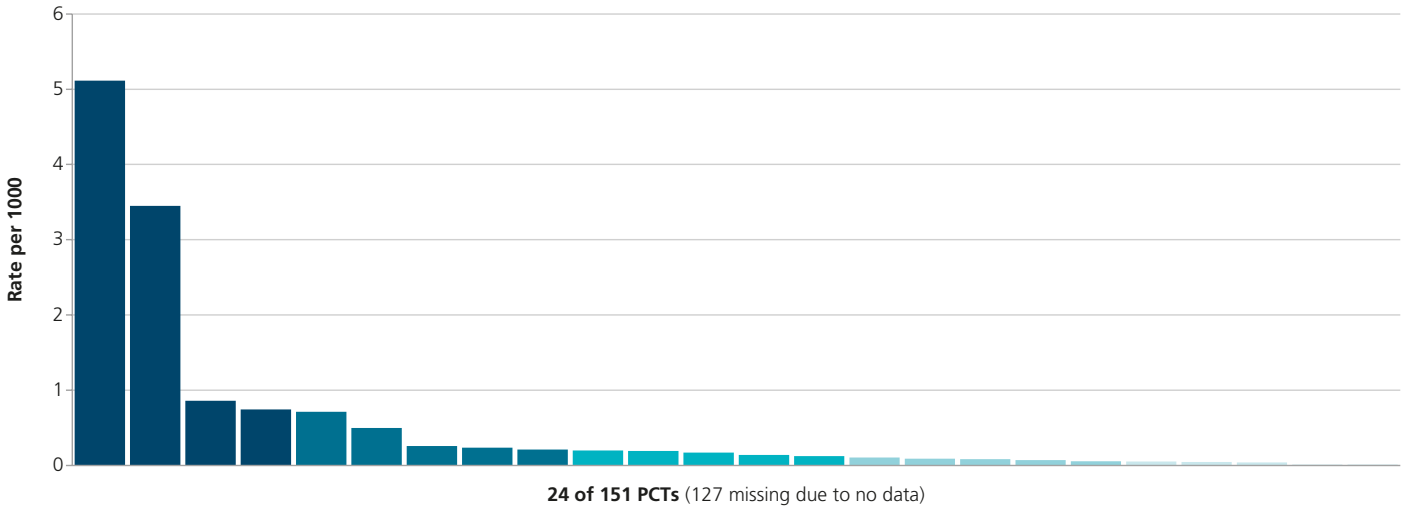
PATHOLOGY SERVICES

Map 67: Estimated annual rate of use for calprotectin tests ordered by GPs per practice population by PCT

2012[1]

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





24 of 151 PCTs (127 missing due to no data)

Context

Calprotectin is produced by neutrophils. Elevated concentrations in faeces are associated with inflammation in the intestine. Faecal calprotectin is used as a marker for inflammatory bowel disease. The negative predictive value of this test for the exclusion of inflammatory bowel disease is about 90%.

Conditions that cause an elevated faecal calprotectin are Crohn's disease, ulcerative colitis and bowel cancer. Faecal calprotectin is normal in coeliac disease where serum tissue trans-glutaminase is a useful predictive indicator.

Chronic abdominal pain or discomfort, accompanied by diarrhoea or constipation, is common. These symptoms can be due to several different conditions, some more serious than others, including irritable bowel syndrome and inflammatory bowel disease. The commonest forms of inflammatory bowel disease are ulcerative colitis and Crohn's disease. Distinguishing between irritable bowel syndrome and inflammatory bowel disease on clinical grounds is difficult, which is the reason why many people with irritable bowel syndrome undergo colonoscopy.

Faecal calprotectin is used to distinguish irritable bowel syndrome from inflammatory bowel disease and cancer. The advantage is that those with a normal calprotectin may not require colonoscopy but can be managed in primary care as having irritable bowel syndrome.

Where patients with gastro-intestinal symptoms are referred via a cancer pathway, there is insufficient time to use faecal calprotectin as a screening test to prioritise endoscopy.

Magnitude of variation

For PCTs in England, the estimated annual rate of use for calprotectin tests ordered by GPs ranged from 0.01 to 5.1 per 1000 practice population (446-fold variation).[2]

The patchy uptake of this test in primary care despite evidence of clinical utility probably indicates

- a lack of understanding of its value;
- lack of availability from local laboratory services, which may result from some secondary care providers being reluctant to lower the rate of endoscopy provided.

Options for action

Commissioners together with clinicians and service providers need to review the potential for reducing the need for endoscopy through access to faecal calprotectin assays. At the time of writing, a NICE Diagnostic Assessment is scheduled for publication in February 2014.[3,4]

RESOURCES

- van Rheenen PF, Van de Vijver E, Fidler V (2010) Faecal calprotectin for screening of patients with suspected inflammatory bowel disease: diagnostic meta-analysis. *British Medical Journal* 341; c3369. http://www.bmj.com/content/341/bmj.c3369.pdf%2Bhtml
- Lab Tests Online. Inflammatory Bowel Diseases. http://www.labtestsonline.org.uk/understanding/conditions/inflammatory-bowel/start/1
- NICE (2013) Faecal calprotectin diagnostic tests for inflammatory diseases of the bowel (DG11). http://guidance.nice.org.uk/DG11

1 Data were extracted from 23 days at end of May-beginning of June 2012.

2 There are no data from 127 PCTs.

3 National Institute for Health Research. Health Technology Assessment Programme. Faecal calprotectin testing for differentiating amongst inflammatory and non-inflammatory bowel diseases: a systematic review and economic evaluation. http://www.hta.ac.uk/3007

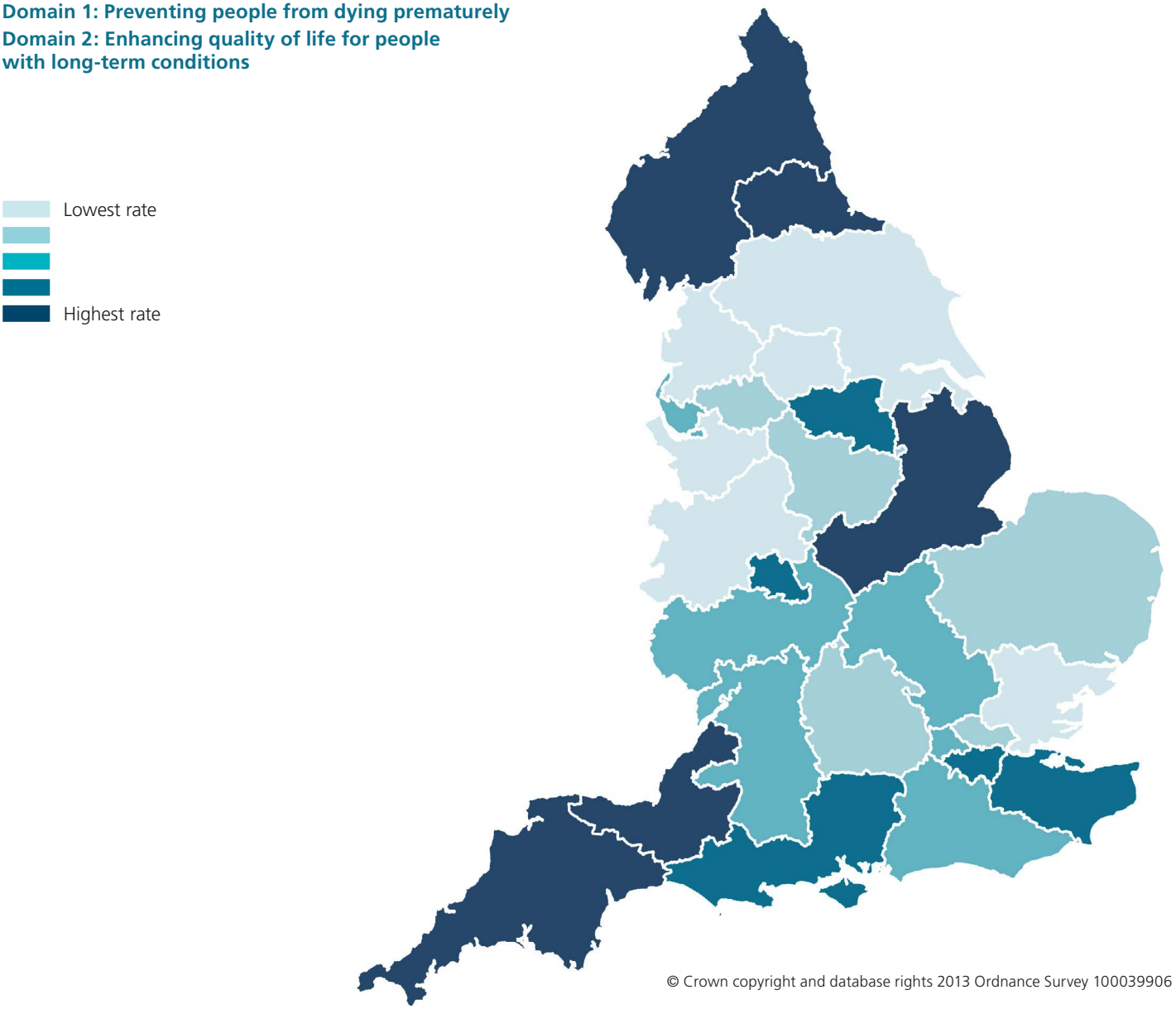
4 NICE (2013) Faecal calprotectin diagnostic tests for inflammatory diseases of the bowel: diagnostics consultation document. http://guidance.nice.org.uk/DT/12/Consultation/DraftGuidance

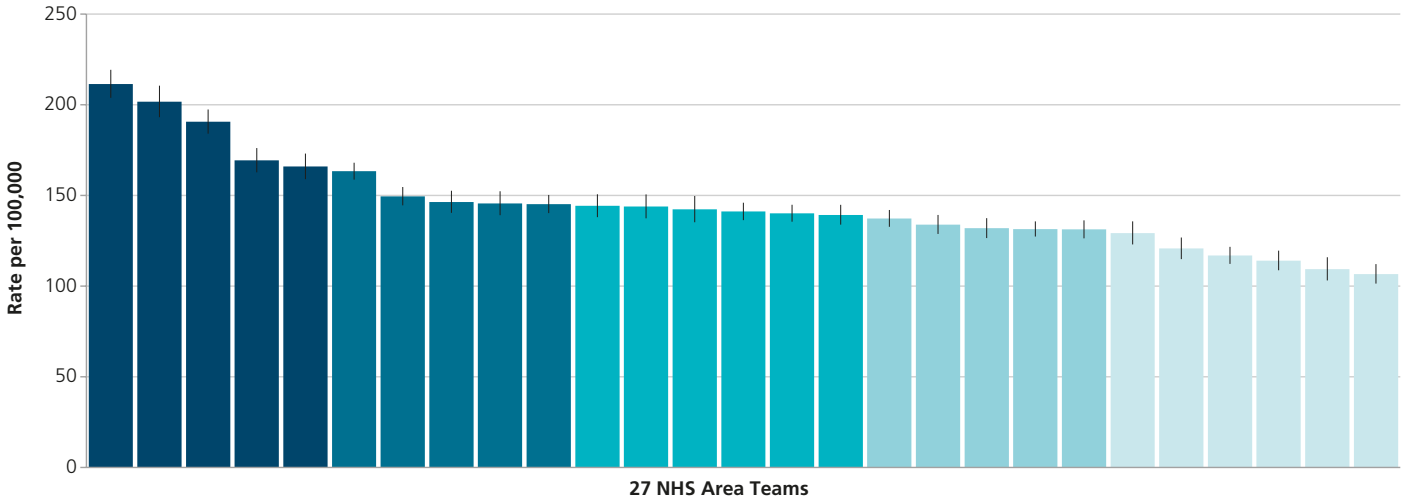
GENETIC TESTING

Map 68: Rate of overall genetic test reporting undertaken per population by NHS area team

