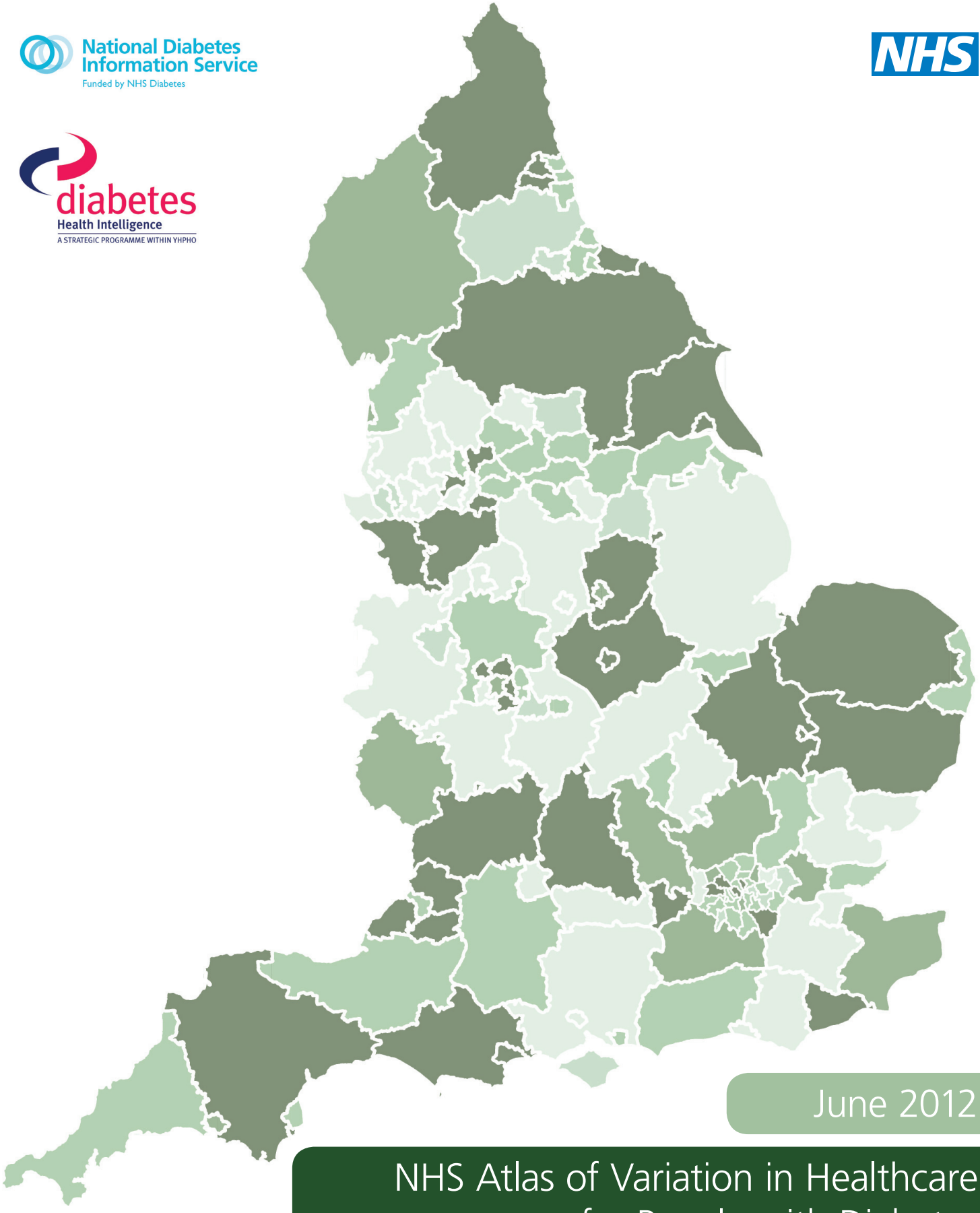
National Diabetes Information Service
Funded by NHS Diabetes

NHS

diabetes
Health Intelligence
A STRATEGIC PROGRAMME WITHIN YHPHO



June 2012

NHS Atlas of Variation in Healthcare for People with Diabetes

Reducing unwarranted variation to increase value and improve quality

RightCare

www.rightcare.nhs.uk

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The Diabetes Atlas has been prepared in partnership with a range of organisations:

Diabetes Health Intelligence is a strategic programme within the **Yorkshire and Humber Public Health Observatory** (YHPHO). YHPHO has a commitment to support the diabetes community by providing timely, quality-assured national diabetes health intelligence. YHPHO is part of a network of nine public health observatories in England.

http://www.yhpho.org.uk/

The National Diabetes Information Service (NDIS) is a national strategic partnership which provides health commissioners, providers and people with diabetes with the necessary information to aid decision-making and improve services on a local and national level. The five partner organisations are NHS Diabetes, Diabetes UK, Diabetes Health Intelligence, Innove and the NHS Information Centre for health and social care. The service is funded by NHS Diabetes and is hosted by Diabetes Health Intelligence (YHPHO).

http:// www.diabetes-ndis.org/

NHS Diabetes provides the essential link between diabetes strategy and frontline service improvements for patients. Through the integrated work programmes NHS Diabetes provides national leadership and direction and supports local teams working to champion good-quality diabetes care.

http://www.diabetes.nhs.uk

NHS Information Centre for health and social care (NHS IC) is England's central authoritative source of essential data and statistical information for frontline decision-makers in health and social care.

http://www.ic.nhs.uk/

The national Child and Maternal Health Observatory (ChiMat) provides information and intelligence to improve decision-making for high quality, cost effective services. It supports policy makers, commissioners, managers, regulators, and other health stakeholders working on children's, young people's and maternal health. This specialist observatory is part of the Yorkshire and Humber Public Health Observatory (YHPHO) which is part of a network of nine Public Health Observatories in England.

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

British Association of Day Surgery (BADS) aims to provide information about day surgery and the British Association of Day Surgery for patients, relatives, carers and health care professionals.

http://daysurgeryuk.net/bads/joomla/

Solutions for Public Health (SPH) is a not-for-profit public health organisation within the NHS dedicated to better health and better healthcare for all. SPH works with decision-makers across the public and third sectors to improve health and reduce health inequalities. SPH brings together a unique synthesis of clinical and public health experience, analytical and research skills and business performance to help customers improve the services they offer and commission.

http://www.sph.nhs.uk/

Case-studies provided by:

Salford Royal NHS Foundation Trust
University Teaching Trust
safe • clean • personal

Salford Royal NHS Foundation Trust is an integrated provider of hospital, community and primary care services, including the University Teaching Hospital, and has the highest consistent rating for service quality. It employs 6000 staff and provides local services to the City of Salford and specialist services to Greater Manchester and beyond. Specialist care is offered to people from all over the UK for brain, neuroscience, kidney, bone, intestine or skin conditions.

http://www.srft.nhs.uk/

Bexley Diabetes

Bexley Diabetes: the goal of our service is to ensure people with diabetes receive high-quality patient-centred integrated care. Patients are at the centre of everything we do. We apply evidenced-based best practice, tailored as appropriate. Care is designed around the patient and delivered where it is clinically and economically best to do so. We are committed to measuring our impact and are openly accountable.

http://www.bexleydiabetes.org.uk

South Devon Healthcare NHS
NHS Foundation Trust

South Devon Healthcare NHS Foundation Trust runs the Torbay General Hospital serving the South Devon area, covering 300 square miles, and a resident population of almost 300,000 people, plus about 100,000 visitors at any one time during the summer. Our ambition is for Torbay to be the best hospital of its class in England, achieving the highest standards and demonstrating excellence in all that we do.

http://www.sdhct.nhs.uk

Plymouth Hospitals NHS
NHS Trust

Plymouth Hospitals NHS Trust provides comprehensive hospital and specialist healthcare to people in the South West peninsula. We offer a full range of general hospital services and specialist services. We want to provide healthcare services that patients and their families can trust and depend on, and to be a major university teaching hospital and healthcare provider, recognised as one of the best in the country. We will lead with excellence and care with compassion.

http://www.plymouthhospitals.nhs.uk/Pages/Home.aspx

Whittington Health NHS

Whittington Health came into being in April 2011 when the **Whittington Hospital** merged with the provider services of **Haringey** and **Islington** to form one of the first integrated care organisations in the UK, bringing together acute and community health services for the benefit of the local population. Whittington Health works in partnership with the local community, local authorities, general practitioners, schools and service users to deliver the overall objectives of this new health industry.

http://www.whittington.nhs.uk/

Portsmouth Hospitals NHS
NHS Trust

Portsmouth Hospitals NHS Trust provides a range of acute and specialist healthcare services to over half a million patients each year. We want to be recognised as a world-class hospital, leading the field through innovative healthcare solutions focused on the best outcome for our patients delivered in a safe, caring and inspiring environment.

http://www.porthosp.nhs.uk/

Right Care continues to pay homage to the inspirational publication, *The Dartmouth Atlas of Health Care 1998*, and the vision and commitment of Professor John Wennberg who first charted this territory.

Contents

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Foreword

Diabetes is a common, chronic and complicated condition. It often causes distress, disability and early death. However, there is extensive evidence to show that the complications of diabetes can be prevented by appropriate care, and people with diabetes can enjoy a good quality of life.

It is recommended in national guidance that every person with diabetes be offered checks to identify risks for complications and/or the complications themselves so that treatment can be started to prevent deterioration. There are nine basic care processes for diabetes.

There will always be a degree of variation in care outcomes, and a few patients will decline or not need some of the care processes. However, most patients should have all of the care processes and achieve the outcomes recommended in national guidance.

As there are nearly 2.5 million people diagnosed with diabetes in England, care needs to be well organised. As every person is different, care needs to be tailored according to an individual's needs and wishes, and in full discussion with the patient. Diabetes is a life-long condition, and appointments and other contacts with healthcare professionals need to be made accessible and suited to the varied lifestyles of people with diabetes.

Is every person who has diabetes getting the care he or she needs?

Many people might be, but the indicators in this Diabetes Atlas clearly demonstrate there is considerable variation in both the processes and outcomes of care. Sadly, there are a substantial number of patients who are not receiving all of the nine basic care processes designed to identify treatable risks and early complications of diabetes. In the absence of these care processes, patients do not know if their level of health matches the recommended outcomes or if further care is needed, nor do the healthcare professionals.

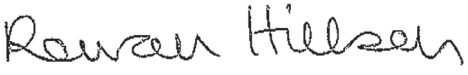
No-one with diabetes should suffer incomplete or inadequate care.

Could diabetes care be better in your patch?

Check your local figures.

In England, we have world-class information about the processes and outcomes of diabetes care via the National Diabetes Information Service (NDIS). In the *NHS Atlas of Variation in Healthcare for People with Diabetes*, only a small selection of the available data analyses has been included.

Apart from highlighting variation, this Diabetes Atlas includes suggestions for improvements in care, and NHS Diabetes are there to provide help not only with advice but also through supporting networks for care.



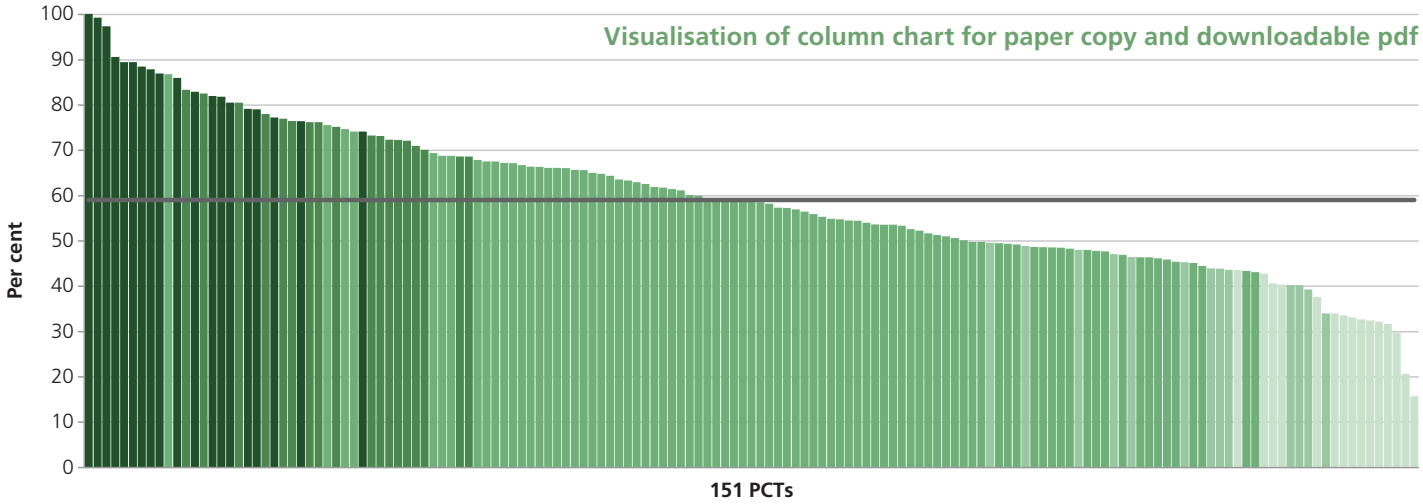
Dr Rowan Hillson MBE
National Clinical Director for Diabetes
May 2012

Innovations for the Diabetes Atlas

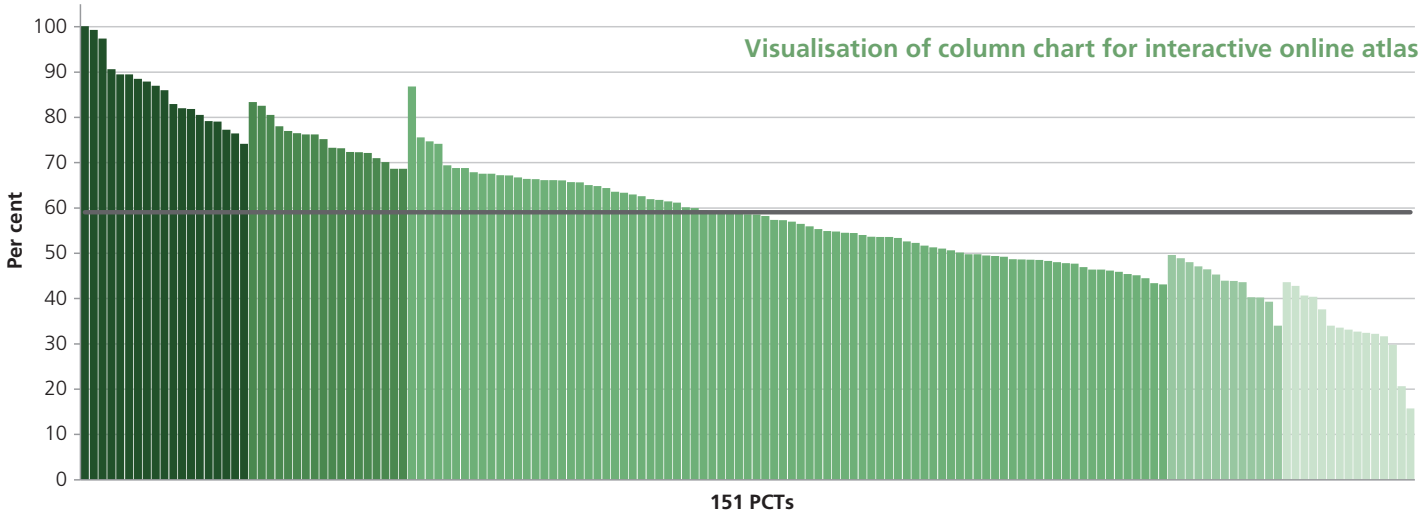
For Maps 1–9 and 13–22, the shading for the maps and column charts is based on statistical difference from the England value (see pages 20–21 for further explanation). As a result, the column charts in the paper atlas and the downloadable pdfs have a different appearance from those in Atlases 1.0 and 2.0 and the Child Health Atlas. These column charts give the reader two different messages about PCTs:

1. the actual PCT indicator value (e.g. the percentage), which is shown by the height of the column – the columns are ordered from the highest values on the left to the lowest values on the right;

2. the statistical *significance* of PCT values from the England value, shown by the shading of the columns. In general, darker shades, indicating that a PCT value is significantly higher than the England value, are on the left and the lighter shades, indicating that a PCT value is significantly lower than the England value, are on the right. However, some of the differently shaded columns are mixed, with some of the lighter shaded columns appearing towards the right-hand side and some of the darker shaded columns appearing towards the left-hand side. This is because the *significance* of a PCT indicator value from the England value does not depend solely on the size of the indicator value, but also on the statistical *confidence* of the PCT value being either higher or lower than the England value.



For the Interactive Atlas online, it has not been possible to reproduce the column charts in this way (as shown above). Therefore, the columns have been rearranged by colour shading to show those PCTs that are very significantly higher than the England value on the left through to those that are very significantly lower than the England value on the right. Each of the colour shadings is arranged with the highest PCT indicator value on the left and the lowest indicator value on the right (see below).



Reducing unwarranted variation: right care for people with diabetes

Diabetes is a lifelong metabolic condition in which the body does not produce sufficient insulin to regulate blood-glucose levels. Type 1 diabetes is an auto-immune condition in which the cells that produce insulin are destroyed. People with Type 1 diabetes require lifelong treatment with insulin to prevent death. About 10% of people whose diabetes has been diagnosed have Type 1 diabetes. Type 2 diabetes occurs when the body stops producing enough insulin for its needs. Type 2 diabetes is usually accompanied by resistance to the effect of insulin. The condition is progressive requiring lifestyle management (diet and exercise) at all stages. At some point during the course of Type 2 diabetes, there will be a need for the administration of tablets and, eventually, insulin. The chance of developing Type 2 diabetes increases with age, the degree to which a person is overweight and the level of a person's inactivity. People from Black, Middle Eastern and South Asian ethnic groups have a greater risk of developing Type 2 diabetes when compared with people from White ethnic groups.

Diabetes can lead to several long-term complications that affect:

- small blood vessels (microvascular complications);
- large blood vessels (macrovascular complications).

People with diabetes are three times more likely to have a myocardial infarction or a stroke than people who do not have the condition. The risk of end-stage kidney disease is increased by more than four times for people with diabetes when compared with those without diabetes.[1] Approximately half of all lower limb amputations carried out in England occur in people with diabetes.[2] In England and Wales, diabetic eye disease is the leading cause of blindness in people of working age (<65 years).[3]

However, the risk of developing diabetic complications can be minimised by maintaining target levels of blood glucose, blood pressure and cholesterol.

The burden of diabetes in England

In the Europe Region (54 countries and territories), the United Kingdom is one of the countries with the highest number of people with diabetes, together with Germany, Italy, France and Spain.[4]

In 2010/11 in England, there were 2,455,937 people aged 17 years and older diagnosed with diabetes.[5] There could be a further 710,000 adults with the condition who have not yet been diagnosed.[6] The total number of adults with diabetes (diagnosed and undiagnosed) is estimated to increase to 3,822,900 by 2020, thereby affecting 8.5% of the population.[7] (See Figure I.1.)

Diabetes is costly to treat. In 2010/11, prescribing for anti-diabetic items, including blood-testing items, cost £725.1 million and accounted for 8.4% of the total spend on prescriptions in primary care, representing an increase of 41.2% since 2005/06. The cost of prescribing for the treatment of diabetes is increasing faster than that for any other category of drugs.[8]

1 National Diabetes Audit Executive Summary 2009/10. http://www.ic.nhs.uk/webfiles/Services/NCASP/Diabetes/200910%20annual%20report%20documents/National_Diabetes_Audit_Executive_Summary_2009_2010.pdf

2 Holman N, Young RJ, Jeffcoate WJ (2012) Variation in recorded incidence of amputation of the lower limb in England. Diabetologia. Published online 8 March 2012.

3 Bunce C (2006) BMC Public Health 6:58. doi:10.1186/1471-2458-6-58. http://www.biomedcentral.com/1471-2458/6/58

4 International Diabetes Federation (2009) Diabetes Atlas. 5th edition. http://www.idf.org/diabetesatlas/5e/europe

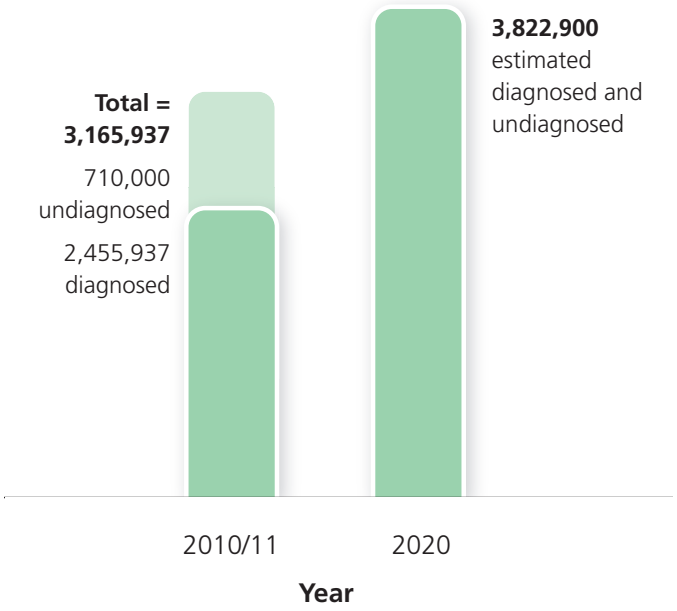
5 Quality and Outcomes Framework 2010/11. http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework

6 APHO Diabetes Prevalence Model. http://www.yhpho.org.uk/resource/view.aspx?RID=81090 and Quality and Outcomes Framework 2010/11 http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework

7 APHO Diabetes Prevalence Model. http://www.yhpho.org.uk/resource/view.aspx?RID=81090

8. Prescribing for Diabetes in England 2005/06 to 2010/11. http://www.ic.nhs.uk/webfiles/publications/prescribing%20diabetes%20200506%20to%20201011/Prescribing_for_Diabetes_in_England_20056_to_201011.pdf

FIGURE I.1: Number in population ≥17years with diabetes



In Box I.1, headline findings from the NDA and the VIA: Diabetes tool on the burden of diabetes in England are presented. It can be seen that the use of inpatient services is greater in people with diabetes when compared with that in people who do not have the condition. In November 2010, 15% of hospital beds were occupied by someone with diabetes;[9] this is because people with diabetes are more likely:

- to be admitted to hospital than people without diabetes;
- to stay in hospital longer than patients of the same age without diabetes but who have similar reasons for admission (19.4% longer, see Map 13, page 52).

In 2009/10, people with diabetes were in hospital for a total of 795,000 bed-days.[10] After adjusting for age, sex, method of admission and type of hospital, inpatients with diabetes are 9.9% more likely to die when compared with inpatients without diabetes.[11]

In 2008, 24,000 excess deaths were attributed to diabetes. The risk of death for people with Type 1 diabetes is 2.6 times higher than that for the general population, and the risk of death for people with Type 2 diabetes is 1.6 times higher than that for the general population.[12]

Box I.1: Burden of diabetes in England – headline findings from the National Diabetes Audit (NDA; audit period: 1 January 2009 to 31 March 2010) and the VIA: Diabetes tool

- More than 60% of people of all ages with Type 1 diabetes and almost half of people of all ages with Type 2 diabetes did not receive all nine care processes essential for management and detection of early complications
- More than 70% of people of all ages with Type 1 diabetes and over 30% of people of all ages with Type 2 diabetes did not have a most recent HbA1c measurement of 7.5% or less, making the long-term complications of diabetes more likely
- Two in 10 children aged 0–15 years have a most recent HbA1c of over 10%, making the long-term complications of diabetes more likely
- More than 30% of people of all ages with Type 1 diabetes and almost 40% of people of all ages with Type 2 diabetes did not have a most recent blood-pressure measurement that was within target, increasing the risk of cardiovascular and renal complications
- Over 25% of people of all ages with Type 1 diabetes and more than 20% of people of all ages with Type 2 diabetes did not have a most recent cholesterol measurement of 5 mmol/l or less, increasing the risk of cardiovascular complications
- People of all ages with diabetes are >50% more likely to have an emergency re-admission than people of a similar age who do not have the condition
- People of all ages with diabetes stay in hospital almost 20% longer than people of a similar age who do not have the condition
- Almost 25% of children aged 0–15 years with previously diagnosed diabetes were admitted to hospital with diabetic ketoacidosis (DKA), a potentially fatal but preventable condition

9 National Diabetes Inpatient Audit 2010. http://www.yhpho.org.uk/Diabetes_inpatient_audit/Default.aspx

10 Variation in Inpatient Activity (VIA): Diabetes tool. http://www.yhpho.org.uk/resource/view.aspx?RID=105866

11 Diabetes Health Intelligence (2012) Mortality among inpatients with diabetes. Key findings for England. http://www.yhpho.org.uk/resource/view.aspx?RID=139172

12 National Diabetes Mortality Analysis 2007-2008. http://www.ic.nhs.uk/webfiles/Services/NCASP/Diabetes/New%20web%20documents/NHS_Diabetes_Audit_Mortality_Report_2011_V3_0_2_.pdf

The concept of unwarranted variation in diabetes care

The aim of the Diabetes Atlas is to identify and quantify the extent of 'unwarranted' variation that may be due to unjustified geographical differences in medical practice and/or patients not gaining access to the appropriate level of intervention for their need. The resulting sub-optimal (either over-use or under-use) uptake of medical intervention is defined as 'unwarranted'.

Professor John Wennberg, founder of *The Dartmouth Atlas of Health Care* and originator of health atlases, defines unwarranted variation as:

> *"Variation in the utilization of health care services that cannot be explained by variation in patient illness or patient preferences."*[13]

Variation in aspects of diabetes care

The degree of variation in the percentage of people with Type 1 diabetes achieving treatment targets for HbA1c (blood-glucose control; Map 3, page 32) is greater when compared with that in the percentage of people with Type 2 diabetes achieving treatment targets for HbA1c (blood-glucose control; Map 4, page 34). This could be because people with Type 1 diabetes receive their ongoing care in diverse settings whereas people with Type 2 diabetes are most likely to receive care predominantly in a primary care setting.

The degrees of variation observed for the indicators highlighting diabetic complications (Maps 16–22, pages 58–71) are greater when compared with those for the indicators focussing on care processes (Maps 1 and 2, pages 28–31) and treatment targets (Maps 3–9, pages 32–45). Cardiovascular disease, kidney disease and diabetic foot disease develop after a person has had diabetes for many years. The variation observed for these complications is likely to be the result of variations in care and differences in the degree to which treatment targets have been met over several decades.

Variation in care over time

Each indicator in the Diabetes Atlas has been correlated with the same indicator for the previous year to ascertain whether the degree of variation observed is persistent over time. For some of the indicators, scatter plots are presented showing the indicator for the year featured against the same indicator for the previous year (correlation coefficient is shown in the accompanying commentary).

Data on the variation in care and outcomes of people with diabetes are presented for the following time-periods:

- For Maps 1–9, 13–16 and 18–21, the time-period is 2009/10;[14]
- For Maps 10–12, the time-period is 2010/11;
- For Maps 17 and 22, the time-period is five years prior to the end of the audit period (31 March 2010).[14]

If the association is strong, it suggests that similar numbers of PCTs are at the high and low end of the range from one year to the next, and the variation is persistent. If the association is weak, it suggests that the variation is random, and it will be more difficult to target changes in medical and/or patient behaviour geographically to reduce unwarranted variation.

Prescribing costs in 2009/10 (Maps 10–12) explain over 90% of the variation in spending on diabetic items in 2010/11. This indicates that a similar number of PCTs spent the most per person with diabetes in 2009/10 as did those in 2010/11. The existence of a strong association between spending on diabetes prescriptions from one year to the next suggests there may be inertia in prescribing medications for long-term conditions. However, it could also indicate that the variation in prescribing patterns is embedded in the structure and culture of local services.

The analysis of the use of inpatient services by people with diabetes shows that there was a strong association between 2008/09 and 2009/10 in the shortfall in day-case procedures for people with diabetes when compared with people without diabetes (Map 15, page 56). This finding suggests that the degree of variation in day-case listing rates for people with diabetes reflects differences in local practices and policies.

The degree of variation in excess emergency re-admissions among people with diabetes for 2009/10 was not associated with that for the same indicator during the previous year (Map 14, page 54). This could

13 Wennberg JE (2010) Tracking Medicine. A Researcher's Quest to Understand Healthcare. Oxford University Press. Also available at: http://www.dartmouthatlas.org/

14 For Maps 1–9 and 16–22, the "population" is the cohort of people in the NDA during the audit period (1 January 2009 to 31 March 2010).

indicate that the factors influencing excess emergency re-admissions in people with diabetes are less likely to be due to differences in local health service structures or policies.

Full results of this analysis can be found in the Online Appendix to the Diabetes Atlas:
http://www.rightcare.nhs.uk/atlas/

Variation in care by deprivation

A comparison of the indicators with deprivation levels can give valuable insights into the potential cause of variation. If there is little or no association between deprivation and a specific indicator, there is evidence to suggest that very little of the variation is due to patients behaving differently. It is more likely to be due to differences in the behaviour of medical practitioners. If there is a discernible trend across the deprivation gradient, there is evidence to suggest that some of the variation among PCTs may be due to patients with diabetes accessing medical interventions/services differently according to their deprivation status. A deprivation gradient may indicate differences in education and the use of information across social groups, which result in different attitudes to, and degrees of involvement in, decisions about treatment. Where relevant, scatter plots showing a comparison of the indicator against deprivation at PCT level are presented.

If the degree of variation in service use or in health outcomes is found to be associated with deprivation, the explanation for the variation observed is likely to be due to differences in factors such as environment, lifestyle, nutrition and/or level of need. However, if there is no clear association with deprivation, the explanation for the variation observed is more likely to be due to differences in the structure and organisation of local health services.[15]

For all of the indicators in the Diabetes Atlas, the potential for association with the deprivation score (Index of Multiple Deprivation 2010[16]) was investigated. However, none of the indicators had a statistically significant association with the average level of deprivation across the PCT. Previous analysis of some of the indicators had shown that when individual-level data are used a deprivation gradient is revealed, whereby people from more-deprived neighbourhoods[17] have worse outcomes when compared with those for people from less-deprived neighbourhoods. This finding suggests that there are factors operating across local health economies (in this case, PCTs) that modify associations with deprivation. From the analysis in the Diabetes Atlas, it can be seen that the variation among PCTs does not correlate with the average levels of deprivation in PCTs, and it is likely that differences in the organisation and delivery of local services contribute to the degree of variation in diabetes care and outcomes observed at the PCT level.

Full results of this analysis can be found in the Online Appendix to the Diabetes Atlas:
http://www.rightcare.nhs.uk/atlas/

Scale of variation across indicators

The degree of variation observed for indicators in the Diabetes Atlas was found to be least (≥1.5-fold variation) for five out of the six indicators relating to the achievement of treatment targets (the exception is blood-glucose control in people with Type 2 diabetes). The degree of variation was found to be greatest (≥9-fold variation) in the percentage of people with diabetes:

- who received all recommended care processes;
- who received renal replacement therapy;
- admitted to hospital for stroke.

The indicators relating to diabetic complications have a greater degree of variation than those relating to current treatment targets among PCTs. As diabetic complications take many years to develop, this variation may reflect historical variations in care for people with diabetes. As there is less variation observed for the indicators on treatment targets, it would suggest that the variation in diabetic complications may decrease in the future.

Indicators in the Diabetes Atlas show that there is variation in healthcare-resource use by people with

15 Appleby J, Raleigh V, Frosini F, Bevan G, Gao H, Lyscom T (2011) Variations in Health care: The good, the bad and the inexplicable. The King's Fund, London. http://www.kingsfund.org.uk/publications/

16 http://www.communities.gov.uk/communities/research/indicesdeprivation/deprivation10/ and an Atlas of the Indices of Deprivation 2010 for England (by lower layer super output areas by local authority) is available at: http://neighbourhood.statistics.gov.uk/HTMLDocs/AtlasOfDeprivation2010/Index.html

17 National Diabetes Audit Executive Summary 2009/10. http://www.ic.nhs.uk/webfiles/Services/NCASP/Diabetes/200910%20annual%20report%20documents/National_Diabetes_Audit_Executive_Summary_2009_2010.pdf

diabetes across England. However, the degrees of variation for indicators relating to inpatient activity among people with diabetes when compared with people without diabetes are greater than those for indicators relating to expenditure on prescribing.

Measuring variation in diabetes care using the England value

As described in "Map and chart presentation" (see page 19), for most of the indicators (Maps 1–9 and 13–22), PCTs have been allocated to one of five groups determined by statistical difference from the England value. Thus, PCT populations with values not significantly different from the England value (see the dashed line in Figure I.2A) are represented by the mid-tone on the maps and column charts.

This type of comparison is useful when rapidly analysing the potential for variation among populations or datasets. However, for some of the indicators in the Diabetes Atlas, it is important not only to measure the spread of the data but also to look closely at the England value.

For example, if the England value is 50% (see point B in Figure I.2B) and the spread is relatively wide (see Figure I.2B), it is important not only to reduce the spread to that shown in Figure I.2C but also to shift the distribution such that the overall England value changes, in this case to 90%.

This is the situation, for instance, with respect to the two indicators showing the percentage of people with diabetes in the NDA who have received all nine NICE-recommended basic care processes between 1 January 2009 and 31 March 2010:

- For people with Type 1 diabetes, the England value is 31.9% and the range is 5.4–47.9% (Map 1, page 28);
- For people with Type 2 diabetes, the England value is 52.9% and the range is 7.0–71.4% (Map 2, page 30).

For indicators where the England value is relatively poor, the focus should not be limited to the spread, the performance of or the degree of variation among PCTs that are at the high and/or low end of the range, but expanded to narrowing the range and shifting the distribution. Thus, even the PCTs identified as performing well when compared with the England value need to improve the services provided to the local population. Therefore, it is important that all services across the country are encouraged to make improvements.

FIGURE I.2: Shifting the distribution

Figure I.2A

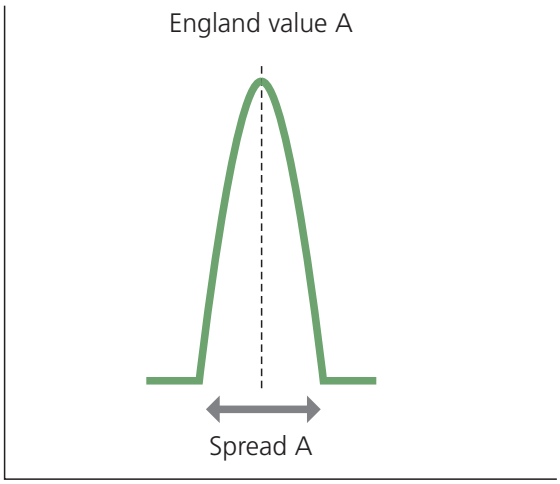


Figure I.2B

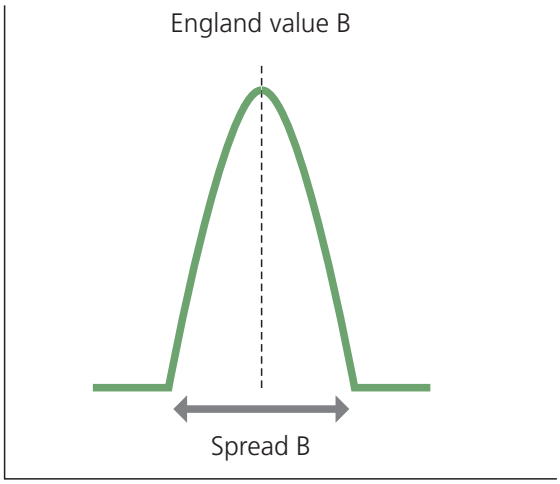
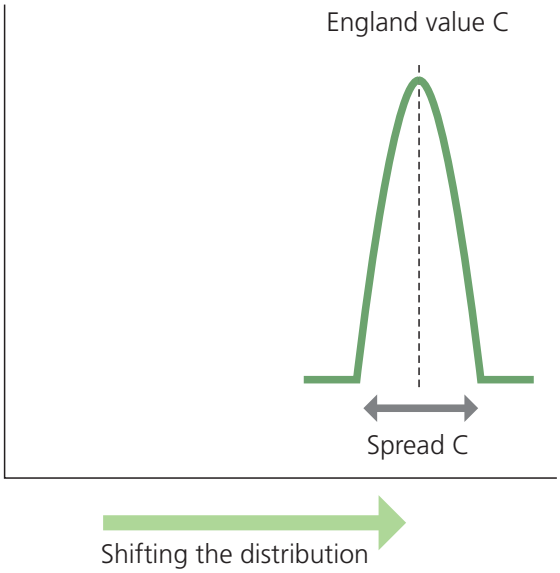


Figure I.2C



Changes need to be made in every aspect of diabetes care locally (see Box I.2), which will then translate into an improvement nationally. The aim in shifting the distribution towards improved performance is to optimise the delivery of essential diabetes care such that early detection is promoted and complications are detected, thereby improving health outcomes for all people with diabetes in the country.

