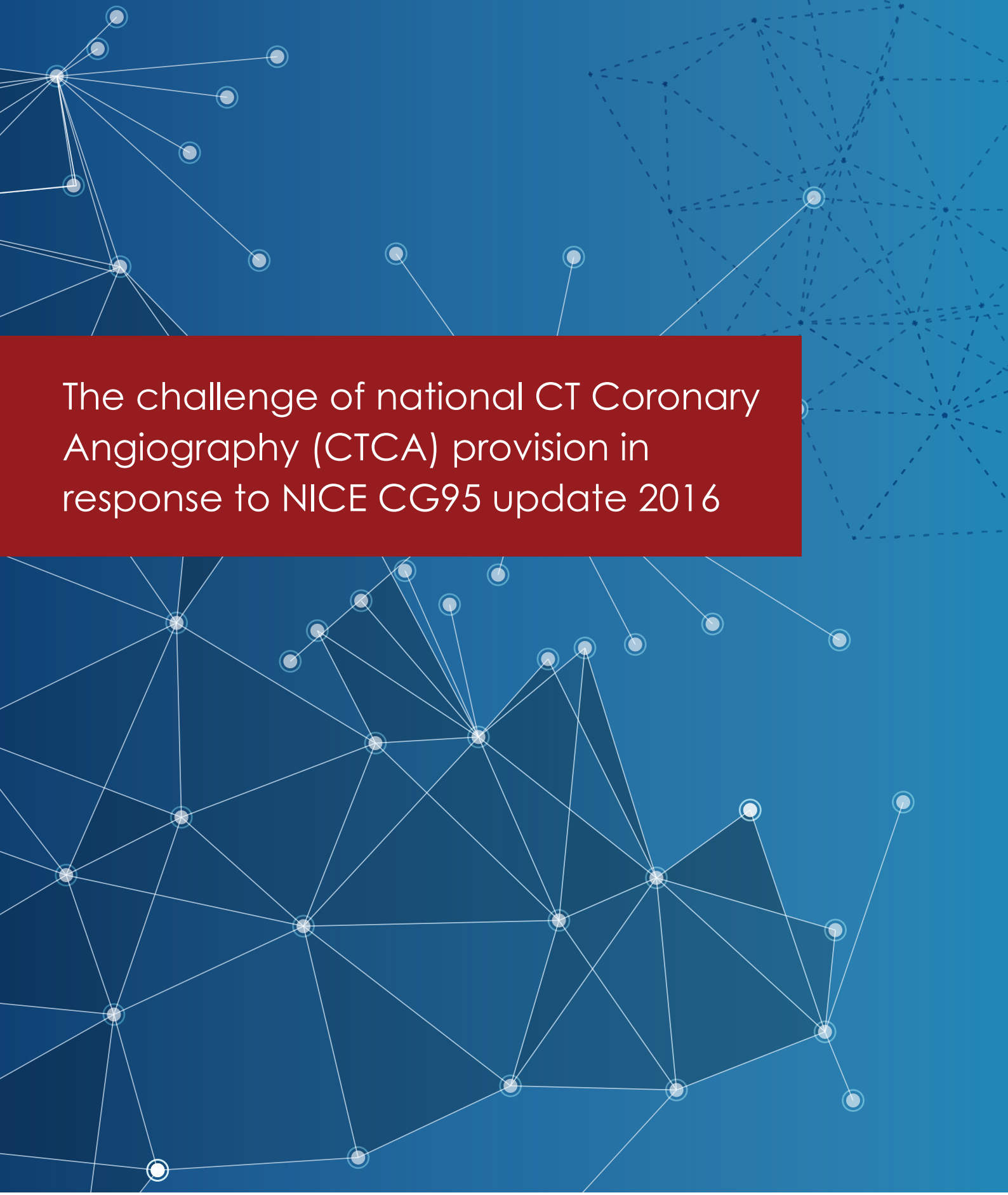
The challenge of national CT Coronary Angiography (CTCA) provision in response to NICE CG95 update 2016



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Foreword

The recently published National Institute for Health and Care Excellence (NICE) clinical guideline on 'Chest pain of recent onset: assessment and diagnosis (CG95)', suggests Computed Tomography Coronary Angiography (CTCA) as the first line investigation for patients with stable chest pain if clinical assessment indicates typical or atypical angina, or non-anginal chest pain with ECG changes suggesting underlying coronary artery disease. Functional imaging or invasive angiography is recommended as a second-line investigation in those cases where CTCA is equivocal or positive[i].

CTCA is a relatively new technique and therefore the number of professionals currently trained in its acquisition and reporting is limited. Furthermore, high quality, low dose, CTCA also can only be performed using relatively modern CT equipment. For these reasons there is geographic variation in the availability and delivery of CTCA services within the UK.