Directly standardised by age 2011/12

Domain 1: Preventing people from dying prematurely
Domain 2: Enhancing quality of life for people with long-term conditions





Context

The NHS Directory of Genetic Disorders/Genes for Diagnostic Testing[1] (formerly entitled the NHS Directory of Genetic Testing) is a reference resource listing all the disorders and associated genes for the test services offered by member laboratories of the UK Genetic Testing Network (UKGTN) for patient care within the NHS. The UKGTN online database provides information on all tests associated with the conditions and genes in the Directory that have been recommended for NHS service. All the tests have been evaluated by the UKGTN for clinical validity and utility. The directory is updated annually to incorporate new tests approved for service from April each year to align with commissioning contracts. In Version 10 of the NHS Directory of Genetic Testing (2013), there are tests for 604 conditions, 810 genes, and 11 panel tests (a panel test is used to analyse in a single test several different genes associated with several different diseases that overlap in clinical presentation).

The UKGTN collected data on all eligible genetic test reports issued by its member molecular genetic laboratories for the period 1 April 2011 to 31 March 2012. Data were received from all the regional NHS molecular genetic laboratories in England. Exclusion criteria were necessary to ensure valid comparison of genetic test report activity between areas. Test reports for cytogenetic data are not included in this indicator.

Magnitude of variation

For NHS area teams in England, the rate of overall genetic test reporting undertaken ranged from 106.6 to 211.4 per 100,000 population (2.0-fold variation). In Figure 68.1, the rate of overall genetic test reporting undertaken per 100,000 population is shown for the four regions of England against the mean for England; the range is 138.2–152.4 per 100,000 population, and the variation is 1.1-fold.

It is likely that the degree of variation observed includes both warranted and unwarranted variation in test activity. Currently, it is not possible to identify the exact nature and contribution of the factors for the variation in these rates. Potential reasons for variation include differences in:

- the prevalence of inherited conditions in different local populations;
- the capacity for molecular genetic testing;
- access to testing;
- commissioning;
- clinical practice.

Options for action

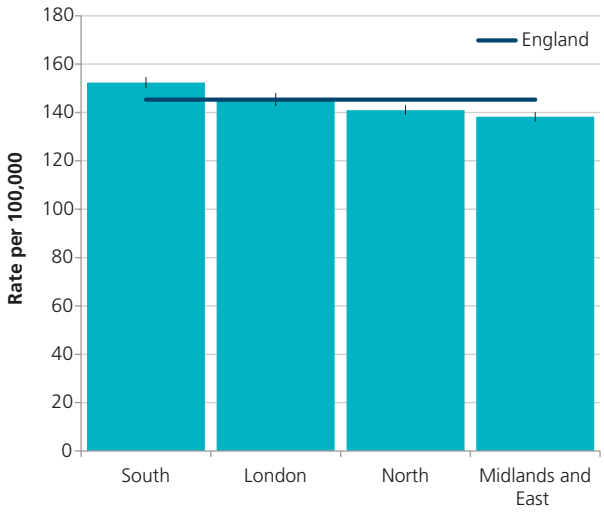
The UKGTN needs to work with commissioners and providers:

- to improve the quality of data collected and the scope of data collection;
- to understand the nature of the variation observed, whether it is warranted or unwarranted, and determine the reasons for that variation, especially to ensure that there is equity of access to genetic testing where needed.

RESOURCES

- UKGTN. Molecular genetic test rates in the United Kingdom 2011/12 (report scheduled for publication in Autumn 2013). http://www.ukgtn.nhs.uk/
- NHS Directory of Genetic Disorders/Genes for Diagnostic Testing. A list of diseases and genes for which tests are offered by UK Genetic Testing Network Laboratories. 1 Version 10, 01/04/2013. http://ukgtn.nhs.uk/fileadmin/uploads/ukgtn/Documents/Resources/Library/Reports_Guidelines/NHS_Directory_of_Genetic_Testing/UKGTN%20Directory%20of%20Genetic%20Testing%20version%20v10%20FINAL.pdf
- UK Genetic Testing Network (2011) Review of Commissioning Arrangements for Genetic Services and Strategic Recommendations. March 2011. http://ukgtn.nhs.uk/fileadmin/_migrated/tt_news/news_files/UKGTN_Review_of_Commissioning_Arrangements_for_Genetic_Services_01.pdf
- Human Genomics Strategy Group (2012) Building on our inheritance: genomic technology in healthcare. https://www.gov.uk/government/publications/genomic-technology-in-healthcare-building-on-our-inheritance

Figure 68.1: Rate of overall genetic test reporting undertaken per 100,000 population by region, directly standardised by age 2011/12



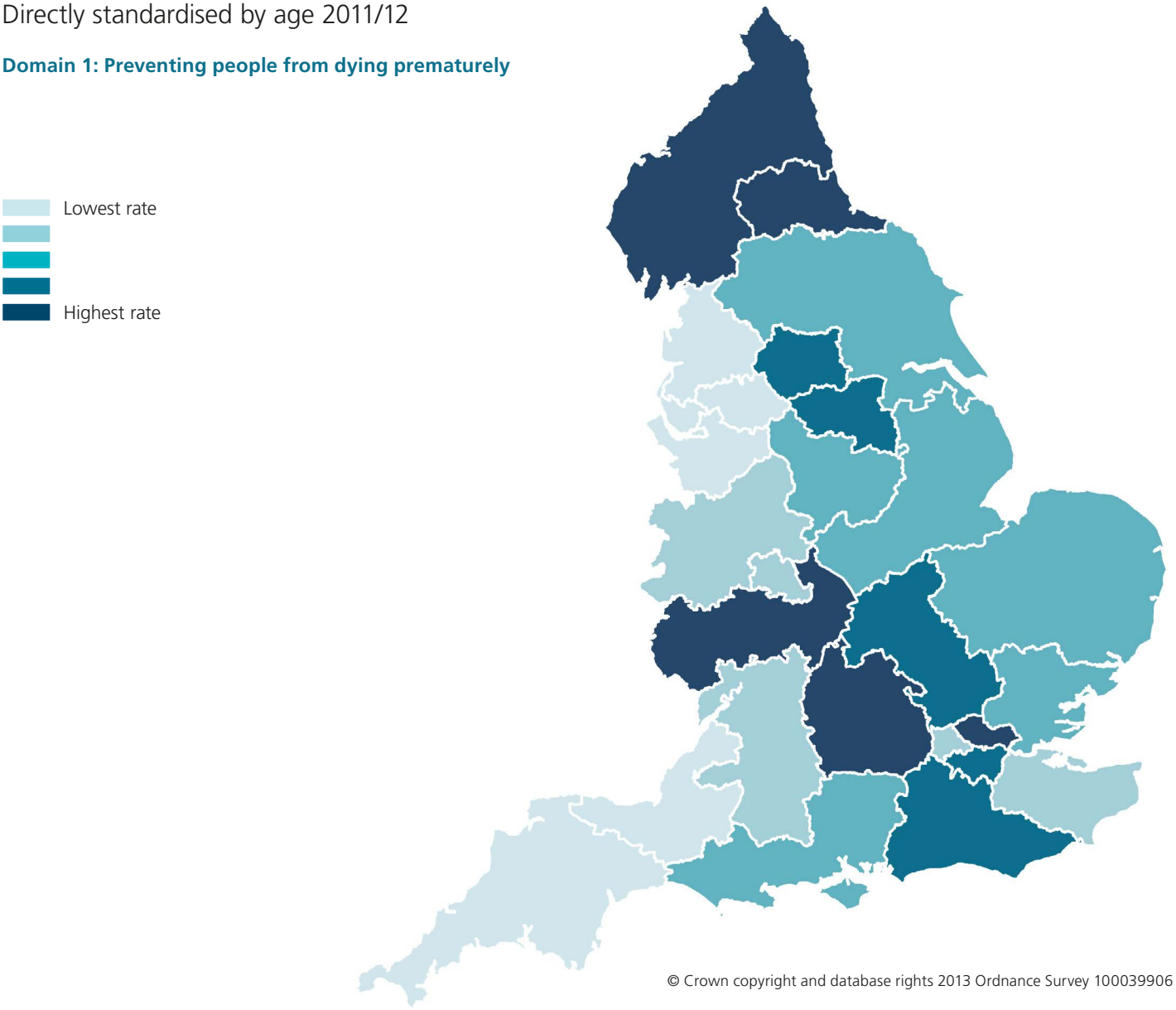
1 NHS Directory of Genetic Disorders/Genes for Diagnostic Testing. A list of diseases and genes for which tests are offered by UK Genetic Testing Network Laboratories. 1 Version 10, 01/04/2013. http://ukgtn.nhs.uk/fileadmin/uploads/ukgtn/Documents/Resources/Library/Reports_Guidelines/NHS_Directory_of_Genetic_Testing/UKGTN%20Directory%20of%20Genetic%20Testing%20version%20v10%20FINAL.pdf

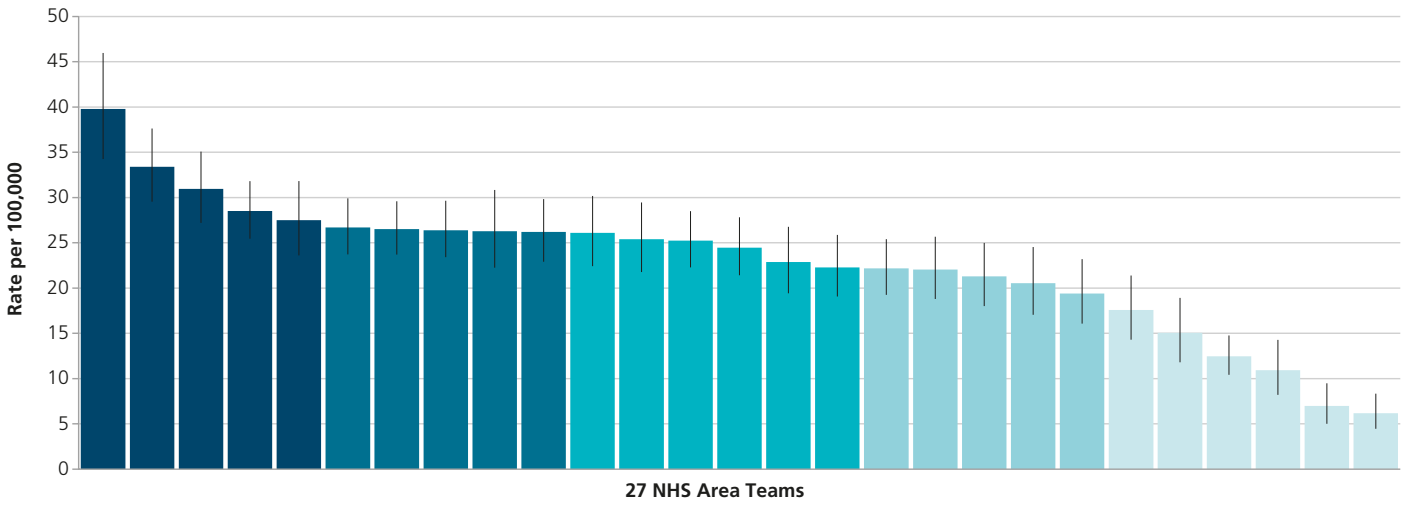
GENETIC TESTING

Map 69: Rate of breast cancer test reporting undertaken in women aged 15 years and over per population by NHS area team

Directly standardised by age 2011/12

Domain 1: Preventing people from dying prematurely





Context

Familial breast cancer is defined as a breast cancer that occurs in people in whose family there is an unusually high number of family members with breast, ovarian or a related cancer.