Box I.2: Potential actions to improve diabetes care across England

- Review of current practice and service organisation to highlight causes of persistent geographical variation
- In primary care, ensure people with Type 1 and Type 2 diabetes receive the nine basic care processes to support management of the condition as well as early diagnosis of diabetic complications
- Organise services to ensure ease of access to primary care for people with diabetes, with GPs maintaining regular follow-up
- Ensure multidisciplinary management of all inpatients with diabetes
- During hospital admission, review by a specialist nurse or consultant for medication review, patient education, assessment of compliance and discussion of long-term complications
- Following discharge, assessment by GP within 2 weeks for medication review, patient education, assessment of compliance and discussion of long-term complications
- Patient education needs to involve easy access to results for patients and for them to be offered a reliable clinical point of contact, e.g. GP or specialist nurse
- Review of administrative systems to ensure all patients admitted to hospital are followed up by the GP and non-attenders are reminded in a timely fashion
- Commissioners need to monitor aspects of care where the standards are not being met such that appropriate review and support can be provided

Tools

Variation in Inpatient Activity (VIA): Diabetes tool

The Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool allows users to compare inpatient activity for those with and without diabetes to generate evidence on differing care patterns. It is possible to compare the number of bed-days, the proportion of elective admissions listed as a day-case procedure, and emergency re-admissions within 28 days for people with diabetes and people without diabetes who are of a similar age and admitted for similar conditions.

VIA: Diabetes can be accessed at: http://www.yhpho.org.uk/resource/view.aspx?RID=105866

National Diabetes Audit (NDA)

In the National Diabetes Audit (NDA), data on people with diagnosed diabetes are collected from primary and secondary care. Data are compiled on:

- the care processes received;
- treatment outcomes;
- hospital admissions and treatment for diabetic complications via linkages with Hospital Episode Statistics (HES).

A dashboard has been produced that confers the ability to compare care processes, treatment targets and complications at PCT level, and a set of profiles have been developed for each PCT to provide additional local data. The NDA toolkit – Performance Indicator Analysis Online (PIANO) – can be used to analyse the diabetes audit data in more detail. Data from primary care, secondary care and HES/Patient Episode Database for Wales (PEDW) sources are linked; data quality reports and data analysis are provided. Data can be stratified and analysed in many different ways, e.g. by sex, age, ethnicity, or deprivation.

Further details can be found at: http://www.ic.nhs.uk/services/national-clinical-audit-support-programme-ncasp/diabetes.

DiabetesE

The DiabetesE tool can be used to measure and benchmark the performance of all aspects of a system of diabetes care, and its use actively encourages continuous improvement to meet and surpass national standards.

As well as displaying the DiabetesE results dashboards, the "How Do I Compare" pages also display:

- the most recent National Diabetes Audit (NDA) PCT dashboards;
- the Quality and Outcomes Framework (QOF) diabetes indicator results.

Further information can be found at: https://www.diabetese.net/Public/HowDoICompareOptions.aspx?AspxAutoDetectCookieSupport=1

Diabetes Outcomes Versus Expenditure Tool (DOVE)

The Diabetes Outcomes Versus Expenditure (DOVE) tool allows users to compare expenditure on diabetes care with:

- clinical outcomes for a selected PCT;
- spend in other PCTs with similar populations;
- spend in all other PCTs.

Spending on diabetes care can be compared with several outcomes at PCT level.

DOVE can be accessed at: http://www.yhpho.org.uk/resource/view.aspx?RID=88739

PCT Spend and Outcome Factsheets and Tool (SPOT)

The PCT Spend and Outcome Factsheets and Tool (SPOT) helps commissioners to link health outcomes and expenditure using programme budgeting, a technique for assessing programmes of care rather than services. It provides information on spending and outcomes across a range of programme budgets for each PCT and

will allow users to identify how spend and outcomes for diabetes compare with those for other diseases/ programme budgets in their local area.

SPOT can be accessed at: http://www.yhpho.org.uk/resource/view.aspx?RID=49488

Disease Management Information Toolkit (DMIT) – Diabetes

The paediatric diabetes module of DMIT has information on emergency hospital admissions for patients aged less than 19 years with a primary diagnosis of diabetes at primary care trust (PCT) level. DMIT enables PCTs to compare their emergency admission rates, bed-days and lengths of stay with a range of comparators. It is designed to highlight variations at PCT level and enable benchmarking which in turn can inform the commissioning decision-making process for children's services.

DMIT can be accessed at: http://www.chimat.org.uk/resource/view.aspx?QN=CHMTDMIT

All the tools described on pages 17–18 are available through the National Diabetes Information Service (NDIS) web portal: http://www.diabetes-ndis.org

Map and chart presentation

Selection of indicators

The indicators included in the Diabetes Atlas were chosen:

- to reflect the range of diabetes care;
- because they could be calculated at PCT level using robust nationally collated data.

Indicators were revised following consultation with the National Diabetes Information Service (NDIS) Expert Reference Group.

Order of appearance

The indicators in the Diabetes Atlas are presented in the following order:

- Care processes;
- Treatment targets;
- Prescribing;
- Use of inpatient services;
- Diabetic complications.

Data sources

The indicators included in the Diabetes Atlas are based on data from the following sources:

- National Diabetes Audit;
- Prescribing data;
- Quality and Outcomes Framework;
- Variation in Inpatient Activity: Diabetes.

National Diabetes Audit (NDA)

The National Diabetes Audit (NDA) collects data from primary and secondary care on people whose diabetes has been diagnosed. Data are compiled on:

- the care processes received;
- the treatment outcomes;
- hospital admissions and treatment for diabetic complications via linkages with Hospital Episode Statistics (HES).

The audit data in the Diabetes Atlas cover the period 1 January 2009 to 31 March 2010. In this period, 1,929,985 people with diabetes were included, representing 81% of people diagnosed with diabetes in England. Linked data on hospital admissions for diabetic complications cover different time-periods from the 15-month audit.

A list of participating GP practices by PCT can be found at: http://www.ic.nhs.uk/services/national-clinical-audit-support-programme-ncasp/national-diabetes-audit/analysis-and-participation/2009-2010-analysis

Further details of the NDA can be found at: http://www.ic.nhs.uk/services/national-clinical-audit-support-programme-ncasp/diabetes.

Prescribing data

Data on prescribing for diabetic items were taken from ePACT, a database of all prescriptions issued by doctors, nurses and other prescribers in primary care and dispensed in the community in England. Prescriptions are allocated to Primary Care Trusts (PCTs) according to the usual location of the prescriber. Prescriptions issued in secondary care are not included in these data but account for only 2% of spending on diabetic items.

Further details of ePACT can be found at: http://www.nhsbsa.nhs.uk/815.aspx.

Quality and Outcomes Framework (QOF)

The Quality and Outcomes Framework (QOF) is a reward and incentive programme for general practice in England. As part of this programme, data are collected on the number of people with certain specified

long-term conditions including diabetes. Data on the number of people aged 17 years and older diagnosed with diabetes were used to calculate spending on prescriptions for diabetic items per adult with diabetes.

Further details of the QOF can be found at: http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework.

Variation in Inpatient Activity (VIA): Diabetes

The Variation in Inpatient Activity (VIA): Diabetes tool can be used to compare the actual use of inpatient services by people with diabetes with the use of inpatient services that would be expected if people with diabetes had the same resource-use patterns as people of a similar age who do not have the condition. Data in the VIA: Diabetes tool are taken from Hospital Episode Statistics (HES), a database of all NHS inpatient, day-case and outpatient activity in England.

Further details on the VIA: Diabetes tool can be found at: http://www.yhpho.org.uk/resource/view.aspx?RID=105866.

Classification

Data for each of the indicators in the Diabetes Atlas are displayed as both a thematic map and a ranked column chart to show variation in terms of magnitude and geographical location within England. London is shown as a page inset on all PCT maps to keep detail that might otherwise be lost as a result of relatively small geographical areas.

The charts and maps for all indicators are colour classified into thematic displays, which group the PCTs into categories and allow the reader to view and compare areas on the map without having to refer to individual values. For each indicator, PCTs are allocated to one of five groups for the purpose of shading the map and column chart for that indicator. PCTs are displayed with same shade on the map and the ranked column chart.

Two methods of classification have been used to display the indicators.

1. For Maps 1–9 and 13–22, shading is based on statistical difference from the England value;
2. For Maps 10–12, shading is based on the equal counts method of quintiling because statistical significances could not be calculated with the data available.

Maps 1–9 and 13–22

For Maps 1–9 and 13–22, the group to which a PCT is allocated is determined by the statistical significance of any difference in its indicator value when compared with the corresponding England value (see grey horizontal line across each column chart). To indicate the extent of variation from the England value, the 95% and 99.8% confidence limits are used as the cut-off points to allocate PCTs to one of five groups. The key below shows the degree of significance associated with each of the five shades used in the maps and column charts.

PCT shading	Significance
	Very significantly lower than England value (99.8% level)
	Significantly lower than England value (95% level)
	Not significantly different from England value
	Significantly higher than England value (95% level)
	Very significantly higher than England value (99.8% level)

- Values that are not significantly different from the England value (mid-shade) are said to display 'random' variation.
- Values that are different from the England value at the 95% level are deemed to be statistically significant. However, because 151 PCT values have been compared simultaneously with the England value, the likelihood of finding PCT values that are significantly different from the England value is raised by chance alone. It is for this reason that a more stringent 99.8% significance level is also applied (see below).
- Values that are significant at the 99.8% level (darkest shade and lightest shade) are likely to be due to variation that warrants further investigation. In these PCTs, it is likely that the process or system generating these values is markedly different from that in other PCTs, and the variation may be unwarranted.
- If there are a large number of PCT values that are significant at the 99.8% level, this may reflect over-dispersion, in which the variation is larger than expected. Over-dispersion arises when there are factors, such as demographic risk factors, case-mix or localised service constraints, which are not accounted for in the relationship with England using confidence

limits. Given the method used in the Diabetes Atlas, these additional factors may account for the larger than expected difference from the England value. It is important to bear this in mind when determining whether variation is 'unwarranted' or not.

Both the percentage and the number of PCTs significantly different from the England value at the 99.8% level at the high end and at the low end of the range are provided in the relevant commentaries.

Maps 10–12

For the prescribing indicators (Maps 10–12) a simple method of classification using equal counts of areas was used to display the indicators, regardless of data distribution within the indicators. Five equal counts of areas or 'quintiles' were classified for the indicator data where possible. However, as the indicators include a total number of areas that are not divisible by five (i.e. 151 PCTs), the classifications do not include exactly the same number of areas. The method used to create the classification was to rank order the areas from highest to lowest values, then divide the ranks into five equal categories.

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 green (lowest value) to dark green (highest value) on both the charts and maps. The ranges and their shading do not indicate whether a high or low value for an area represents either good or poor performance.

Each quintile represents ~20% of the PCTs.

PCT shading	Quintile
	Lowest spending 20% of PCTs
	Second lowest spending of PCTs
	Third highest spending 20% of PCTs
	Second highest spending 20% of PCTs
	Highest spending 20% of PCTs

Chart production

The charts have been originally produced in Microsoft Excel 2007 and the maps originally created using MapInfo Professional 10.5.

Estimating the magnitude of variation

The shape of the ranked column charts gives an impression of the overall extent of variation among PCTs, and the shading indicates the number of PCTs that are statistically different from the England value.

The extent of variation in an indicator can be measured in several ways. The extent of variation among PCTs in England with respect to the indicators in the Diabetes Atlas has been assessed using a combination of two statistics.

- The simplest is by comparing the highest PCT with the lowest PCT as a ratio (highest PCT divided by lowest PCT). However, if there is a small number of PCTs that are much higher or lower than the majority of PCTs (sometimes referred to as outliers) their influence can distort the degree of variation.
- The coefficient of variation is presented in the Online Appendix for the Diabetes Atlas (see http://www.rightcare.nhs.uk/atlas/) and has been used to compare the degree of variation across indicators measured on different scales. The coefficient of variation is calculated by dividing the standard deviation by the mean. This statistic is influenced by all the values in the distribution and is not skewed by outliers. The coefficient of variation has been used to inform the commentary for the indicators but the values have not been presented in the text.

Confidence intervals

Confidence intervals are used to represent the level of uncertainty of an estimated value (the calculation). Statistical uncertainties usually arise because the indicators are based on a random sample or subset either from a population of interest or over a defined time-period, both of which may not be representative of the whole population. A smaller confidence interval indicates that the estimate is more reliable, and a larger confidence interval indicates that the estimate is less reliable.

Although none of the charts in the Diabetes Atlas are displayed with confidence intervals, confidence

intervals were used to determine the shading in the charts and the thematic maps for Maps 1–9 and 13–22. Confidence intervals were calculated using:

- the Wilson Score method[1] for the indicators in Maps 1–9 and 16–22;
- the Byars method[2] for the indicators in Maps 13–15.

Standardisation: adjusting for need

Computationally, the first step is to adjust the indicators for perceived variations in 'need' that may exist among PCT populations, such that the 'unwarranted' element of an indicator value is isolated. Several methods are available for adjusting indicators for 'need'. These adjustments commonly attempt to remove the effect of differences among populations in such factors as age, sex, deprivation and case-mix of the population. The population denominator in the rate calculation may be weighted or the rate could be standardised.

- The indicators on inpatient activity (Maps 13–15) have been adjusted for age.
- The indicators on care processes (Maps 1 and 2), treatment targets (Maps 3–9), prescribing (Maps 10–12) and diabetic complications (Maps 16–22) are not adjusted for any differences in the population with diabetes due to a lack of robust data to undertake the adjustments. As most diabetic complications are more prevalent in older people, the age-structure of the people with diabetes in each PCT may influence the variation observed for the indicators relating to diabetic complications (Maps 16–22). Where relevant, this is noted in the commentary to the indicators.

Association with deprivation

The association between each indicator and the level of deprivation (Indices of Multiple Deprivation 2010) was assessed using Spearman's Rank correlation coefficient, which gives a score of between 0 and +/-1.

- A correlation coefficient of 0 indicates that there is no association between the level of deprivation and the indicator at PCT level;
- A correlation coefficient of +1 indicates that the PCT with the highest level of deprivation has the highest score on the indicator, the PCT with the second highest level of deprivation has the second highest score on the indicator, and so on.
- A correlation coefficient of -1 indicates that the PCT with the highest level of deprivation has the lowest score on the indicator, the PCT with the second highest level of deprivation has the second lowest score on the indicator, and so on.

Persistence through time

Each indicator in the Diabetes Atlas has been correlated with the same indicator for the previous year to ascertain whether the variation observed is persistent over time using the Pearson Product Moment correlation coefficient.

- If the association is strong, it suggests that the variation is persistent.
- If the association is weak, it suggests that the variation is random, and therefore it will be more difficult to target changes in medical and/or patient behaviour geographically to reduce unwarranted variation.

Scatter plots have been provided for some of the indicators to illustrate pertinent points.

Associations across indicators

In cases when one indicator could have an impact on another indicator in the Diabetes Atlas (for example, spending on diabetes drugs could influence the level of blood-glucose control), the correlation between the indicators has been assessed using Spearman's Rank correlation coefficient (see "Association with deprivation" for an explanation). Scatter plots have been provided for some of the indicators to illustrate pertinent points.

Strength of correlation

In the Diabetes Atlas, the strength of correlation has been described consistently according to the text set out in Table M.1.[3]

1 Wilson EB (1927) Probable inference, the law of succession, and statistical inference. *Journal of the American Statistical Association* 22: 209-212.

2 Breslow NE, Day NE (1987) *Statistical methods in cancer research, volume II: The design and analysis of cohort studies*. Lyon: International Agency for Research on Cancer, World Health Organization.

3 University of Washington. http://faculty.washington.edu/ddbrewer/s231/s231regr.htm

Table M.1: Strength of correlation

Value of correlation coefficient, *r*	Description
0.0–0.2	Weak/slight
0.2–0.4	Mild/modest
0.4–0.6	Moderate
0.6–0.8	Moderately strong
0.8–1.0	Strong

Exclusions

For the prescribing indicators (Maps 10–12) the range of variation presented in the accompanying commentaries has been calculated for the full range and for the range when the highest five values and the lowest five values have been excluded. This is because "outliers" may be the result of data artefacts, 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 continued to use the "Richards heuristic" in Atlas 2.0 and the Child Health Atlas.

Domains in the NHS Outcomes Framework

Underneath the title for each indicator, the domain or domains in the NHS Outcomes Framework 20011/12 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.1A: Summary of 19 indicators in the Diabetes Atlas (Maps 1–9 and 13–22), showing the range and magnitude of variation, the England value and the number of PCTs at the high end of the range and at the low end of the range very significantly different from the England value at the 99.8% level ; each indicator has been assigned to one of the following categories – activity, cost, equity, outcome, quality (performance as compared with a standard), and safety.

Map no.	Title	Range	Fold difference	England value	PCTs very significantly different from England value at high end of range	PCTs very significantly different from England value at low end of range	Category of indicator
1	Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes receiving all nine key care processes by PCT 1 January 2009 to 31 March 2010	5.4–47.9%	9	31.9%	37 (24.5%)	37 (24.5%)	Quality
2	Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes receiving all nine key care processes by PCT 1 January 2009 to 31 March 2010	7.0–71.4%	10	52.9%	73 (48.3%)	57 (37.7%)	Quality
3	Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less by PCT 1 January 2009 to 31 March 2010	16.2–40.9%	2.5	28.2%	17 (11.2%)	20 (13.2%)	Outcome
4	Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less by PCT 1 January 2009 to 31 March 2010	52.8–76.6%	1.5	66.5%	62 (41.0%)	50 (31.1%)	Outcome
5	Percentage of children aged 0–15 years in the National Diabetes Audit (NDA) with diabetes whose most recent HbA1c measurement was 10% (86 mmol/mol) or less by PCT 1 January 2009 to 31 March 2010	41.7–100%	2.4	80.0%	7 (4.6%)	5 (3.3%)	Outcome
6	Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent blood-pressure measurement was within target by PCT 1 January 2009 to 31 March 2010	53.9–77.4%	1.4	63.2%	16 (10.6%)	17 (11.2%)	Outcome
7	Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent blood-pressure measurement was within target by PCT 1 January 2009 to 31 March 2010	39.9–60.1%	1.5	49.5%	43 (28.5%)	51 (33.8%)	Outcome
8	Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent cholesterol measurement was 5 mmol/l or less by PCT 1 January 2009 to 31 March 2010	62.1–79.0%	1.3	72.5%	9 (6.0%)	9 (6.0%)	Outcome
9	Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent cholesterol measurement was 5 mmol/l or less by PCT 1 January 2009 to 31 March 2010	69.8–84.2%	1.2	78.3%	40 (26.5%)	31 (20.5%)	Outcome

Map no.	Title	Range	Fold difference	England value	PCTs very significantly different from England value at high end of range	PCTs very significantly different from England value at low end of range	Category of indicator
13	Excess length of stay (%) in hospital among people with diabetes when compared with people without diabetes by PCT 2009/10	-0.4–46.7%	Not applicable	19.4%	55 (36.4%)	65 (43.0%)	Outcome
14	Excess emergency re-admissions (%) within 28 days among people with diabetes when compared with people without diabetes by PCT 2009/10	15.8–100.2%	6	59.1%	19 (12.6%)	15 (9.9%)	Outcome
15	Percentage of elective procedures undertaken as day-cases in people with diabetes when compared with people without diabetes by PCT 2009/10	-37.3–2.2%	Not applicable	-10.4%	20 (13.2%)	30 (19.9%)	Outcome
16	Percentage of people with previously diagnosed diabetes in the National Diabetes Audit (NDA) admitted to hospital for diabetic ketoacidosis (DKA) at least once by PCT 2009/10	0.3–1.3%	5	0.48%	5 (3.3%)	10 (6.6%)	Outcome
17	Percentage of children aged 0–15 years with previously diagnosed diabetes in the National Diabetes Audit (NDA) admitted to hospital for diabetic ketoacidosis five years prior to the end of the audit period by PCT; Audit period: 1 January 2009 to 31 March 2010	6.4–46.7%	7	24.6%	0	5 (3.3%)	Outcome
18	Percentage of people with diabetes in the National Diabetes Audit (NDA) who received renal replacement therapy (RRT) by PCT 2009/10	0.1–1.0%	10	0.38%	18 (11.9%)	29 (19.2%)	Outcome
19	Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for myocardial infarction (MI) by PCT 2009/10	0.2–1.7%	8	0.60%	7 (4.6%)	14 (9.3%)	Outcome
20	Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for stroke by PCT 2009/10	0.2–2.4%	15	0.69%	13 (8.6%)	27 (17.9%)	Outcome
21	Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for cardiac failure by PCT 2009/10	0.8–5.0%	6	1.58%	18 (11.9%)	25 (16.5%)	Outcome
22	Percentage of people in the National Diabetes Audit (NDA) having major lower limb amputations five years prior to the end of the audit period by PCT; Audit period: 1 January 2009 to 31 March 2010	0.0–0.5%	Not applicable	0.24%	5 (3.3%)	13 (8.6%)	Outcome

Table S.1B: Summary of the three prescribing indicators in the Diabetes Atlas (Maps 10–12), showing the range and magnitude of variation before and after exclusions;[1] each indicator has been assigned to one of the following categories – activity, cost, equity, outcome, quality (performance as compared with a standard), and safety.

Map no.	Title	Range	Fold difference	Range after exclusions	Fold difference after exclusions	Category of indicator
10	Insulin total net ingredient cost per patient on GP diabetes registers by PCT 2010/11	£79–£176	2.2	£95–£158	1.7	Cost
11	Non-insulin anti-diabetic drugs total net ingredient cost per patient on GP diabetes registers by PCT 2010/11	£65–£180	2.8	£73–£154	2.1	Cost
12	Blood-testing items total net ingredient cost per patient on GP diabetes registers by PCT 2010/11	£43–£87	2	£49–£80	1.6	Cost

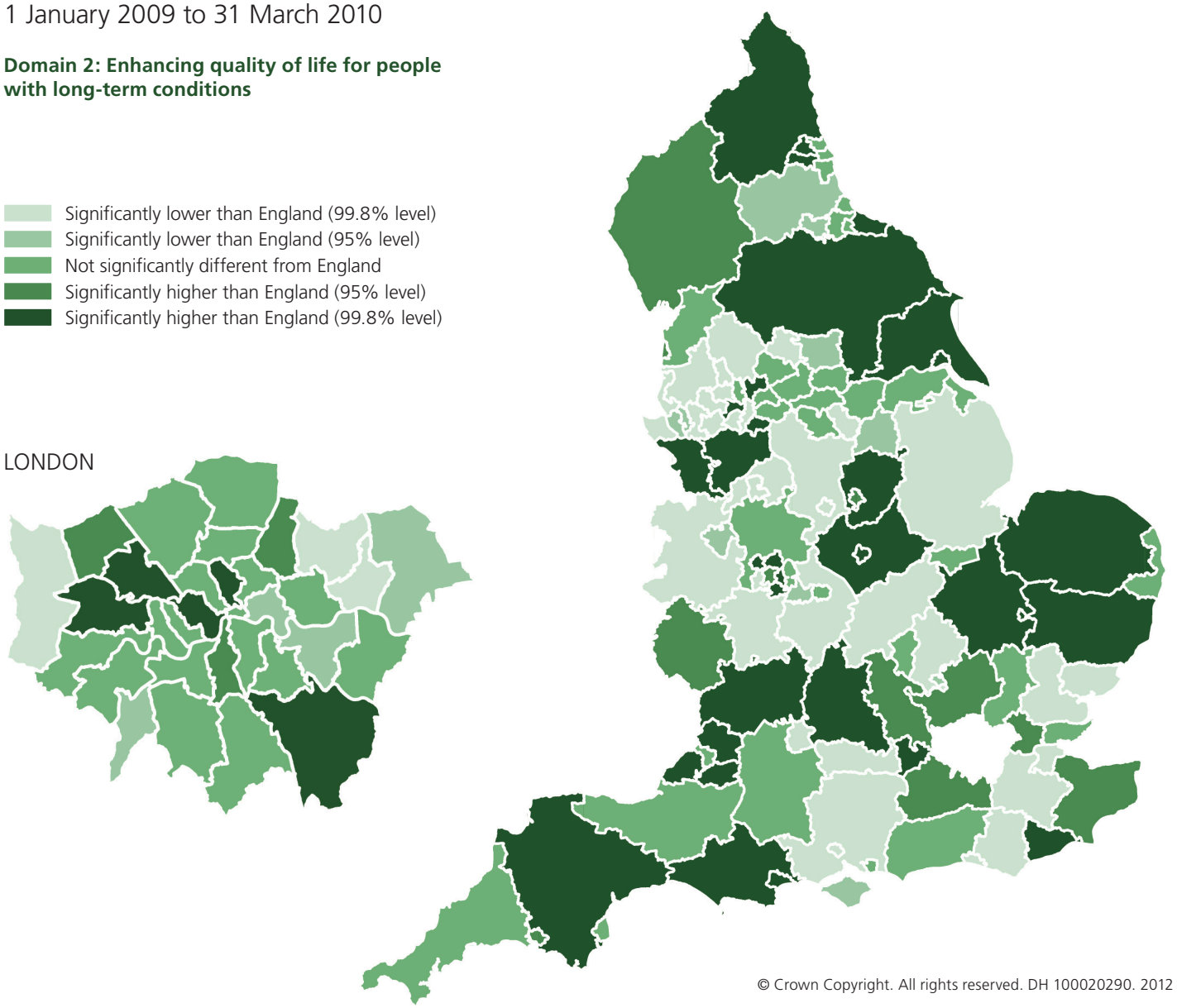
1 For Maps 10–12, where the "equal numbers" method of quintiling has been used, the PCTs with the five highest values and the PCTs with the five lowest values have been excluded.

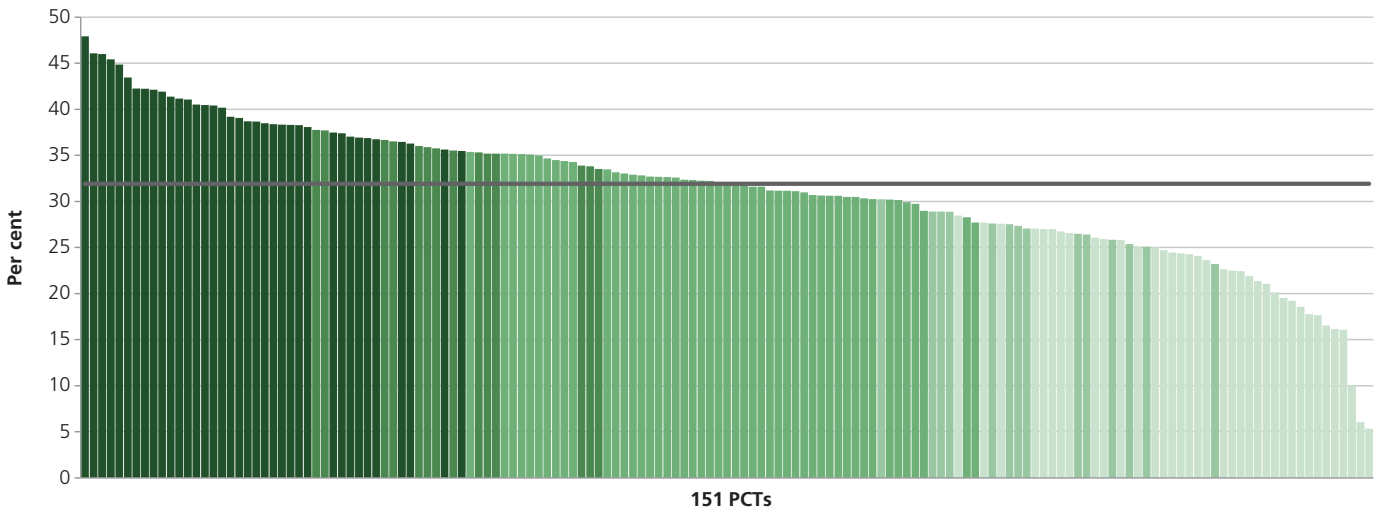
CARE PROCESSES

Map 1: Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes receiving all nine key care processes by PCT

1 January 2009 to 31 March 2010

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





Context

In NICE guidance (see "Resources"), it is recommended that all people with Type 1 diabetes should receive the following care processes at least once a year:

- HbA1c measurement;
- Cholesterol measurement;
- Creatinine measurement;
- Micro-albuminuria measurement;
- Blood-pressure measurement;
- Body mass index (BMI) measured;
- Smoking status recorded;
- Eye examination;
- Foot examination.

These care processes are essential for the ongoing management of diabetes and early detection of complications. They are incentivised within the Quality and Outcomes Framework (QOF).

Only 31.9% of people of all ages with Type 1 diabetes in England in the National Diabetes Audit (NDA) had received all nine care processes between 1 January 2009 and 31 March 2010.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 1 diabetes receiving all nine key care processes:

- For PCTs in England, the range is from 5.4% to 47.9%, a 9-fold variation;
- The England value is 31.9%: at the high end of the range 24.5% of PCTs (n=37) and at the low end of the range 24.5% of PCTs (n=37) are very significantly different from the England value (at the 99.8% level).

The overall degree of variation for this indicator is less than that for the corresponding indicator for people with Type 2 diabetes (see Map 2, page 30).

There is a moderately strong association between the percentage of people with Type 1 diabetes who received all nine care processes in 2008/09 and the percentage in 2009/10 (correlation coefficient, $r = 0.789$; $p<0.00005$; see Figure 1.1). This finding suggests that the degree of variation is moderately persistent over time. There is no statistically significant correlation between this indicator and deprivation at PCT level (see Figure 1.2). These results suggest that the degree of variation observed is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As two out of three people with Type 1 diabetes have not received the basic standard of care, it is important that all commissioners and service providers ensure robust arrangements are put in place for everyone with Type 1 diabetes to receive an annual review covering all nine care processes. Arrangements could include:

- Administrative systems that reliably invite all people with Type 1 diabetes for their annual checks;
- Processes to follow-up and remind non-attenders;
- Alternative access arrangements;
- Ensuring that scheduled checks are undertaken on attendance, and results recorded accurately.

RESOURCES

- NICE Guidance Type 1 diabetes. Diagnosis and management of type 1 diabetes in children, young people and adults. http://guidance.nice.org.uk/CG15
- NICE Care pathway for diabetes. http://pathways.nice.org.uk/pathways/diabetes

Although this indicator appears in Atlas 2.0, statistical difference from the England value has been used to illustrate variation in the Diabetes Atlas (see page 20), therefore, the shading used in the maps and the appearance of the column charts will differ between the two publications, as will reporting for the "Magnitude of variation" section.

Figure 1.1: People with Type 1 diabetes (%) receiving all nine key care processes over time

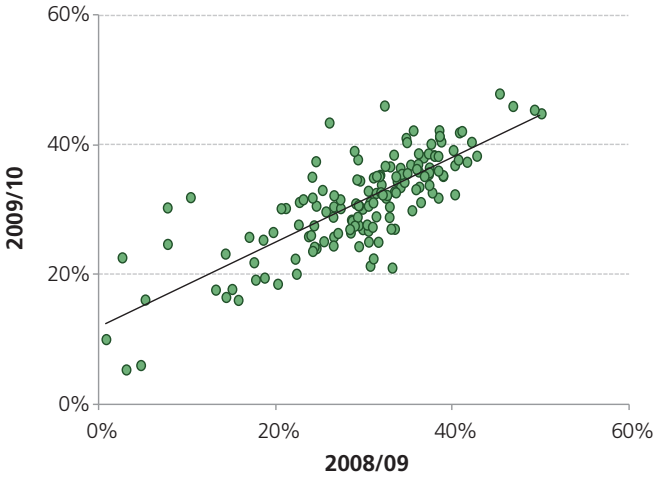
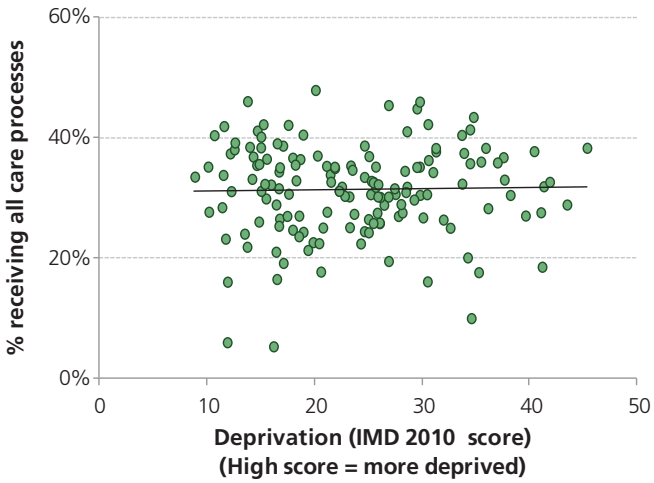


Figure 1.2: People with Type 1 diabetes (%) receiving all nine key care processes in relation to deprivation

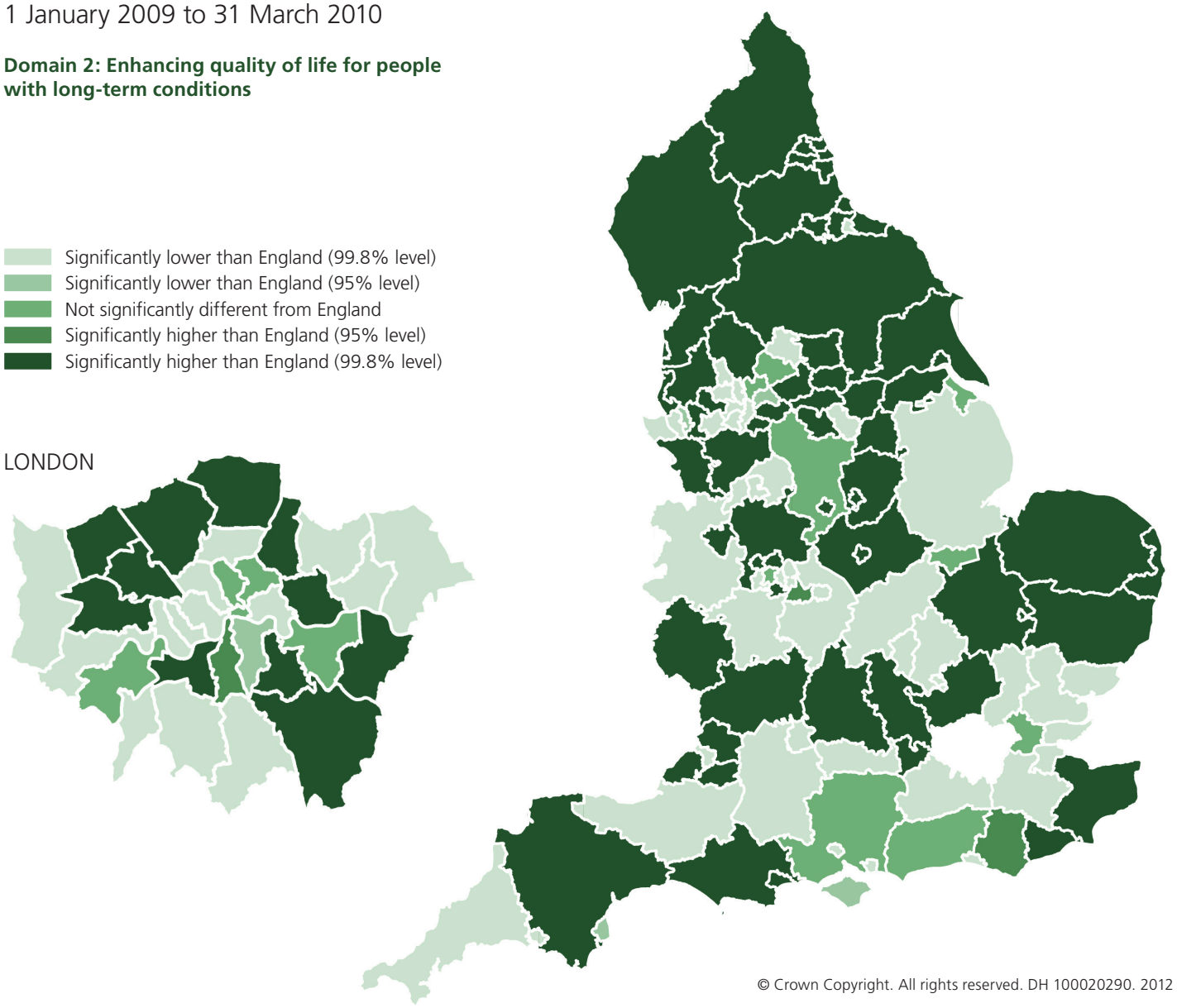


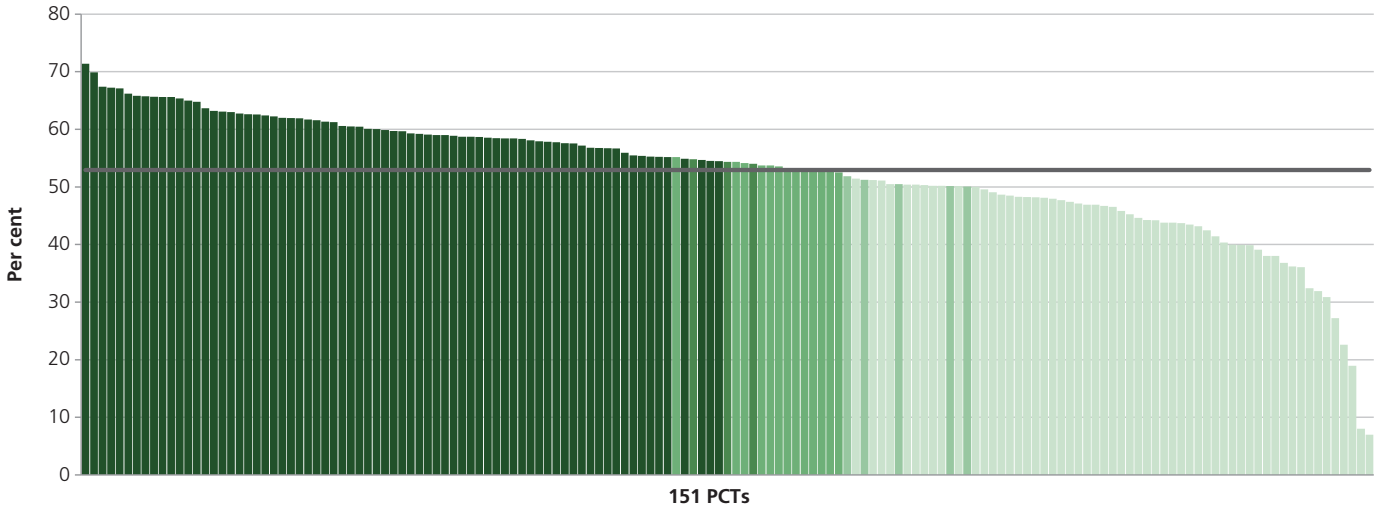
CARE PROCESSES

Map 2: Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes receiving all nine key care processes by PCT

1 January 2009 to 31 March 2010

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





Context

In NICE guidance (see "Resources"), it is recommended that all people with Type 2 diabetes should receive the following care processes at least once a year:

- HbA1c measurement;
- Cholesterol measurement;
- Creatinine measurement;
- Micro-albuminuria measurement;
- Blood-pressure measurement;
- Body mass index (BMI) measured;
- Smoking status recorded;
- Eye examination;
- Foot examination.