Based on available data, the BSCI/BSCCT have assessed the current provision of CTCA and modelled the expected demands on services, based on the current sustainability and transformation plan (STP) populations in England, and Health Boards in the devolved nations. This report, which we welcome, should prove helpful to commissioners of these services, to hospitals providing clinics for the assessment of those with suspected stable cardiac chest pain, and to those considering the workforce implications of providing CTCA services more widely and to national standards[ii].

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The BSCI/BSCCT has worked hard to ensure the veracity of the data within this report. Nonetheless it should be acknowledged that data on volumes of CTCA specifically are challenging due to the quality of, and potential variety of, coding data held centrally. Determining exact figures for RACPC attendance in the UK has been extrapolated from the English data used by NICE, whilst the process for estimating the potential upper limit of stable chest pain referrals, to whom the NICE CG95 update applies, from all sources, has also required extrapolation from historic peer reviewed publications.

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Executive Summary

There has been a sustained growth in the provision of cardiovascular CT, including CTCA, in the UK since that described in 2010[iii], however the delivery of CTCA remains highly variable across the UK and even within regions. The introduction of the new NICE guidelines for stable chest pain will require significant investment in new technology, a far wider and more uniform geographical delivery of CTCA, and extensive investment in the clinical workforce to ensure training and experience is accessible and provided, to deliver high quality CTCA against agreed standards[ii]. This paper focusses specifically on the location of cardiac capable scanners (whether cardiac enabled or not), the location and number of individuals currently accredited in cardiovascular CT and the current delivery of CTCA both by centre and population.

To ensure the quality of CTCA provision remains high in the UK it will be necessary to ensure that:

- CTCA is performed on appropriate, cardiac enabled, CT scanners with adequate reporting workstation software to allow thorough and complete analysis and report generation.

- The workforce (radiographers, nurses, radiologists and cardiologists) are appropriately trained in CTCA and are both confident and competent to acquire CTCA images in all patients, including those who may be technically challenging (high heart rates, arrhythmias, high BMI etc.).

- Departments develop close relationships with local centres of excellence (including level 3 accredited practitioners) plus industry partners to ensure an ongoing, iterative process to protocol optimisation.

- Departments have appropriate medical physics support to routinely assess the doses delivered for CTCA locally and ensure that they are close to the National Dose Reference Level (NDRL)*

* **A NDRL is expected to be published by Public Health England in early 2017. This will be based on the results of the BSCI/BSCCT National dose survey[iv] with a median dose for CTCA of 200mGy.cm.**

Introduction

CT coronary angiography (CTCA) is a non-invasive, x-ray based, technique that allows assessment of both the coronary artery lumen as well as atheromatous plaque morphology. CTCA has almost 100% accuracy in excluding functionally significant (chest pain producing) coronary artery disease and can help detect those at high risk of developing acute coronary syndromes [v].

Whilst current doses for CTCA in the UK are acceptable (median 200mGy.cm) [iv], it is a demanding radiological technique, that requires a thorough understanding of ECG-gated protocols, dose optimisation strategies and CT scanner technology. Without specific training of both radiographers and medical practitioners, CTCA can be a high-dose technique delivering sub-optimal image quality.

Specific standards for the acquisition of CTCA have been published by the BSCI/BSCCT and endorsed by both the Royal College of Radiologists and Royal College of Physicians [ii]. Additional guidelines on appropriate scanner technology for cardiovascular CT has been published by NICE [vi].

CTCA has almost 100% accuracy in excluding significant coronary artery disease (CAD) and when compared with functional imaging tests or invasive angiography it is the lowest cost technique. The rapid technological advances that allow CTCA to be delivered at a low dose and the substantial amount of new scientific evidence published support its widespread use in clinical practice [vii] [viii] [ix] and provide the backdrop to the recent NICE review. The review of the evidence has brought about the new recommendations that propose CTCA as the most clinically and cost effective diagnostic first line test for all patients presenting with stable chest pain.

The new guidelines present considerable delivery challenges in the short term. CTCA is a relatively new technique and therefore the number of professionals trained in its acquisition and reporting are limited, with considerable geographic variation in delivery and practice within the UK. High quality, low dose, CTCA also can only be performed on relatively modern CT equipment, particularly for difficult patients such as those with arrhythmia.

To assess the current provision and capability within the UK the BSCI/BSCCT has worked closely with industry partners, the Royal College of Radiologists, British Cardiovascular Society, and other national stakeholders to obtain detailed and accurate data on current UK cardiovascular CT (including CTCA) practice. The BSCCT has looked at infrastructure (including equipment), current delivery of CTCA and cardiovascular CT services, and accredited personnel figures to assess the likely impact of the updated NICE guidelines in the delivery of the requirements proposed for assessment of patients with stable chest pain. We have also modelled the expected demands on these services, based on the current sustainability and transformation plan (STP) populations in England and Health Boards in the devolved nations to produce Red-Amber-Green (RAG) maps that visually highlight the key areas that need addressing.