Mutations in several genes have been linked to a significant increase in the risk of breast cancer:

- BRAC1;
- BRAC2;
- TP53;
- PTEN;
- E-cadherin;
- STK11.

Genetic tests are available to identify mutations in the genes listed above, although TP53, PTEN, E-cadherin and STK11 are genes involved in rare conditions, and it is not routine to test for mutations in these genes for all familial breast cancer referrals.[1]

The majority of hereditary breast cancers result from inherited mutations in BRCA1 and BRCA2. Between 45 and 90 out of every 100 women with BRCA gene mutations will develop breast cancer at some point in their lives. In some ethnic populations, there are specific mutations in these genes that occur at a high frequency, for example, in people of Ashkenazi Jewish descent, there are three commonly occurring mutations in the BRCA genes for which testing is available.

NICE defines the criteria for referral to a specialist genetics clinic (see "Resources"). The criteria comprise specific combinations of factors in families, including:

- age at diagnosis of breast cancer in first- or second-degree relatives;
- occurrence of ovarian cancer at any age;
- occurrence of male breast cancer.

Additional criteria for referral to a specialist genetics clinic include:

- formal risk assessments in which the likelihood of there being a gene mutation in a family has been calculated at ≥10%;
- the increased risk of a person developing breast cancer.

Genetic testing for familial breast cancer can be offered to individuals who fulfil the appropriate NICE criteria. There are two types of testing:

1. Diagnostic testing or mutation searching/scanning, which is usually undertaken in a person who has or who has had breast cancer, to look for a mutated gene;
2. Predictive testing, in which a healthy individual is tested to determine whether they carry the same gene mutation as an affected relative.

The UKGTN collected data on all eligible genetic test reports issued by its member molecular genetic laboratories for the period 1 April 2011 to 31 March 2012. Data were received from all the regional NHS molecular genetic laboratories in England. Genetic test activity for breast cancer was identified. It is highly likely that the majority of this testing was for only BRCA1 and BRCA2. Exclusion criteria were necessary to ensure valid comparison of genetic test report activity among areas. Data for breast cancer tumour DNA tests are excluded.

Magnitude of variation

For NHS area teams in England, the rate of breast cancer test reporting undertaken in women aged 15 years and over ranged from 6.2 to 39.8 per 100,000 population (6-fold variation). In Figure 69.1 (page 192), the rate of breast cancer test reporting undertaken in women aged 15 years and over per 100,000 population is shown for the four regions of England against the mean for England; the range is 21.1–26.2 per 100,000 population, and the variation is 1.2-fold.

It is likely that the degree of variation observed in test activity includes both warranted and unwarranted variation. Currently, it is not possible to identify the exact nature and contribution of the factors for the variation in these rates. Potential reasons for variation include differences in:

- the prevalence of inherited breast cancer in different local populations;
- patient preference;
- capacity for the specific molecular genetic tests for breast cancer genes;
- access to testing;
- commissioning;
- clinical practice.

Options for action

The UKGTN needs to work with commissioners and service providers:

- to improve the quality of data collected and the scope of data collection;
- to understand the nature of the variation observed, whether it is warranted or unwarranted, and determine the reasons for that variation, especially to ensure that there is equity of access to breast cancer testing where needed.

RESOURCES

- NICE (2013) Familial breast cancer: classification and care of people at risk of familial breast cancer and management of breast cancer and related risks in people with a family history of breast cancer (CG164). http://guidance.nice.org.uk/CG164
- NICE Pathways. Familial breast cancer overview. http://pathways.nice.org.uk/pathways/familial-breast-cancer
- UKGTN. Molecular genetic test rates in the United Kingdom 2011/12 (report scheduled for publication in Autumn 2013). http://www.ukgtn.nhs.uk/
- UK Genetic Testing Network (2011) Review of Commissioning Arrangements for Genetic Services and Strategic Recommendations. March 2011. http://ukgtn.nhs.uk/fileadmin/_migrated/tt_news/news_files/UKGTN_Review_of_Commissioning_Arrangements_for_Genetic_Services_01.pdf

1 Variants in several other genes alter the risk of breast cancer but testing for these variants is not routinely available

Additional visualisations for Maps 23, 25, 27, 29, 30 and 69

Figure 23.1: Rate of audiology assessments commissioned per 1000 population January 2007 to March 2013[1]

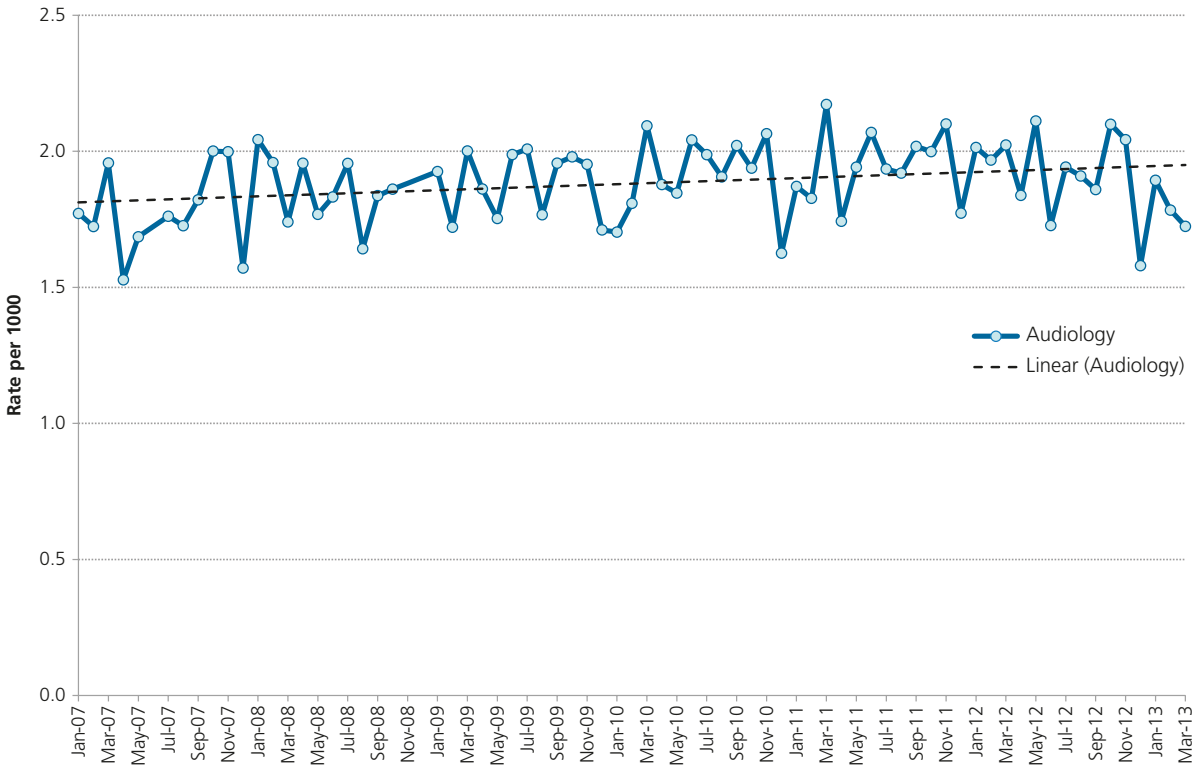
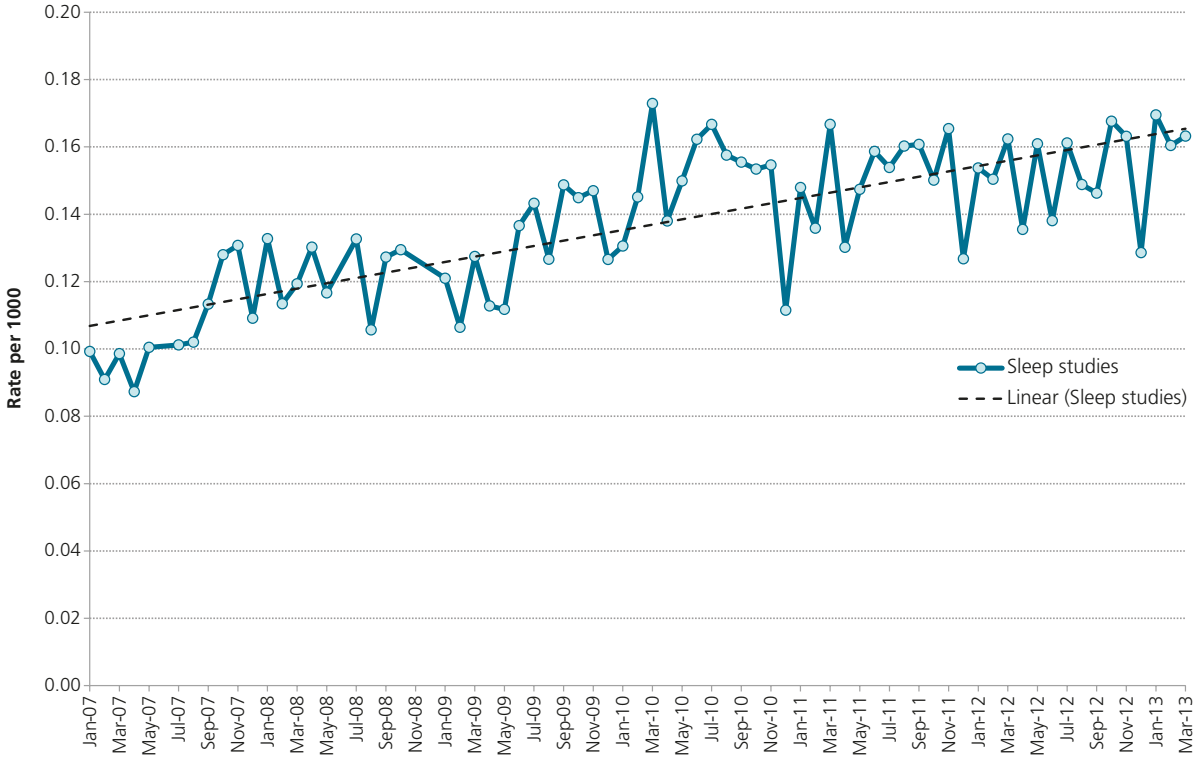


Figure 25.1: Rate of respiratory physiology sleep studies commissioned per 1000 population January 2007 to March 2013[2]



1 Source: Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01); data from June 2007, November 2008 and December 2008 have been removed due to data quality.