These care processes are essential for the ongoing management of diabetes and early detection of complications. They are incentivised within the Quality and Outcomes Framework (QOF).

Only 52.9% of people of all ages with Type 2 diabetes in England in the National Diabetes Audit (NDA) had received all nine care processes between 1 January 2009 and 31 March 2010.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 1 diabetes receiving all nine key care processes:

- For PCTs in England, the range is from 7.0% to 71.4% , a 10-fold variation;
- The England value is 52.9%: at the high end of the range 48.3% of PCTs (n=73) and at the low end of the range 37.7% of PCTs (n=57) are very significantly different from the England value (at the 99.8% level).

The overall degree of variation observed for this indicator is greater than that for the corresponding indicator for people with Type 1 diabetes (see Map 1, page 28).

There is a moderately strong association between the percentage of people with Type 2 diabetes who received all nine care processes in 2008/09 and the percentage in 2009/10 (correlation coefficient, $r = 0.783$; $p<0.00005$; see Figure 2.1). This finding suggests that the degree of variation is moderately persistent over time. There is no statistically significant correlation between this indicator and deprivation at PCT level (see Figure 2.2). These results suggest that the degree of variation observed is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As almost half of the people with Type 2 diabetes have not received the basic standard of care, it is important that all commissioners and service providers ensure robust arrangements are put in place for everyone with Type 2 diabetes to receive an annual review covering all nine care processes. Arrangements could include:

- Administrative systems that reliably invite all people with Type 2 diabetes for their annual checks;
- Processes to follow-up and remind non-attenders;
- Alternative access arrangements;
- Ensuring that scheduled checks are undertaken on attendance, and results recorded accurately.

RESOURCES

- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66
- NICE Care pathway for diabetes. http://pathways.nice.org.uk/pathways/diabetes

Although this indicator appears in Atlas 2.0, statistical difference from the England value has been used to illustrate variation in the Diabetes Atlas (see page 20), therefore, the shading used in the maps and the appearance of the column charts will differ between the two publications, as will reporting for the "Magnitude of variation" section.

Figure 2.1: People with Type 2 diabetes (%) receiving all nine key care processes over time

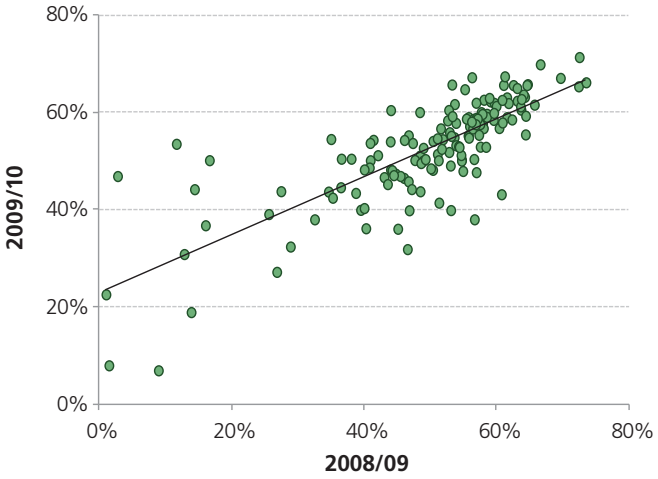
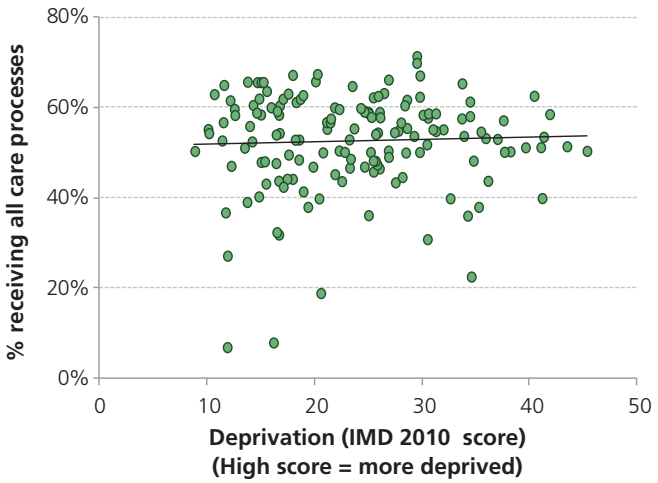


Figure 2.2: People with Type 2 diabetes (%) receiving all nine key care processes in relation to deprivation

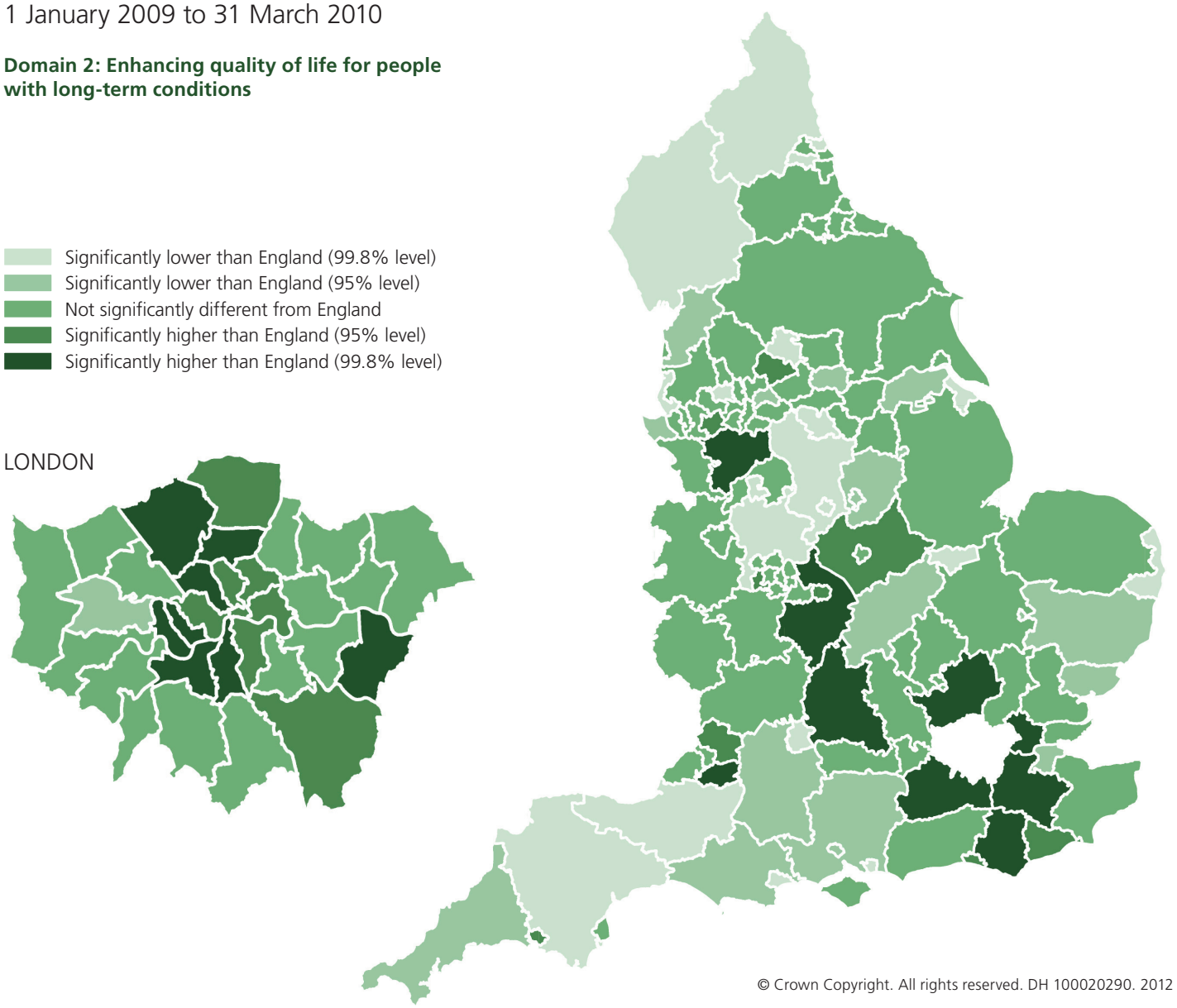


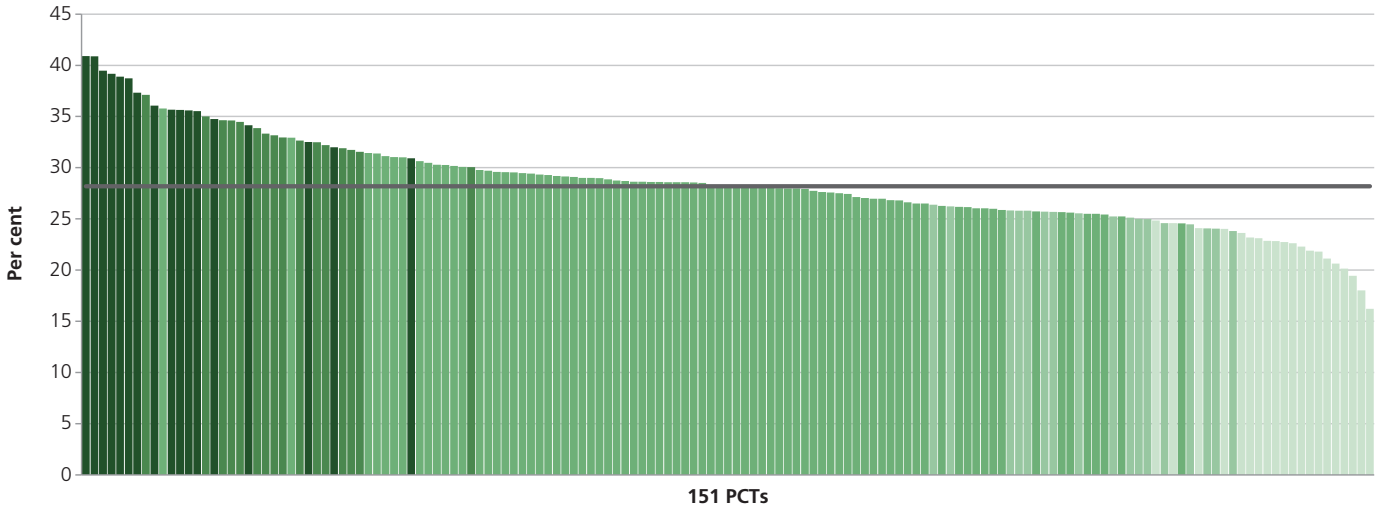
TREATMENT TARGETS

Map 3: Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less by PCT

1 January 2009 to 31 March 2010

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





Context

Glycated haemoglobin or HbA1c is a measure of average blood-glucose levels over the previous 8–12 weeks. Good blood-glucose control reduces the risk of developing diabetic complications in the longer term. In NICE guidance (see "Resources"), it is recommended that people with Type 1 diabetes should have an HbA1c measurement of 7.5% (58 mmol/mol) or less.

In England, of all people of all ages with Type 1 diabetes in the National Diabetes Audit (NDA), only 28.2% had a most recent HbA1c measurement of 7.5% or less between 1 January 2009 and 31 March 2010. During the same time period, 17.0% had a most recent HbA1c measurement of >10% (>86 mmol/mol): this group of people is at a high risk of developing diabetic complications.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 1 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less:

- For PCTs in England, the range is from 16.2% to 40.9% (2.5-fold variation);
- The England value is 28.2%: at the high end of the range 11.2% of PCTs (n=17) and at the low end of the range 13.2% of PCTs (n=20) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is greater than that for the corresponding indicator for people with Type 2 diabetes (see Map 4, page 34).

There is a moderately strong association between the percentage of people with Type 1 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less in 2008/09 and the percentage in 2009/10 (correlation coefficient, $r = 0.785$; $p<0.00005$; see Figure 3.1). This finding suggests that the degree of variation is moderately persistent over time. There is no statistically significant correlation between this indicator and deprivation at PCT level (see Figure 3.2). These results suggest that the degree of variation observed in blood-glucose control in people with Type 1 diabetes is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice with a view to optimising them.

As two out of three people with Type 1 diabetes are at high risk of developing complications due to glucose control above recommended levels, it is important that all commissioners and service providers ensure that NICE guidance on the management of Type 1 diabetes is implemented (CG15; see "Resources"), including:

- Structured patient education programmes and supported self-management;
- Coordinated transitional care for young adults;
- Insulin pumps for people with Type 1 diabetes who have difficulty maintaining blood glucose within recommended targets (see "Resources" – TA151);
- Access to results for patients, and collaborative care planning with appropriate goal setting.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled.] http://guidance.nice.org.uk/CG15
- NICE Guidance (2008) Continuous subcutaneous insulin infusion for the treatment of diabetes (review) Technology appraisals, TA151. http://guidance.nice.org.uk/TA151
- NICE (2009) Insulin pump therapy service. Commissioning guide. Implementing NICE guidance.
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp
  Glycaemic control webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/glycaemiccontrol.jsp

Figure 3.1: People with Type 1 diabetes (%) whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less over time

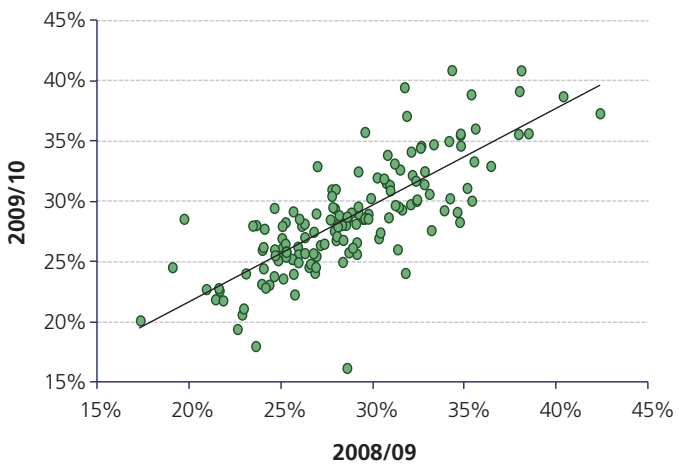
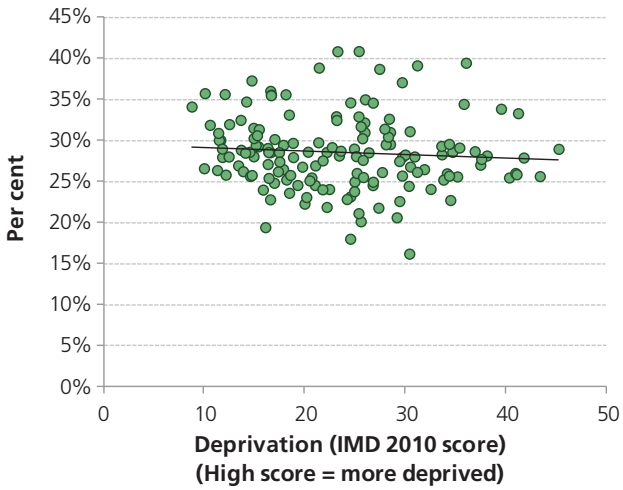


Figure 3.2: People with Type 1 diabetes (%) whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less in relation to deprivation

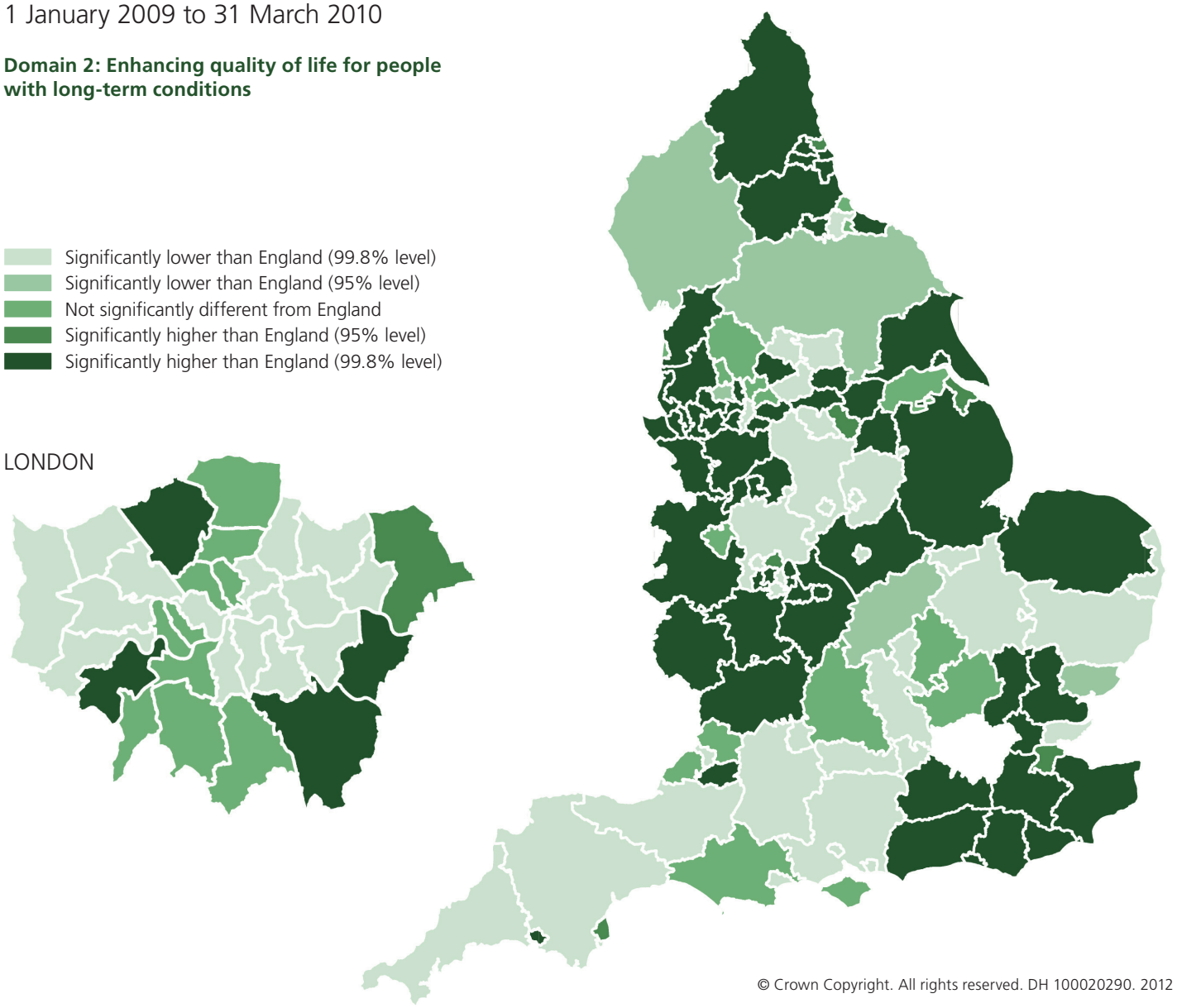


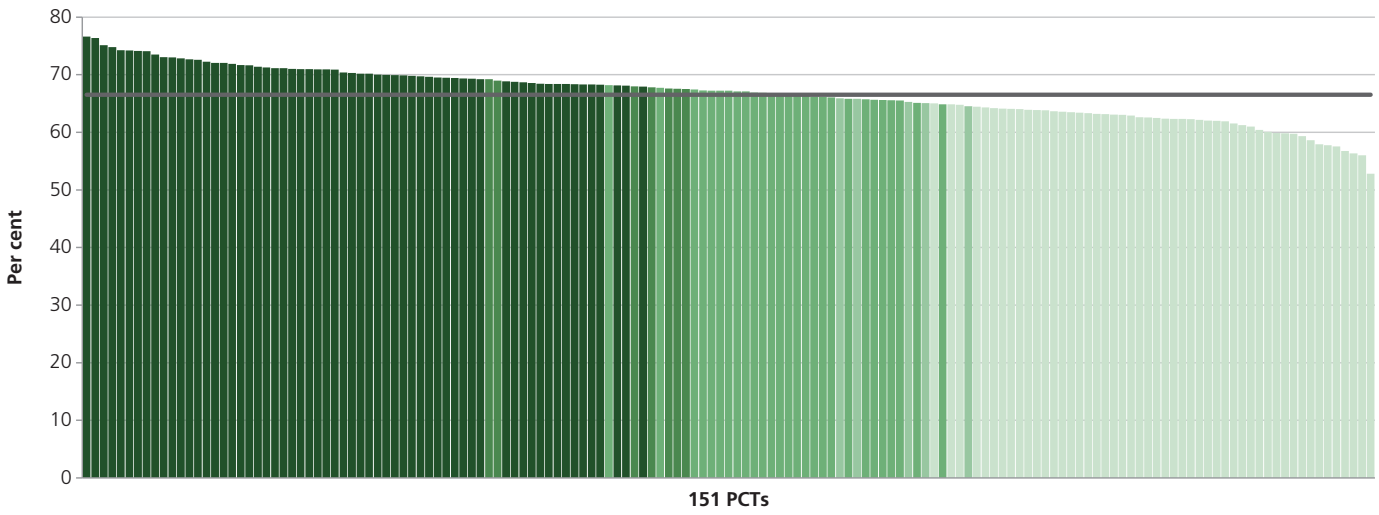
TREATMENT TARGETS

Map 4: Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less by PCT

1 January 2009 to 31 March 2010

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





Context

Glycated haemoglobin or HbA1c is a measure of average blood-glucose levels over the previous 8-12 weeks. Good blood-glucose control reduces the risk of developing diabetic complications in the longer term. In NICE guidance (see "Resources"), it is recommended that people with Type 2 diabetes should have an HbA1c of 7.5% (58 mmol/mol) or less.

In England, of all people of all ages with Type 2 diabetes in the National Diabetes Audit (NDA), only 66.5% had a most recent HbA1c measurement of 7.5% or less between 1 January 2009 and 31 March 2010. During the same period, 6.7% of people with Type 2 diabetes had a most recent HbA1c measurement of >10% (>86 mmol/mol): this group of people is at high risk of developing diabetic complications.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less:

- For PCTs in England the range is from 52.8% to 76.6%, a 1.5-fold variation;
- The England value is 66.5%: at the high end of the range 41.0% of PCTs (n=62) and at the low end of the range 31.1% of PCTs (n=50) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is less than that for the corresponding indicator for people with Type 1 diabetes (see Map 3, page 32).

There is a strong association between the percentage of people with Type 2 diabetes whose most recent HbA1c measurement was 7.5% or less in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.837; p<0.00005; see Figure 4.1), suggesting that the variation is persistent over time. There is no statistically significant association between this indicator and deprivation at PCT level (see Figure 4.2). These results suggest that the degree of variation observed in blood-glucose control among people with Type 2 diabetes is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As one in three people with Type 2 diabetes are at risk of developing complications due to glucose levels above recommended levels, all commissioners and service providers need to ensure that NICE guidance on the management of Type 2 diabetes (CG66 & CG87; see "Resources") is implemented locally, including:

- Treatment regimens to optimise blood-glucose control;
- Structured patient education programmes and supported self-management;
- Support for lifestyle changes, including weight management;
- Access to results for patients, and collaborative care planning with appropriate goal setting.

RESOURCES

- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp
  Glycaemic control webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/glycaemiccontrol.jsp

Figure 4.1: People with Type 2 diabetes (%) whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less over time

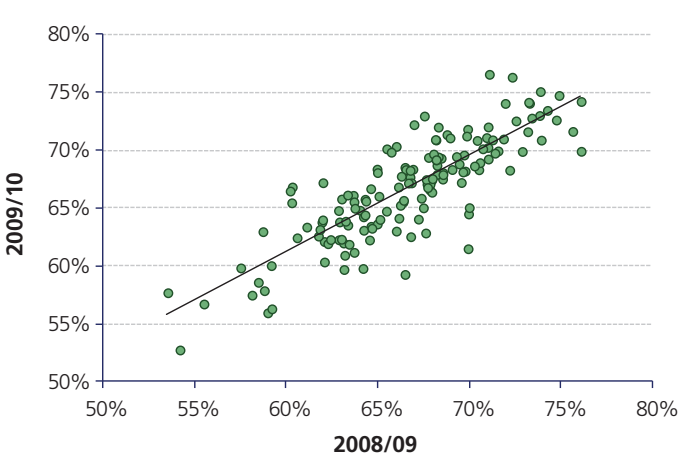
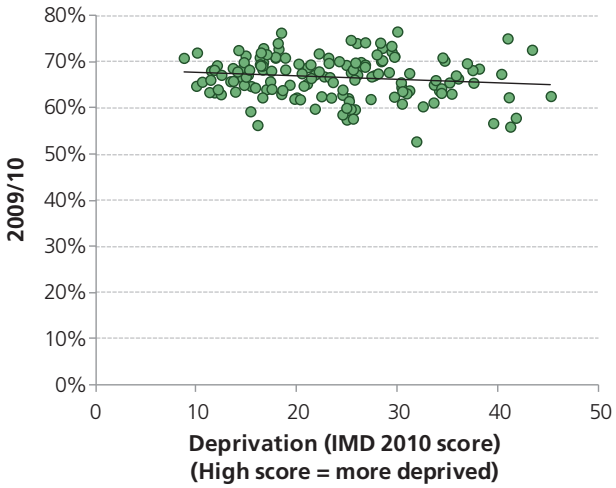


Figure 4.2: People with Type 2 diabetes (%) whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less in relation to deprivation

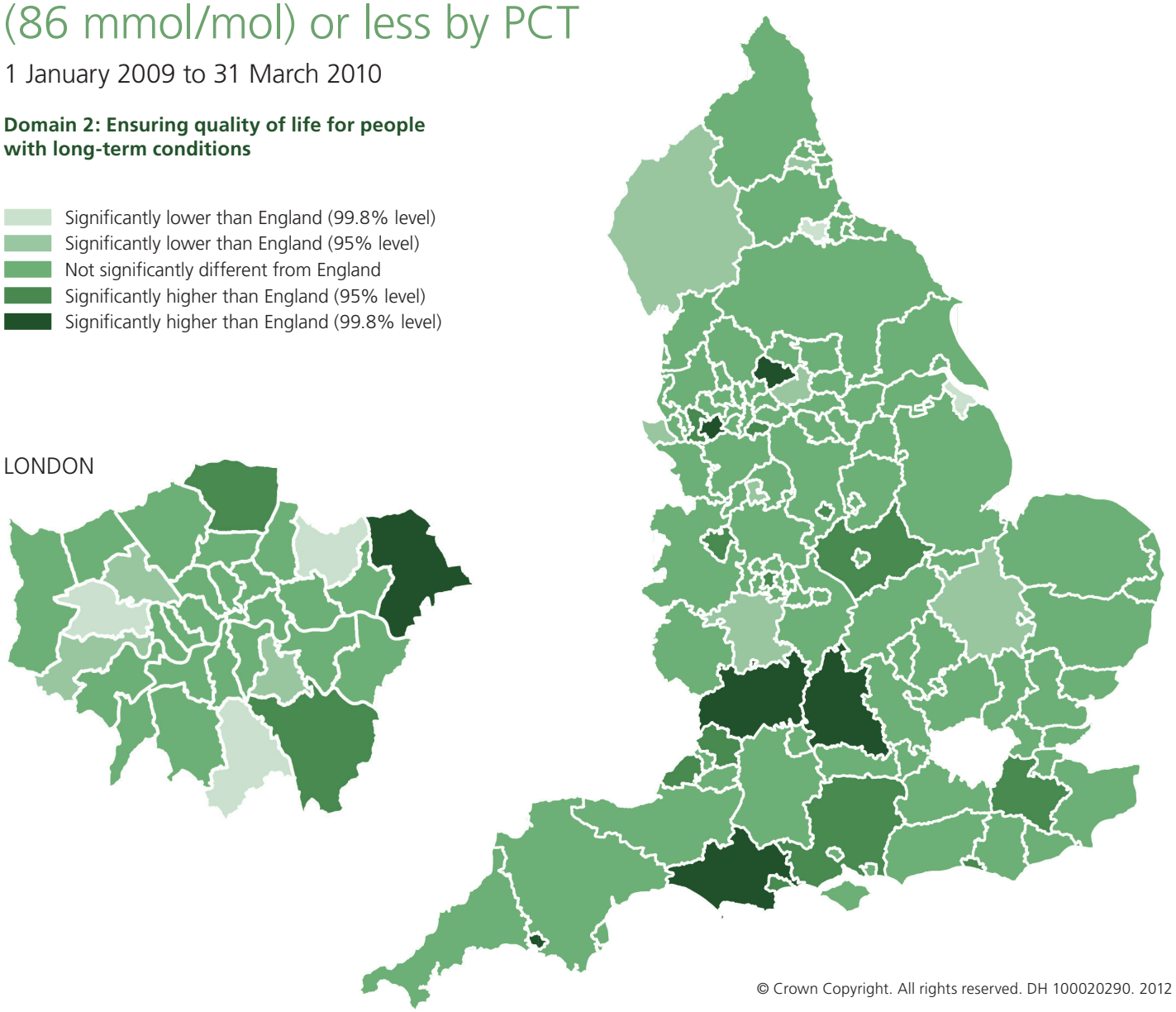


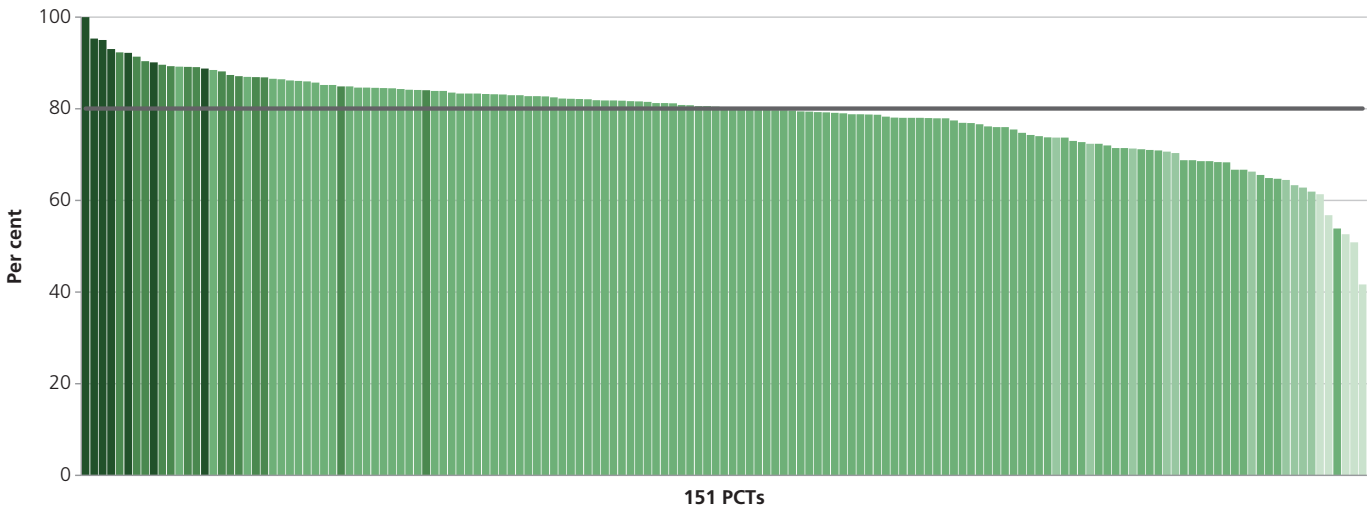
TREATMENT TARGETS

Map 5: Percentage of children aged 0–15 years in the National Diabetes Audit (NDA) with diabetes whose most recent HbA1c measurement was 10% (86 mmol/mol) or less by PCT

1 January 2009 to 31 March 2010

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





Context

Good blood-glucose control reduces the risk of developing diabetic complications in the longer term. Glycated haemoglobin (HbA1c) is an indicator of average blood-glucose levels during the previous 8–12 weeks. In national and international guidance, it is recommended that children and young people with diabetes should have an HbA1c measurement of 7.5% (58 mmol/mol) or less (see "Resources").

In England, 85% of children and young people with diabetes in the National Diabetes Audit (NDA) are at high risk of developing diabetic complications because they had a most recent HbA1c measurement of more than 7.5%.

Given the very small number of children whose most recent HbA1c measurement is 7.5% or less, data are presented for children aged 0–15 years whose most recent HbA1c measurement was 10% (86 mmol/mol) or less,[1] 80% of whom are in this category. In 2002, 96% of children in Sweden were in this category, a percentage that only one PCT in England can match currently.

Magnitude of variation

With respect to the percentage of children aged 0–15 years in the NDA with diabetes whose most recent HbA1c measurement was 10% (86 mmol/l) or less:

- For PCTs in England, the range is from 41.7% to 100.0%, a 2.4-fold variation;
- The England value is 80.0%: at the high end of the range, 4.6% of PCTs (n=7) and at the low end of the range 3.3% of PCTs (n=5) are very significantly different from the England value (at the 99.8% level).

There is no statistically significant association between this indicator and deprivation at PCT level (see Figure 5.1), suggesting that the degree of variation observed in blood-glucose control among children with diabetes is related to how local services organise and deliver care and education to children and young people and their families, rather than to individual patient behaviour alone.

Options for action

At least four out of five children aged 0-15 years with diabetes are at high risk of developing complications due to blood-glucose control being above recommended levels. To improve glycaemic control in this patient group, commissioners and providers need to ensure:

- minimum service specifications are in line with current NICE guidance and Department of Health policy on service configuration (see "Resources") – peer-review of services can promote best practice and help to assess performance and improve outcomes;
- appropriate patients are given access to technologies (e.g. insulin pumps, continuous glucose monitoring) in accordance with NICE guidance (see "Resources");
- complete data submission to the National Paediatric Diabetes Audit (NPDA), thereby allowing comparisons of outcomes across networks nationally and internationally;
- that standardised, structured, self-management education programmes, individually tailored for each child, their family and school, are delivered by skilled experienced multidisciplinary teams under clear clinical leadership;
- the provision of well-coordinated developmentally appropriate transitional care services which support the increasing independence of young people as they move from paediatric to adult healthcare.

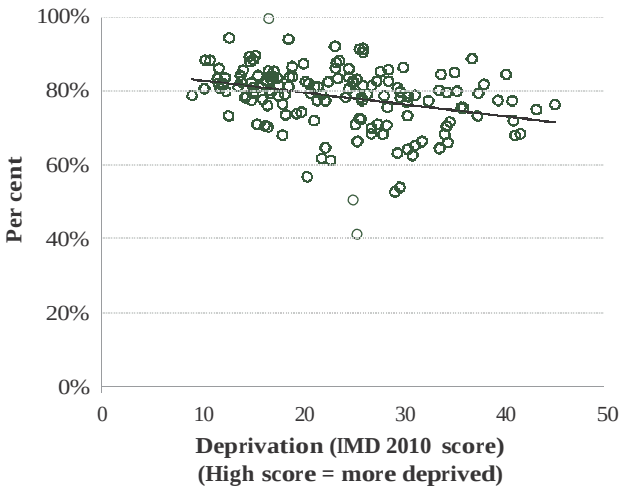
Professionals need to deliver care using the essential components of a high-quality consultation: age-appropriate communication and collaborative care planning with appropriate goal-setting.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled.] http://guidance.nice.org.uk/CG15
- NICE Guidance (2008) Continuous subcutaneous insulin infusion for the treatment of diabetes (review). Technology appraisals, TA151. http://guidance.nice.org.uk/TA151
- NICE (2009) Insulin pump therapy service. Commissioning guide. Implementing NICE guidance. http://www.nice.org.uk/media/87F/E2/InsulinPumpsToolDevelopmentUpdate.pdf
- Department of Health (2007) *Making every young person with diabetes matter.* http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_073674
- ISPAD (2009) ISPAD Clinical Practice Consensus Guidelines. *Pediatric Diabetes* 10: Suppl 12. http://www.ispad.org/FileCenter.html?CategoryID=5
- National Paediatric Diabetes Audit (NPDA) http://www.rcpch.ac.uk/npda

Although this indicator appears as Map 11 in the Child Health Atlas (pages 40–41), statistical difference from the England value has been used to illustrate variation in the Diabetes Atlas (see page 20), therefore, the shading used for the maps and the appearance of the column charts will differ between the two publications, as will reporting of the "Magnitude of variation" section.