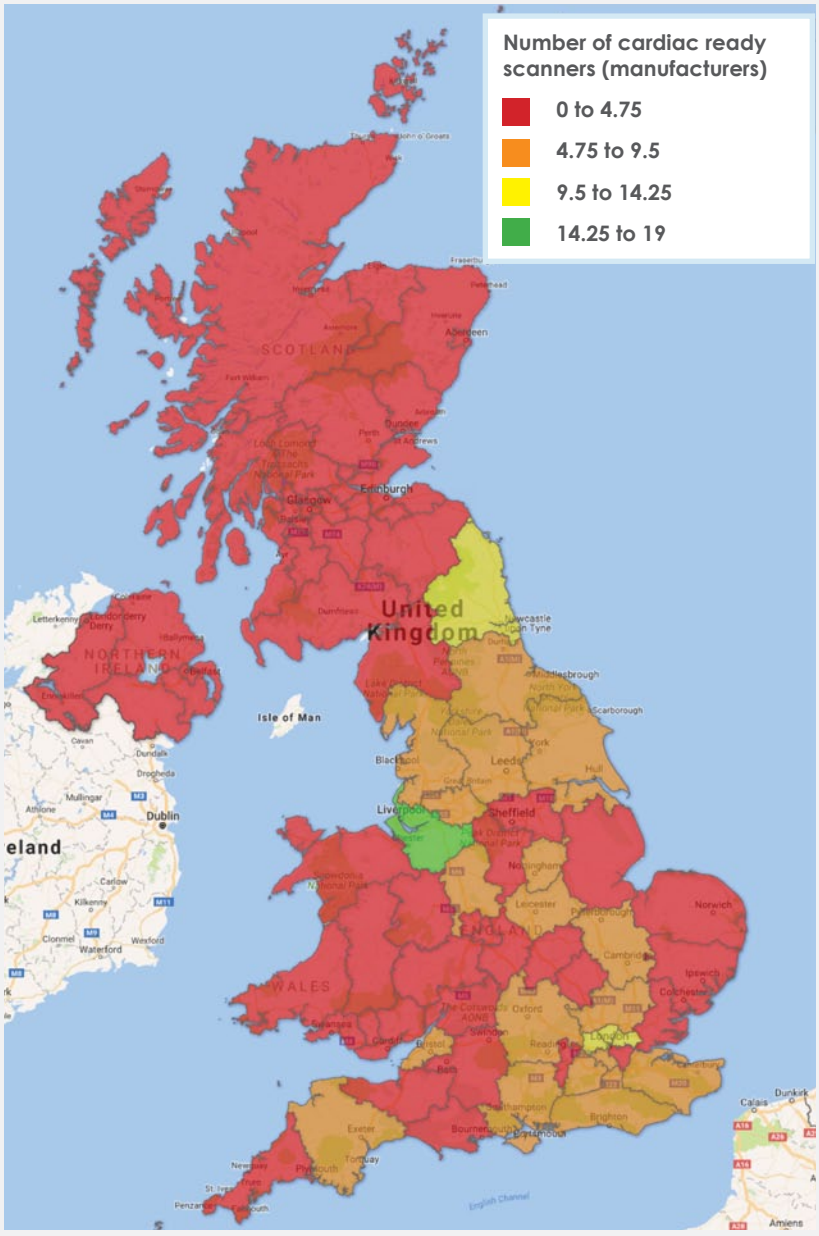
CT scanner base in the UK

The UK has some of the most intensively used MRI and CT scanners in the EU[x] and the demand for general CT continues to grow in the UK. In the last decade CT studies performed have risen by 160% whilst between 2012 and 2015 demand increased 29% in England and 55% in Scotland[xi]. Even for general CT there is currently a lack of capacity to respond to this demand. The UK has a very low number of CT scanners as compared with other OECD countries, with around 9 CT scanners per million population; compared to Germany (19), Spain (17), and France (14) per million population[xii].

Map 1. Cardiac enabled scanners by region in the UK*

As per NICE guidelines, Cardiac CT scanners must be of a higher specification; they must be a minimum of 64-detector technology, however, as NICE have previously commented, both dose and image quality are better on more modern technology[vi].

The BSCI/BSCCT, working with all the CT manufacturers, has created a database of cardiac capable CT scanners. Currently there are only 228 cardiac capable scanners in the UK (this equates to 4 scanners/million patients and 50% of all CT scanners in the UK) with wide geographic variation (see Map 1). Not all are cardiac enabled (i.e. they do not have the required software to support CTCA acquisition). Therefore, the additional workload that will be generated by the new NICE guidelines will require investment in both hardware (cardiac enabled CT scanners) and software (to allow these scanners to be used to acquire, and generate CTCA studies).