2 Source: Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01); data from June 2007, June 2008, November 2008 and December 2008 have been removed due to data quality.

Figure 27.1: Rate of urodynamic (pressures and flows) tests commissioned per 1000 population from January 2007 to March 2013[1]

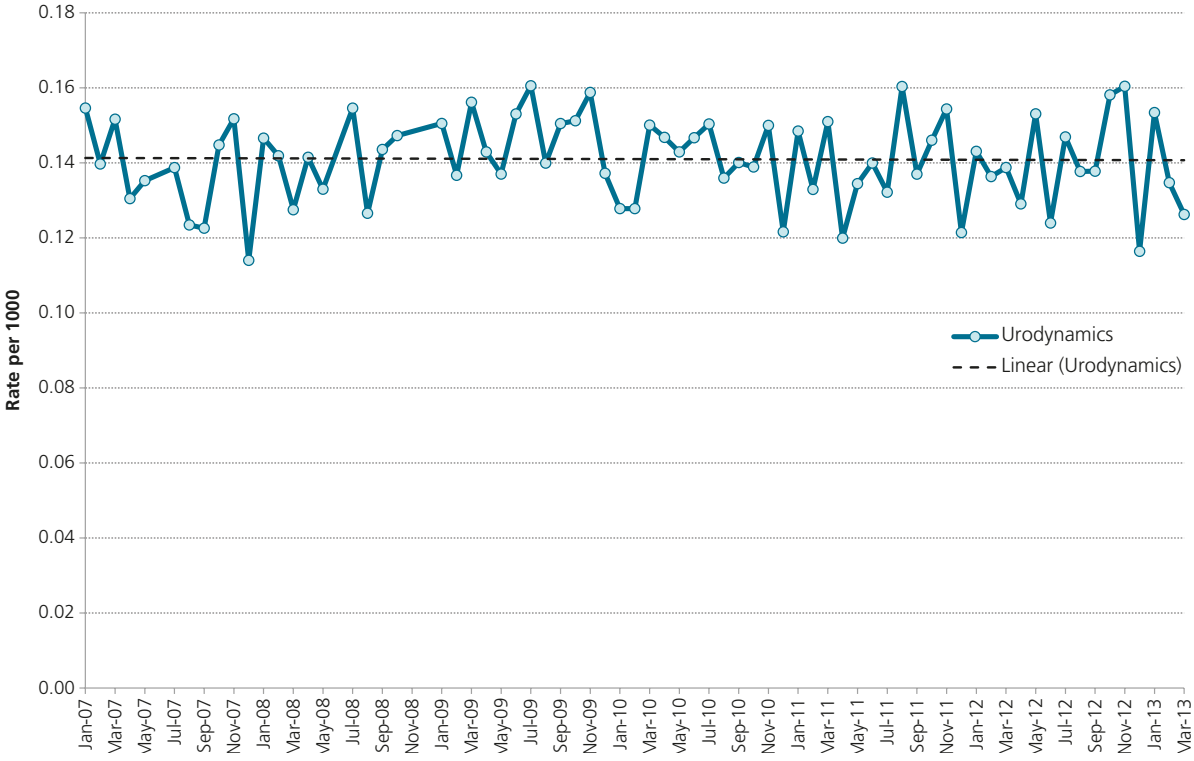
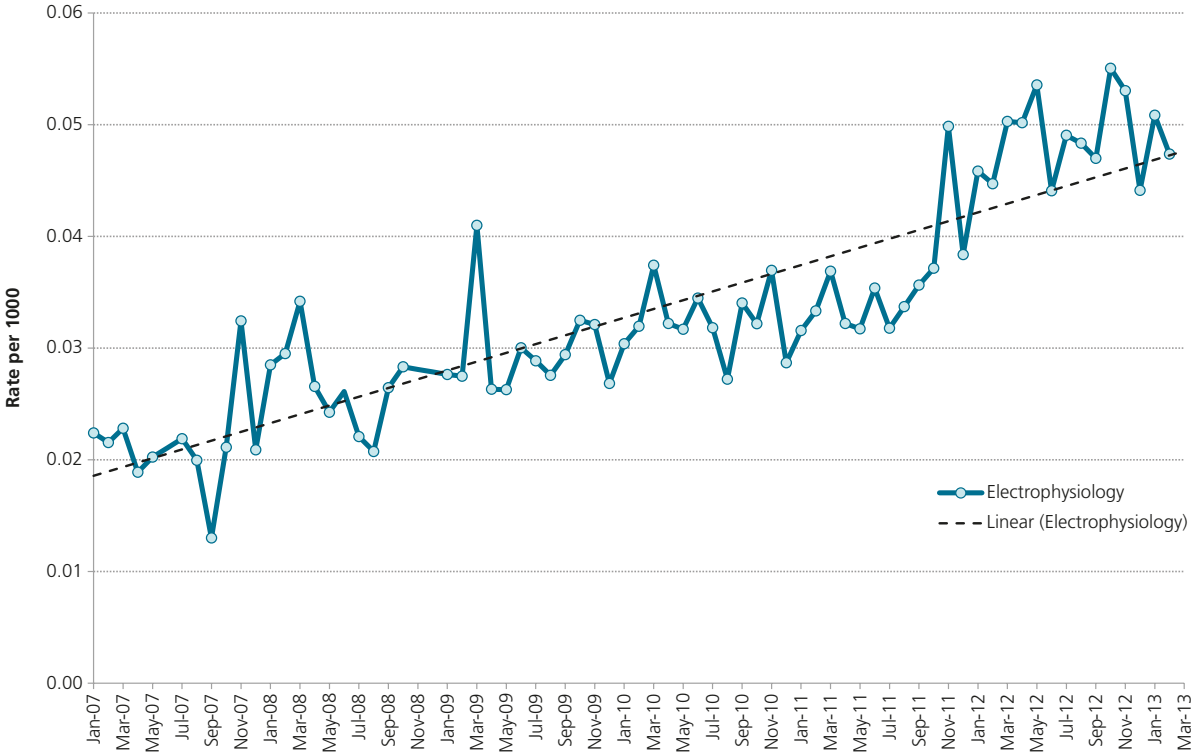


Figure 29.1: Rate of diagnostic invasive electrophysiology activity commissioned per 1000 population from January 2007 to March 2013[3]



3 Source: Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01); data from June 2007, November 2008, December 2008 and March 2013 have been removed due to data quality.

Figure 30.1: Rate of peripheral neurophysiology tests commissioned per 1000 population from January 2007 to March 2013[4]

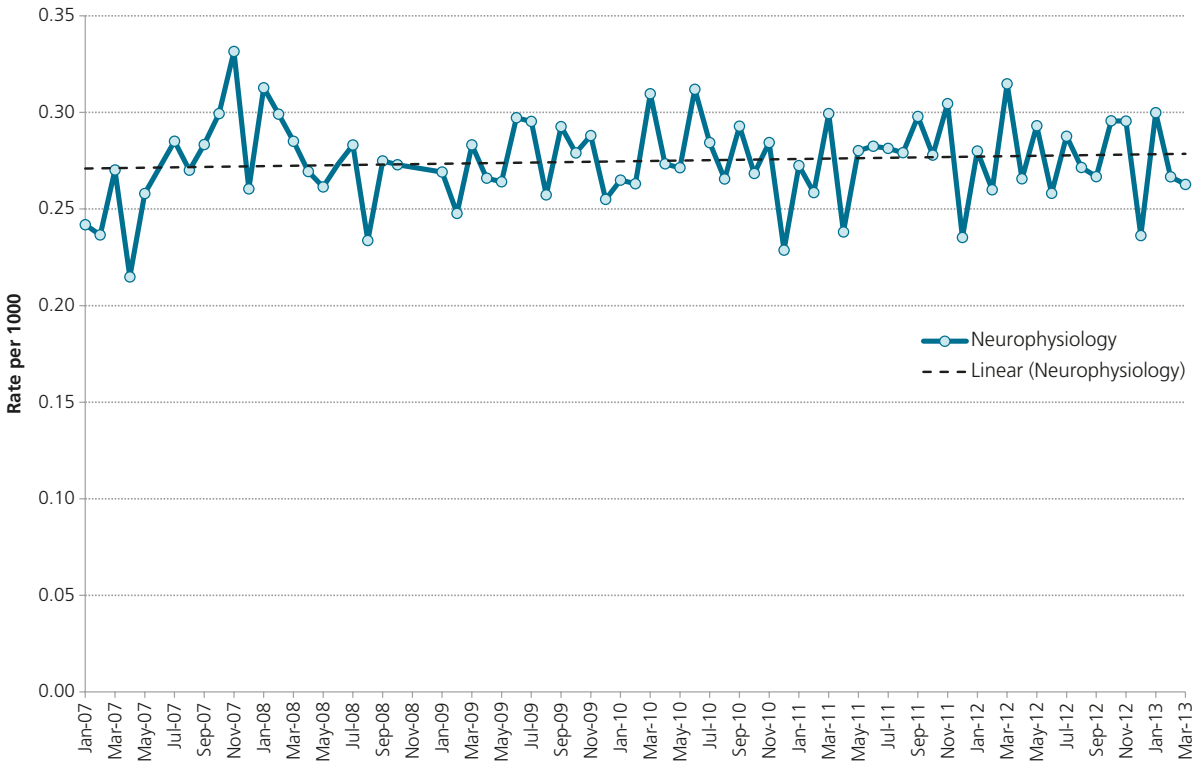
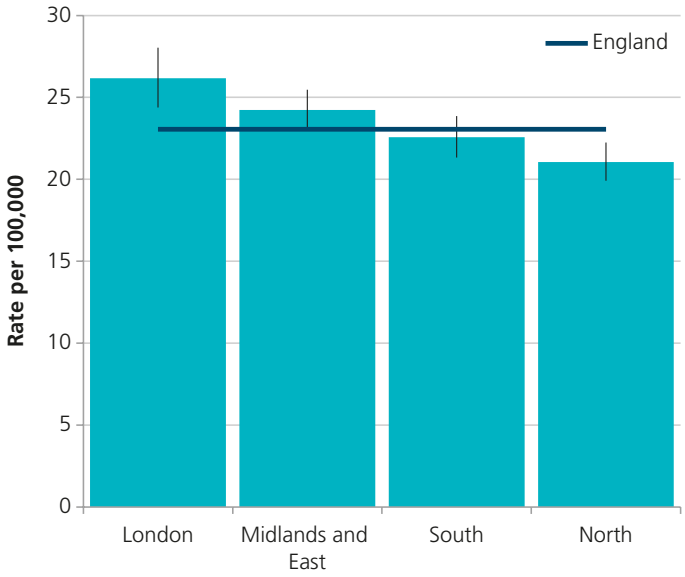


Figure 69.1: Rate of breast cancer test reporting undertaken in women aged 15 years and over per population by region
Directly standardised by age 2011/12



4 Source: Diagnostic waiting times reporting of the monthly waiting times and activity reporting (DM01); data from June 2007, November 2008 and December 2008 have been removed due to data quality.