Figure 5.1: Children aged 0–15 years with diabetes (%) whose most recent HbA1c measurement was 10% (86 mmol/mol) or less in relation to deprivation



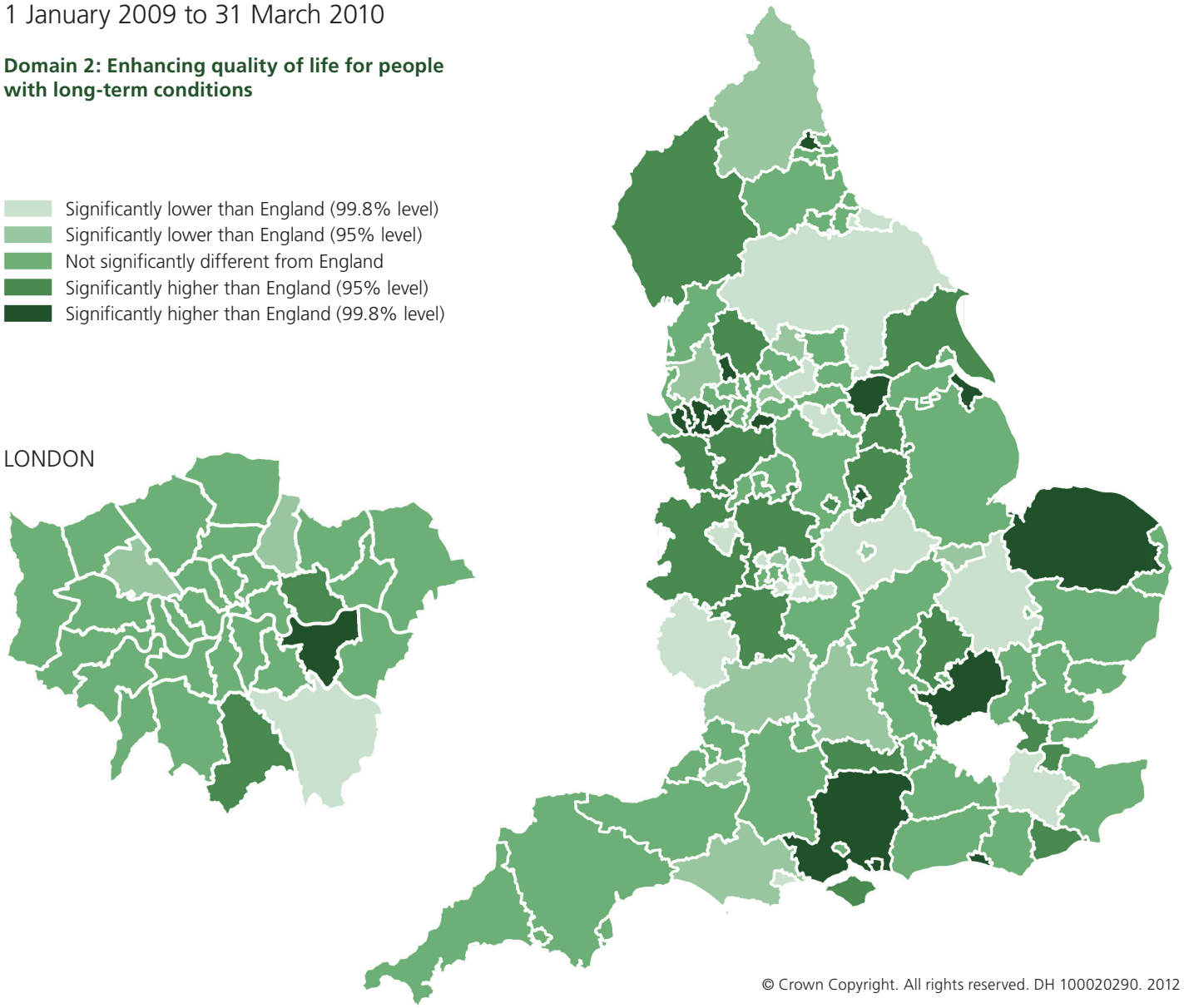
1 The population is the cohort of children and young people in the NDA during the audit period 1 January 2009 to 31 March 2010.

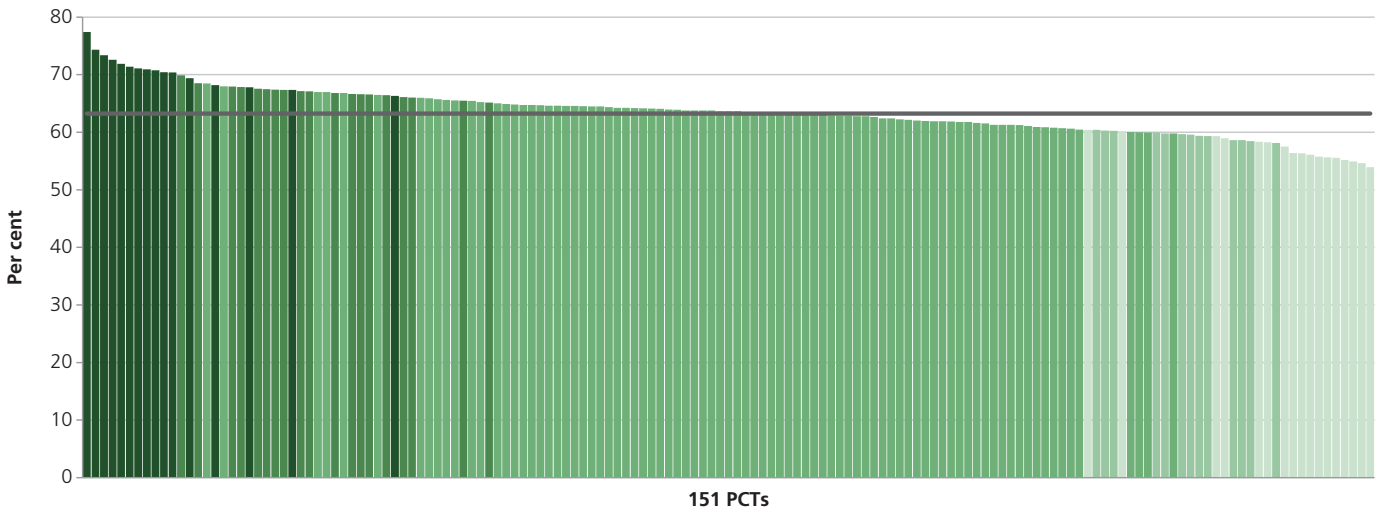
TREATMENT TARGETS

Map 6: Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent blood-pressure measurement was within target by PCT

1 January 2009 to 31 March 2010

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





Context

Action to lower high blood pressure reduces the risk of developing diabetic complications. For people with diabetes who have eye, kidney or vascular disease, a lower target blood pressure is recommended in NICE guidance (CG15; see "Resources") than that for people with diabetes who do not have eye, kidney or vascular disease.

For this indicator, the definition of "within target" is:

- <140/80 mmHg for people with diabetes who do not have eye, kidney or vascular disease;
- <130/80 mmHg for people with diabetes who also have evidence of eye, kidney or vascular disease.

In England, of all people of all ages in the National Diabetes Audit (NDA) with Type 1 diabetes, 63.2% had a most recent blood-pressure measurement that was within target.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 1 diabetes whose most recent blood-pressure measurement was within target:

- For PCTs in England, the range is from 53.9% to 77.4%, a 1.4-fold variation;
- The England value is 63.2%: at the high end of the range 10.6% of PCTs (n=16) and at the low end of the range 11.2% of PCTs (n=17) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is similar to that for the corresponding indicator for people with Type 2 diabetes (see Map 7, page 40).

As for the indicator showing blood-glucose control (see Map 3, page 32), there is a moderately strong association between the percentage of people with Type 1 diabetes with blood-pressure control within target in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.763; p<0.00005; see Figure 6.1). This finding suggests the variation is moderately persistent over time. There is no statistically significant association with deprivation at PCT level (see Figure 6.2). These results suggest that the degree of variation observed in blood-pressure control within target among people with Type 1 diabetes is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As about one in three people with Type 1 diabetes are at high risk of developing complications due to blood-pressure control above recommended levels, commissioners and service providers need to ensure that detailed recommendations on the assessment and treatment of high blood pressure in NICE guidance (CG15; see "Resources") are implemented locally, including:

- Targeting people with evidence of early complications;
- Prescribing anti-hypertensive drugs according to recommended algorithms;
- Providing information on lifestyle changes that could help to lower blood pressure.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled.] http://guidance.nice.org.uk/CG15

Figure 6.1: Blood-pressure control within target* in people with Type 1 diabetes (%) over time

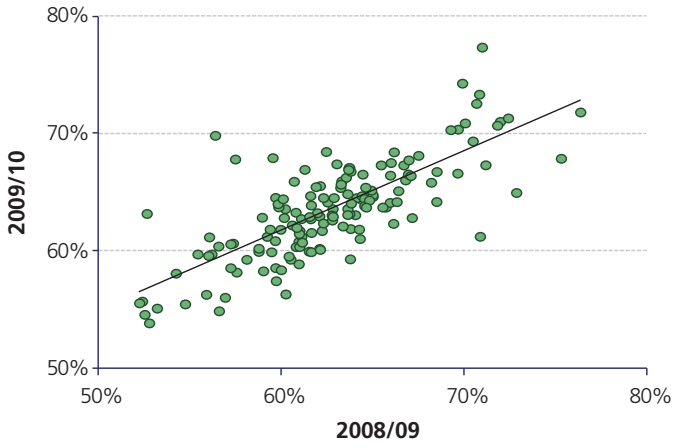
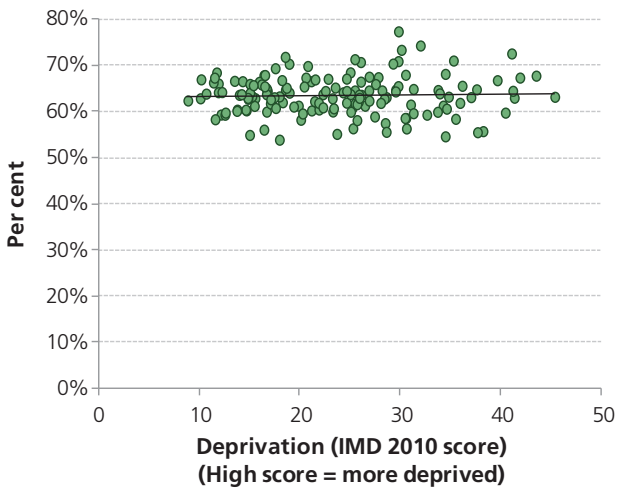


Figure 6.2: Blood-pressure control within target* in people with Type 1 diabetes (%) in relation to deprivation



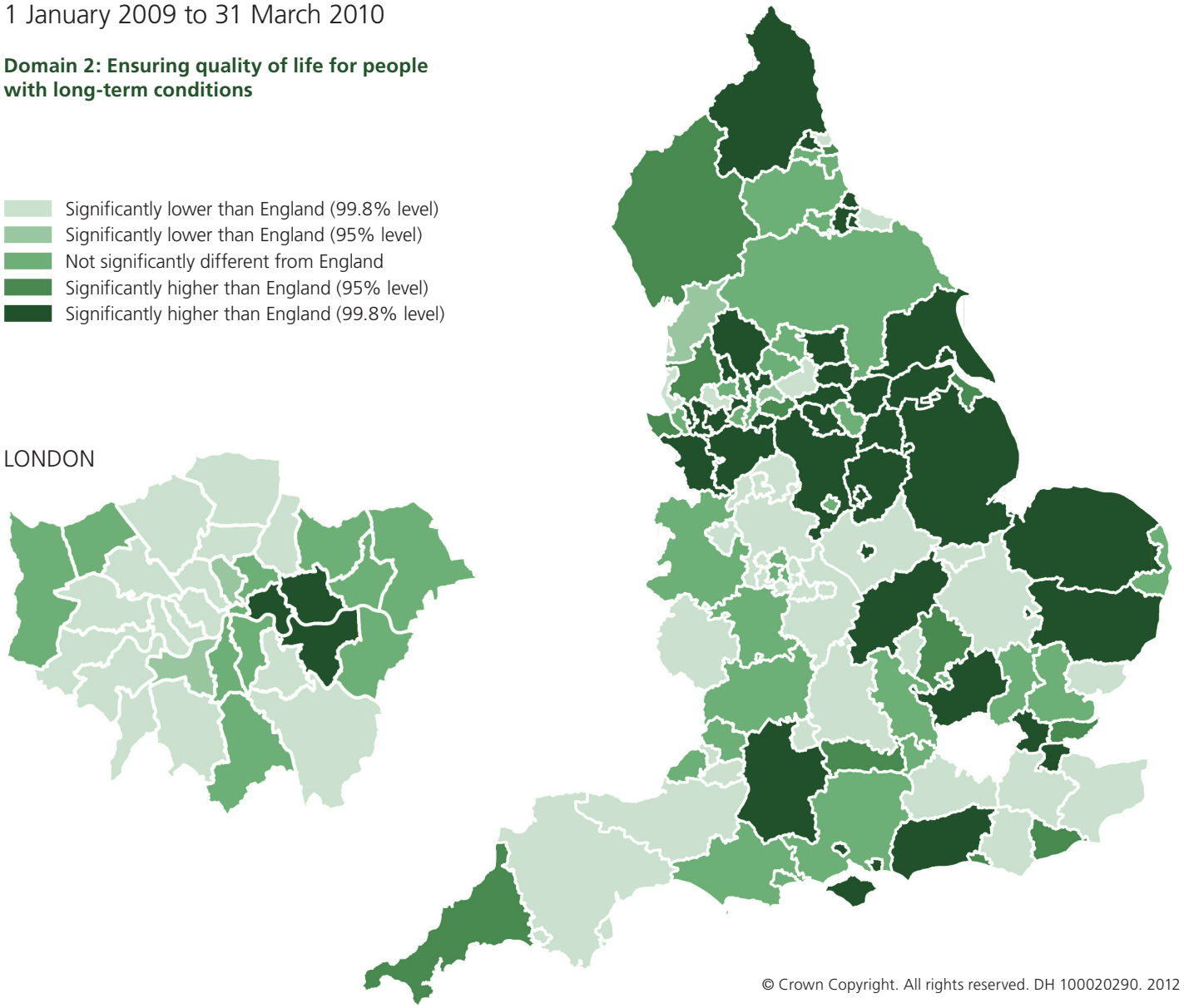
*<140/80 mmHg or <130/80 mmHg with evidence of eye, kidney or vascular disease

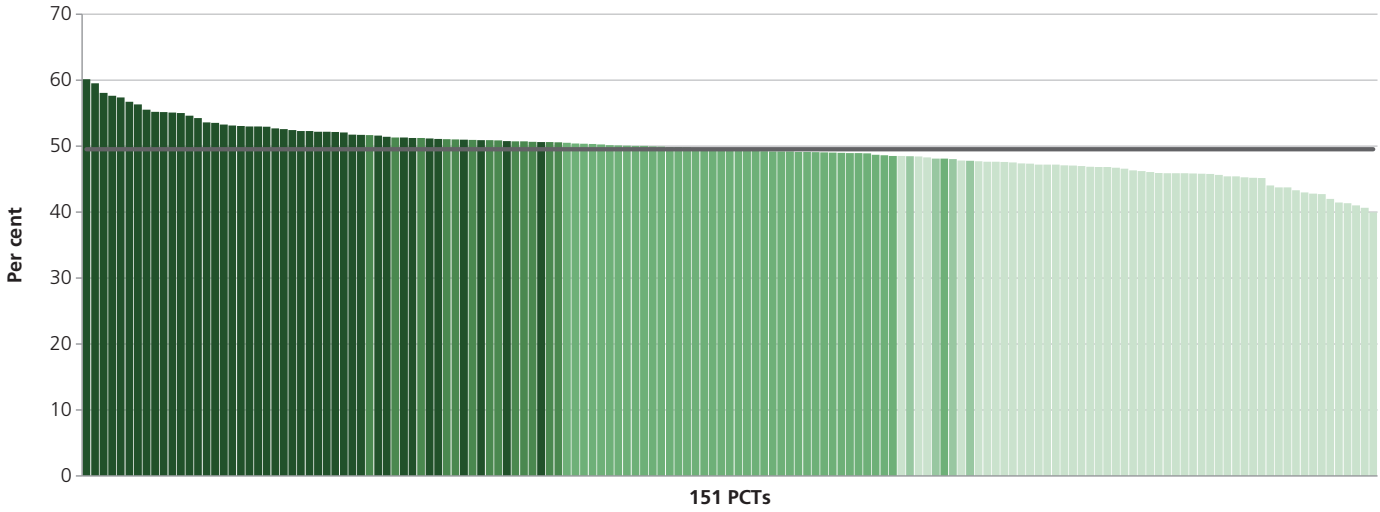
TREATMENT TARGETS

Map 7: Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent blood-pressure measurement was within target by PCT

1 January 2009 to 31 March 2010

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





Context

Action to lower high blood pressure reduces the risk of developing diabetic complications. For people with diabetes who have eye, kidney or vascular disease, a lower target blood pressure is recommended in NICE guidance (see "Resources") than that for people with diabetes who do not have eye, kidney or vascular disease.

For this indicator, the definition of "within target" is:

- <140/80 mmHg for people with diabetes who do not have eye, kidney or vascular disease;
- <130/80 mmHg for people with diabetes who have evidence of eye, kidney or vascular disease.

In England, of all people of all ages with Type 2 diabetes in the National Diabetes Audit (NDA), 49.5% had a most recent blood-pressure measurement that was within target.

Magnitude of variation

With respect to the indicator the percentage of people in the NDA with Type 2 diabetes whose most recent blood-pressure measurement was within target:

- For PCTs in England, the range is from 39.9% to 60.1%, a 1.5-fold variation;
- The England value is 49.5%: at the high end of the range 28.5% of PCTs (n=43) and at the low end of the range 33.8% of PCTs (n=51) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is similar to that for the corresponding indicator for people with Type 1 diabetes (see Map 6, page 38).

As for the indicator showing blood-glucose control (see Map 4, page 34), there is a strong association between the percentage of people with Type 2 diabetes with blood-pressure control within target in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.819; p<0.00005; see Figure 7.1). This finding suggests that the degree of variation is persistent over time. There is no statistically significant association with deprivation at PCT level (see Figure 7.2). These results suggest that the degree of variation observed in blood-pressure control within target in people with Type 2 diabetes is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As more than one in three people with Type 2 diabetes are at high risk of developing complications due to blood-pressure control above recommended levels, all commissioners and service providers need to ensure that detailed recommendations on the assessment and treatment of high blood pressure in NICE guidance (CG66 &CG87; see "Resources") are implemented locally, including:

- Personalised lifestyle advice (weight, diet, exercise) about how to lower blood pressure;
- Targeting people with evidence of early complications;
- Prescribing anti-hypertensive drugs according to recommended algorithms.

RESOURCES

- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66

Figure 7.1: Blood-pressure control within target* in people with Type 2 diabetes (%) over time

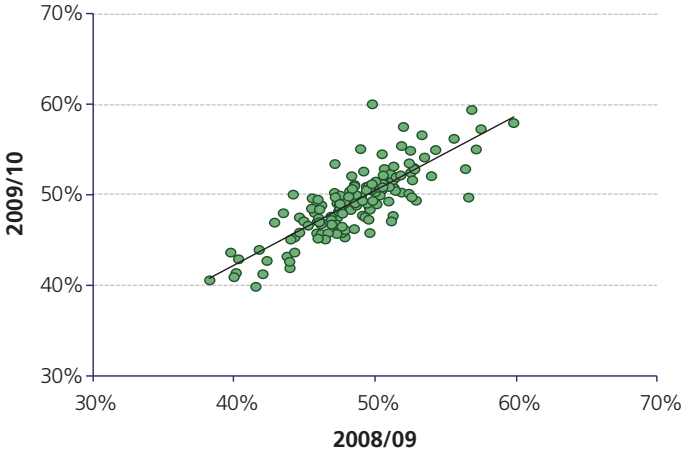
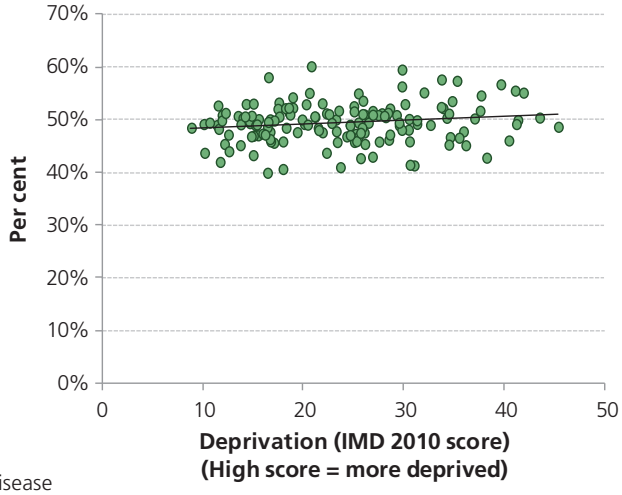


Figure 7.2: Blood-pressure control within target* in people with Type 2 diabetes (%) in relation to deprivation



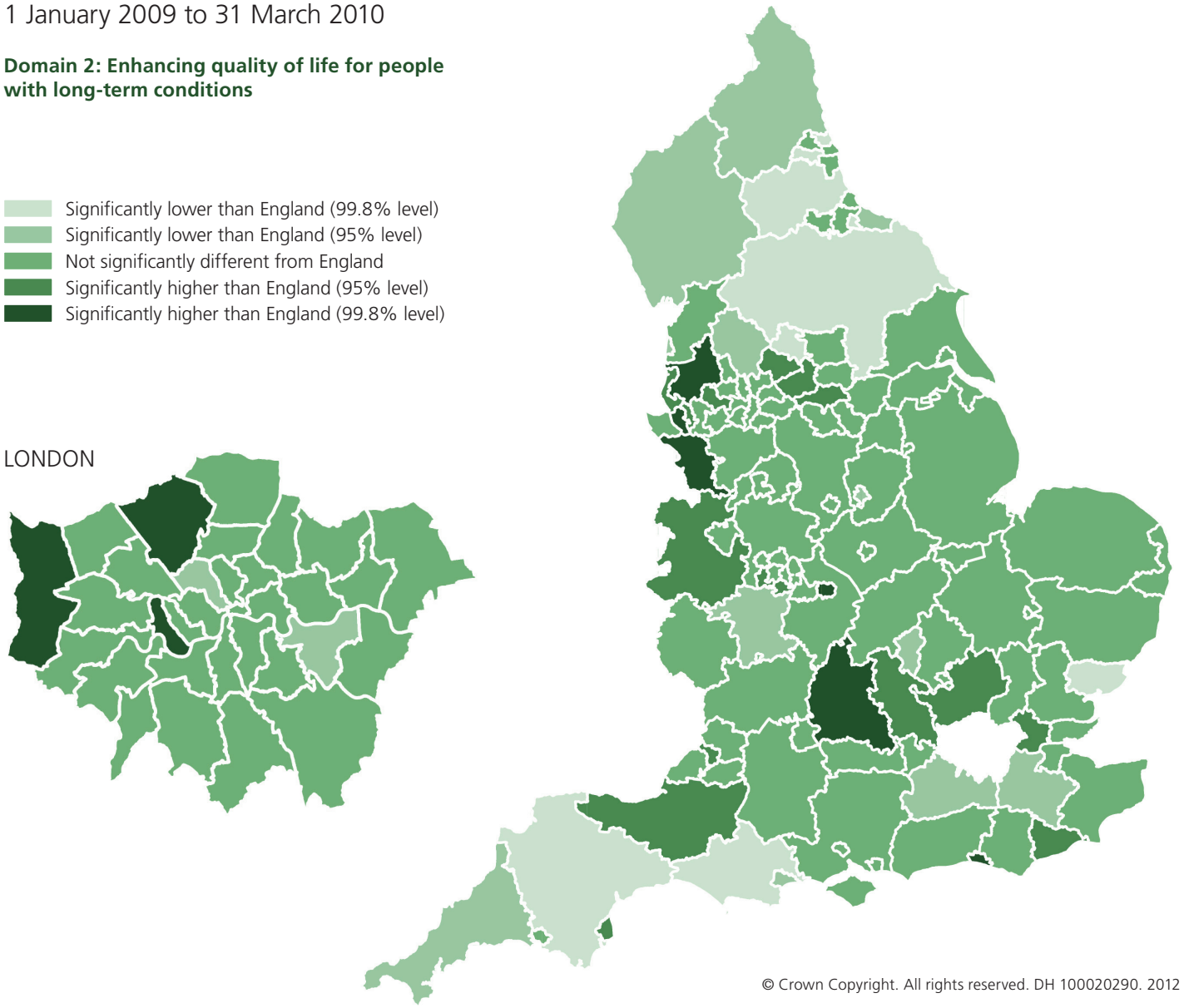
*<140/80 mmHg or <130/80 mmHg with evidence of eye, kidney or vascular disease

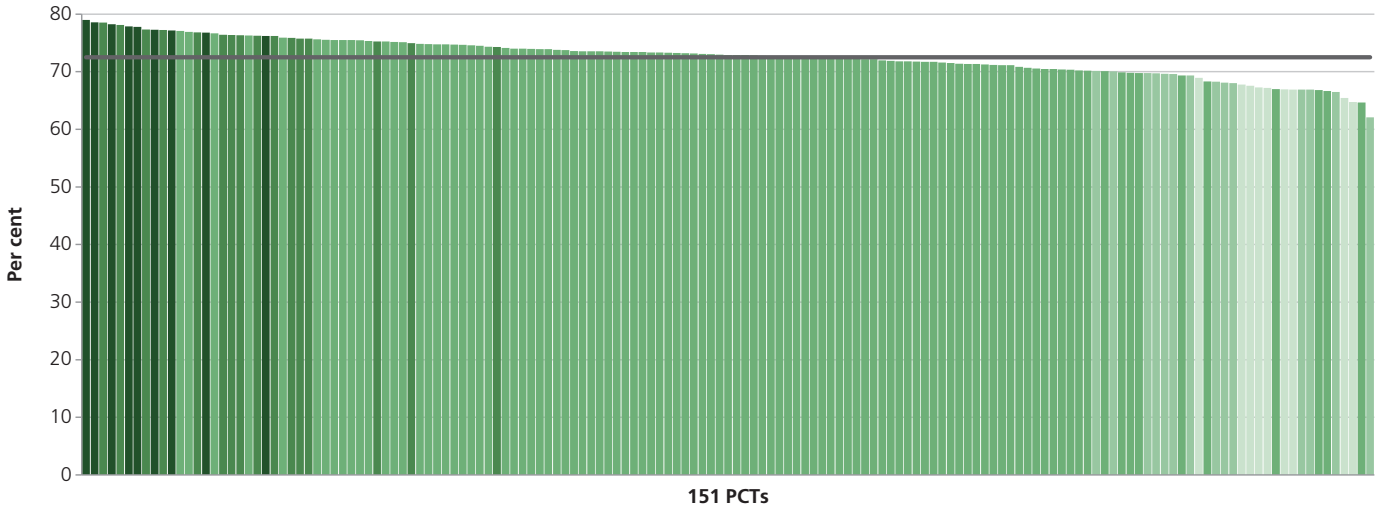
TREATMENT TARGETS

Map 8: Percentage of people in the National Diabetes Audit (NDA) with Type 1 diabetes whose most recent cholesterol measurement was 5 mmol/l or less by PCT

1 January 2009 to 31 March 2010

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





Context

The control of cholesterol reduces the risk of cardiovascular complications in people with diabetes. In England, for 72.5% of people of all ages with Type 1 diabetes in the National Diabetes Audit (NDA), their most recent cholesterol measurement was 5 mmol/l or less.

Magnitude of variation

With respect to the percentage of people in the NDA with Type 1 diabetes whose most recent cholesterol measurement was 5mmol/l or less:

- For PCTs in England, the range is from 62.1% to 79.0%, a 1.3-fold variation;
- The England value is 72.5%: at the high end of the range 6.0% of the PCTs (n=9) and at the low end of the range 6.0% of the PCTs (n=9) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is greater than that for the corresponding indicator for people with Type 2 diabetes (see Map 9, page 44).

There is a moderate association between control of cholesterol levels in people with Type 1 diabetes in 2008/09 and that in 2009/10 (correlation coefficient, r=0.575; p<0.00005; see Figure 8.1). This finding suggests that there is some variation over time. There is no statistically significant association between control of cholesterol and deprivation at PCT level (see Figure 8.2). These results suggest that the degree of variation observed in control of cholesterol among people with Type 1 diabetes may be related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As at least one in four people with Type 1 diabetes are at risk of developing cardiovascular complications due to cholesterol control above recommended levels, commissioners and service providers need to ensure that detailed recommendations on the assessment and treatment of high cholesterol levels in NICE guidance (CG15; see "Resources") are implemented locally.

RESOURCES

- NICE Guidance Type 1 diabetes. Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). http://guidance.nice.org.uk/CG15

Figure 8.1: People with Type 1 diabetes (%) whose most recent cholesterol measurement was 5 mmol/l or less over time

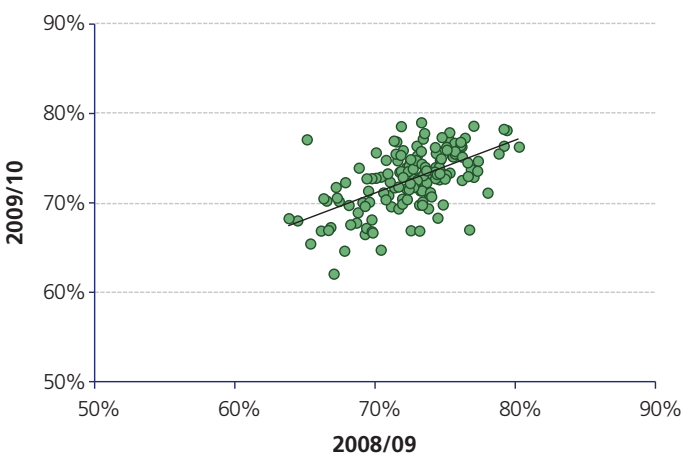
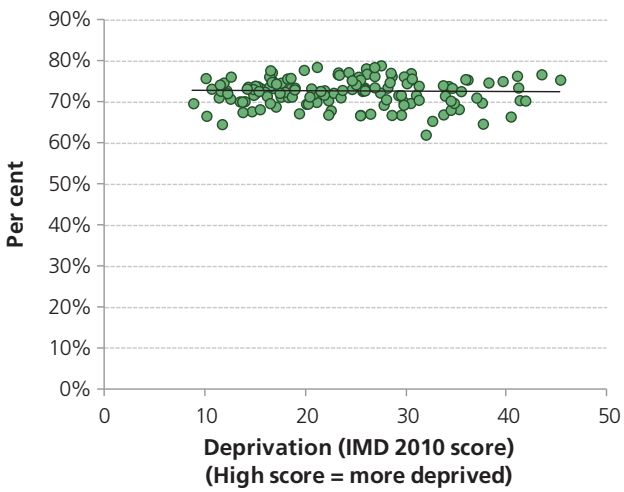


Figure 8.2: People with Type 1 diabetes (%) whose most recent cholesterol measurement was 5 mmol/l or less in relation to deprivation

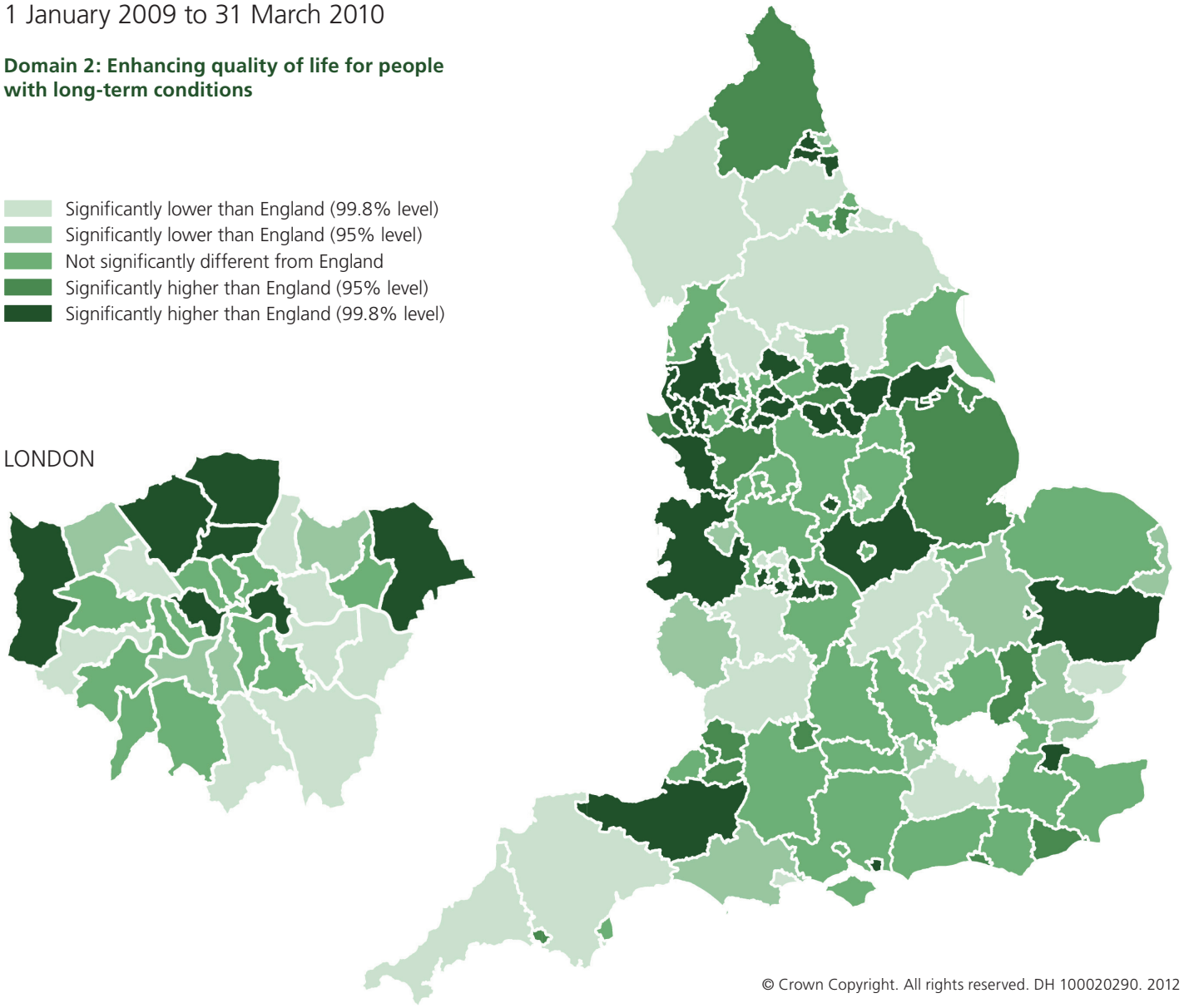


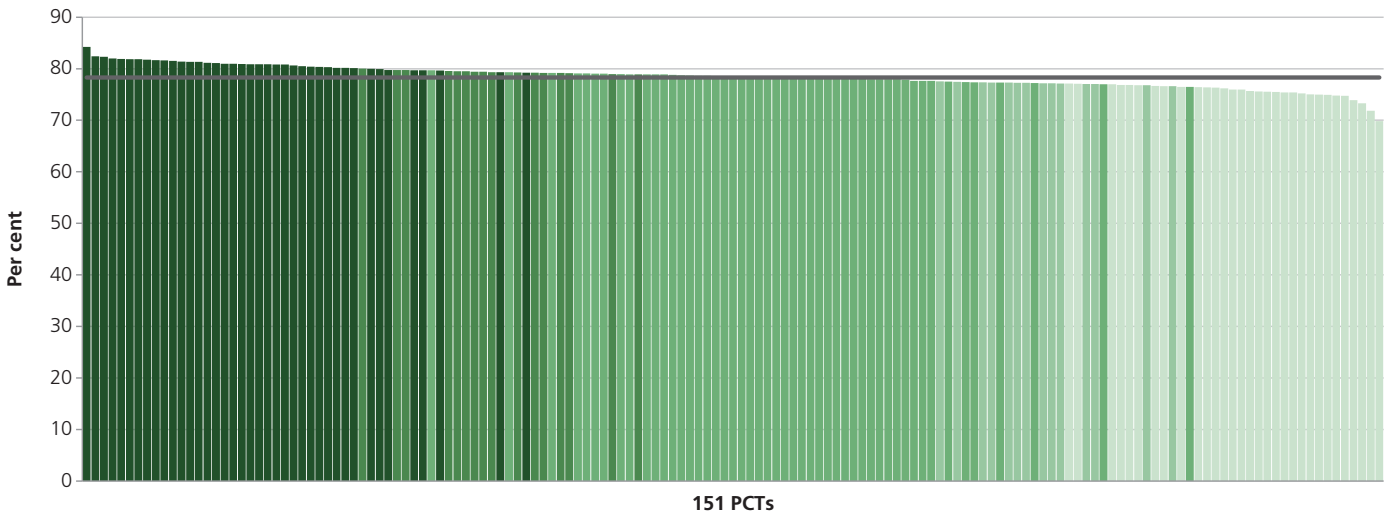
TREATMENT TARGETS

Map 9: Percentage of people in the National Diabetes Audit (NDA) with Type 2 diabetes whose most recent cholesterol measurement was 5 mmol/l or less by PCT

1 January 2009 to 31 March 2010

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





Context

The control of cholesterol reduces the risk of cardiovascular complications in people with diabetes. In England, for 78.3% of people of all ages with Type 2 diabetes in the National Diabetes Audit (NDA), their most recent cholesterol measurement was 5 mmol/l or less.