*** STP in England, Regional Health Boards in Scotland, Northern Ireland and Wales**

CTCA delivery in the UK

The BSCI/BSCCT has obtained national data for the current provision of cardiovascular CT for 2015 (Map 2). This data demonstrates the low number of centres performing high volumes within each region.

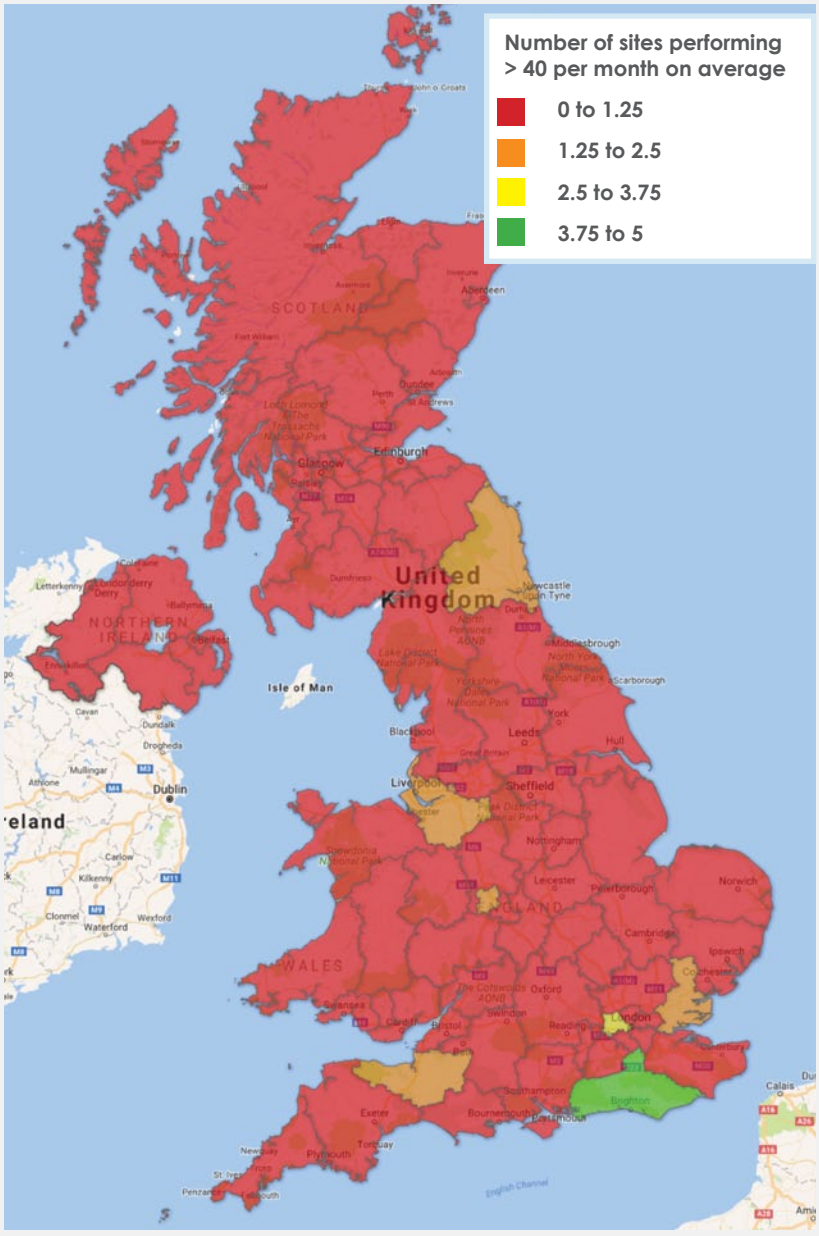
Map 2. Number of centres per region* performing >40 CTCA per month

101 centres performed a total of 38,455 ECG-gated cardiac CT scans** (including CTCA) in the UK in 2015. 34% of these scans are performed in the 10 largest centres in the UK. 68% of centres who undertake Cardiovascular CT perform <10 cardiac scans per week. Of the Trusts that deliver Cardiovascular CT currently <10% perform >40 scans per month.

In Scotland 8 centres are currently performing cardiac CT with only one centre performing > 10 cardiovascular CT scans per week. There are 7 cardiovascular CT centres in Wales and 5 in Northern Ireland Only one Welsh centre performs >10 cardiovascular CT scans per week with no higher volume centres in Northern Ireland.