Case-study

Innovations in major system reconfiguration in England: a study of the effectiveness, acceptability and processes of implementation of different models of stroke care

Background

Significant changes in provision of clinical care within the English National Health Service (NHS) have been discussed in recent years, with the proposal to concentrate specialist services, such as major trauma, cardiac surgery, and specialist paediatrics, in fewer centres serving larger populations. The case for such change in stroke services was strong, with clear evidence of unacceptable variations in the quality of care, with many patients not receiving timely, evidence-based care.

Major system change for stroke was prompted by the publication of the Department of Health's National Stroke Strategy (2007), and London and Greater Manchester led the way in this process. This involved a radical re-organisation of hospital and community services in both areas, summarised in Figure CS1.1.

Before reconfiguration, in both London and Greater Manchester, suspected stroke patients were taken to the nearest hospital with an Accident and Emergency service, then passed on to a specialist stroke unit or general medical ward.

In London before reconfiguration, stroke services were provided by over 30 hospitals. After reconfiguration, a system was implemented that featured the following services in a network:

- 8 Hyperacute Stroke Units (HASUs), providing rapid access to stroke specialists, scanning and interventions, including thrombolysis, 24 hours per day, seven days per week;
- 24 Stroke Units, providing acute rehabilitation services;
- 5 organisations had all stroke services withdrawn.

Any person presenting with a suspected stroke is transferred to a HASU for assessment and treatment, then repatriated to a Stroke Unit, to a nursing home, or to their own home (see Figure CS1.1). The reconfigured London model was implemented in July 2010.

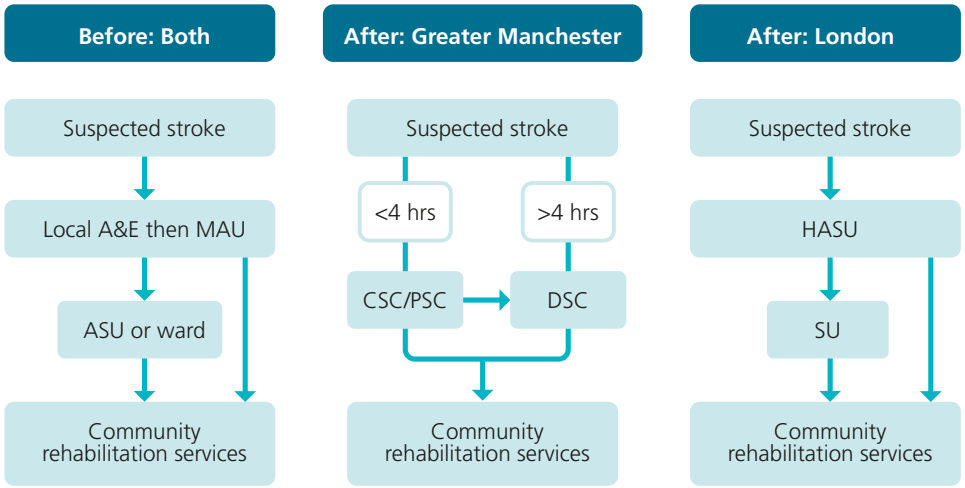
In Greater Manchester's reconfigured model, the system is organised as follows:

- the local population is now served by 10 hospital Trusts, each providing District Stroke Centre (DSC) services;
- one of these Trusts also hosts a Comprehensive Stroke Centre (CSC), which offers hyperacute stroke services in a neurosciences centre with access to interventional neuroradiology and neurosurgery (24 hours per day, seven days per week);
- two of these Trusts host Primary Stroke Centres (PSCs), providing thrombolysis (from 7 am to 7 pm, Monday to Friday).

Any individual presenting within four hours of developing stroke symptoms is transferred to either the CSC or PSC for hyperacute care; once stable, he or she is repatriated to a DSC, to a nursing home, or their own home (see Figure CS1.1). If presenting outside this four-hour "window", stroke patients in Greater Manchester are taken to the DSC to which they are nearest, much as they were prior to reconfiguration. In Manchester, the reconfiguration was achieved in a step-wise fashion, commencing in December 2008 and completed in April 2010.

In 2012, Greater Manchester began preparations for further reconfiguration of their services, and NHS organisations in the Midlands and the East of England began discussing proposals to reconfigure their stroke services.

Figure CS1.1. Overview of stroke service models – before and after reconfiguration



Case-study

Aims of the research

The evaluation aims to bring together quantitative data on "What works and at what cost?" with qualitative data on "understanding implementation and sustainability" to understand major system change in a range of settings across the English NHS.

Our research questions are:

1. What are the key processes of, and factors influencing, the development and implementation of the stroke service reconfigurations?
2. To what extent have system changes delivered process and outcome improvements?
3. Have changes delivered improvements that stakeholders (e.g. commissioners, staff, patients and the public, and reconfiguration leads) think are worthwhile?
4. Have changes delivered value for money?
5. How is service reconfiguration influenced by the wider context of major structural change in the NHS?

Approach

These questions will be addressed using existing data relating to the quality of care before, during and after the reconfigurations took place. Routinely collected data on patients experiencing stroke services, covering the whole of the English NHS, will be analysed to examine the extent to which reconfigurations have made a difference to the clinical processes provided, patient outcomes, such as mortality and length of stay, and the cost of services.

We are also conducting a series of case-studies based on stakeholder interviews and analysis of documents. These will identify drivers for change, and how the reconfigurations were governed, developed, and implemented.

The original reconfigurations of stroke services in Greater Manchester and London are being studied retrospectively. The further changes in Greater Manchester and reconfigurations under discussion or planned across the Midlands and the East of England are being studied concurrently.

It is likely that health services will continue to be reconfigured. Other parts of the English NHS are now seeking to reconfigure their stroke services. Other services, such as major trauma, are being, or are planned to be, reconfigured. The lessons drawn from this evaluation will help ensure these efforts are carried out in an effective and evidence-based way.

Outputs

In addition to traditional research outputs, such as journal articles and conference papers, stakeholders will receive regular updates on progress and any relevant learning as the evaluation progresses.

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Study website (including study protocol):
http://www.ucl.ac.uk/dahr/research_pages/stroke_study

Glossary of Technical Terms

Imaging services

Abbreviated Injury Scale (AIS)

The Abbreviated Injury Scale (AIS) is an anatomical scoring system introduced in 1969. It has been revised and updated against survival so that it now provides a reasonably accurate way of ranking the severity of injury on a scale of 1 to 6, with 1 being minor, 5 severe and 6 an injury from which a patient will not survive. The scale represents the 'threat to life' associated with an injury and is not meant to represent a comprehensive measure of severity.

Contrast medium

A contrast medium (or agent) is a substance used to enhance the contrast of structures or fluids within the body. It is commonly used to enhance the visibility of blood vessels or the gastro-intestinal tract.

Double-contrast images

Double-contrast images are taken of the lower intestine using barium and air to look for abnormalities.

Fragility fracture

A fragility fracture is one that results from mechanical forces that would not ordinarily cause fracture in a healthy young adult.

Glasgow Coma Scale (GCS)

The Glasgow Coma Scale (GCS) is a reliable and universally comparable way of recording the conscious state of a person. The GCS is used to help predict the progression of a person's condition. Three types of response are measured:

- the best motor response;
- the best verbal response;
- eye opening.

Each of these responses is allocated a score, and the lowest score for each type of response is 1. The scores for each type of response are added together to give a total score, therefore, the lowest total score is 3, indicating no response to pain + no verbalisation + no eye opening. Thus, a low score indicates a low conscious state:

- a GCS of ≤8 indicates severe injury;
- a GCS of 9–12 indicates moderate injury;
- a GCS of 13–15 indicates a minor injury.

Graft/grafting

A stent-graft is a tubular structure composed of two parts. The stent is a mesh-like structure made of metal (such as stainless steel). Its function is to provide support to the graft. The graft is composed of a special fabric impervious to blood, and lines the stent. The stent-graft is packed in small diameter tubes and expands to its original diameter when released from these tubes. It is threaded into the blood vessel where an aneurysm is located. The stent graft is expanded like a spring to hold tightly against the wall of the blood vessel and cut off the blood supply to the aneurysm.

Megacolon

Megacolon is abnormal dilation of the colon.

Micro-particles

Micro-particles are spheres or beads released to block blood flow to vascular uterine fibroids.

Osteopenia

Osteopenia refers to early signs of bone loss, where bone mineral density is lower than normal but not yet low enough to be considered osteoporosis.

Osteoporosis

Osteoporosis is a condition that affects the bones, causing them to become weak and fragile and more likely to break.

Papilloedema

Papilloedema is swelling of the optic disc(s) secondary to raised intracranial pressure. It is most usually bilateral.

Thrombolysis

Thrombolysis is the breakdown (lysis) of blood clots by pharmacological means. It is often referred to as "clot busting" for this reason.

Endoscopy services

Abdominal radiation injury

Almost all patients undergoing radiation to the abdomen, pelvis, or rectum will show signs of acute enteritis (inflammation of the intestine). Therapeutic radiation affects not only malignant tumours but also surrounding normal tissues. In general, the higher the daily and total dose delivered to the normal bowel and the greater the volume of normal bowel treated, the greater the risk of radiation enteritis.

Capsule endoscopy

Capsule endoscopy involves swallowing a small capsule containing a colour camera, battery, light source and transmitter. Once swallowed the camera moves naturally through the digestive tract. Approximately eight hours after ingesting the camera, patients return and the recording device is removed, the images are downloaded to a computer and evaluated. The capsule is disposable and will be passed naturally in the bowel movement.

Device-assisted enteroscopy

Device-assisted enteroscopy includes double-balloon enteroscopy (DBE), single-balloon enteroscopy (SBE), and spiral enteroscopy (SE). Device-assisted enteroscopy has both diagnostic and therapeutic capabilities. The technique allows an endoscopist access to areas of the small intestine that were previously inaccessible. This technique was introduced almost at the same time as capsule endoscopy and roughly 10% of those patients will need enteroscopy for further evaluation or for imparting therapy.

Dysphagia

Dysphagia is the term used to describe difficulty in swallowing. Dysphagia is usually caused by nerve or muscle problems and may occur after a stroke, throat and mouth cancer, gastro-oesophageal reflux disease (GORD), or as a symptom of several different neurological conditions. Pain can cause dysphagia, because pain in the throat may make swallowing difficult.