Magnitude of variation

With respect to the indicator the percentage of people in the NDA with Type 2 diabetes whose most recent cholesterol measurement was 5mmol/l or less:

- For PCTs in England, the range is from 69.8% to 84.2%, a 1.2-fold variation;
- The England value is 78.3%: at the high end of the range 26.5% of PCTs (n=40) and at the low end of the range 20.5% of PCTs (n=31) are very significantly different from the England value (at the 99.8% level).

The degree of variation observed for this indicator is less than that for the corresponding indicator for people with Type 1 diabetes (see Map 8, page 42).

As with the indicators for blood-glucose control and blood-pressure control (Map 4, page 34, and Map 6, page 36, respectively), there is a moderately strong association between the percentage of people with Type 2 diabetes having a most recent cholesterol measurement of less than 5 mmol/l in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.754; p<0.00005 see Figure 9.1). This finding suggests that the degree of variation is moderately persistent over time. There is no statistically significant association with deprivation at PCT level (see Figure 9.2). These results suggest that the degree of variation observed in cholesterol control among people with Type 2 diabetes is related to how local services are organised.

Options for action

Commissioners and service providers need to review:

- any local variation and ascertain the reasons for it;
- service organisation and current practice, with a view to optimising them.

As one in five people with Type 2 diabetes are at risk of developing cardiovascular complications due to cholesterol control above recommended levels, commissioners and service providers need to ensure that detailed recommendations in NICE guidance on the assessment and treatment of high cholesterol levels (CG66 & CG87; see "Resources") are implemented locally.

RESOURCES

- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66

Figure 9.1: People with Type 2 diabetes (%) whose most recent cholesterol measurement was 5 mmol/l or less over time

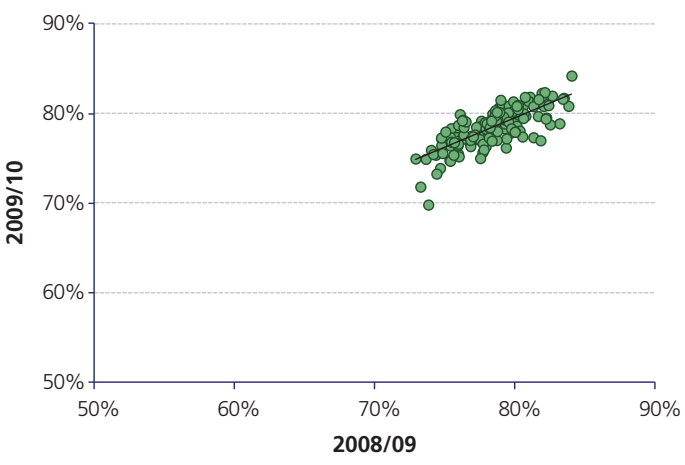
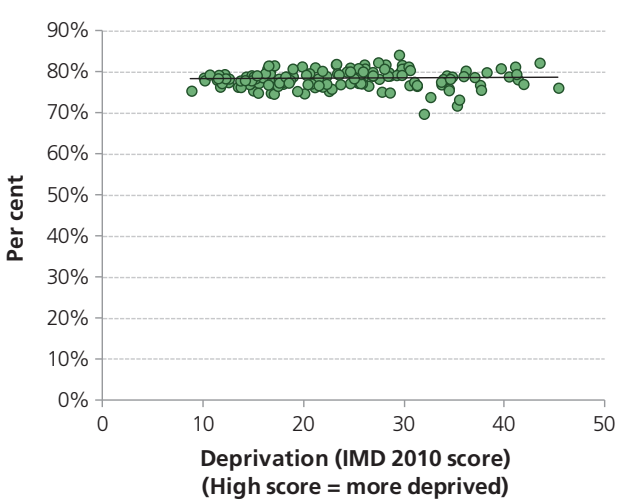


Figure 9.2: People with Type 2 diabetes (%) whose most recent cholesterol measurement was 5 mmol/l or less in relation to deprivation

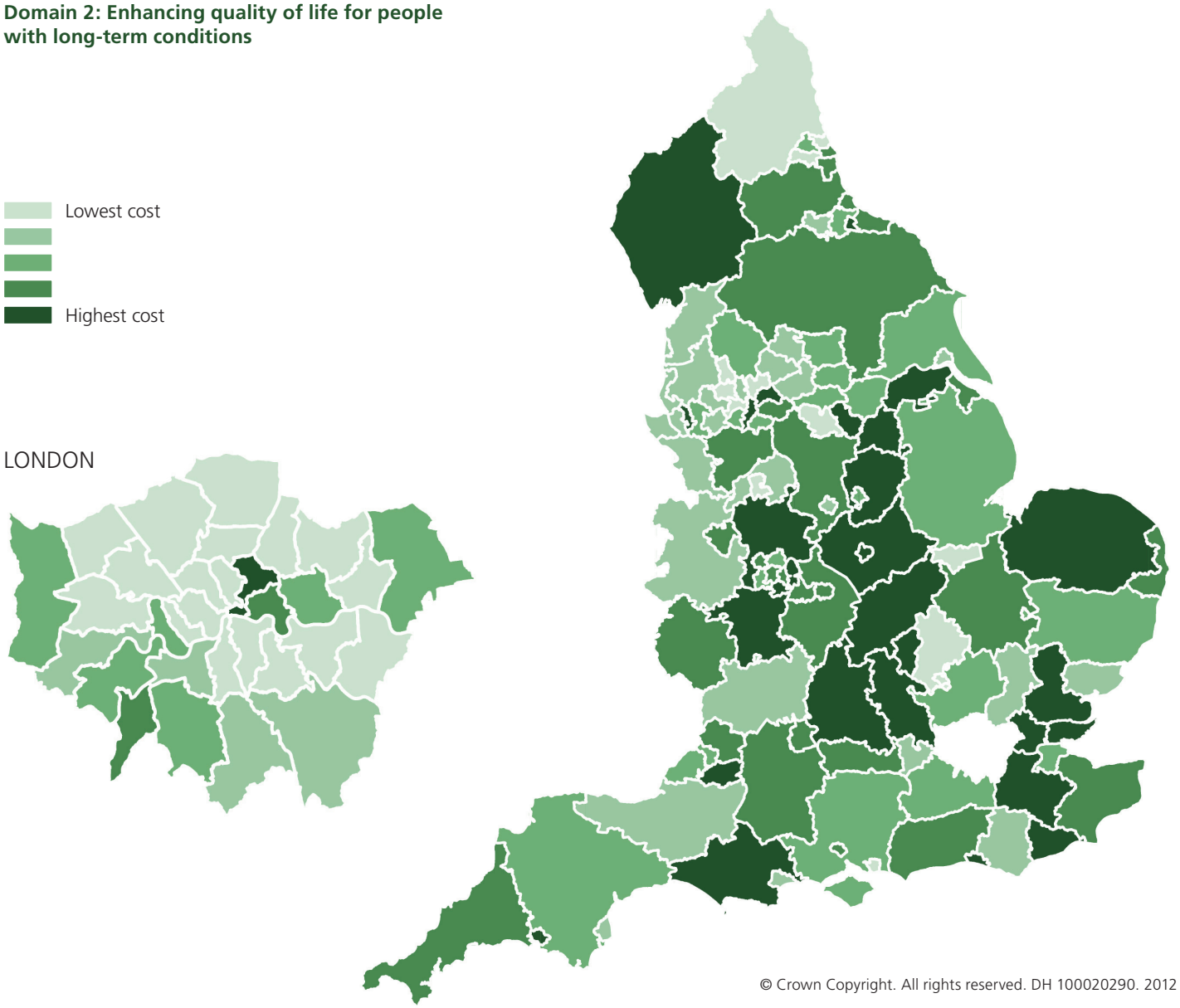


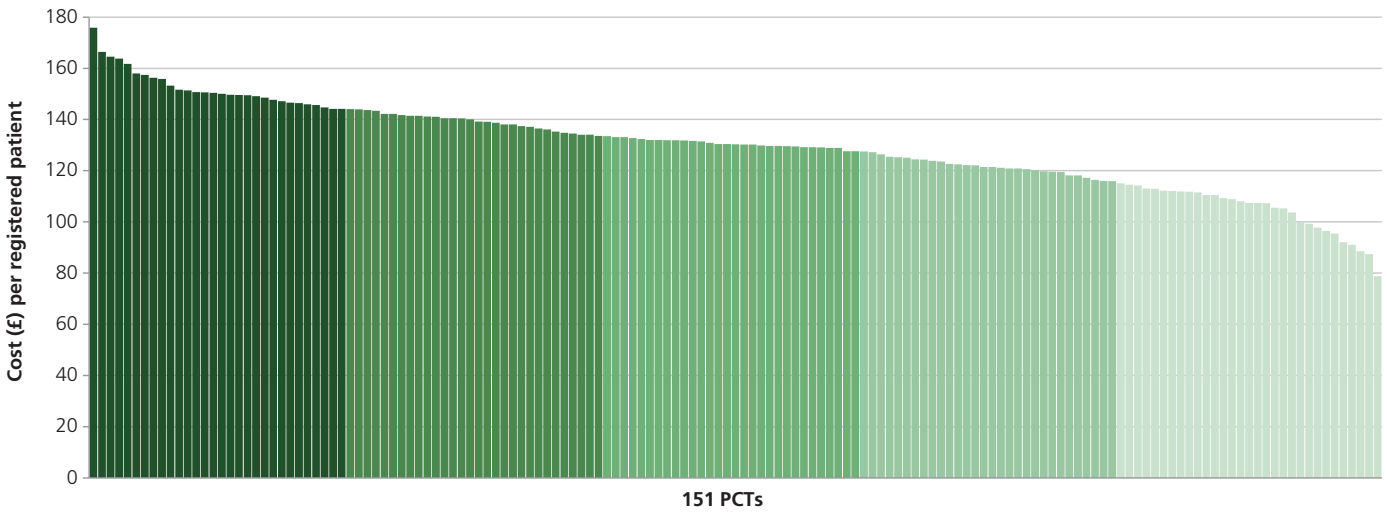
PRESCRIBING

Map 10: Insulin total net ingredient cost per patient on GP diabetes registers

2010/11

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





Context

Insulin is used to lower the blood glucose level of people with Type 1 diabetes and that of people with Type 2 diabetes when non-insulin drugs are not providing adequate control. In 2010/11 in England, prescriptions for insulin cost £307 million, with an average spend per adult with diabetes of £131.46.

Magnitude of variation

For PCTs in England, insulin total net ingredient cost per patient on GP diabetes registers ranged from £79 to £176 (2.2-fold variation). When the five PCTs with the highest costs and the five PCTs with the lowest costs are excluded, the range is £95–£158 per patient, and the variation is 1.7-fold.

The degree of variation for spending on insulin items is less when compared with that for spending on non-insulin anti-diabetic items (see Map 11, page 48), but similar to that observed for the cost of prescriptions for blood-testing items (see Map 12, page 50).

There is no correlation between spending on insulin items and the percentage of people with Type 1 diabetes or with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less at PCT level (see Figure 10.1). This would indicate that the PCTs spending the most on insulin do not necessarily have the greatest percentage of people with diabetes who have optimal blood-glucose control.

There is a strong association between spending on insulin items in 2009/10 and that in 2010/11 (correlation coefficient, r=0.977; p<0.00005; see Figure 10.2), suggesting that prescribing patterns at a PCT level are persistent over time.

These results suggest that the degree of variation observed in spending on insulin items is related to how local services are organised.

Options for action

Commissioners and service providers need to ensure that the recommended treatment regimens in NICE guidelines for people with Type 1 and Type 2 diabetes are implemented locally (CG15, and CG66 partially updated by CG87, respectively; see "Resources").

For localities where insulin costs are high and glucose control is poor when compared with these variables in other localities, commissioners and service providers need to review local policies, education programmes and incentives to change to more cost-effective treatment regimens.

Any review of variation in spending on insulin at a local level needs to consider whether local prescribing practice is in line with NICE guidance, including:

- Local case-mix;
- Patterns of insulin use among people with Type 2 diabetes.

RESOURCES

- NICE Guidance Type 1 diabetes. Diagnosis and management of type 1 diabetes in children, young people and adults. http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66
- NICE Care pathway for diabetes. http://pathways.nice.org.uk/pathways/diabetes
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp

  Insulin therapy webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/insulintherapy.jsp

Figure 10.1: Blood-glucose control for people with Type 1 and Type 2 diabetes (%) compared with spend (£) on insulin items

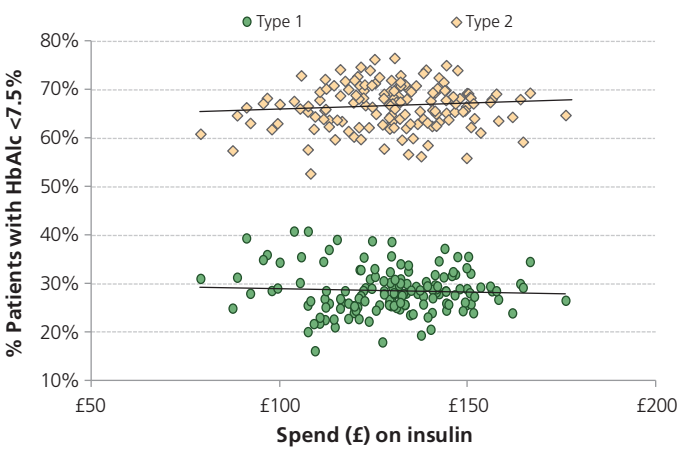
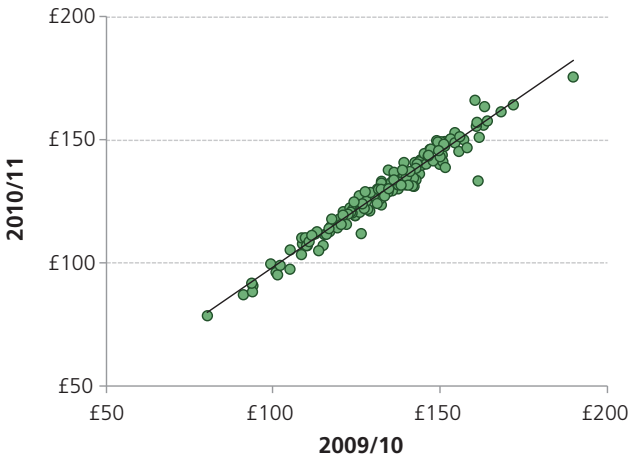


Figure 10.2: Spend (£) on insulin items over time

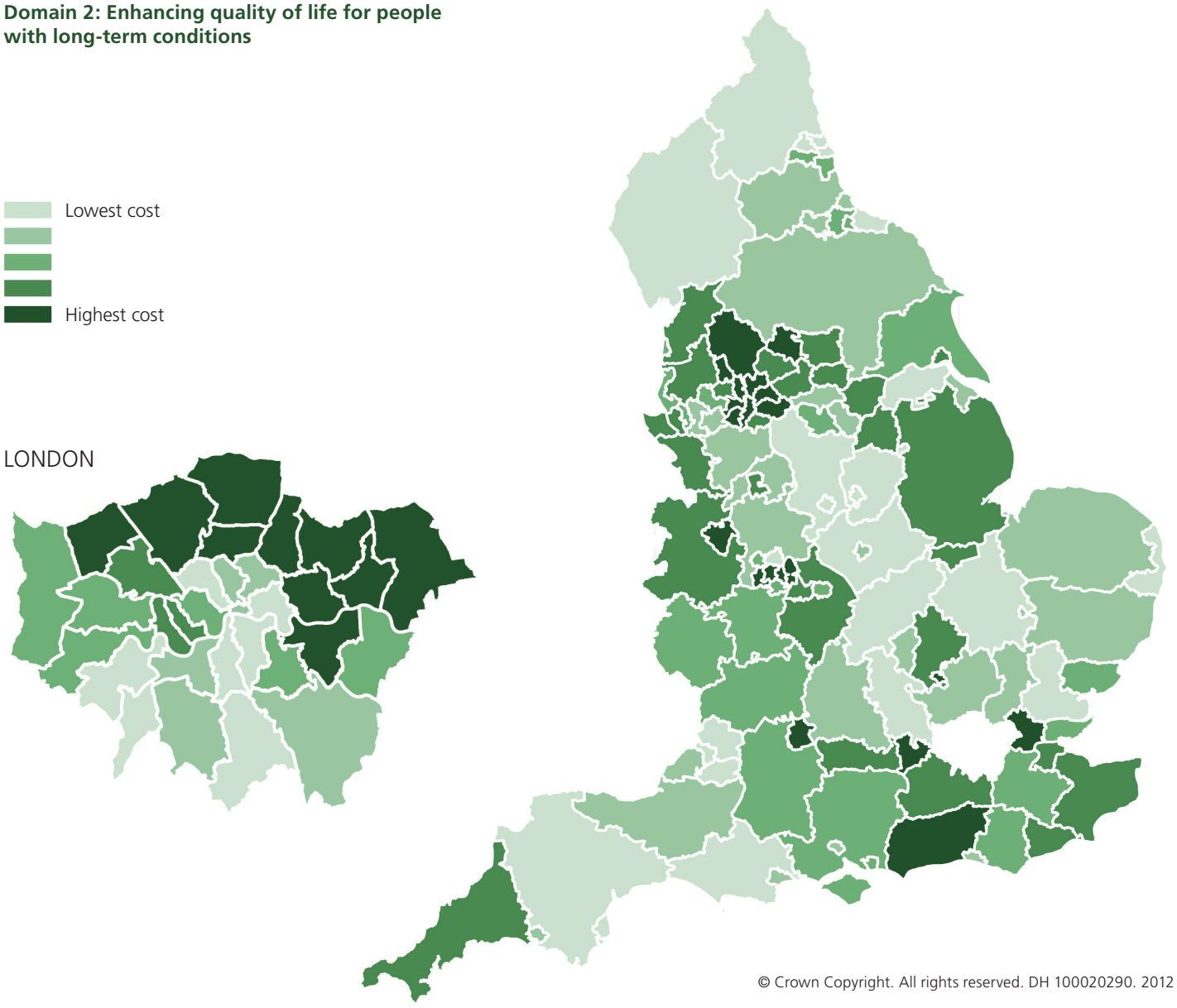


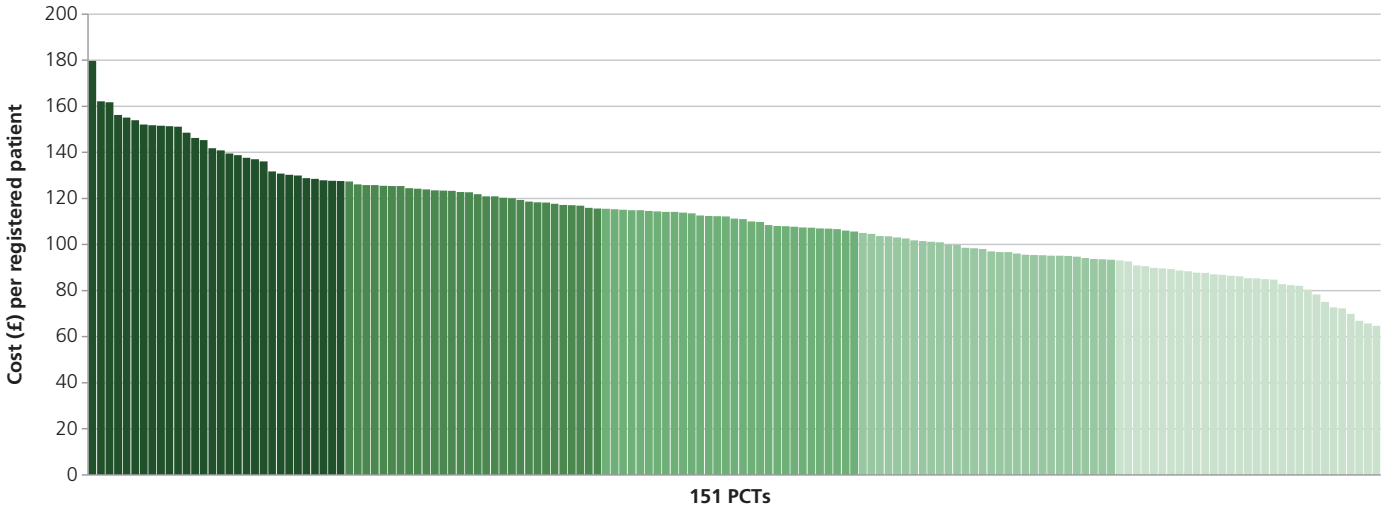
PRESCRIBING

Map 11: Non-insulin anti-diabetic drugs total net ingredient cost per patient on GP diabetes registers by PCT

2010/11

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





Context

Non-insulin anti-diabetic items (mainly tablets) are used to control blood-glucose levels in people with Type 2 diabetes. In England in 2010/11, prescriptions for non-insulin anti-diabetic items cost £259 million or £110.79 per adult with diabetes.

Magnitude of variation

For PCTs in England, the non-insulin anti-diabetic drugs total net ingredient cost per patient on GP diabetes registers ranged from £65 to £180 (2.8-fold variation). When the five PCTs with the highest costs and the five PCTs with the lowest costs are excluded, the range is £73–£154 per patient, and the variation is 2.1-fold.

The degree of variation observed for spending on non-insulin anti-diabetic items is greater than that for spending on insulin items (see Map 10, page 46) and that for spending on prescriptions for blood-testing items (see Map 12, page 50).

There is no correlation between spending on non-insulin anti-diabetic items and the percentage of people with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less (see Figure 11.1). This would indicate that PCTs spending the most on non-insulin anti-diabetic drugs do not necessarily have the greatest percentage of people with diabetes who have optimal blood-glucose control.

There is a strong association between spending on non-insulin anti-diabetic items in 2009/10 and that in 2010/11 (correlation coefficient, r=0.964; p<0.00005; see Figure 11.2), suggesting that prescribing patterns at a PCT level are persistent over time.

These results suggest that the degree of variation observed in spending on non-insulin anti-diabetic items is related to how local services are organised.

Options for action

Commissioners and service providers need to investigate variation in local expenditure on non-insulin anti-diabetic drugs and consider whether local prescribing practice is in line with NICE guidance. Investigation of local prescribing patterns could include:

- Variation among practices in the mix of non-insulin anti-diabetic items prescribed;
- Practice-based net ingredient cost for diabetes drugs versus glucose control in people with Type 2 diabetes;
- The association between prescribing for non-insulin anti-diabetic items and HbA1c outcomes.

Commissioners and providers need to ensure that NICE guidance (see "Resources") on recommended treatment regimens for people with Type 2 diabetes are implemented locally.

For localities where non-insulin anti-diabetic item costs are high and glucose control is poor when compared with those variables in other localities, commissioners and service providers need to review local policies, education programmes and incentives to change to more cost-effective treatment regimens.

RESOURCES

- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66
- NICE Care pathway for diabetes. http://pathways.nice.org.uk/pathways/diabetes

Figure 11.1: Blood-glucose control for people with Type 2 diabetes (%) compared with spend (£) on non-insulin anti-diabetic items

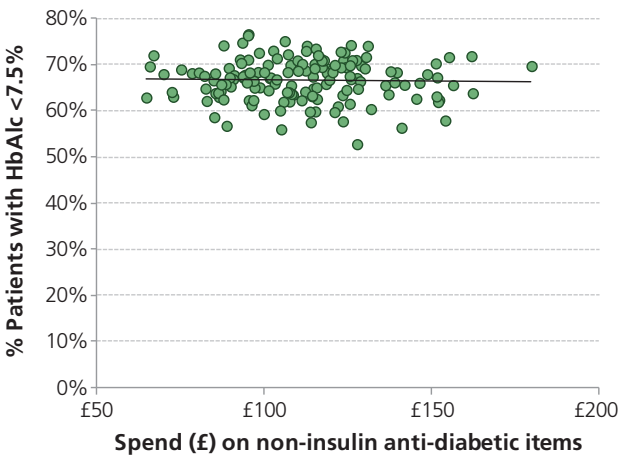
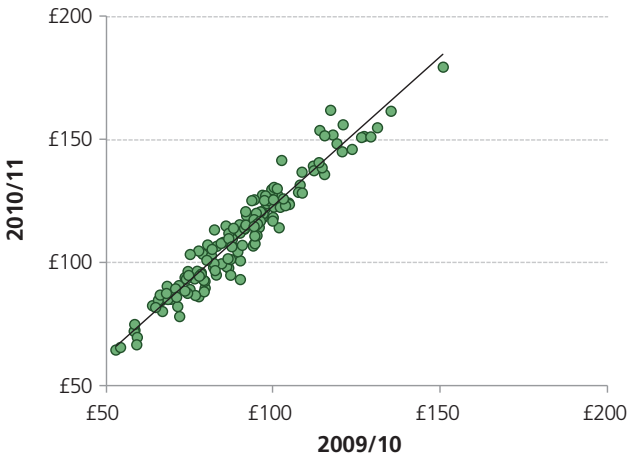


Figure 11.2: Spend (£) on non-insulin anti-diabetic items over time

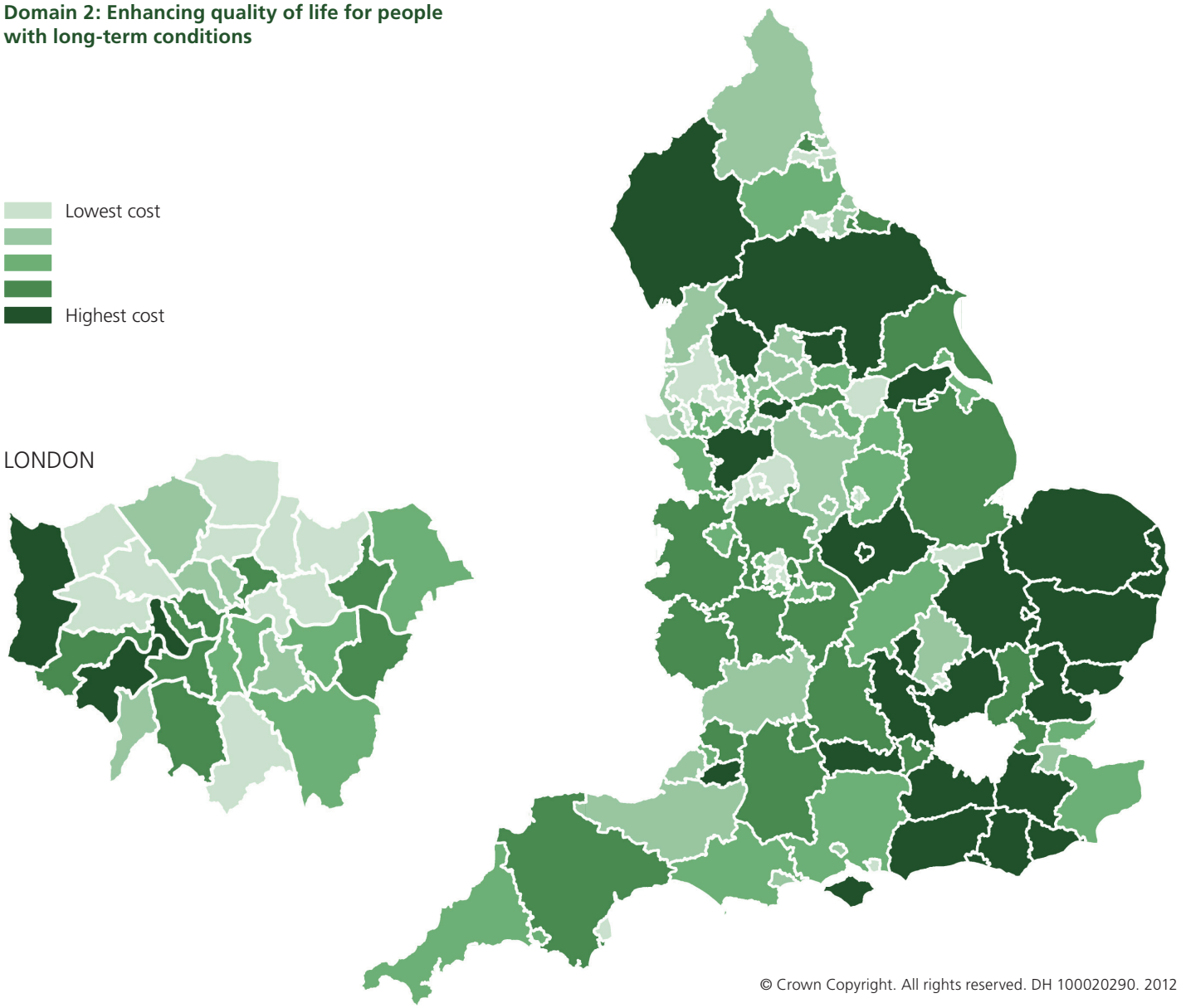


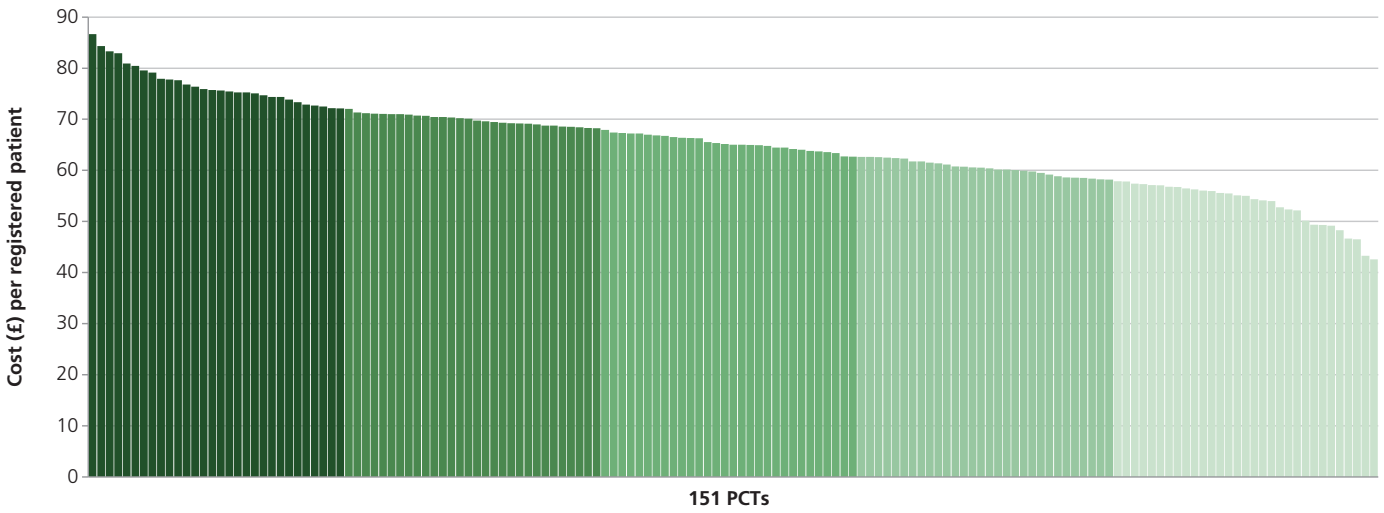
PRESCRIBING

Map 12: Blood-testing items total net ingredient cost per patient on GP diabetes registers by PCT

2010/11

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





Context

Blood-testing items are required for the self-monitoring of blood glucose mainly in people using insulin. Appropriate blood-ketone testing can identify the early stages of diabetic ketoacidosis, a potentially fatal complication of Type 1 diabetes. In England in 2010/11, prescriptions for blood-testing items costing £154 million were dispensed, equivalent to £66.01 per adult with diabetes.

Magnitude of variation

For PCTs in England, blood-testing items total net ingredient cost per patient on GP diabetes registers ranged from £43 to £87 (2-fold variation). When the five PCTs with the highest costs and the five PCTs with the lowest costs are excluded, the range is £49-£80 per patient, and the variation is 1.6-fold.

The degree of variation observed for this indicator is similar to that for the corresponding indicator for insulin items (see Map 10, page 46); however, the degree of variation for the total net ingredient cost for blood-testing items is less than that for total net ingredient cost for non-insulin anti-diabetic items (see Map 11, page 48).

There is no association between spending on blood-testing items and the percentage of people with Type 1 diabetes or with Type 2 diabetes whose most recent HbA1c measurement was 7.5% (58 mmol/mol) or less at PCT level (see Figure 12.1). This would indicate that the PCTs spending the most on blood-testing items do not necessarily have the greatest percentage of people with diabetes who have optimal blood-glucose control.

There is a strong association between spending on blood-testing items in 2009/10 and that in 2010/11 (correlation coefficient, r=0.974; p<0.00005; see Figure 12.2), suggesting that prescribing patterns at a PCT level are persistent over time.

These results suggest that the degree of variation observed in spending on blood-testing items is related to how local services are organised.

Options for action

Commissioners and service providers need to review the degree of variation in spending on blood-testing items locally and local prescribing practice in relation to recommendations in the NICE guidance. Investigation could include:

- the case-mix of patients using blood-glucose monitoring;
- the pattern of insulin prescribing in people with Type 2 diabetes;
- variation among GP practices in the prescribing of blood-testing items;
- the association between spending on blood-testing items and blood-glucose control among people with diabetes.

Commissioners and service providers need to ensure that the recommendations in NICE guidance for the effective use of blood-glucose monitoring for people with Type 1 and Type 2 diabetes are implemented locally.

For localities where blood-testing item costs are high and glucose control is poor when compared with those variables in other localities, commissioners and service providers need to review local policies, education programmes and incentives to change to more cost-effective blood-testing regimens.