* STP in England, Regional Health Boards in Scotland, Northern Ireland and Wales

** Cardiac CT coded CACRY



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Projected requirement for CTCA following updated NICE GG95 guidelines

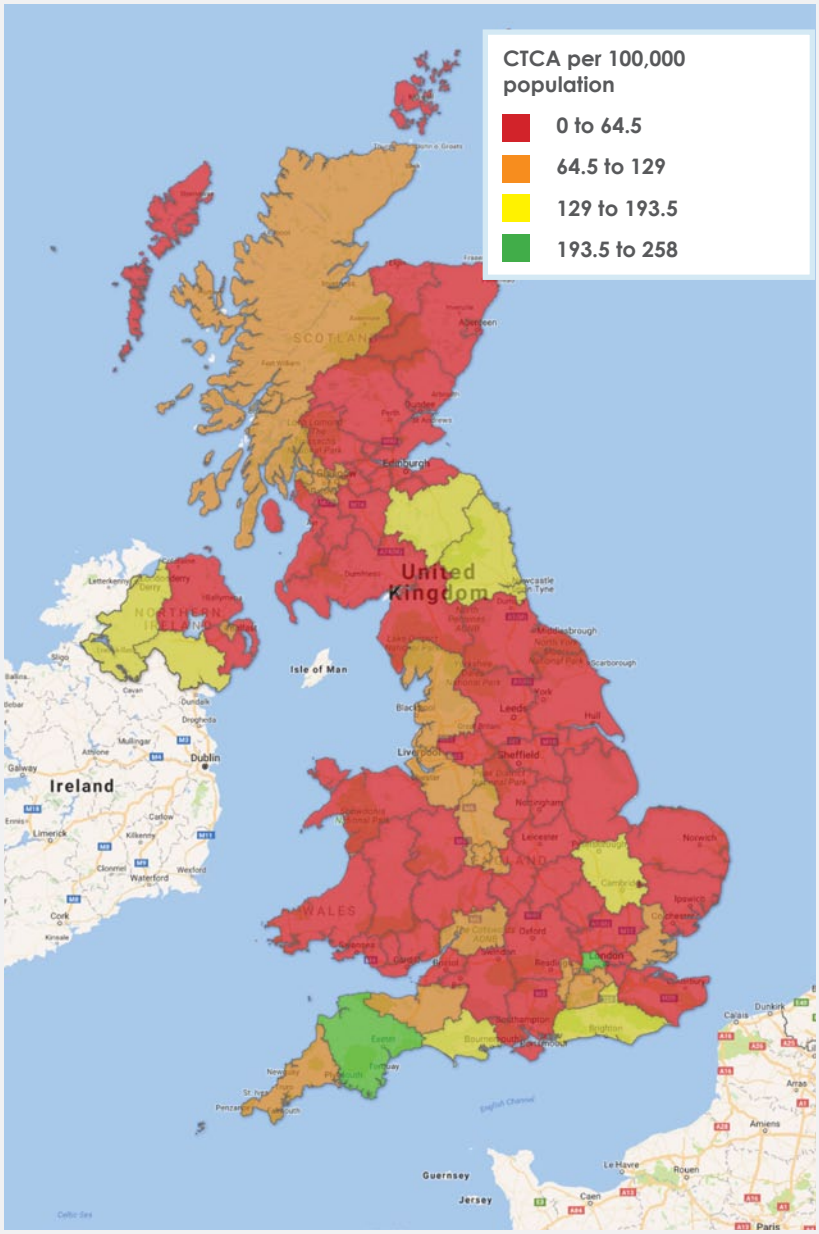
In 2010 there were 120,000 referrals to rapid access chest pain clinics (RACPC) in Englandi. This would equate to 148,000 referrals per year in the UK (assuming an equivalent attendance to RACPC in Wales, Scotland and NI). This equates to 200 CTCA per 100,000 population, if 90% were referred for CTCA. Currently only 2 regions in the UK (Devon and North West London) are currently delivering this volume of CTCA.

Map 3. CTCA per 100,000 population by region* in the UK

However, as not all patients with chest pain go through a RACPC, this number is likely to represent an underestimation of the total referrals generated for CTCA. Patients also present via the emergency department (ED), medical admissions units (MAU) and via specialty clinics.

Using previous published assumptions used to predict the demand in nuclear cardiology for myocardial perfusion scintigraphy (MPS) [xiv] the true figure may be as high as 340,000 referrals per annum (or 523 CTCA per 100,000 population, per annum).

It is therefore estimated that up to an additional 200,000 patients may require CTCA across the UK under the new NICE stable chest pain guidelines. This represents a 700% increase in current cardiovascular CT delivery.