Endoscope

An endoscope is a medical device consisting of a long, thin, flexible (or rigid) tube with a light and a video camera, which is used to examine the interior surfaces of an organ or tissue. Images of the inside of the patient's body can be seen on a screen. The examination can be recorded so that doctors can review it after the procedure. The endoscope can also be used for enabling biopsies and retrieving foreign objects.

Enteropathy

Enteropathy is any pathology of the intestine.

Eosinophilic oesophagitis

Eosinophilic oesophagitis is characterised by the infiltration of a large number of eosinophils, a type of white blood cell, in the oesophagus. Eosinophils are an important part of the immune system, helping to fight off certain types of infections, such as parasites. A variety of stimuli may trigger this abnormal production and accumulation of eosinophils, including certain foods. Eosinophilic oesophagitis means eosinophils infiltrating the oesophagus and causing swelling. People with eosinophilic oesophagitis commonly have other allergic diseases such as asthma or eczema.

Gastro-oesophageal reflux disease (GORD)

Gastro-oesophageal reflux disease (GORD) is a common condition in which stomach acid leaks out of the stomach and into the oesophagus. Common symptoms include heartburn and regurgitation caused by stomach acid coming back up into the mouth, creating a sour taste in the mouth and pain and/or difficulty swallowing.

Inflammatory bowel disease (IBD)

Inflammatory bowel disease (IBD) is a term used mainly to describe two diseases: Crohn's disease and ulcerative colitis. Both are chronic diseases that involve inflammation of the gastro-intestinal tract. Ulcerative colitis affects only the colon whereas Crohn's disease can affect the entire digestive tract.

Minimally invasive procedure

A minimally invasive procedure is one that is carried out by entering the body through the skin or through a body cavity or anatomical opening, but with the smallest damage possible to these structures.

Polyps

Polyps are small growths on the inner lining of the bowel or rectum. They are quite common and do not usually cause symptoms. Polyps are not usually cancerous, although they may become cancerous if left untreated.

Staging of malignancy

Staging describes the severity of a person's cancer based on the size and/or extent (reach) of the original (primary) tumour and whether cancer has spread in the body. It is based on knowledge of the way cancer progresses. It gives health professionals a transferrable common terminology. Staging is important to help plan the appropriate treatment, estimate prognosis and identify suitable clinical trials.

Stricture

An intestinal stricture, also known as a stenosis, is a narrowing of a tubular part of the body.

Transmural disease

Transmural disease involves all the layers of the bowel rather than just the mucosa and sub-mucosa.

Physiological diagnostics services

Ambulatory urodynamics

Ambulatory urodynamics is a test that assesses the way in which the bladder works. Patients pass urine into a special toilet that records the amount and the rate at which urine flows. An ultrasound scan may be done to check the bladder is empty. Two fine tubes are passed, one into the bladder and one into the rectum (back passage). An "electronic" continence pad, connected to a special recorder, will record any leaks while normal activities are performed for several hours.

Cystometrogram or video-cystometrogram

A cystmetrogram is a diagnostic procedure used to evaluate bladder function.

Herceptin

Herceptin, also known as Trastuzumab, is a monoclonal antibody – a type of targeted treatment that can control the growth of cancer cells, which produce excess human epidermal growth factor receptor 2 (HER2).

Narcolepsy

Narcolepsy is a long-term neurological condition that disrupts normal sleeping patterns.

Peripheral nervous system (PNS)

The peripheral nervous system (PNS) consists of the nerves and ganglia outside of the brain and spinal cord. The main function of the PNS is to connect the central nervous system (CNS) to the limbs and organs.

Polysomnography

Polysomnography is a sleep study.

Radiofrequency ablation and radiofrequency electrical energy

Radiofrequency energy (low-voltage, high-frequency electricity) is targeted using special wires or catheters threaded into the heart, toward the area(s) causing an abnormal heart rhythm, permanently damaging small areas of tissue with heat (radiofrequency ablation).

Stress echocardiography

Stress echocardiography is a test that uses ultrasound to show how well heart muscle is working. It is mainly used to detect a decrease in blood flow to the heart.

Uroflowmetry

Uroflowmetry measures the volume of urine released from the body, the speed with which it is released, and how long the release takes.

Valvular heart disease

Valvular heart disease is any disease process involving one or more of the valves of the heart (the aortic and mitral valves on the left, and the pulmonary and tricuspid valves on the right).

Vestibular disorders

A vestibular disorder is a balance disorder originating in the inner ear. There are many causes of vestibular disorder.

Pathology services

Albumin

Albumin is a protein made by the liver. It is the main protein of plasma.

Alcoholic myopathy

Alcoholic myopathy is muscle weakness, cramps or spasm, and muscle stiffness seen in people who consume harmful levels of alcohol.

Anti-cyclic citrullinated peptide

Anti-cyclic citrullinated peptide is a blood test that detects auto-antibodies which can be present in the blood of people with rheumatoid arthritis.

Atheromatous plaques

Atheromatous plaques are commonly referred to as a hardening or furring of the arteries.

Bacterial endocarditis

Bacterial endocarditis is inflammation of the inner tissue of the heart (such as its valves) caused by infection.

C-Reactive protein (CRP) testing

The C-reactive protein (CRP) test is a blood test used to detect the presence and amount of inflammation.

Chronic hepatitis

Chronic hepatitis is an inflammatory disease of the liver lasting for more than six months.

Cisplatin therapy

Cisplatin is a chemotherapy drug.

Dermatomyositis

Dermatomyositis is an uncommon inflammatory disease marked by muscle weakness and a distinctive skin rash.

Dyslipidaemia

Dyslipidaemia is an abnormal amount of lipids (e.g. cholesterol and/or fat) in the blood.

Familial hypercholesterolaemia

Familial hypercholesterolaemia is an inherited condition, in which the level of low-density lipoprotein (LDL) cholesterol in the blood is higher than normal from birth.

Familial hyperlipidaemia

Familial hyperlipidaemia, also known as primary hyperlipidaemia, is caused by specific genetic abnormalities.

Glomeruli

Glomeruli are tiny tufts of capillaries which carry and filter blood.

Haemochromatosis

Haemochromatosis is a genetic disorder causing the body to absorb too much iron from the diet.

Hyperuricaemia

Hyperuricaemia is an abnormally high level of uric acid in urine.

Intrinsic factor

Intrinsic factor is a protein essential for absorption of vitamin B12.

Intercurrent illness

Intercurrent illness is a disease occurring during the course of another disease with which it has no connection.

Leukaemia

Leukaemia is cancer of the white blood cells.

Metabolic syndrome

Metabolic syndrome is the medical term for a combination of diabetes, high blood pressure and obesity.

Mono-arthropathy

Mono-arthropathy is inflammation of a single joint.

Myocardial infarction

A myocardial infarction is a heart attack.

Myocarditis

Myocarditis is inflammation of the heart muscle.

Myositis

Myositis is inflammation of the muscles.

Nephrotic syndrome

Nephrotic syndrome is a condition of the kidney in which large amounts of protein leak from the blood into urine.

Pituitary gland

The pituitary gland is a small pea-sized gland found just below the base of the brain. It produces hormones that regulate many activities of other endocrine glands and plays a major role in regulating vital body functions and general well-being.

Polymyalgia

Polymyalgia is an inflammatory condition that causes pain in the muscles.

Pre-eclampsia

Pre-eclampsia is a condition characterised by high blood pressure and significant amounts of protein in the urine of a pregnant woman.

Primary biliary cirrhosis

Primary biliary cirrhosis is a long-term liver disease that damages the small bile ducts in the liver.

Pulmonary embolus

A pulmonary embolus is a blockage of the main artery of the lung, or one of its branches, most often caused by a blood clot.

Semi-quantitative test

A semi-quantitative test gives the amount of analytes relative to other analytes, rather than as an exact amount of a specific analyte.

Sjögren's syndrome

Sjögren's syndrome is a systemic auto-immune disease characterised by chronic inflammation and dysfunction of glands that secrete their products into ducts, which results in a dry mouth and dry eyes. Sjögren's syndrome also causes systemic inflammation and sometimes the development of B-cell lymphoma, thus severely compromising the physical and mental health of people with the condition.

Systemic lupus erythematosus

Systemic lupus erythematosus is an auto-immune disease, which means the body's immune system mistakenly attacks healthy tissue.

Tachyarrhythmia

A tachyarrhythmia is a disturbance of the heart rhythm in which the heart rate is abnormally increased.

Thyroiditis

Thyroiditis is inflammation of the thyroid gland.

Troponins

Troponins are proteins that are released when the heart muscle has been damaged, such as by a heart attack.

Glossary of Essential Terms

Introduction

Much of the disagreement that occurs during the commissioning or management of services arises because different people use the same term but have a different understanding of its meaning. This Glossary is provided to help develop a shared or common language. If there is a clear, short or memorable definition from the literature, this has been cited and presented in italics; where definitions in the literature do not meet any of these criteria, Right Care has composed and provided a definition.

Access to healthcare

Facilitating access is concerned with helping people to command appropriate health care resources in order to preserve or improve their health. There are at least four aspects.

1. *If services are available, in terms of adequate supply of services, then a population may 'have access' to health care.*
2. *The extent to which a population 'gains access' to health care also depends on financial, organisational and social or cultural barriers that limit utilisation. Thus utilisation is dependent on the affordability, physical accessibility and acceptability of services and not merely the adequacy of supply.*
3. *The services available must be relevant and effective if the population is to 'gain access to satisfactory health outcomes'.*
4. *The availability of services, and barriers to utilisation, have to be evaluated in the context of differing perspectives, health needs and the material and cultural settings of diverse groups in society.*

Source: Gulliford M et al (2001) *Access to Health Care. Report of a Scoping Exercise for the National Co-ordinating Centre for NHS Service Delivery and Organisation R&D (NCCSDO).* http://www.kcl-phs.org.uk/martin/reprints/accessscopingexercise_report.pdf

Appropriate

A procedure is termed appropriate if its benefits sufficiently outweigh its risks to make it worth performing …

Source: Kahan JP et al (1994) Measuring the necessity of medical procedures. *Medical Care* 32: 352-365.

Audit

While inspection has traditionally focused on organizational systems and processes, rather than the assessment of internal control systems, audit has usually been the mechanism for examining internal controls (…). However, audit is more associated with stewardship of resources, whereas inspection traditionally is primarily concerned with 'professional and service standards' (…).

Source: Scrivens E (2005) *Quality, Risk and Control in Health Care*. Open University Press (page 128).

Average, *see* ***Mean***

British National Formulary (BNF)

The British National Formulary is a joint publication of the British Medical Association and the Royal Pharmaceutical Society. It provides prescribers, pharmacists and other healthcare professionals with up-to-date information about the use of medicines.

Burden of disease

The burden of disease is a measurement of the gap between a population's current health and the optimal state where all people attain full life expectancy without suffering major ill-health.

Source: World Health Organization. Health Promotion Glossary Update. [Modified definition (WHO, 2000).] http://www.who.int/healthpromotion/about/HPR%20Glossary_New%20Terms.pdf

Care pathway

… the expected course of events in the care of a patient with a particular condition, within a set timescale.