RESOURCES

- Clar C, Barnard K, Cummins E, Royle P, Waugh N (2010) Self-monitoring of blood glucose in type 2 diabetes: systematic review. Health Technology Assessment 14; (12).
- NICE Guidance Type 1 diabetes. Diagnosis and management of type 1 diabetes in children, young people and adults. http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes (update). http://www.nice.org.uk/CG66
- NICE Care pathway for diabetes. http://pathways.nice.org.uk/pathways/diabetes

Figure 12.1: Blood-glucose control for people with Type 1 diabetes (%) and people with Type 2 diabetes (%) compared with spend (£) on blood-testing items

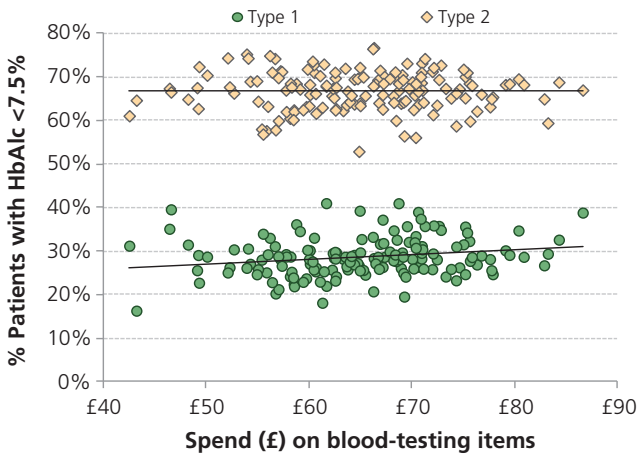
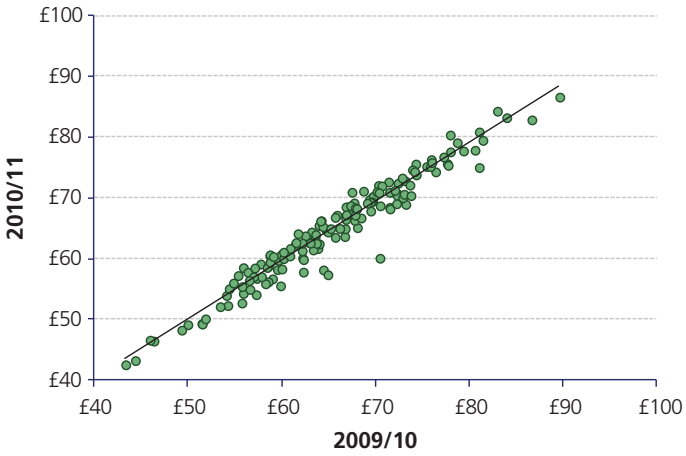


Figure 12.2: Spend (£) on blood-testing items over time

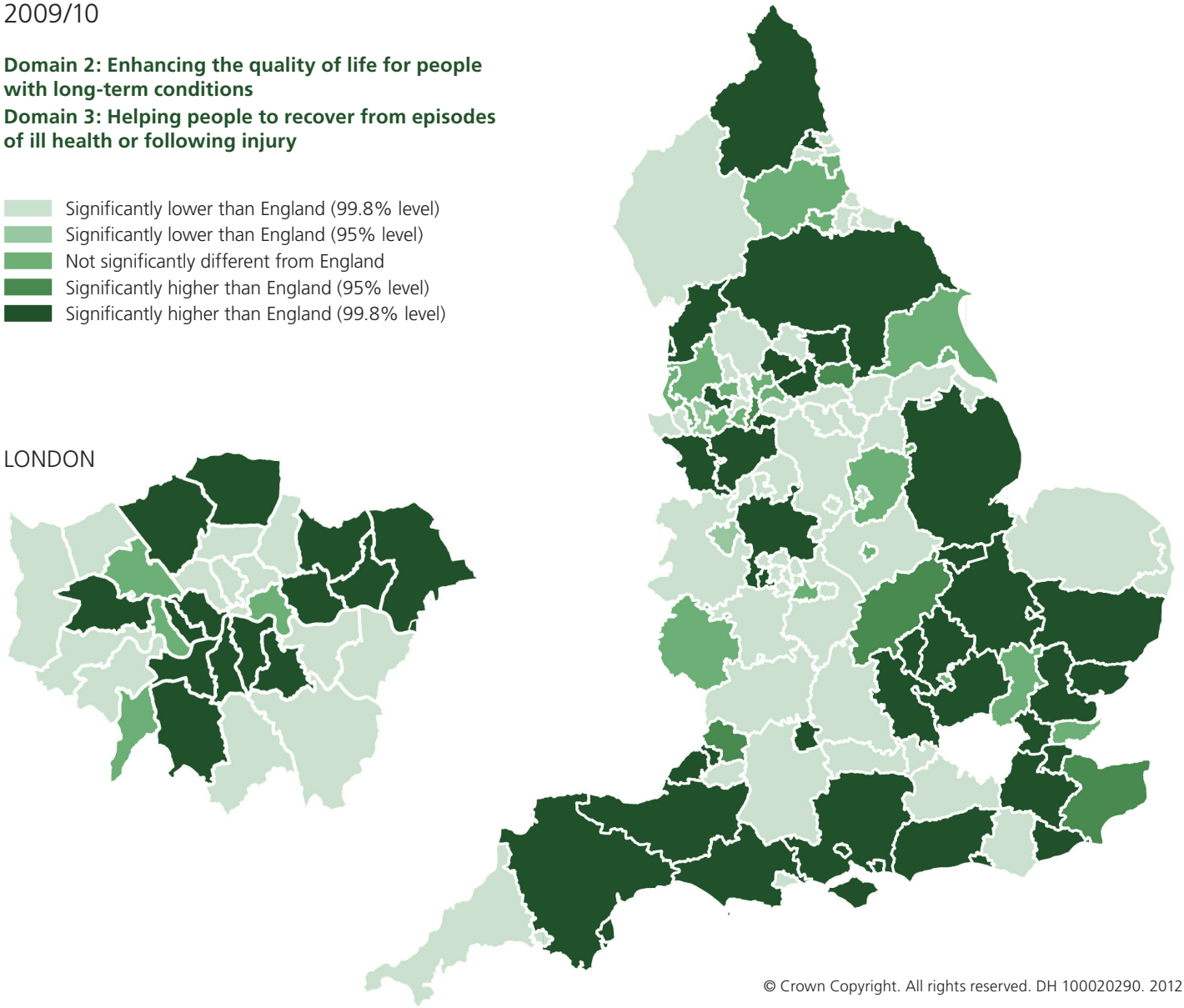


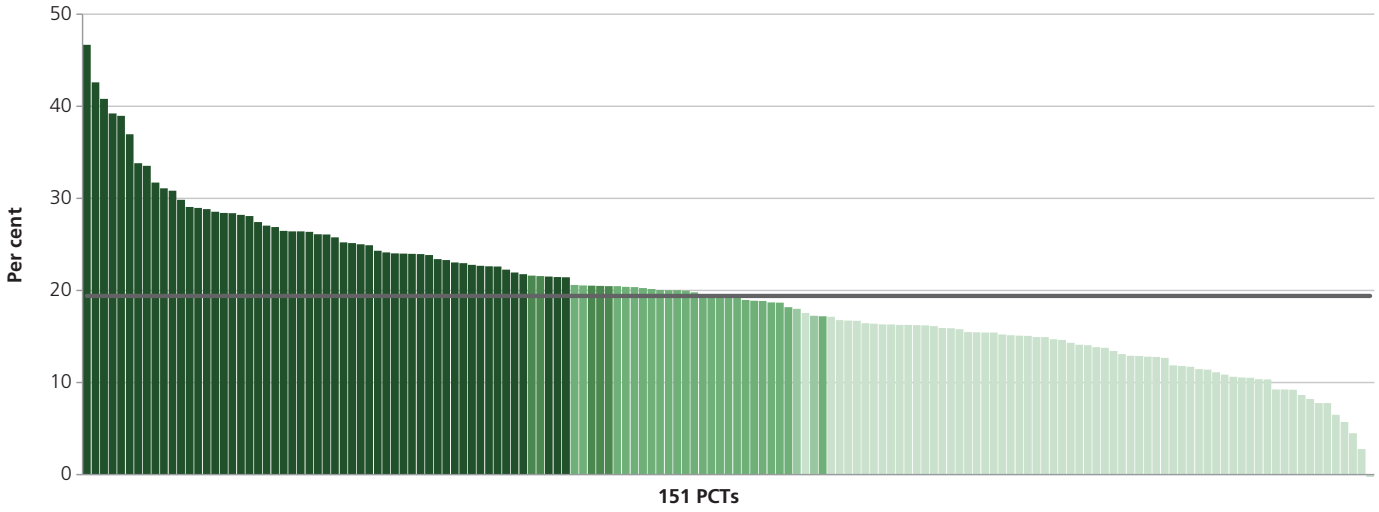
NEED FOR SECONDARY CARE

Map 13: Excess length of stay (%) in hospital among people with diabetes when compared with people without diabetes by PCT

2009/10

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





Context

People with diabetes are more likely than those without diabetes to be admitted to hospital. When in hospital, people with diabetes stay for longer when compared with people of a similar age admitted for similar conditions but who do not have diabetes.

In England in 2009/10, people of all ages with diabetes stayed in hospital 795,000 days or 19.4% longer than would have been expected if they had had the same length of stay as people of a similar age without diabetes. This excess length of stay equates to an additional 2178 beds being occupied[1] by people with diabetes when compared with the bed occupancy of people with the same conditions but who did not have diabetes, at an estimated cost of £184 million.[2]

The main factors involved in longer lengths of stay in people with diabetes are:

- diabetes-related morbidities complicating admissions to hospital for other reasons;
- inadequate control and management of diabetes while people are in hospital for reasons unrelated to diabetes.

This indicator is taken from the Variation in Inpatient Activity: Diabetes tool (VIA: Diabetes; see "Resources").

Magnitude of variation

With respect to excess length of stay in hospital among people with diabetes when compared with people without diabetes:

- For PCTs in England, the range is from –0.4% to 46.7%;
- The England value is 19.4%: at the high end of the range 36.4% of PCTs (n=55) and at the low end of the range 43.0% of PCTs (n=65) are very significantly different from the England value (at the 99.8% level).

There is a moderately strong association between the percentage excess length of stay among people with diabetes when compared with people without diabetes in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.718; p<0.00005; see Figure 13.1). This result suggests that the degree of variation observed at the PCT level in percentage excess length of stay among people with diabetes when compared with people who do not have the condition is related to how local services are organised.

Options for action

Commissioners and service providers need to review local services to ascertain whether length of stay for people with diabetes can be reduced by introducing dedicated inpatient diabetes teams, as achieved in local studies in Plymouth and Norwich.[3,4] Dedicated inpatient diabetes teams, including diabetes specialist nurses, can reduce the length of stay for people with diabetes by providing:

- diabetes training and awareness raising for non-diabetes clinical staff;
- protocols for the management of patients with diabetes;
- specific input into the management of patients experiencing problems with the control of their diabetes.

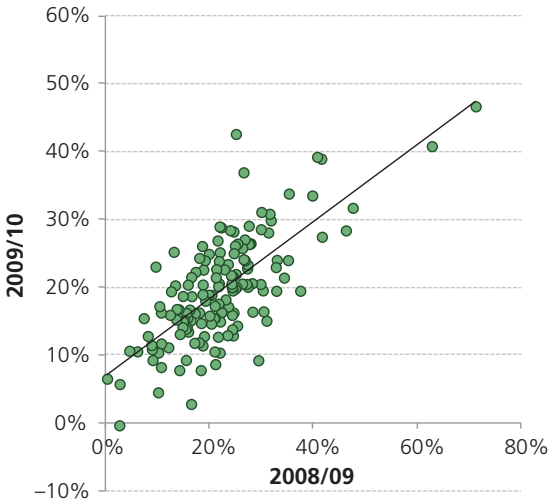
RESOURCES

- Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool. This tool enables users to compare information on inpatient activity for people with and without diabetes to provide evidence on differing care patterns.
  http://www.yhpho.org.uk/resource/view.aspx?RID=105866
- NICE Care pathway for diabetes.
  http://pathways.nice.org.uk/pathways/diabetes
- NICE (2011) Diabetes in adults quality standard.
  http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp
  Inpatient care webpage within quality standard.
  http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/inpatientcare.jsp

See also page 81, Case-study 5

Although this indicator appears in Atlas 2.0, statistical difference from the England value has been used to illustrate variation in the Diabetes Atlas (see page 20), therefore, the shading used in the maps and the appearance of the column charts will differ between the two publications, as will reporting for the "Magnitude of variation" section.

Figure 13.1: Excess length of stay (%) in hospital among people with diabetes when compared with people without diabetes over time



1 Calculated from total excess bed-days divided by 365.

2 Calculated from total excess bed-days multiplied by the average additional bed-day cost in the tariff for 2012/13.

3. Flanagan D et al (2008) Diabetes care in hospital – the impact of a dedicated inpatient care team. *Diabetic Medicine* 25; 147-151.

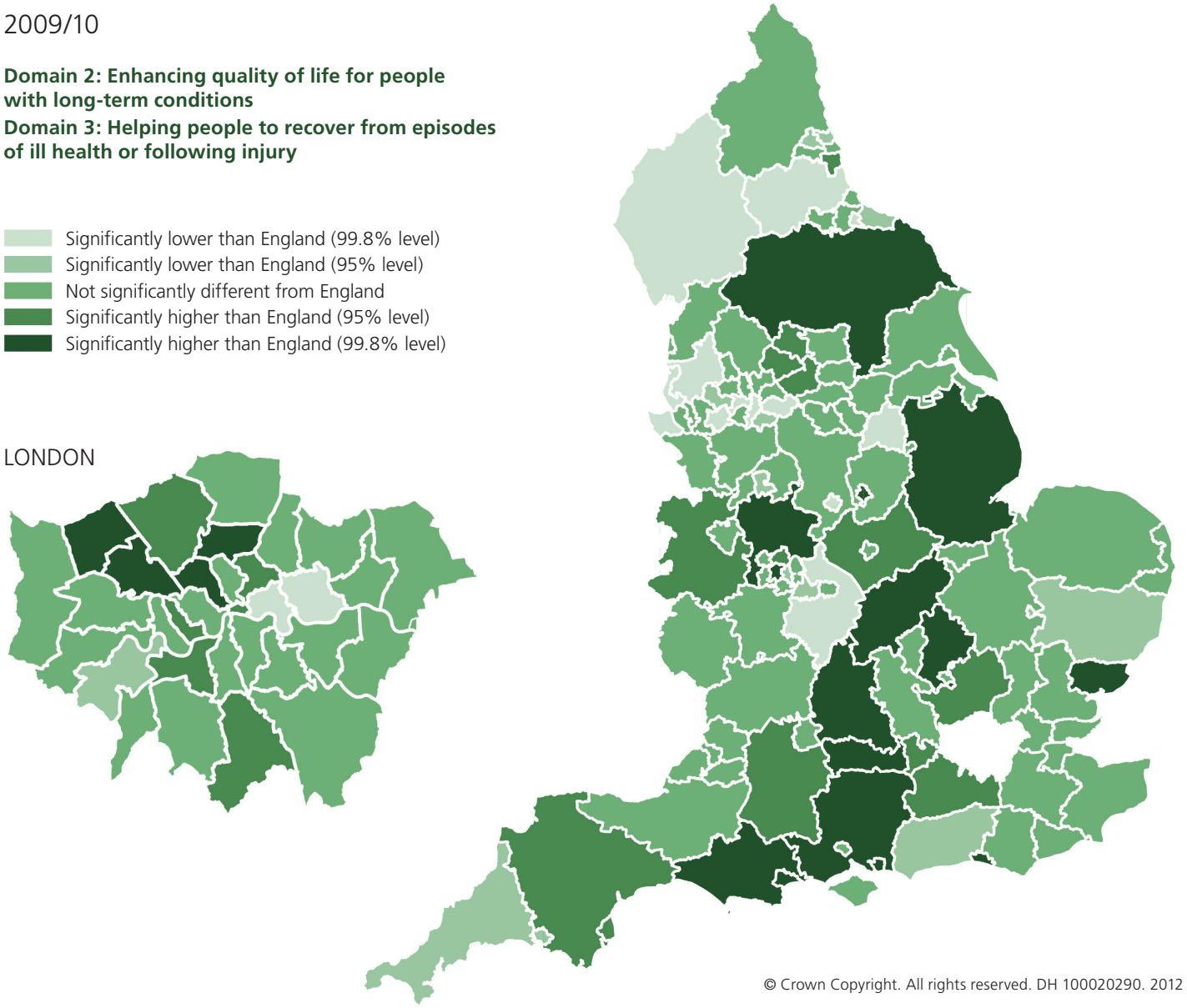
4. Sampson MJ et al (2006) Trends in bed occupancy for inpatients with diabetes before and after the introduction of a diabetes inpatient specialist nurse service. *Diabetic Medicine* 23; 1008-1015.

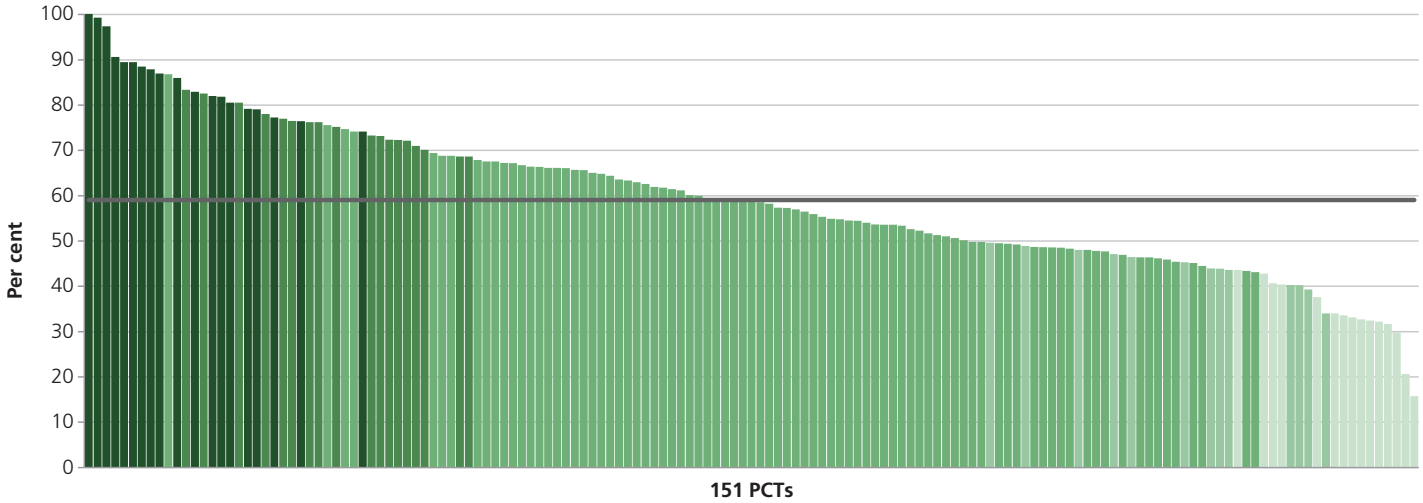
NEED FOR SECONDARY CARE

Map 14: Excess emergency re-admissions (%) within 28 days among people with diabetes when compared with people without diabetes by PCT

2009/10

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

In England in 2009/10, people of all ages with diabetes were re-admitted to hospital as an emergency within 28 days of discharge from either an elective admission or an earlier emergency admission 100,400 times. This is 59.1% more emergency re-admissions than would be expected if people with diabetes had the same rate of re-admission as people of a similar age who do not have the condition.

In the NHS Operating Framework, the importance of addressing unnecessary re-admission as a key factor in Outcome Framework Domain 3 is highlighted. The framework states that:

- Commissioners need not reimburse hospitals for admissions within 30 days of discharge following elective admission, but that savings are to be invested in clinically driven initiatives through re-ablement and post-discharge support;
- Commissioners are to work with partners to ensure initiatives are understood and used by patients

The investigation of excess rates of re-admission for any patient group provides an opportunity:

- to improve care;
- for hospitals to avoid re-admission with the prospect of no reimbursement.

People with diabetes are known to have hospital stays longer than those for people of a similar age who do not have diabetes but are admitted to hospital for similar conditions (see Map 13, page 52). There may be factors in common between longer than expected lengths of stay and higher than expected re-admission rates.

This indicator is taken from the Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool (see "Resources").

Magnitude of variation

With respect to excess emergency re-admissions among people with diabetes when compared with people without diabetes:

- For PCTs in England, the range is from 15.8% to 100.2%, a 6-fold variation;
- The England value is 59.1%: at the high end of the range 12.6% of PCTs (n=19) and at the low end of the range 9.9% of PCTs (n=15) are very significantly different from the England value (at the 99.8% level).

There is a moderate association between the percentage excess emergency re-admissions among people with diabetes when compared with people without diabetes in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.519; p<0.00005; see Figure 14.1). This result indicates that some of the variation observed may be related to how local services are organised; however, other factors, such as natural variation in patient populations, may also influence the data.

Options for action

Commissioners and providers need to investigate variation at a local level, and consider auditing the reasons for re-admission of people with diabetes to identify whether there are specific factors that could be addressed. Outcomes from these audits may include:

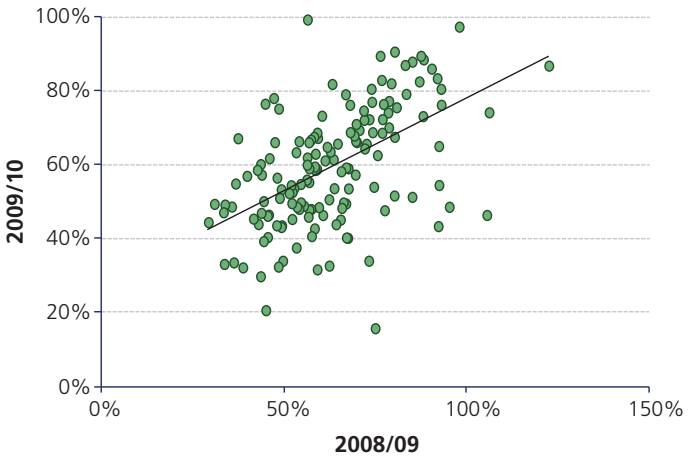
- Improvements in the care of patients with diabetes during hospital stay for the initial episode of treatment;
- Reviewing relevant policies and procedures relating to discharge planning;
- Improving the interface between primary and secondary care, and encouraging GP follow-up after discharge;
- Investment by commissioners, working with providers, in clinically driven initiatives to improve the hospital care of people with diabetes;
- Improving self-care through education about compliance with insulin and non-insulin medication and managing other risk factors.

RESOURCES

- Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool. This tool enables users to compare information on inpatient activity for people with and without diabetes to provide evidence on differing care patterns. http://www.yhpho.org.uk/resource/view.aspx?RID=105866
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp

  Inpatient care webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/inpatientcare.jsp

Figure 14.1: Excess emergency re-admissions (%) in hospital among people with diabetes when compared with people without diabetes over time

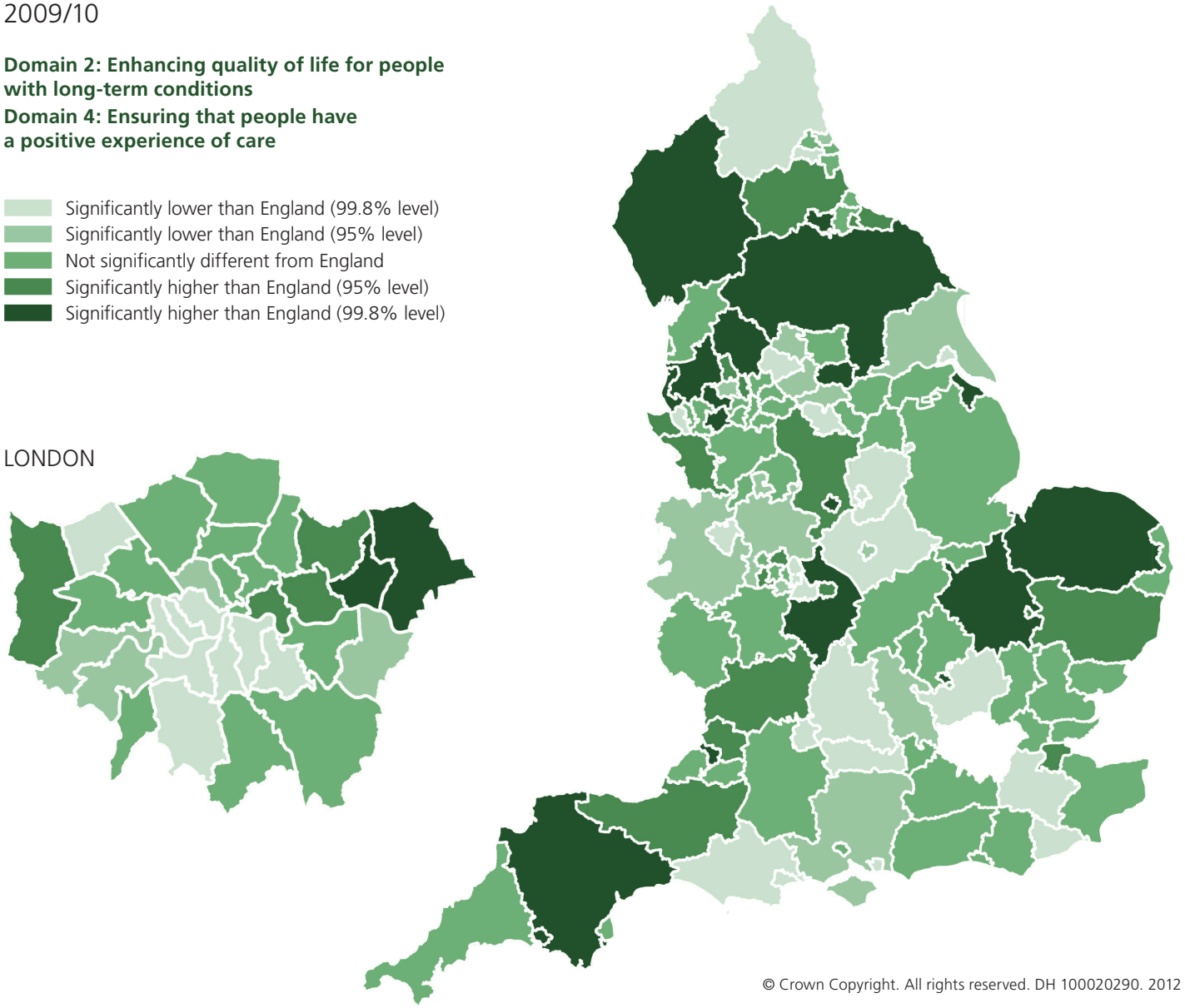


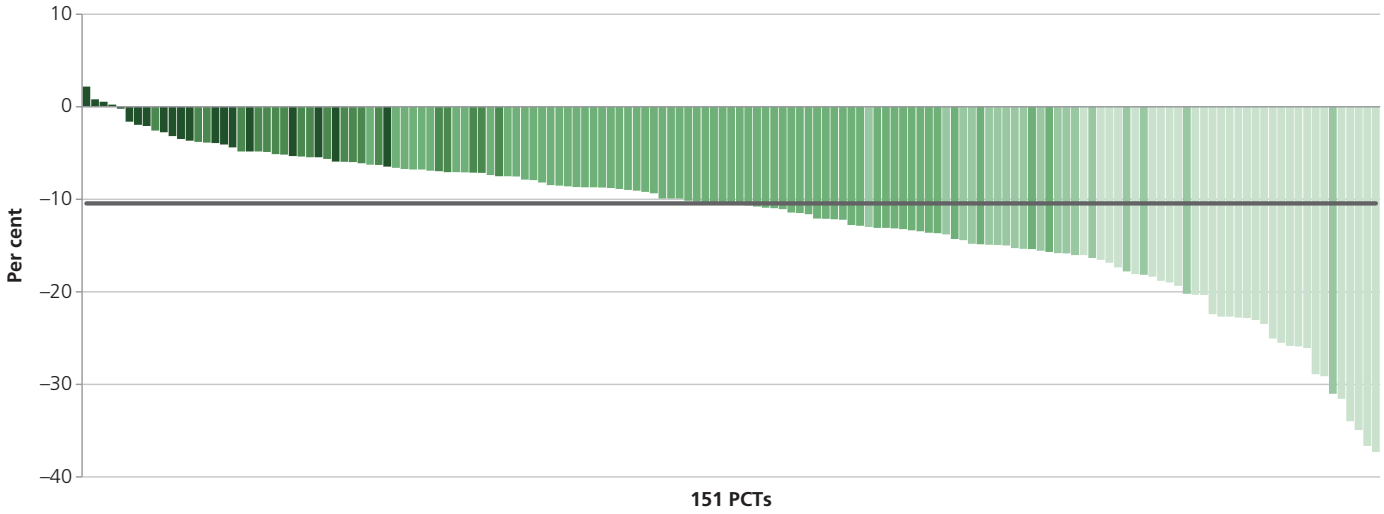
NEED FOR SECONDARY CARE

Map 15: Percentage of elective procedures undertaken as day-cases in people with diabetes when compared people without diabetes by PCT

2009/10

Domain 2: Enhancing quality of life for people with long-term conditions
Domain 4: Ensuring that people have a positive experience of care





Context

In 2009/10 in England, 332,400 day-case procedures were undertaken on people of all ages with diabetes, which is 10.4% fewer than would be expected if people with diabetes underwent a similar proportion of elective day-case procedures as people of a similar age without diabetes. However, it may be optimistic to expect day-case surgery rates for people with diabetes to achieve the same proportion as age-matched controls, given the higher prevalence of related co-morbidities which could preclude safe care on a day-stay basis.

Patients with Type 1 diabetes undergoing more complex operations as potential day-cases, with the anticipation of two missed meals, may require a variable-rate intravenous insulin infusion to maintain peri-operative normoglycaemia. Although this is not an absolute contra-indication to day surgery, it may be ambitious to expect that transfer back to normal insulin regimens can be achieved in a post-operative recovery period of only a few hours before home discharge.

However, in a recently conducted national audit of day-case management of people with diabetes,[1] it was found that:

- One-quarter of day-case units preclude the routine management of Type 1 diabetes;
- Almost half of day-case units had no care pathways to guide the management of any person with diabetes on admission.

This indicator is taken from the Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool (see "Resources").

Magnitude of variation

With respect to the percentage of elective procedures undertaken as day-cases in people with diabetes when compared with people without diabetes:

- For PCTs in England, the range is from –37.3% to 2.2%;
- The England value is –10.4%: at the high end of the range 13.2% of PCTs (n=20) and at the low end of the range 19.9% of PCTs (n=30) are very significantly different from the England value (at the 99.8% level).

There is a strong association between the percentage of elective procedures undertaken as day-cases in people with diabetes when compared with people without diabetes in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.879; p<0.00005; see Figure 15.1), suggesting that the degree of variation observed in the shortfall of day-case listing at PCT level is related to how local services are organised.

Options for action

Commissioners and providers of day-surgery care need to investigate local variation in day-case listing among people with diabetes, including reviewing:

- local policies for elective procedures;
- anaesthetic protocols for people with diabetes.

Commissioners and providers need to ensure services for the care of people with diabetes are in line with recently published evidence and guidelines (see "Resources").

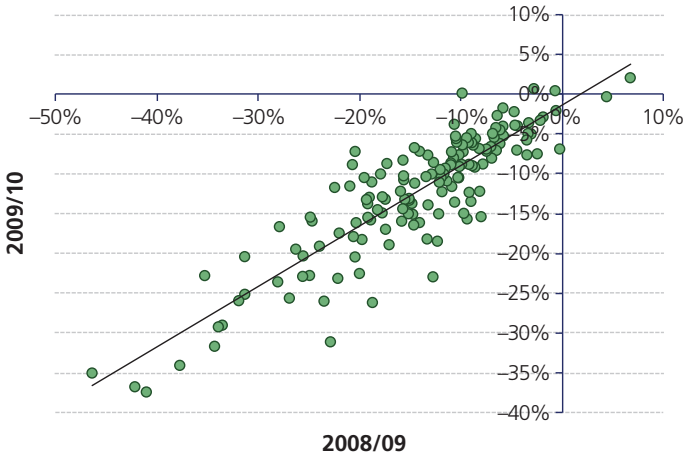
In a local study in Plymouth (see "Resources", Flanagan et al), establishing a specific diabetes team to focus on the surgical pre-assessment, admissions planning and post-operative care of elective admissions for people with diabetes increased the percentage of elective admissions undertaken as day-cases among people with diabetes when compared with people without diabetes.

RESOURCES

- Variation in Inpatient Activity: Diabetes (VIA: Diabetes) tool. This tool enables users to compare information on inpatient activity for people with and without diabetes to provide evidence on differing care patterns. http://www.yhpho.org.uk/resource/view.aspx?RID=105866
- Jones K, Montgomery J (2012) Diabetes. In: Smith I et al (editors) *Day Case Surgery*. Oxford University Press, pages 332-333.
- Lipp A (editor) (2011) *Managing patients with diabetes for day and short stay surgery*, 3rd edition. British Association of Day Surgery.
- Dhatariya K et al (2011) Management of adults with diabetes undergoing surgery and elective procedures: improving standards. NHS Diabetes. http://www.diabetes.nhs.uk/areas_of_care/emergency_and_inpatient/perioperative_management/
- Flanagan D et al (2010) Diabetes management of elective hospital admissions. *Diabetic Medicine* 25; 1289-1294.

See also page 79, Case-study 4

Figure 15.1: Elective procedures undertaken as day-cases (%) in people with diabetes when compared with people without diabetes over time



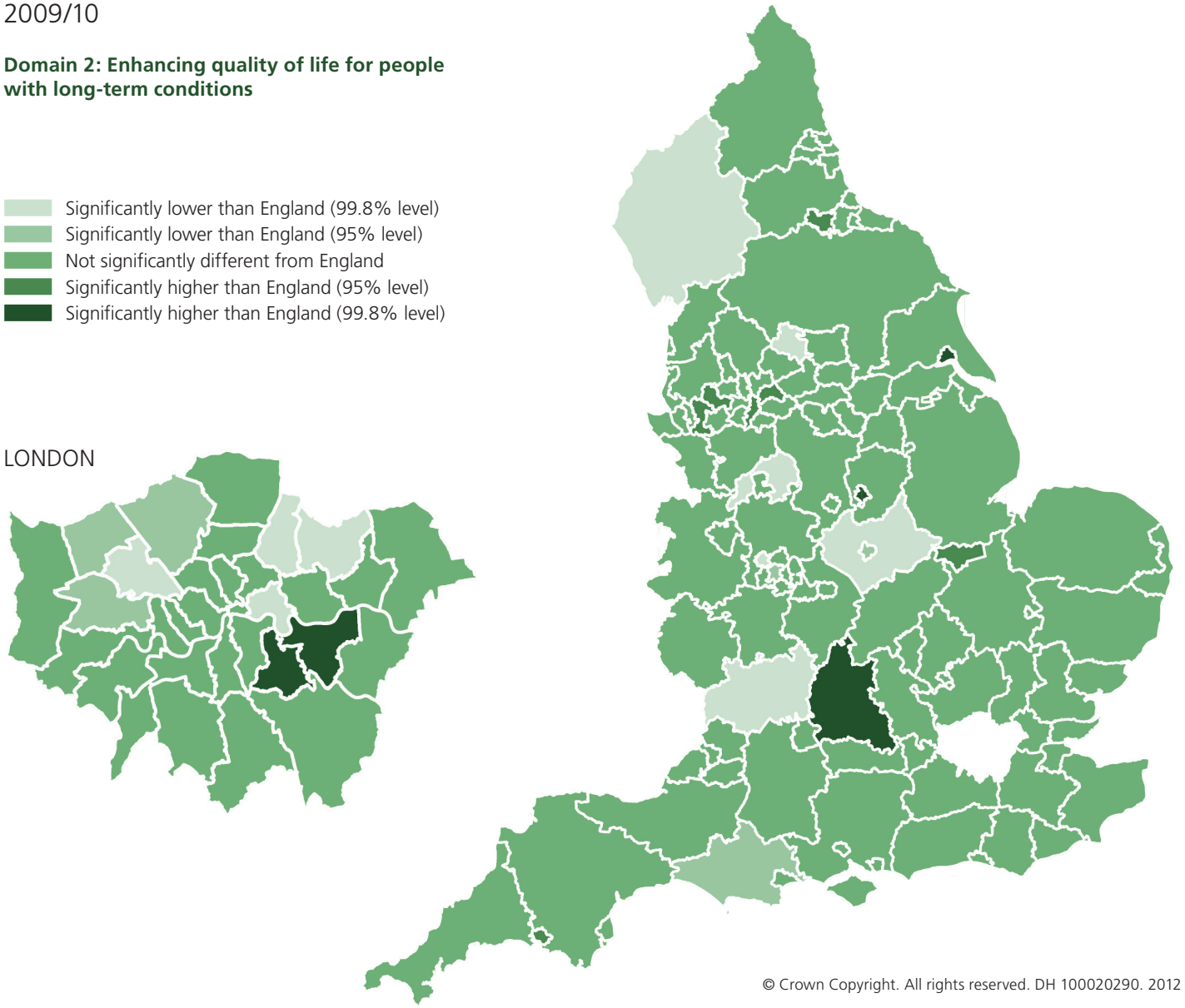
1 Modi A, Levy N, Lipp A (2012) A National Survey on the Perioperative Management of Diabetes in Day Surgery Units. *Journal of One Day Surgery* 22.3 (Suppl): P15.

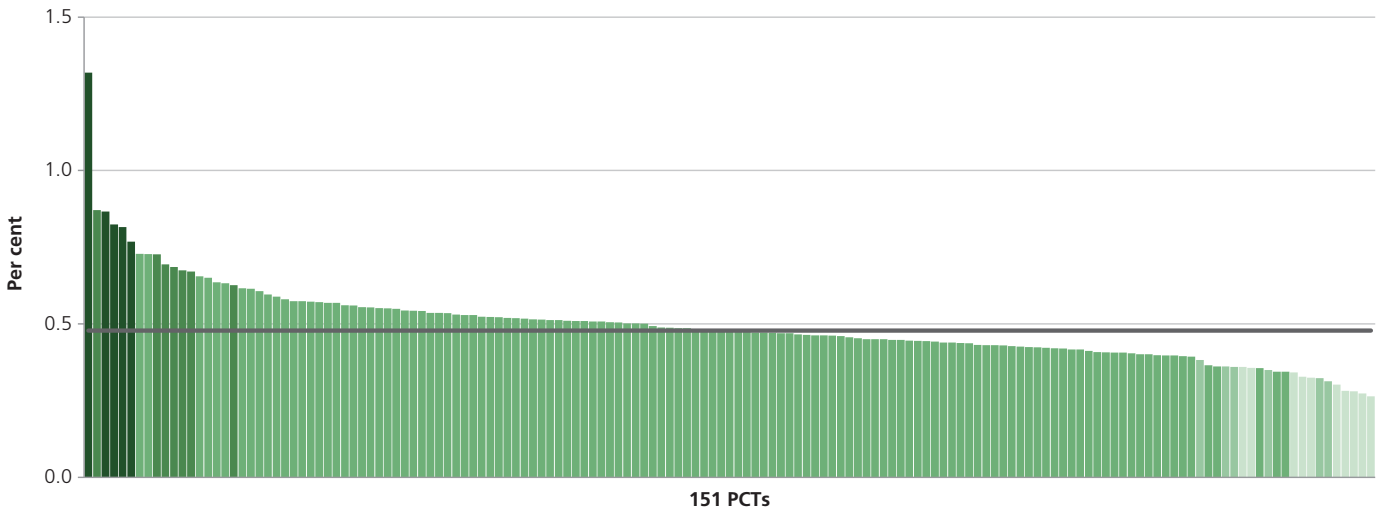
NEED FOR SECONDARY CARE

Map 16: Percentage of people with previously diagnosed diabetes in the National Diabetes Audit (NDA) admitted to hospital for diabetic ketoacidosis (DKA) at least once by PCT

2009/10

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





Context

Diabetic ketoacidosis (DKA) is a dangerous complication of diabetes, and can be fatal if left untreated. In DKA, the body is unable to break down glucose. It is caused by a lack of insulin in people with Type 1 diabetes. It is rare in people with Type 2 diabetes.

Many or most episodes of DKA are avoidable if people with Type 1 diabetes receive the appropriate education, care and support in the management of their diabetes. Reducing avoidable DKA and hospital admission:

- demonstrates improved care for people with diabetes;
- leads to reductions in commissioning expenditure.

In 2009/10 in England, 0.48% of people of all ages with diabetes included in the National Diabetes Audit (NDA) were admitted to hospital for DKA.[1]

To control for episodes of DKA at the time of diagnosis (i.e. before treatment was possible) influencing the data, people presenting with DKA with previously undiagnosed diabetes in 2009/10 have been excluded from the analysis.

Magnitude of variation

With respect to the percentage of people with previously diagnosed diabetes in the NDA admitted to hospital for DKA at least once:

- For PCTs in England, the range is from 0.3% to 1.3% , a 5-fold variation;
- The England value is 0.48%: at the high end of the range, 3.3% of PCTs (n=5) and at the low end of the range 6.6% of PCTs (n=10) are very significantly different from the England value (at the 99.8% level).

There is a moderate association between the percentage of people with previously diagnosed diabetes in the NDA admitted to hospital for DKA in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.559; p<0.00005; see Figure 16.1). This result suggests that there is some variation over time. There may be a relationship between deprivation and the likelihood of DKA occurring. However, much of the degree of variation observed may relate to differences in:

- Patient education;
- The organisation of services for young people with diabetes (see Map 17, page 60).