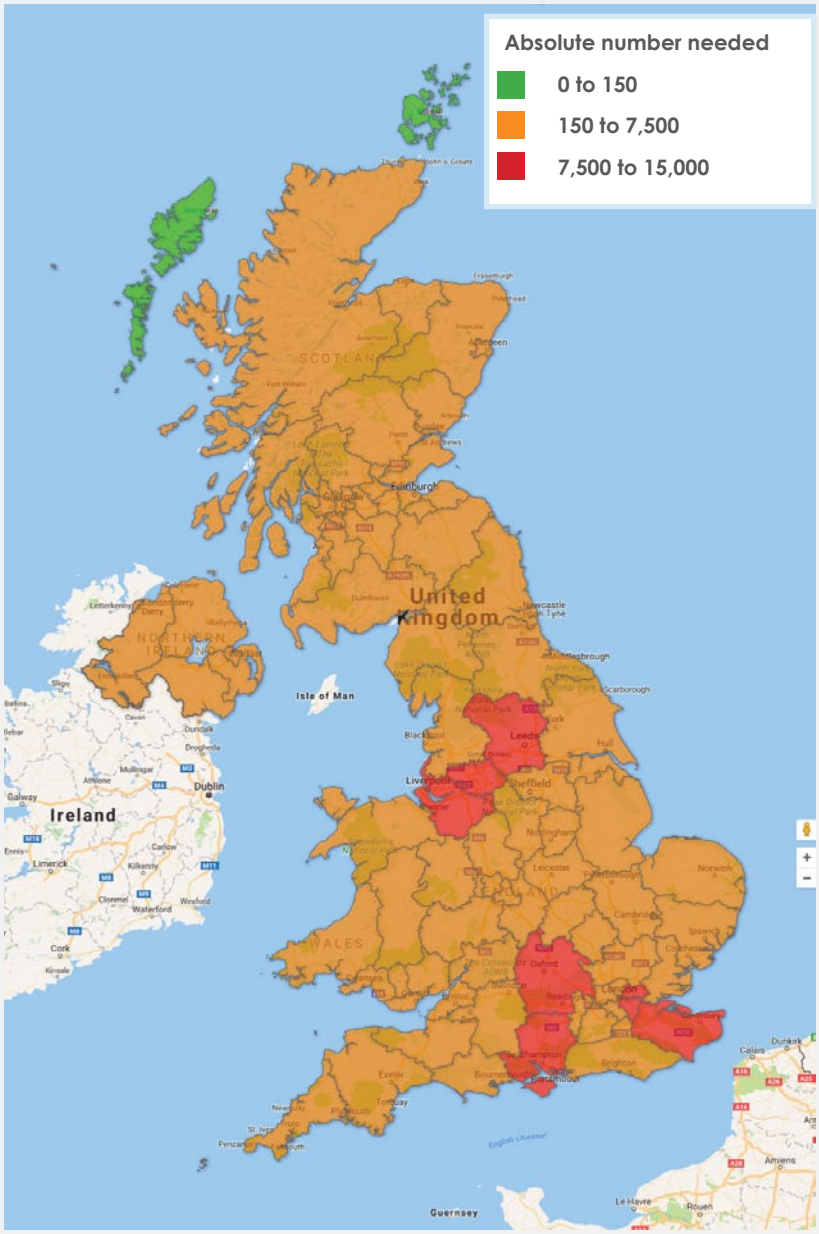


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Projected Requirement for CTCA - Absolute Increase in Provision Needed

Map 4. Absolute increase in number of CTCA required by region* in the UK

Conversely, in more heavily populated regions, such as Greater Manchester, there is also a relatively low provision to the large population and nearly 15,000 extra scans will be required per year to meet the projected NICE guidelines. This represents a 7000% increase compared with current activity. Even in North-West London where CTCA activity is highest in the UK, the proportionate increase in activity is the lowest but still requires a more than 100% increase in throughput. This is not an insignificant change in delivery for any cardiac CT service.