Source: Kitchiner D, Davidson D, Bundred P (1996) Integrated Care Pathways: effective tools for continuous evaluation of clinical practice. *J Eval Clin Pract* 2; 65-69.

Clinical guidelines

… systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific circumstances.

Source: Timmermans S, Berg M (2003) *The Gold Standard. The challenge of evidence-based medicine and standardization in health care*. Temple University Press, Philadelphia .

Commissioner

… to be the advocate for patients and communities, securing a range of appropriate high-quality health care services for people in need [and] to be the custodian of tax-payers' money; this brings a requirement to secure best value in the use of resources.

Source: House of Commons Health Committee (2010) Commissioning. Fourth Report of Session 2009-10. Volume 1. http://www.publications.parliament.uk/pa/cm200910/cmselect/cmhealth/268/268i.pdf

Commissioning

Commissioning in the NHS is the process of ensuring that the health and care services provided effectively meet the needs of the population. It is a complex process with responsibilities ranging from assessing population needs, prioritising health outcomes, procuring products and services, and managing service providers.

Source: Department of Health (2010) Commissioning [Archived content]. http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/managingyourorganisation/commissioning/index.htm

Confidence intervals

Confidence intervals give the range within which the true size of a treatment effect (which is never precisely known) lies, with a given degree of certainty (usually 95% or 99%).

Source: Evans I, Thornton H, Chalmers I (2006) *Testing Treatments. Better Research for Better Healthcare*. The British Library.

Costs

Cost is not solely financial. Cost may be measured as the time used, the carbon produced, or the benefit that would be obtained if the resources were used for another group of patients (i.e. the opportunity cost).

Culture

Culture is the shared tacit assumptions of a group that it has learned in coping with external tasks and dealing with internal relationships.

Source: Schein EH (1999) *The Corporate Culture Survival Guide*. John Wiley & Sons (page 186).

Deprivation

Deprivation is a concept that overlaps, but is not synonymous with poverty. Absolute poverty can be defined as the absence of the minimum resources for physical survival, whereas relative poverty relates to the standards of living in a particular society at a specific time. The different concepts of deprivation include the following:

- *Material deprivation, which reflects the access people have to material goods and resources. Access to these goods and resources enables people "to play the roles, participate in relationships and follow the customary behaviour which is expected of them by virtue of their membership in society" (as described by Townsend).*
- *Social deprivation has been separately distinguished as relating to people's roles and relationships, membership and social contacts in society.*
- *Multiple deprivation relates to the occurrence of several forms of deprivation concurrently, such as low income, poor housing, and unemployment. This can be particularly stressful for families.*

Source: http://www.show.scot.nhs.uk/publications/isd/deprivation_and_health/background.HTM

Effective care

The extent to which an intervention, procedure regimen, or service produces a beneficial outcome under ideal circumstances (e.g., in a randomized controlled trial).

Source: Canadian Agency for Drugs and Technologies in Health (2009) *Optimal Therapy Report: Cost effectiveness of blood glucose test strips in the management of adult patients with diabetes mellitus*. Volume 3, Issue 3.

Efficiency

See also ***Productivity***

… efficiency can be defined as maximising well-being at the least cost to society.

Source: Mitton C, Donaldson C (2004) Priority setting toolkit. A guide to the use of economics in healthcare decision making. BMJ Publishing Group.

Equity

Equity is a subjective judgment of fairness.

Evidence

Evidence is generally considered to be information from clinical experience that has met some established test of validity, and the appropriate standard is determined according to the requirements of the intervention and clinical circumstance. Processes that involve the development and use of evidence should be accessible and transparent to all stakeholders.

Source: Olsen LA, Goolsby WA, McGinnis JM; Roundtable on Evidence-Based Medicine (2009) *Leadership Commitments to Improve Value in Health Care: Finding Common Ground: Workshop Summary*. National Academies Press. Free to download at:
http://www.nap.edu/catalog.php?record_id=11982

Health

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Source: Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19 June-22 July 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. The definition has not been amended since 1948.
http://www.who.int/suggestions/faq/en/index.html

Health needs

… objectively determined deficiencies in health that require health care, from promotion to palliation.

Source: World Health Organization (WHO). Health Systems Strengthening Glossary. http://www.who.int/healthsystems/hss_glossary/en/index.html

Healthy life-expectancy

See also ***Life-expectancy*** *and* ***Life-expectancy at birth***

Average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury.

Source: World Health Organization (WHO) Health statistics and health information systems. Health Status Statistics: Mortality.
http://www.who.int/healthinfo/statistics/indhale/en/

Index of Multiple Deprivation (IMD)

See also ***Deprivation***

The English Indices of Multiple Deprivation identify the most deprived areas across the country. They combine a number of indicators, chosen to cover a range of economic, social and housing issues, into a single deprivation score for each small area in England. The Indices are used widely to analyse patterns of deprivation, identify areas that would benefit from special initiatives or programmes and as a tool to determine eligibility for specific funding streams.

Source: Office of National Statistics. Index of Multiple Deprivation. What is the Index of Multiple Deprivation?
http://www.ic.nhs.uk/services/population-geography-information/geographical-information/index-of-multiple-deprivation

Inequalities in health

Inequalities in health are objectively measured differences in health status, healthcare access and health outcomes.

Input, Output and Outcome

Input is a term used by economists to define the resources used, such as the number of hospital beds, to produce the output, such as the number of patients admitted per bed per year.

The economists' terminology is different from the language utilised in quality assurance, in which the terms structure, process and outcome are used. Input equates to structure and process, i.e. the number of beds and the number of admissions per bed, respectively. However, the outcome is distinct from the output. Outcome includes some measure of the effect the process has had on the patients, for example, the number of patients who were discharged to their own home.

Integrated care

Clinical integration, where care by professionals and providers to patients is integrated into a single or coherent process within and/or across professions such as through use of shared guidelines and protocols.

Source: Kodner DL, Spreeuwenberg C (2002) Integrated care: meaning, logic, applications and implications – a discussion paper. *International Journal of Integrated Care* 2: 1-6.

International Classification of Diseases (ICD)

The International Classification of Diseases is the standard diagnostic tool for epidemiology, health management and clinical purposes. This includes the analysis of the general health situation of population groups. It is used to monitor the incidence and prevalence of diseases and other health problems.

It is used to classify diseases and other health problems recorded on many types of health and vital records including death certificates and health records. In addition to enabling the storage and retrieval of diagnostic information for clinical, epidemiological and quality purposes, these records also provide the basis for the compilation of national mortality and morbidity statistics by WHO Member States. It is used for reimbursement and resource allocation decision-making by countries.

ICD-10 was endorsed by the Forty-third World Health Assembly in May 1990 and came into use in WHO Member States as from 1994. The 11th revision of the classification has already started and will continue until 2015.

Source: World Health Organization. International Classification of Diseases (ICD).
http://www.who.int/classifications/icd/en/

Life-expectancy

See also ***Healthy life-expectancy*** *and* ***Life-expectancy at birth***

Life-expectancy at a specific age is the average number of additional years a person of that age could expect to live if current mortality levels observed for ages above that age were to continue for the rest of that person's life.

Source: Population Division, DESA, United Nations. World Population Ageing 1950-2050, Annex 1.
http://www.un.org/esa/population/publications/worldageing19502050/pdf/95annexi.pdf

Life-expectancy at birth

See also ***Healthy life-expectancy*** *and* ***Life-expectancy at birth***

… , life-expectancy at birth is the average number of years a newborn would live if current age-specific mortality rates were to continue.

Source: Population Division, DESA, United Nations. World Population Ageing 1950-2050, Annex 1.
http://www.un.org/esa/population/publications/worldageing19502050/pdf/95annexi.pdf

Mean (average)

The mean is the sum of values, e.g. size of populations, divided by the number of values, e.g. number of populations in the sample.

Medical care epidemiology

… studies the use of health care services among populations living within the geographic boundaries of "natural" health care [populations].

Source: Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Health Care*. Oxford University Press.

Medical signature

See also ***Surgical signature***

The patterns of variation in the discharge rates for medical conditions have their own recognizable "medical signatures". The medical signature, however, is strikingly unlike the surgical signature. The typical surgical signature reflects the idiosyncratic way in which surgery varies – high rates of one procedure and low rates of another. Moreover, the overall likelihood of having surgery (the total surgical discharge rate) does not correlate closely with the likelihood of having any specific procedure.

By contrast, the risk of hospitalization for a specific high variation medical condition tends to be closely associated with the total discharge rate for all medical conditions in the hospital referral region. Indeed, the practice profiles captured by the medical signature suggest that the rules governing decisions about whether to hospitalize patients (rather than treat them elsewhere) are subject to a kind of "thermostat" of supply, set for the hospital referral region that establishes the level of risk of hospitalization for high variation medical conditions. The level at which the thermostat is set is independent of morbidity levels in the community or the specific condition for which the patient is being treated.

Source: Dartmouth Medical School, Center for the Evaluative Clinical Sciences (1998) *The Dartmouth Atlas of Health Care 1998*. AHA Publishing Inc.

Network

If a system is a set of activities with a common set of objectives, the network is the set of organisations and individuals that deliver the systems.

Outcome, *see* ***Input***

Output, *see* ***Input***

Over-diagnosis

A condition is diagnosed that would otherwise not go on to cause symptoms or death.

Source: Elmore JG, Fletcher SW (2012) Overdiagnosis in Breast Cancer Screening: Time to Tackle Underappreciated Harm. *Annals of Internal Medicine* 156; 536.

Over-use

See also ***Under-use***

Over-use describes a process of care in circumstances where the potential for harm exceeds the potential for benefit. Prescribing an antibiotic for a viral infection like a cold, for which antibiotics are ineffective, constitutes over-use. The potential for harm includes adverse reactions to the antibiotics and increases in antibiotic resistance among bacteria in the community. Over-use can also apply to diagnostic tests and surgical procedures.

Source: RWJ Foundation, USA.

Patient decision aid

Patient decision aids are … intended to supplement rather than replace patient–practitioner interaction. They may be leaflets, interactive media, or video or audio types. Patients may use them to prepare for talking with a clinician, or a clinician may provide them at the time of the visit to facilitate decision making. At a minimum, patient decision aids provide information about the options and their associated relevant outcomes.

Source: Elwyn G (2006) Developing a quality criteria framework for patient decision aids; online international Delphi Consensus process. *British Medical Journal*, 333: 417-427.

Population healthcare

The aim of population healthcare is to maximise value and equity by focusing not on institutions, specialties or technologies, but on populations defined by a common symptom, condition or characteristic, such as breathlessness, arthritis, or multiple morbidity.

Population medicine

Population medicine is a style of clinical practice in which the clinician is focused not only on the individual patients referred but also on the whole population in need.

Preference-sensitive treatment decisions

Preference sensitive treatment decisions involve making value trade-offs between benefits and harms that should depend on informed patient choice.