Options for action

Commissioners and providers need to ensure that the NICE Quality Standard for diabetes is implemented and adhered to locally. People admitted to hospital with DKA need to receive educational and psychological support prior to discharge and be followed up by a specialist diabetes team. Actions could include undertaking:

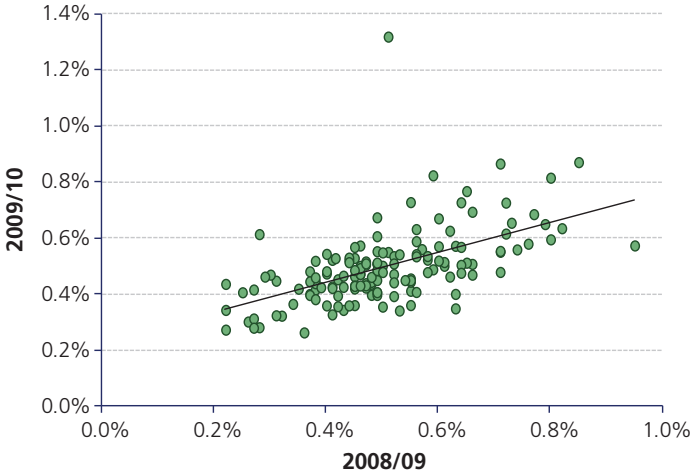
- Structured patient education programmes and supported self-management;
- Coordinated transitional care for young adults;
- A specialist diabetes team review of all patients admitted with DKA;
- A practice-level review of the level of achievement of the NICE Quality Standard to identify practices that need support in delivering better diabetes care.

Commissioners and service providers also need to ensure there is monitoring of patient outcomes.

RESOURCES

- NICE Guidance (2004) Type 1 diabetes: diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled] http://guidance.nice.org.uk/CG15
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp Diabetic ketoacidosis webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabeticketoacidosis.jsp

Figure 16.1: People with previously diagnosed diabetes in the NDA admitted to hospital for DKA (%) over time



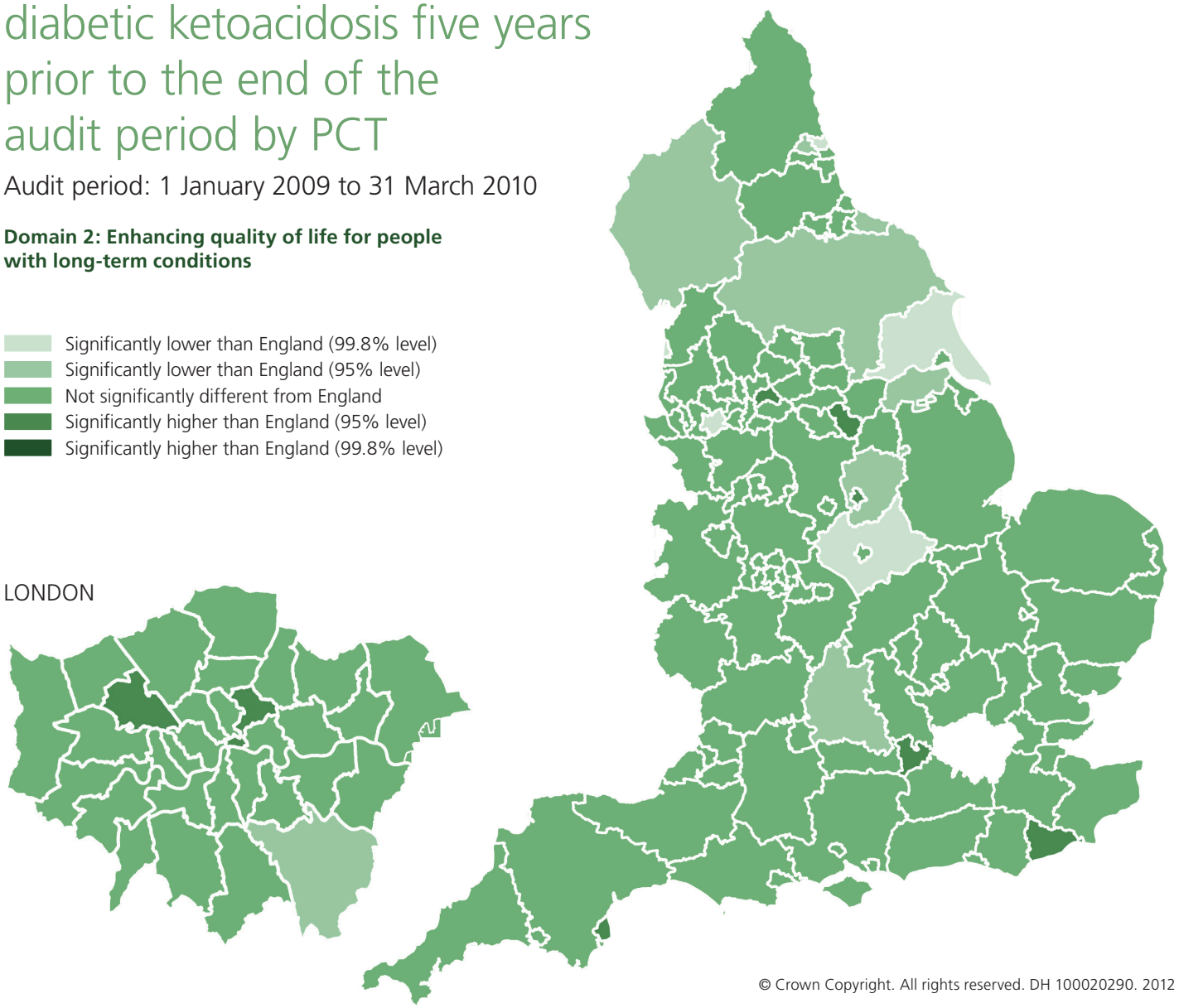
1 The population is the cohort of people in the NDA during the audit period 1 January 2009 to 31 March 2010.

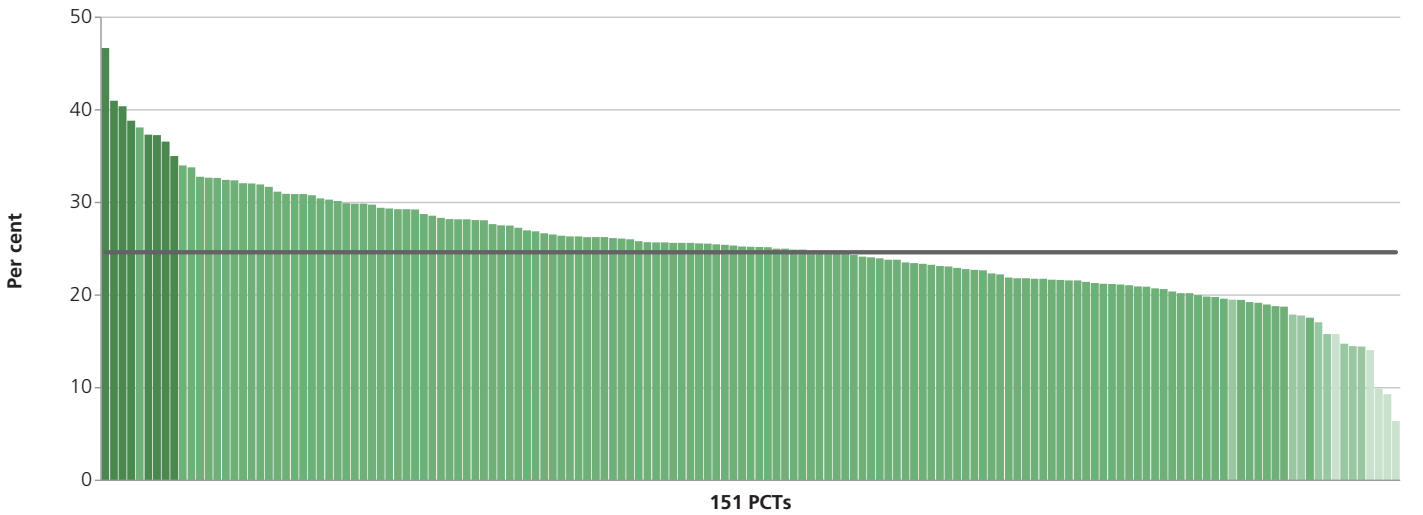
NEED FOR SECONDARY CARE

Map 17: Percentage of children aged 0-15 years with previously diagnosed diabetes in the National Diabetes Audit (NDA) admitted to hospital for diabetic ketoacidosis five years prior to the end of the audit period by PCT

Audit period: 1 January 2009 to 31 March 2010

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





Context

Diabetic ketoacidosis (DKA) is a preventable cause of mortality and morbidity in children and young people with diabetes. It is the most common cause of diabetes-related death in children with Type 1 diabetes. Around 94% of children and young people with diabetes are recorded as having Type 1 diabetes, and 1.5% as having Type 2 diabetes.

Diabetic ketoacidosis is caused by a lack of insulin and results in blood-glucose levels becoming dangerously high. A key management goal of good diabetes care is the prevention of episodes of DKA.

In England, in the five years prior to the end of the audit period, 24.6% of children and young people with diabetes included in the National Diabetes Audit (NDA)[1] were admitted to hospital for at least one episode of DKA:

- around 15% had had one episode;
- around 10 % had had two or more episodes.

As many of the attendances to hospital for DKA involve children for whom it is the first, diagnostic, episode, these cases need to be discounted when using this indicator as an outcome measure for the management of children with established diabetes. This indicator excludes children who were newly diagnosed with diabetes during the audit period between 1 January 2009 and 31 March 2010.

Magnitude of variation

With respect to the indicator, the percentage of children aged 0–15 years with previously diagnosed diabetes in the NDA admitted to hospital for DKA five years prior to the end of the audit period:

- For PCTs in England, the range is from 6.4% to 46.7%, a 7-fold variation;
- The England value is 24.6%: at the low end of the range 3.3% of PCTs (n=5) are very significantly different from England value (at the 99.8% level).

Options for action

To help prevent DKA in children and young people with diabetes, service providers and commissioners need to work in close collaboration to ensure that the clinical services provided to children and their families are delivered in accordance with NICE guidance (see "Resources") and the International Society for Pediatric and Adolescent Diabetes (ISPAD) consensus guidelines(see "Resources"). Commissioners and providers also need to ensure that patient outcomes are monitored.

Any commissioned diabetes service needs to provide a continuum of care from the hospital to the community, delivered by a specialist paediatric multidisciplinary team, including consultant paediatricians with expertise in children and young people with diabetes, paediatric diabetes specialist nurses, paediatric dietitians, psychologists with an interest in diabetes, social workers, pharmacists and play therapists.

One of the keys to preventing and treating DKA in children is to have adequate numbers of highly trained staff with the knowledge and skills to provide 24-hour expert advice on the management of diabetes in children and young people, using written management guidelines and local pathways. A clinical network providing services for children and young people with diabetes can deliver the broader coordinated approach necessary to ensure a standardised approach to the prevention of DKA.

Age- and maturity-appropriate, structured, standardised self-management education programmes need to be developed urgently alongside national standards of training for healthcare professionals. Programmes of re-education need to be targeted at children who are particularly at risk of DKA, such as adolescents, looked-after children, children from non-English-speaking families, and children known to have poor glycaemic control.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of Type 1 Diabetes in children, young people and adults (CG15). [Update currently being scheduled.] http://guidance.nice.org.uk/CG15
- International Society for Pediatric and Adolescent Diabetes (ISPAD) (2009) ISPAD clinical practice consensus guidelines. http://www.ispad.org/FileCenter.html?CategoryID=5
- National Paediatric Diabetes Audit (NPDA). http://www.rcpch.ac.uk/npda

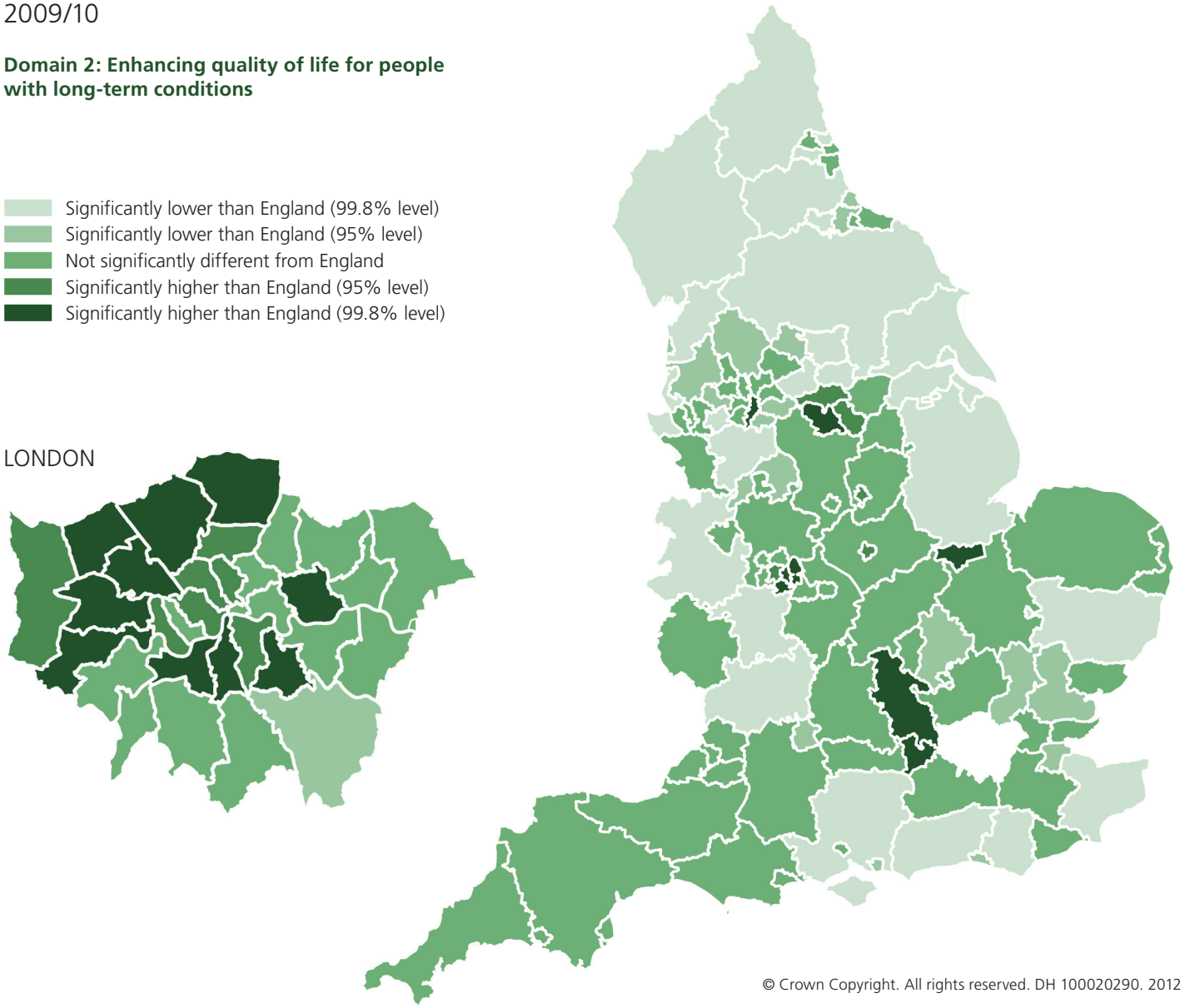
1 The population is the cohort of children and young people in the NDA during the audit period 1 January 2009 to 31 March 2010.

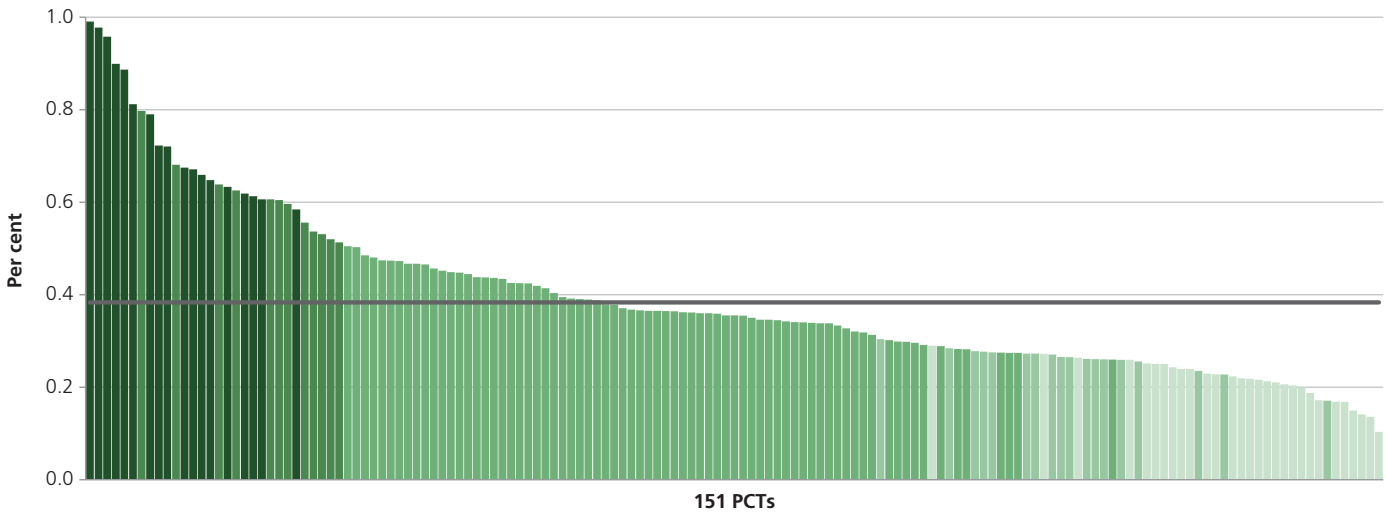
NEED FOR SECONDARY CARE

Map 18: Percentage of people with diabetes in the National Diabetes Audit (NDA) who received renal replacement therapy (RRT) by PCT

2009/10

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





Context

End-stage chronic kidney disease (CKD5) is 12 times higher among men and 8 times higher among women with diabetes when compared with people who do not have the condition.[1] In the UK, approximately 14% of people receiving renal replacement therapy (RRT) have diabetes as the cause of their kidney disease.[2] In 2009/10 in England, 0.38% of people of all ages with diabetes in the National Diabetes Audit (NDA) received RRT.[3]

Magnitude of variation

With respect to the percentage of people with diabetes in the NDA who received RRT:

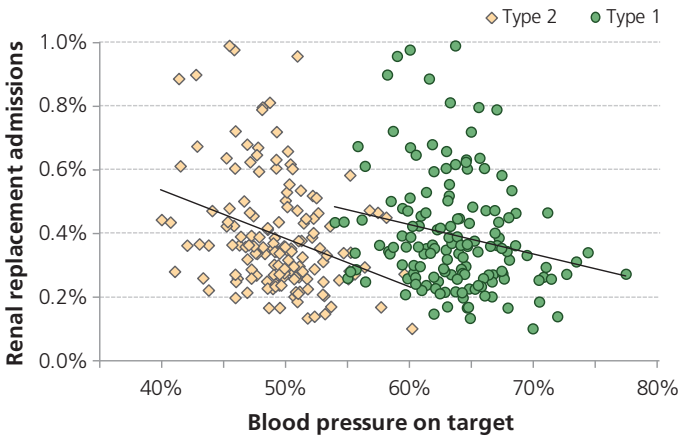
- For PCTs in England, the range is from 0.1% to 1.0%, a 10-fold variation;
- The England value is 0.38%: at the high end of the range 11.9% of PCTs (n=18) and at the low end of the range 19.2% of PCTs (n=29) are very significantly different from the England value (at the 99.8% level).

The risk of a person with diabetes requiring RRT increases with age. People with diabetes from Black and Asian ethnic groups are more likely to have severe chronic kidney disease than those from White ethnic groups.[4] Therefore, the age-structure and ethnic group composition of the population with diabetes could influence the degree of variation among PCTs.

In some PCTs, there are fewer people with diabetes whose blood-pressure levels are within target and a higher percentage of people with diabetes who have received RRT. However, this pattern is not consistent across England (see Figure 18.1) because it is the achievement of target blood pressure from the earliest stages of diabetic kidney disease over many years that reduces progression to end-stage kidney disease.

There is a strong association between the percentage of people in the NDA with diabetes who received RRT in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.859; p<0.00005; see Figure 18.2), suggesting that the variation persists over time. Potential reasons for variation include ethnicity, population age-structure, level of deprivation, capacity for RRT and service delivery (metabolic management).

Figure 18.1: Blood-pressure levels in relation to RRT in people with Type 1 and Type 2 diabetes



Options for action

For people with diabetes, good control of blood glucose and of blood pressure reduces the risk of developing kidney disease (see Maps 3–7). To help prevent kidney disease in people with diabetes, commissioners and service providers need to ensure the early identification of kidney damage through annual checks to detect micro-albuminuria. If kidney damage is present, appropriate preventative care (see Maps 1 and 2) is effective, and includes:

- Achieving and sustaining blood-glucose control targets, which requires patient education and engagement;
- Maintaining annual urine micro-albumin;
- Treating blood pressure to target levels in patients with micro-albuminuria using angiotensin converting enzyme inhibitors (ACEIs) or angiotensin-receptor blockers (ARBs) as first-line blood-pressure-lowering medications.

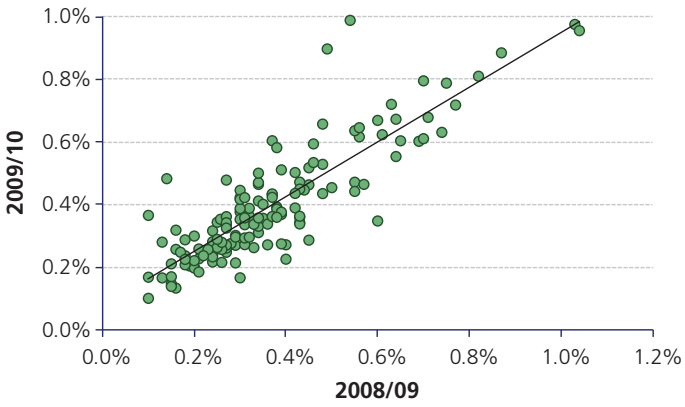
Other important considerations include:

- Being aware of the risk of acute kidney injury (AKI) in this population – implement effective preventive medicines management and basic care during acute events;
- Using a "vascular care bundle" because of the enhanced risk of macrovascular disease;
- Ensuring intensive coordinated care in multi-morbid patients with advanced kidney disease (CKD4/5).

RESOURCES

- Diabetes with kidney disease: key facts publication, http://www.yhpho.org.uk/resource/item.aspx?RID=105786
- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled] http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes http://www.nice.org.uk/CG66

Figure 18.2: People with diabetes in the NDA receiving renal replacement therapy (%) over time



1 Hippisley-Cox J, Coupland C (2010) Predicting the risk of chronic kidney disease in men and women in England and Wales: prospective derivation and external validation of the QKidney scores. *BMC Fam Pract* 11: 49.

2 Ansell D et al. UK Renal Registry 2009: the twelfth annual report of the Renal Association. *Nephron Clin Pract* [Internet]. 2010 [cited 2011 Jan 5];115 (Suppl. 1). http://www.renalreg.com

3 The population is the cohort of people in the NDA during the audit period 1 January 2009 to 31 March 2010.

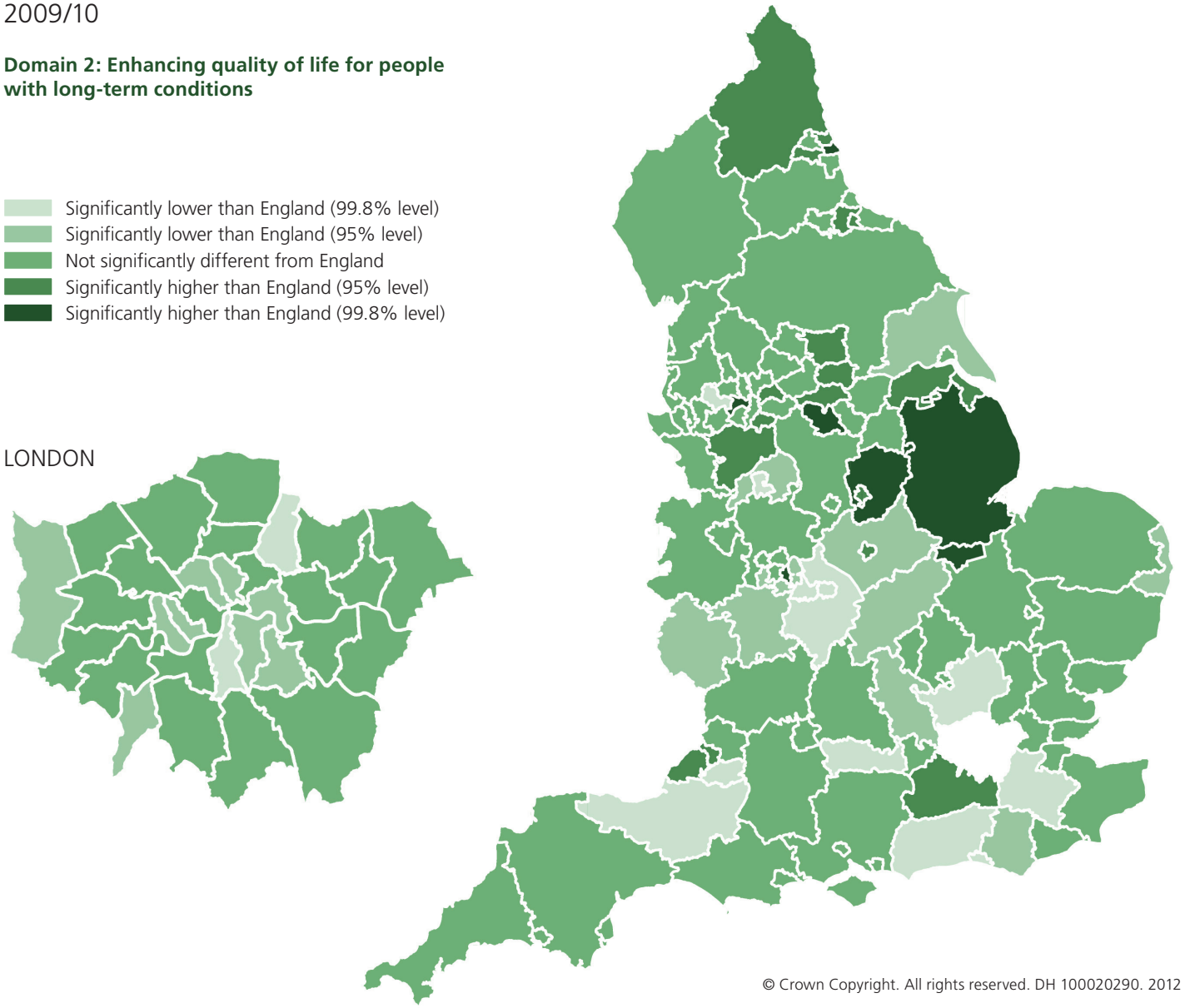
4 Dreyer G et al. The effect of ethnicity on the prevalence of diabetes and associated chronic kidney disease. *Q J Med* [Internet]. 2009 [cited 2011 Jan 5]; 102(4): 261-9. http://qjmed.oxfordjournals.org/content/102/4/261.long

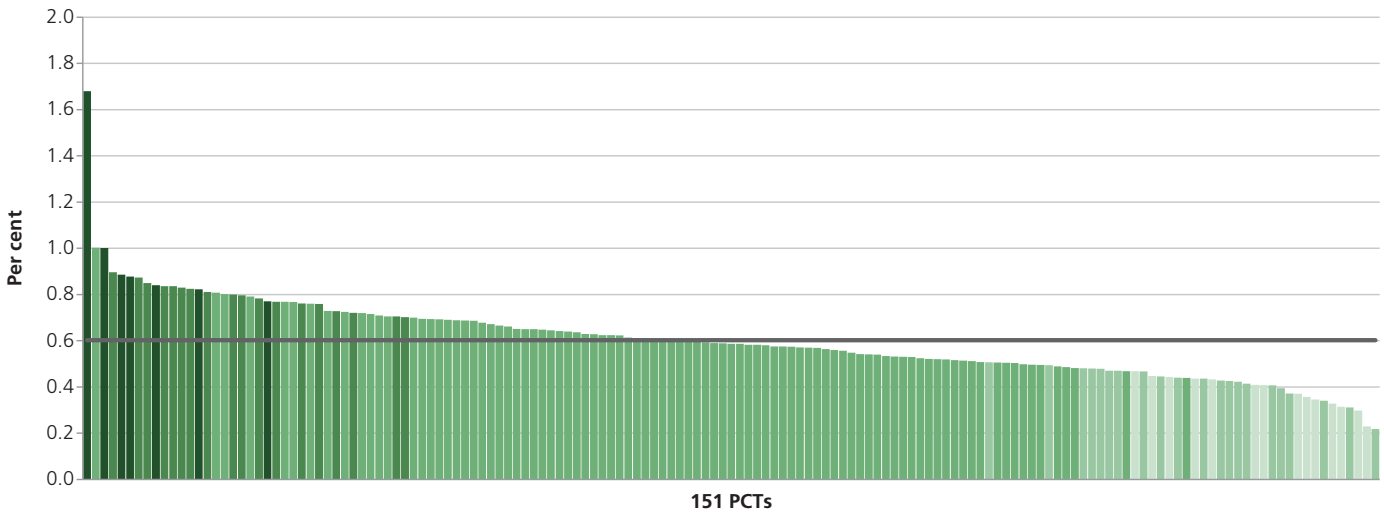
NEED FOR SECONDARY CARE

Map 19: Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for myocardial infarction (MI) by PCT

2009/10

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





Context

People with diabetes are at greater risk of having a myocardial infarction (MI) or heart attack than people who do not have the condition. Myocardial infarction is a major cause of death and ill health, but prompt and appropriate treatment reduces the likelihood of death and recurrent MI.

There is good evidence[1] that:

- the overall rate of acute MI is declining;
- survival from acute MI has improved over the time-period 2002–2010.

Thirty-day mortality post-MI has decreased in people with diabetes and people without diabetes, although it remains higher for those with diabetes.

In 2009/10 in England, 0.60% of people of all ages with diabetes included in the National Diabetes Audit (NDA) were admitted to hospital for MI.[2] By comparison, among the whole population of England, acute MI events represented 0.17% of the population in 2009 and 0.16% of the population in 2010.[1] This difference probably over-states the higher risk of people with diabetes because the age-structure of the population with diabetes will be older than that of the general population.

Magnitude of variation

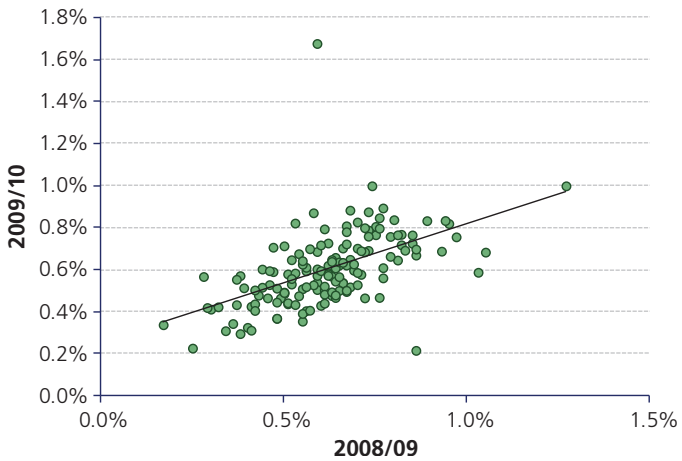
With respect to the percentage of people with diabetes in the NDA admitted to hospital for MI:

- For PCTs in England, the range is from 0.2% to 1.7%, an 8-fold variation;
- The England value is 0.60%: at the high end of the range 4.6% of PCTs (n=7) and at the low end of the range 9.3% (n=14) are very significantly different from the England value (at the 99.8% level).

As for the general population, the risk of people with diabetes having an MI increases with age. Therefore, the age-structure of the local population with diabetes could influence the degree of variation among PCTs.

There is a moderate association between the percentage of people in the NDA with diabetes admitted to hospital for MI in 2008/09 and the percentage in 2009/10, suggesting there is some variation over time (correlation coefficient, r=0.539; p<0.00005; see Figure 19.1).

Figure 19.1: People with diabetes in the NDA admitted to hospital for MI (%) over time



Other potential reasons for variation include:

- Ethnicity – people from a South Asian ethnic background have higher rates of coronary heart disease (CHD);
- Deprivation, which is associated with higher rates of CHD;
- Service delivery (cardiovascular risk management).

Options for action

To help reduce the risk of MI in people with diabetes, commissioners and service providers need to ensure that recommendations on the identification and management of arterial disease risk in NICE guidance (see "Resources") are implemented locally, including:

- Promoting and supporting healthy lifestyle choices;
- Smoking cessation;
- Good control of blood glucose, blood pressure and cholesterol (see Maps 3–9).

Commissioners and service providers need to review local-level data to identify where support to improve diabetes care is needed.

Once admitted, a patient's diabetic condition needs to be managed throughout their hospital stay.

In England, the availability and uptake of cardiac rehabilitation is variable.[3] It is important that people with diabetes who have had an MI are offered cardiac rehabilitation to reduce the risk of further cardiac events.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15) http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes http://www.nice.org.uk/CG66
- NICE Guidance (2008) Lipid modification: Cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular disease (CG67). http://www.nice.org.uk/CG67
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp

  Inpatient care webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/inpatientcare.jsp

1 Smolina et al (2012) Determinants of the decline in mortality from acute myocardial infarction in England between 2002 and 2010: linked national database study. *British Medical Journal* 344:d8059.

2 The population is the cohort of people in the NDA during the audit period 1 January 2009 to 31 March 2010.

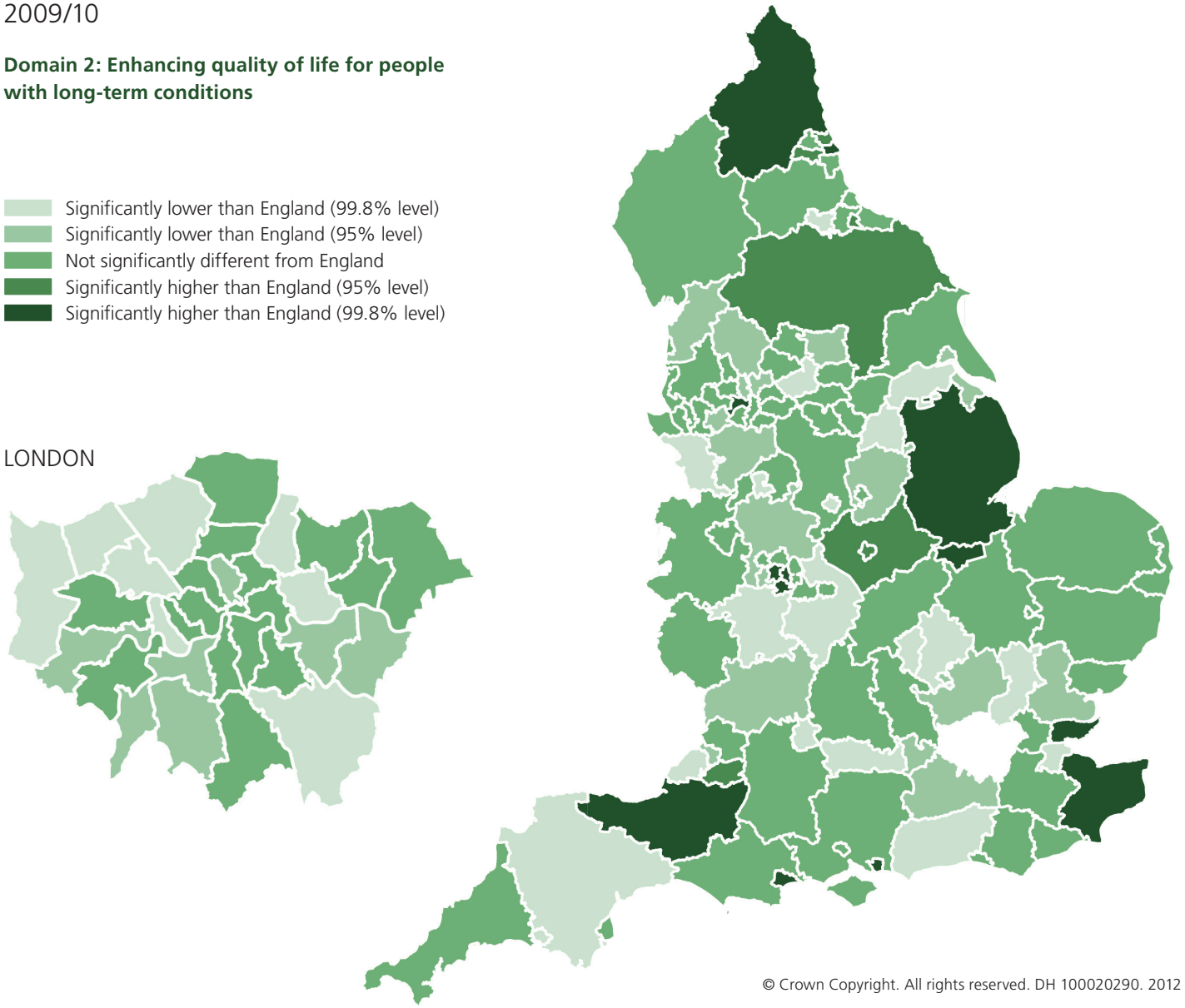
3 British Heart Foundation (2011) The National Audit of Cardiac Rehabilitation. Annual Statistical Report 2011. http://www.bhf.org.uk/publications/view-publication.aspx?ps=1001754

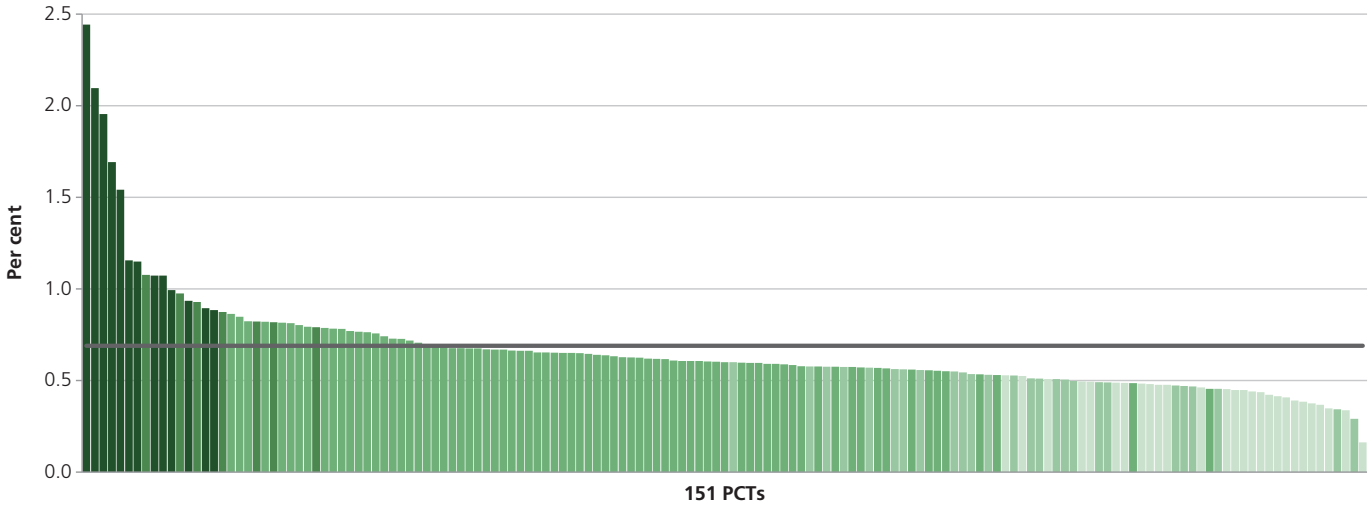
NEED FOR SECONDARY CARE

Map 20: Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for stroke by PCT

2009/10

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





Context

Stroke is the third biggest cause of death in the UK, and the largest single cause of severe disability. Each year more than 110,000 people in England suffer from a stroke. Stroke costs about £7 billion a year:

- £2.8 billion in direct costs to the NHS;
- £2.4 billion in informal care costs (e.g. home nursing costs borne by patients' families);
- £1.8 billion in lost income due to disability and decreased productivity.[1]

People with diabetes are at greater risk of stroke than people who do not have the condition. The relative risk of a stroke for people with diabetes when compared with people without diabetes is higher for women than it is for men. Women with diabetes lose the 'protection' of their sex, and the prevalence of stroke is equally high in men as in women with diabetes.[2]

The results of several studies have shown an increase in short- and long-term morbidity and mortality in patients with diabetes or glucose-intolerance who have had a stroke. Functional recovery, return to work, and five-year mortality are all negatively influenced by diabetes.