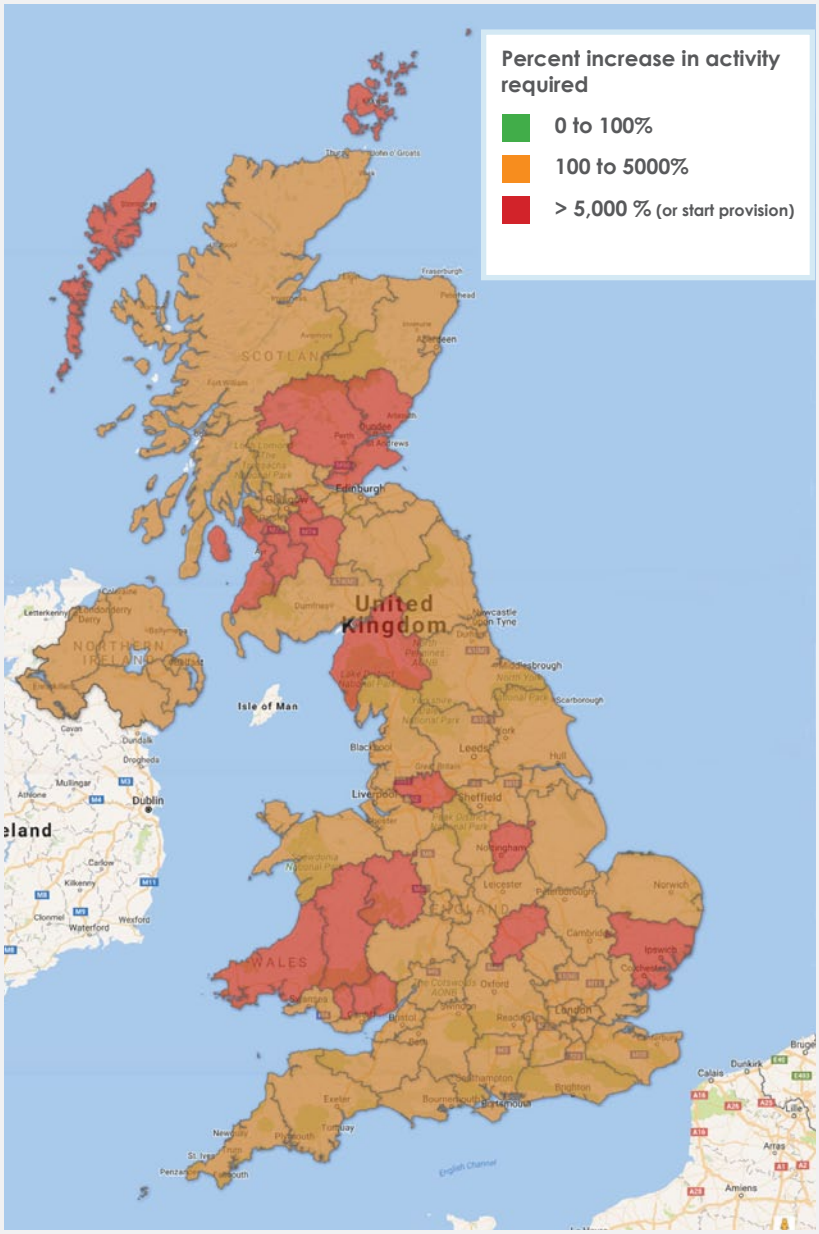


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Projected Requirement for CTCA - Relative Increase in Provision Needed

Map 5. Percentage increase in number of CTCA required by region* in the UK

It is clear that the UK cardiovascular CT community faces a significant challenge to deliver the output required from this revision to NICE guidance. Even the best prepared regions and departments face a minimum of a doubling of CTCA scans they will be asked to provide. Many centres will face much greater increases in demand, and some will effectively be starting from scratch. It must also be understood that the revised guidelines come with no additional funding, and for many centres the recommended numbers will remain aspirational for some time.