Source: O'Connor AM et al (2007) Toward the 'Tipping Point': Decision aids and informed patient choice. *Health Affairs* 26: 716-725.

Preference-sensitive care

… "elective", or "preference-sensitive" care, interventions for which there is more than one option and where the outcomes will differ according to the option used because patients delegate decision making to doctors, physician opinion rather than patient preference often determines which treatment patients receive. I argue that this can result in a serious but commonly overlooked medical error: operating on the wrong patients – on those who, were they fully informed, would not have wanted the operation they received.

Source: Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Health Care*. Oxford University Press.

Productivity

See also ***Efficiency***

Productivity is the relationship between inputs and outputs, such as the number of operations per theatre per year; efficiency is the relationship between outcomes and inputs, such as the number of successful operations per theatre per year.

Protocol

An agreed framework outlining the care that will be provided to patients in a designated area of practice. They do not describe how a procedure is performed, but why, where, when and by whom the care is given.

Source: Working in Partnership Programme, NHS (2006) Using protocols, standards, policies and guidelines to enhance confidence and career development.
http://www.rcn.org.uk/__data/assets/pdf_file/0004/176368/Tool5.8-UsingProtocols.pdf

Public health

The science and art of promoting and protecting health and well-being, preventing ill-health and prolonging life through the organised efforts of society.

Source: The Faculty of Public Health. What is public health.
http://www.fph.org.uk/what_is_public_health

Quality

Quality is the degree to which a service meets pre-set standards of goodness.

Source: Donabedian A, personal communication.

Quality of life[1]

… individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment.

Source: World Health Organization (WHO) Programme on Mental Health. WHOQOL: Measuring Quality of Life. The World Health Organization Quality of Life Instruments (The WHOQOL-100 and the WHOQOL-BREF). http://www.who.int/mental_health/media/68.pdf

Range

The range is the difference between the highest and lowest value in the sample. The range provides a crude measure of the spread of the data.

Safety

Patient safety can, at its simplest, be defined as: The avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare. … the reduction of harm should be the primary aim of patient safety, not the elimination of error.

Source: Vincent C (2006) *Patient Safety.* Churchill Livingstone.

Self-management

… self-management is especially important for those with chronic disease, where only the patient can be responsible for his or her day-to-day care over the length of the illness. For most of these people self-management is a lifetime task.

Source: Lorig KR, Holman HR (2003) Self-Management Education: History, Definition, Outcomes, and Mechanisms. *Annals of Behavioural Medicine* 26; 1-7. doi 10.1207/S153124796ABM2601_01

Shared decision-making

In a shared decision, a health care provider communicates to the patient personalized information about the options, outcomes, probabilities, and scientific uncertainties of available treatment options, and the patient communicates his or her values and the relative importance he or she places on benefits and harms.

Source: Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Health Care.* Oxford University Press.

Standard deviation

See also ***Variance***

The standard deviation is a measure of spread, and is the square root of the variance.

Standards

A minimum level of acceptable performance or results or excellent levels of performance or the range of acceptable performance or results.

Source: Kohn LT, Corrigan JM, Donaldson MS (eds) Committee on Quality of Health Care in America, Institute of Medicine (2000) *To Err is Human. Building a Safer Health System.* National Academy Press, Washington.

Structure

Structure comprises the inter-relation of healthcare facilities through which health services are provided. Healthcare is a localised activity, provided by the organisations that form the general healthcare structure, including hospitals, GP practices, clinics, ambulatory care, rehabilitation centres, home care and long-term-nursing care.

Supply-sensitive care

It differs in fundamental ways from both effective care and preference-sensitive care. Supply-sensitive care is not about a specific treatment per se; rather, it is about the frequency with which everyday medical care is used in treating patients with acute and chronic illnesses. Remedying variation in supply-sensitive care requires coming to terms with the "more care is better" assumption. Are physician services and hospitals in high-cost, high-use regions overused?

Source: Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Health Care.* Oxford University Press.

1 Examples of other quality of life definitions can be found at: http://www.scotland.gov.uk/Publications/2006/01/13110743/11

Surgical signature

See also ***Medical signature***

Surgical signatures reflect the practice patterns of individual physicians and local medical culture, rather than differences in need – or even differences in the local supply of surgeons.

Source: Dartmouth Medical School, Center for the Evaluative Clinical Sciences (1998) *The Dartmouth Atlas of Health Care 1998*. AHA Publishing Inc.

System

A system is a set of activities with a common set of objectives for which an annual report is produced.

Under-use

See also ***Over-use***

Underuse refers to the failure to provide a health care service when it would have produced a favourable outcome for a patient. Standard examples include failure to provide appropriate preventive services to eligible patients (e.g. Pap smears, flu shots for elderly patients, screening for hypertension) and proven medications for chronic illnesses (steroid inhalers for asthmatics; aspirin, beat-blockers and lipid-lowering agents for patients who have suffered a recent myocardial infarction).

Source: RWJ Foundation, USA.

Unwarranted variation

Variation in the utilization of health care services that cannot be explained by variation in patient illness or patient preferences.

Source: Wennberg JE (2010) *Tracking Medicine. A Researcher's Quest to Understand Health Care*. Oxford University Press.

Value

… value is expressed as what we gain relative to what we give up – the benefit relative to the cost.

Source: Institute of Medicine of the National Academies (2008) Learning Healthcare System Concepts v. 2008. The Roundtable on Evidence-Based Medicine, Institute of Medicine. Annual Report.

Value for money

Value for money is achieved "by focusing on the productivity of staff and on prevention rather than cure, as well as by carefully allocating resources to people in greatest need and by adopting the most effective approaches."

Source: The Cabinet Office (2008) Excellence and fairness: achieving world class public services (page 12).

Variation

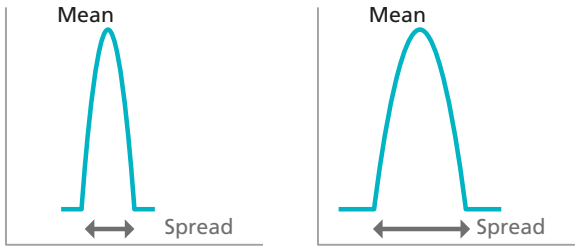
Everything we observe or measure varies. Some variation in healthcare is desirable, even essential, since each patient is different and should be cared for uniquely. New and better treatments, and improvements in care processes result in beneficial variation.

Source: Neuhauser D, Provost L, Bergman B (2011) The meaning of variation to healthcare managers, clinical and health-services researchers, and individual patients. *BMJ Qual Saf* 20 (Suppl 1); i36-i40. doi: 10.1136/bmjqs.2010.046334

Variance

See also ***Range***

The variance is another measure of spread, which describes how far the values in the sample lie away from the mean value. It is the average of the squared differences from the mean and is a better measure of spread than the range.



This figure illustrates how two populations may have the same mean value, but different degrees of variation or spread: the second population shows greater variation than the first.

Glossary of Organisations

Clinical commissioning groups (CCGs)

Clinical commissioning groups are groups of general practitioners (GPs) which as of April 2013 are responsible for planning and designing local health services in England. They commission a range of health and care services including planned hospital care, urgent and emergency care, rehabilitation care, community health services, and mental health and learning disability services. Clinical commissioning groups retain legal accountability and responsibility for meeting their statutory functions, and commissioning decisions cannot be delegated to other organisations.

Department of Health (DH)

The Department of Health is the Government department responsible for improving England's health and well-being. It provides strategic leadership for public health, the NHS and adult social care in England.

Health and Wellbeing Boards (HWBs)

Health and wellbeing boards bring together local commissioners across the NHS, public health and social care, elected members and representatives of HealthWatch to deliver integrated health and care services with the aim of improving the health and wellbeing of people in their area. Health and wellbeing boards commenced operation in April 2013.

NHS Commissioning Board (NHS CB)

The NHS Commissioning Board played a key role in the Government's vision to modernise the health service with the aim of securing the best possible health outcomes for patients by prioritising them in every decision it makes. It was formally established as an independent body, at arm's length to the Government, on 1 October 2012, to carry forward the preparatory work begun as the NHS Commissioning Board Authority while taking on initial statutory responsibilities. Notable among these responsibilities was the authorisation of clinical commissioning groups (CCGs), the drivers of the clinically led commissioning system introduced by the Health and Social Care Act 2012, and preparing for the establishment of NHS England on 1 April 2013.

NHS Commissioning Support Units (CSUs)[1]

NHS Commissioning Support Units offer an efficient locally sensitive and customer-focussed service to clinical commissioning groups (CCGs) for:

- transformational commissioning functions, e.g. service re-design;
- transactional commissioning functions, e.g. market management, healthcare procurement, contract negotiation and monitoring, information analysis and risk stratification.

NHS England

From April 2013, NHS England took on many of the functions of the former primary care trusts (PCTs) with regard to the commissioning of primary care health services, as well as some nationally based functions previously undertaken by the Department of Health. The new arrangements comprise a single operating model for the commissioning of primary care services, which describes the system by which NHS England will use the money the NHS spends on commissioning primary care. The main aim of NHS England is to improve health outcomes for people in England. The work of NHS England covers eight main areas: improving patient experience; commissioning development; technology, systems and data; partnerships and relationships; direct commissioning; quality improvement and clinical leadership; governing frameworks; patient safety. The anticipated benefits include greater consistency and fairness in access and provision for patients, with an end to unjustifiable variations in services and a reduction in health inequalities, better health outcomes for patients through the delivery of high-quality, clinically effective, evidence-based services, and greater efficiencies in the delivery of primary care health services through the introduction of standardised frameworks and operating procedures.

1 http://www.commissioningboard.nhs.uk/files/2012/11/csu-fact-oct.pdf

National Institute for Health and Clinical Excellence (NICE)[2]

The National Institute for Health and Clinical Excellence was set up to help those working in the NHS, local authorities and the wider community deliver high-quality healthcare. It develops evidence-based guidelines on the most effective ways to diagnose, treat and prevent disease and ill-health; it also publishes patient-friendly versions of these guidelines which can help to educate and empower patients and carers. NICE also sets quality standards which define what high quality care should look like for a specific disease, condition or clinical area.

Public Health England (PHE)

Public Health England commenced operations from April 2013. It works collaboratively to provide a range of health protection services across the country. Public Health England will provide both strong strategic leadership and lead on the vision for the protection and improvement of the public's health. It plays a key role in health protection services, establishing and maintaining internationally benchmarked best practice, while also providing professional advice to Government, local authorities, the NHS, the devolved administrations and internationally. Through the health improvement and population health directorate, PHE is also responsible for the development of a 21st century health and wellbeing service, supporting local authorities and the NHS to deliver the greatest possible improvements in the public's health, and acting as professional advocate for the public's health. Additionally, PHE delivers an internationally recognised, high-performing evidence and intelligence service encompassing research, statistics and know-how. This knowledge informs and supports the practice of public health and drives improvements in the public's health. PHE also designs, develops and implements cross-cutting programmes and the commissioning of services from statutory and third sector bodies.

2 In 2013, NICE will keep its acronym but change its name to the National Institute for Health and Clinical Excellence

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