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Specialist workforce

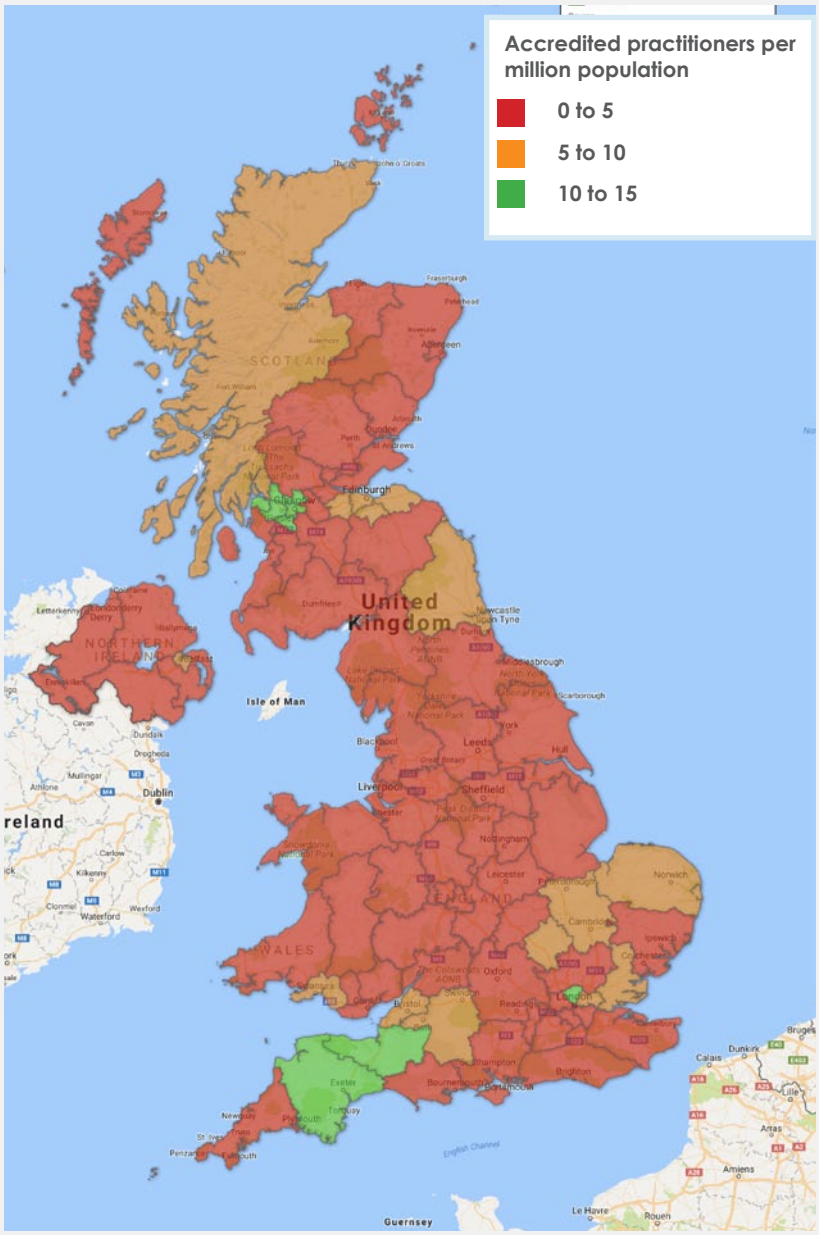
CTCA scans require expertise to acquire and report. In the UK CTCA reporting is usually done by Radiologists and/or Cardiologists. However, the number of available specialists is low.

Map 6. Accredited CTCA Practioners by region* in the UK

There is a general shortage of Radiologists in the UK with a recent Royal College of Radiologists (RCR) report demonstrating that the UK has a low number of radiologists compared to our European counterparts. The UK has 48 radiologists per million population compared with Germany (92), Spain (112) and France (130) [xv]. As a result of activity growth outstripping workforce growth, imaging departments are struggling to keep up with demand. In 2015, 99% of departments were unable to meet their general radiology reporting requirements.

Detailed information of all medical practitioners who have obtained accreditation to report CTCA (either through the BSCI/BSCCT or SCCT) has been collated and whilst accreditation is not currently a requirement to practice, it is a proxy marker of good medical practice, and as such is used for revalidation purposes. Map 6 demonstrates the number of accredited practitioners (Level 2 accreditation) in the UK is relatively small and there is significant regional variability.

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Education and Training

Accreditation in cardiovascular CT can be achieved via both the BSCI/BSCCT and the SCCT. Level 2 accreditation indicates competence to report whilst level 3 indicates a level of experience to train others in CTCA.

Map 7. Level 2 (red dots) and Level 3 (blue pins) accredited CTCA practitioners in the UK.

To deliver a high quality CTCA service across the UK will require significant investment in training. The whole workforce (radiographers, nurses, medical physicists, radiologists and cardiologists) will need to be appropriately trained in both the clinical and technical aspects of CTCA so they are both confident and competent to acquire CTCA images in all patients, including those who may be technically challenging (high heart rates, arrhythmias, high BMI etc.). This will also ensure that Quality Assurance is delivered as a key component of a high quality CTCA service [xvi].

Whilst core and advanced education in CTCA is provided by both the BSCI/ BSCCT and individual providers, it will be necessary to significantly expand these educational offerings and look at alternative methods of delivery. This will require concerted and co-ordinated effort by those responsible for the clinical and technical education of the workforce, in conjunction with the specialist societies to ensure that high quality CTCA is delivered at optimal (as low as reasonably achievable) radiation doses.



*** STP in England, Regional Health Boards in Scotland, Northern Ireland and Wales**

Abbreviations

BMI	Body Mass Index
BSCI/BSCCT	British Society of Cardiovascular Imaging / British Society of Cardiovascular Computed Tomography
CT	Computed Tomography
CTCA	Computed Tomography Coronary Angiography
ED	Emergency Deprtment
MRI	Magnetic resonance Imaging
NDRL	National Dose Reference Level
NICE	National Institute of Health & Care Excellence
OECD	Organisation for Economic Co-operation and Development
RACPC	Rapid Access Chest Pain Clinic
RAG	Red Amber Green
RCP	Royal College of Physicians
RCR	Royal College of Radiologists
SCCT	Society of Cardiovascular Computed Tomography
STP	Sustainability & Transformation Plan
UK	United Kingdom

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