In 2009/10 in England, 0.69% of people of all ages with diabetes in the National Diabetes Audit (NDA) were admitted to hospital for stroke.[3]

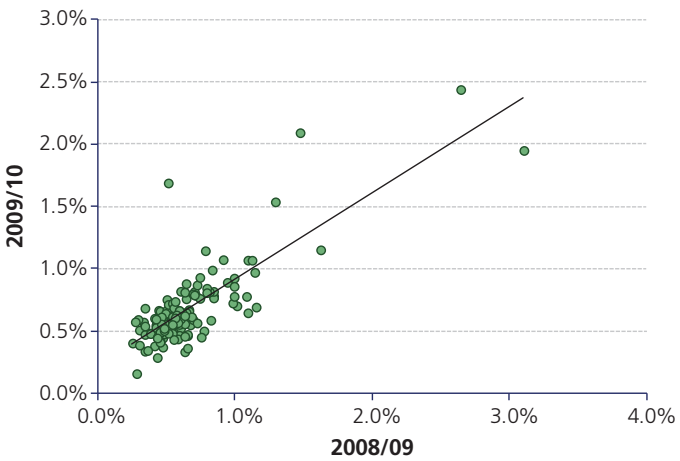
Magnitude of variation

With respect to the indicator the percentage of people with diabetes in the NDA admitted to hospital for stroke:

- For PCTs in England, the range is from 0.2% to 2.4%, a 15-fold variation;
- The England value is 0.69%: at the high end of the range 8.6% of PCTs (n=13) and at the low end of the range 17.9% of PCTs (n=27) are very significantly different from the England value (at the 99.8% level).

As for the general population, the risk of people with diabetes having a stroke increases with age. Therefore, the age-structure of the local population with diabetes could influence the degree of variation among PCTs.

Figure 20.1: Percentage of people with diabetes in the NDA admitted to hospital for stroke (%) over time



There is a strong association between the percentage of people in the NDA admitted to hospital for stroke in 2008/09 and the percentage in 2009/10, suggesting the variation is consistent over time (correlation coefficient, r=0.801; p<0.00005; see Figure 20.1).

Other potential reasons for variation include:

- Ethnicity – African or Caribbean ethnic groups are at higher risk of stroke: incidence rates are twice as high for Black people as for White people;[1]
- Deprivation, which is associated with higher rates of stroke;[1]
- Service delivery (cardiovascular risk management).

Options for action

To help reduce the risk of stroke in people with diabetes, commissioners and service providers need to ensure that NICE guidance on the identification and management of arterial disease risk (see "Resources") is implemented locally, including:

- Healthy lifestyle choices;
- Smoking cessation;
- Good control of blood glucose, blood pressure and cholesterol (see Maps 3–9).

Commissioners and service providers need to review local-level data to identify where support to improve diabetes care is needed.

Once admitted, it is important that a patient's diabetic condition is recognised and managed throughout their hospital stay.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled] http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes http://www.nice.org.uk/CG66
- NICE Guidance (2008) Lipid modification: Cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular disease (CG67). http://www.nice.org.uk/CG67
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp
  Inpatient care webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/inpatientcare.jsp

1 Department of Health (2007) National Stroke Strategy. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081062

2 European Stroke Association. FAQ – Frequently Asked Questions on Stroke. Stroke Prevention by the Practitioner: Diabetes and Stroke. http://www.eso-stroke.org/faq_04.php?cid=8

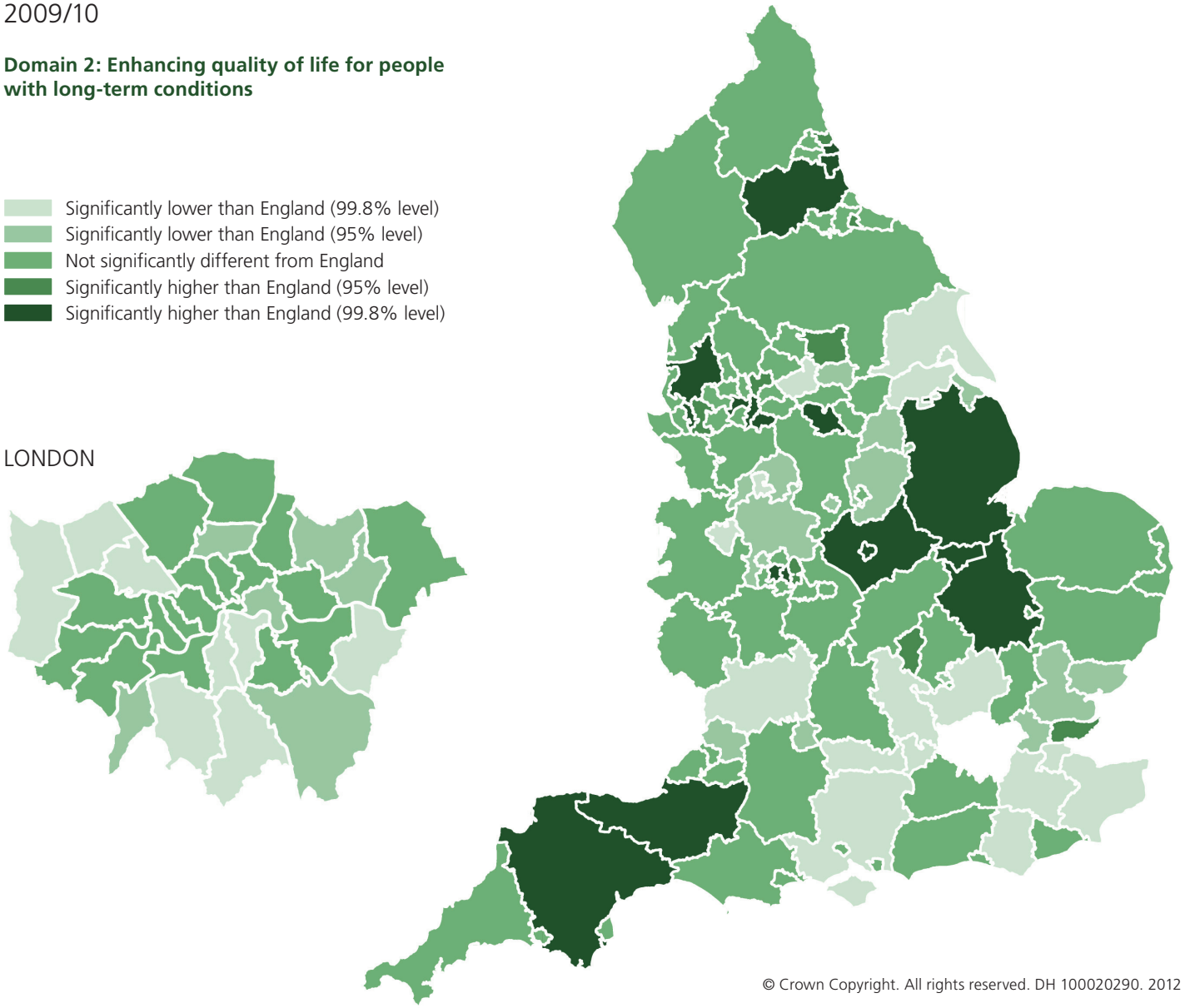
3 The population is the cohort of people in the NDA during the audit period 1 January 2009 to 31 March 2010.

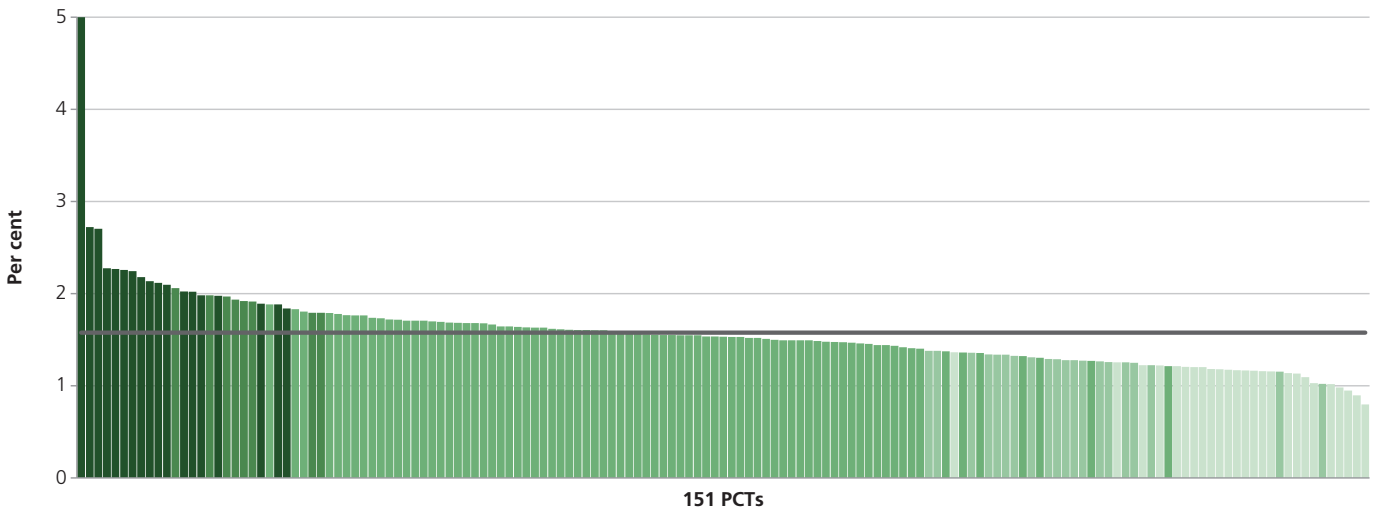
NEED FOR SECONDARY CARE

Map 21: Percentage of people with diabetes in the National Diabetes Audit (NDA) admitted to hospital for cardiac failure by PCT

2009/10

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





Context

People with diabetes are more likely to have cardiac (or heart) failure than people without diabetes.

Cardiac failure affects at least 1% of people in the UK, increasing steeply with age. During the next 20 years, the number of people with cardiac failure is likely to rise due to the combined effects of improved survival in people who develop cardiovascular disease, and an ageing population.[1]

Cardiac failure is one of the commonest reasons for emergency medical admission, re-admission and hospital bed-days' occupancy. Survival rates for cardiac failure are worse than those for breast cancer and for prostate cancer, with annual mortality ranging from 10% to 50% depending on severity.

In the National Heart Failure Audit report, annual mortality in hospitalised patients for 2009/10 confirmed that the prognosis remains poor with mortality rates of 30% at one year.[1] In the audit, hypertension (53%) and ischaemic heart disease (47%) were considered to be the commonest contributory causes of cardiac failure; diabetes (28%) and valvular heart disease (21%) were also common causes.[1]

There is good evidence that appropriate diagnosis of, and treatment and ongoing support for, cardiac failure can:

- improve quality of life;
- reduce morbidity and mortality;
- reduce the length of hospital admissions.

It is important that a patient's diabetic condition is recognised on admission.

In 2009/10 in England, 1.58% of people of all ages with diabetes in the National Diabetes Audit (NDA) were admitted to hospital for cardiac failure.[2]

Magnitude of variation

With respect to the percentage of people with diabetes in the NDA admitted to hospital for cardiac failure:

- For PCTs in England, the range is from 0.8% to 5.0%, a 6-fold variation;
- The England value is 1.58%: at the high end of the range 11.9% of PCTs (n=18) and at the low end of the range 16.5% of PCTs (n=25) are very significantly different from the England value (at the 99.8% level).

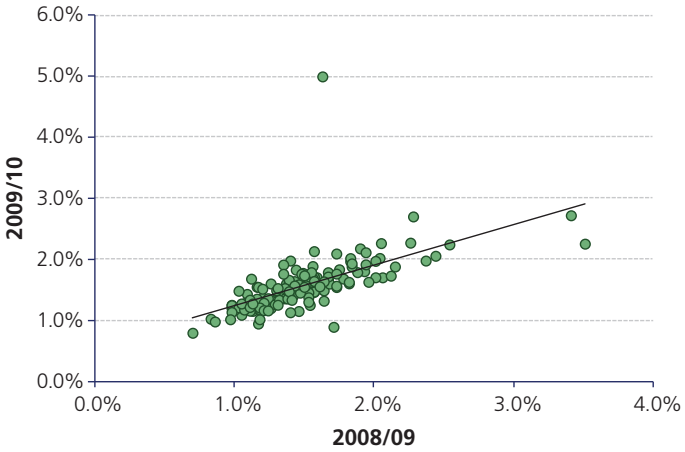
As for the general population, the risk of people with diabetes having cardiac failure increases with age. Therefore, the age-structure of the population with diabetes could influence the degree of variation among PCTs.

There is a moderately strong association between the percentage of people with diabetes in the NDA admitted to hospital for cardiac failure in 2008/09 and the percentage in 2009/10 (correlation coefficient, r=0.624; p<0.00005; see Figure 21.1). This result suggests that the variation is moderately persistent over time.

Other potential reasons for variation include:

- Ethnicity;
- Service delivery (cardiovascular risk management).

Figure 21.1: People with diabetes in the NDA admitted to hospital for cardiac failure (%) over time



Options for action

To help reduce the risk of cardiac failure in people with diabetes, commissioners and service providers need to ensure that NICE guidance on identifying and managing arterial disease risk (see "Resources") is implemented locally, including:

- Healthy lifestyle choices;
- Smoking cessation;
- Good control of blood glucose, blood pressure and cholesterol (see Maps 3–9).

Commissioners and service providers need to review local-level data to investigate variation among primary and secondary providers, and thereby identify where support to improve diabetes care may be required.

Once admitted, it is important that a patient's diabetic condition is managed throughout their hospital stay.

RESOURCES

- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled] http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes http://www.nice.org.uk/CG66
- NICE Guidance (2008) Lipid modification: Cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular disease (CG67). http://www.nice.org.uk/CG67
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp

  Inpatient care webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/inpatientcare.jsp

1 National Institute for Cardiovascular Outcomes Research (2012) *National Heart Failure Audit – April 2010–March 2011*. UCL. http://www.ucl.ac.uk/nicor/nicor/hfannualreport10-11

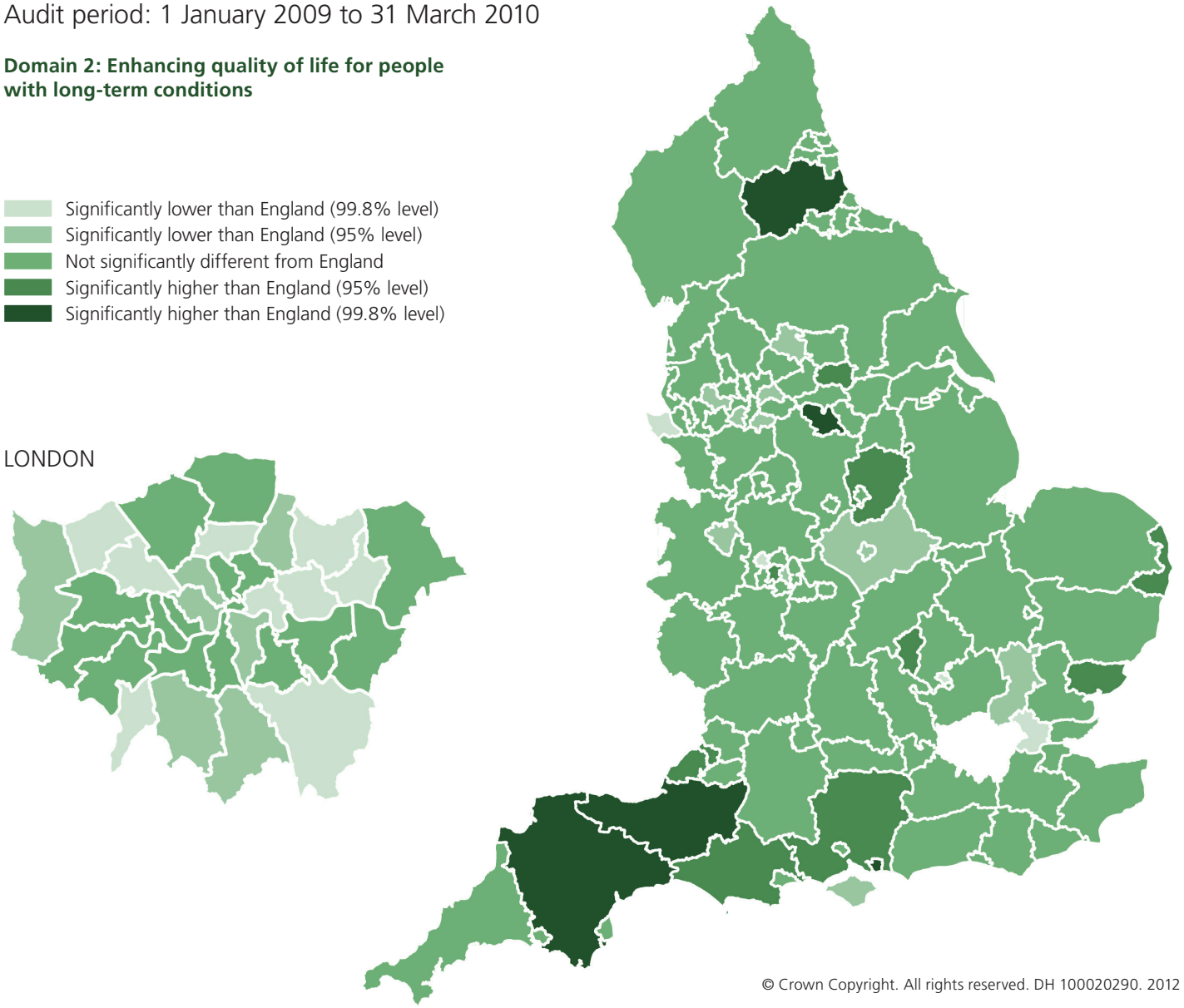
2 The population is the cohort of people in the NDA during the audit period 1 January 2009 to 31 March 2010.

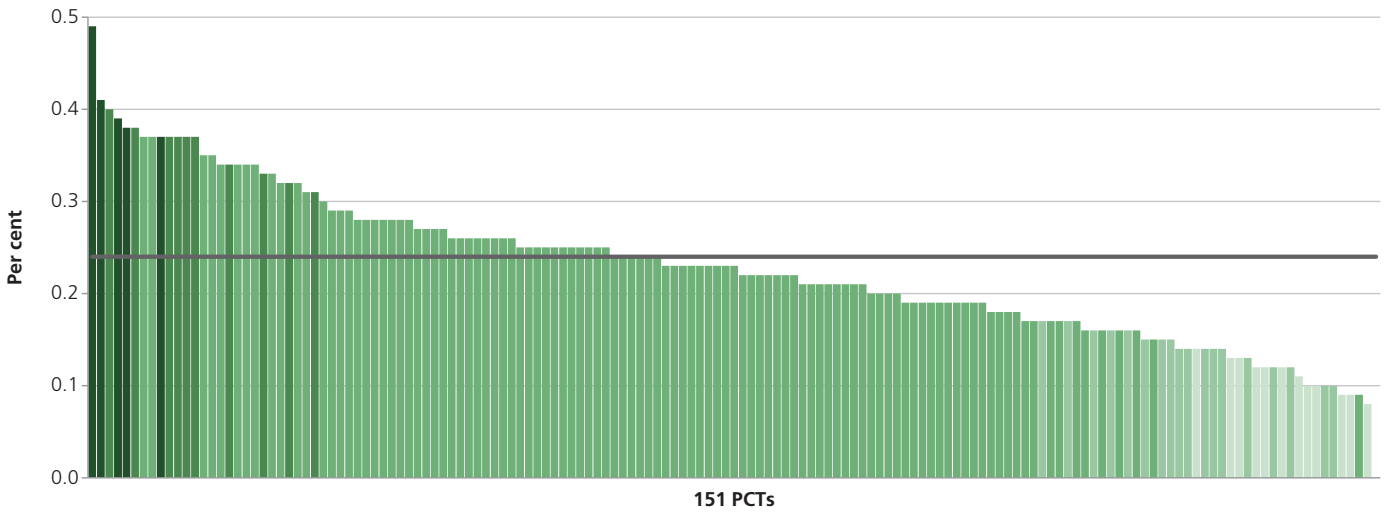
NEED FOR SECONDARY CARE

Map 22: Percentage of people in the National Diabetes Audit (NDA) having major lower limb amputations five years prior to the end of the audit period by PCT

Audit period: 1 January 2009 to 31 March 2010

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





Context

People with diabetes are predisposed to developing foot ulcers primarily because of an increased risk of both peripheral arterial disease (PAD) and peripheral neuropathy. Once ulcers occur, healing may be delayed by several factors, including infection, PAD, and continued unnoticed trauma to the wound due to neuropathy. Chronic ulceration is the commonest precursor to major lower limb amputation (defined as above the ankle). Ulceration and amputation reduce quality of life, and are associated with high mortality.

In England:

- Approximately half of the major lower limb amputations are in people with diabetes;
- In the five years prior to March 2010, 0.24% of people of all ages with diabetes in the National Diabetes Audit (NDA) had had a major lower limb amputation.

Magnitude of variation

With respect to the percentage of people in the NDA having major lower limb amputations five years prior to the end of the audit period:

- For PCTs in England, the range is from 0.0% to 0.5%;
- The England value is 0.24%: at the high end of the range 3.3% of PCTs (n=5) and at the low end of the range 8.6% of PCTs (n=13) are very significantly different from the England value (at the 99.8% level).

In Atlas 1.0 (Map 3), a similar indicator appeared: geography was by strategic health authority, and the patient group was people in the NDA with Type 2 diabetes having a major lower limb amputation in the five years prior to the end of the audit period in 2009. There was a twofold variation at this higher geographical level.

Options for action

For people with diabetes, good control of blood glucose reduces the risk of developing PAD and peripheral neuropathy. Good control of cholesterol and blood pressure and smoking cessation reduce the risk of PAD. Expert assessment and follow-up of people with PAD and/or neuropathy may reduce the onset of new foot disease. Urgent referral to expert services of all newly occurring, or deteriorating, foot disease will lead to improved outcomes.

The results of local studies have shown that the introduction of multidisciplinary teams to assess and treat diabetic foot disease has reduced major and minor amputation rates, and has generated savings.[1]

In current guidelines (see "Resources", CG119), it is recommended that all people with diabetes:

- have an annual examination to assess individual risk, and those at increased risk are referred to a member of a foot protection team (typically includes podiatrists, orthotists and footcare specialists with expertise in protecting the foot) for long-term surveillance;
- have their foot risk assessed on admission to hospital for any reason;
- who have newly occurring foot disease are referred for urgent assessment by a member of a specialist multidisciplinary team.

RESOURCES

- NICE Guidance Diabetic foot problems – inpatient management. Diabetic foot – inpatient management of people with diabetic foot ulcers and infection. http://www.nice.org.uk/guidance/CG119
- NICE (2012) Foot care service for people with diabetes commissioning guide. http://www.nice.org.uk/usingguidance/commissioningguides/footcare/footcareservicediabetes.jsp
- Diabetes UK (2009) Putting Feet First: Commissioning specialist services for the management and prevention of diabetic foot disease in hospitals. http://www.diabetes.org.uk/Professionals/Publications-reports-and-resources/Reports-statistics-and-case-studies/Reports/Putting-feet-first/
- NICE Guidance (2004) Diagnosis and management of type 1 diabetes in children, young people and adults (CG15). [Update currently being scheduled.] http://guidance.nice.org.uk/CG15
- NICE Guidance Type 2 diabetes (partially updated by CG87). Type 2 diabetes: the management of type 2 diabetes. http://www.nice.org.uk/CG66
- NICE (2011) Diabetes in adults quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/diabetesinadultsqualitystandard.jsp

  "At risk" foot webpage within quality standard. http://www.nice.org.uk/guidance/qualitystandards/diabetesinadults/atriskfoot.jsp

See also page 72, Patient case-study, page 73, Case-study 1 and page 83, Case-study 6

Although this indicator appears in Atlas 2.0, statistical difference from the England value has been used to illustrate variation in the Diabetes Atlas (see page 20), therefore, the shading used in the maps and the appearance of the column charts will differ between the two publications, as will reporting in the "Magnitude of variation" section.

1 Kerr M (2012) *Foot Care for People with Diabetes: The Economic Case for Change*. NHS Diabetes. http://www.diabetes.nhs.uk/news_and_events/publication_of_the_week__footcare_for_people_with_diabetes_the_economic_case_for_change/

Patient case-study:
Management of acute Charcot foot and its complications

Introduction

In this case-study, the history of an individual patient is used to show how differences in care at an individual level can aggregate to generate the variations demonstrated at PCT level in the Diabetes Atlas (see in particular Map 22, page 70).

Patient history

A person with Type 2 diabetes developed an acute Charcot foot, but the diagnosis was delayed and the foot became markedly deformed. The deformity led to ulceration over a new bony prominence, which was itself complicated by infection that spread to involve the underlying bone.

The person was admitted to hospital and advised that it was necessary to amputate the lower limb. When arrangements were made for the amputation to be done as an emergency, the patient took their own discharge and was referred to another hospital for a second opinion. At the second hospital, the patient was assessed by an expert multidisciplinary team. The acute Charcot foot was immobilised in a non-removable below-knee fibreglass cast, according to current guidelines,[1] and the infection was successfully managed on an outpatient basis with a prolonged course of appropriate antibiotics.

The infection was eradicated and the skin remains intact. The patient is normally ambulant in fitted footwear two and a half years after referral to the second specialist unit. Although the risk of further ulceration could be reduced by elective resection of the bony prominence, previous experience of hospital admission for the foot means that the patient does not wish to pursue this option for the moment.

Learning points

Although it is possible for the patient's condition to be managed effectively without surgery, the patient in this case-study was advised to have an urgent amputation of the lower leg at the first hospital.

It is essential that each person with diabetes has access to clinicians with appropriate specialist expertise and who work in a multidisciplinary team.

There is evidence to suggest that the degree of variation in amputation among different localities in England may relate, at least in part, to the beliefs and approaches of the clinicians involved.[2]

1 Rogers LC, Frykberg RG, Armstrong DG et al (2011) The Charcot foot in diabetes. *Diabetes Care* 34: 2123-2129.

2 Connelly J, Airey M, Chell S (2001) Variation in clinical decision making is a partial explanation for geographical variation in lower extremity amputation rates. *British Journal of Surgery* 88; 529-535.

Case-study 1: An open outpatient referral service for diabetic footcare[1]

The challenge

The South Devon Healthcare Foundation Trust (FT) serves 14,000 people with diabetes. In 2005, major amputations (defined as above the ankle) in people with diabetes had risen to 36 a year despite continuing efforts to improve the management of foot care.

Aims

The aims of the project were:

- To bring together community and hospital footcare services and create a multidisciplinary team able to accept referrals from patients as well as healthcare professionals;
- To monitor the impact of this change on the amputation rate and the bed-occupancy rate.

What was done?

The diabetes service at South Devon Healthcare FT is pro-active and open to change:

- It was part of the United Kingdom Prospective Diabetes Study (UKPDS), [2] part of which had involved rotating GPs into the service as clinical assistants;
- It runs a liaison group for GPs, and practice and district nurses;
- It has strong links with the local Diabetes UK branch.

To implement the changes needed in footcare services, a project team, led by the consultant diabetologist, was set up in 2006 and included the lead hospital and community podiatrists. The first task was to establish open-access outpatient clinics, which:

- accepted referrals from any source, by telephone, email or fax;
- undertook to respond to referrals within 24 hours.

The new service took about one year to plan, and during this time the outpatient facility was also refurbished.

In a review of the community services shortly after the new outpatient service was established, it was concluded that greater administrative support was required to enable the community podiatrists to improve the way in which they carried out their clinical duties.

The PCT agreed to fund six new part-time administrative posts as additional support, which allowed the community podiatrists to be rotated into the outpatient service for three months at a time. This series of rotations provides the outpatient clinic with valuable extra support and allows the community podiatrists to update their skills and training

What changed?

As a result of the new service:

- Major amputations decreased from 36 per year in 2006 to 14 per year in 2009, and to only 9 in 2010 – there were 12 major amputations in 2011, two of which were undertaken on one patient who had moved to the area with established stroke, contractures and ulceration;
- Bed-occupancy rates also decreased: the average number of patients dropped from 6–7 per week in 2006 to 3–4 per week once the clinic was established;
- 75% of admissions are for planned surgery.

1 This case-study report is based on the one featured on the NHS Diabetes website, but the "What changed?" section has been updated by a representative of the team responsible for the work. http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/footcare/setting_up_an_open_referral_outpatient_service/

2 The UKPDS recruited 5102 patients with newly diagnosed Type 2 diabetes at 23 centres in the UK from 1977 to 1991; post-trial monitoring continued for 10 years until 2007, see: http://www.dtu.ox.ac.uk/ukpds/

Box CS.1: Key outcomes

- A decrease in major amputation rates
- A reduction in bed-occupancy rates
- Three-quarters of admissions for surgery are now planned

Acknowledgements

This case-study is based on the work of the following people and teams:

- Ian Currie, Vascular Surgeon
- James Davis, Orthopaedic Surgeon
- Ruth Gornall, Lead Podiatrist
- Ian Jakin, Orthotist
- Robert Macarthy, Vascular Surgeon
- Richard Paisey, Consultant Physician
- Community Podiatry Team
- Tissue Viability Team

Case-study 2: Implementing the X-PERT Programme – Structured education for people with Type 2 diabetes[1]

The challenge

There are about 11,000 people in Bexley with diabetes.[2] Bexley Care Trust needed to increase the number of people newly diagnosed with diabetes undertaking a structured patient education (SPE) programme. X-PERT is a group education programme at which people learn about up-to-date treatments and self-management of diabetes. In 2008/9, only 80 people completed the X-PERT Programme.[3]

Aim

The aim of the project was:

- To establish a structured patient education programme that 50% of people diagnosed with Type 2 diabetes would attend in the first year following diagnosis.

In addition, Bexley Care Trust wanted to enable 15% of all other people with Type 2 diabetes to complete structured patient education.

What was done?

Bexley Care Trust appointed a new Diabetes Programme Manager. The lack of a structured patient education programme was identified as a key area for improvement, therefore, the diabetes programme manager set up a project to increase uptake of the X-PERT Programme, which started in January 2010. The referral processes were reviewed and changes were made to improve both referrals and attendance (see Box CS2.1).

With the support of other local healthcare professionals, the X-PERT Programme was promoted to GPs and directly to patients. The offer was a taster session, followed by the full course if the patient wished to continue.

Box CS2.1: Changes made to improve referrals and attendance at the X-PERT programme in Bexley Care Trust

- A taster session was offered to people unsure of committing to the programme
- A dedicated administrator was appointed, together with new trainers, including practice nurses and patient support group members
- Marketing was used to raise awareness of the programme: self-referral was promoted and GP practices, pharmacists and opticians were targeted
- The referral process was simplified using an electronic form
- Patient choice was improved by offering sessions at a variety of venues and times
- All trainers were asked to attend regular training and team meetings to ensure sessions were consistent across the borough of Bexley
- A league table of referral rates and outcome data was used to encourage practices to participate (see Figure CS2.1)

Recognising the importance of ease of access, sessions were arranged at a variety of different venues in the area, on several different days and at various times, including at evenings and weekends. The sessions were run by a range of people including those from the local Diabetes UK branch, local community groups and patients who had already completed the Programme.

What changed?

Since February 2010, the average number of people attending the courses is 100 per month. The conversion

1 This case-study report is based on the one featured on the NHS Diabetes website, but has been expanded with further information from the team responsible for the work. http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/avoiding_admissions_and_improving_inpatient_care/implementing_the_xpert_programme/

2 Cotter B, Grumitt J (2011) GP commissioning: Shaping diabetes care in Bexley. Diabetes & Primary Care 13(6); 375-380.

3 X-PERT Programme. http://www.xperthealth.org.uk/

rate from 'taster' session to the full course was much higher than expected at 80%. The Programme achieved the target of reaching 50% of people with Type 2 diabetes who were in the first year of diagnosis.

The initial set of outcomes with respect to average HbA1c levels, average cholesterol levels and average body mass index (BMI) for Bexley Care Trust from the February 2010 series of X-PERT courses is shown in Table CS2.1 and compared with national data for the same time period.

Bexley Care Trust achieved the largest reduction in HbA1c from X-PERT structured patient education in the UK:

- 1.3% at 6 months;
- 1.4% at 12 months.

Improved glycaemic control is important because, for each reduction in HbA1c of 1%, the risk of the following complications decreases:

- Microvascular complications by 37%;
- Amputations by 43%;
- Myocardial infarction by 14%;
- Stroke by 12%;
- Death by 21%.

By 2011, there had been a 20-fold increase in referrals to the X-PERT programme. Positive participant feedback helped to increase the confidence of primary care practitioners to refer other people to the programme.

Other important outcomes from increased referrals to and maximising attendance at the X-PERT programme are shown in Box CS2.2.

Box CS2.2: Other important outcomes from increased referrals to and maximising attendance at the X-PERT programme in Bexley Care Trust

- Blood pressure levels have also been reduced
- Improved patient engagement: patient group membership rose from 492 to 790 in 2011; two new groups were formed – one in a hard-to-reach community and the other for young people
- Increased awareness among clinicians and patients with diabetes
- The success of the X-PERT programme has given momentum to other initiatives
- In conjunction with other initiatives, referral rates to the general diabetes consultant and diabetes specialist nurse clinics have been halved
- Around 200 patients have been transferred from secondary to primary care
- Almost two-thirds of people with Type 2 diabetes in Bexley Care Trust now manage their condition through diet and exercise and achieve an HbA1c level of <7.0%. Almost two-thirds of people with Type 2 diabetes on oral medication in Bexley Care Trust also achieve an HbA1c level of <7.0%.

Table CS2.1: Outcomes from February 2010 series of X-PERT courses – Bexley Care Trust and national data

	Bexley baseline	Bexley 6 months post X-PERT	Overall reduction (%)	National baseline	National 6 months post X-PERT	Overall reduction (%)
Average HbA1c (%)	8.4	7.1	15%	7.7	7.1	8%
Average cholesterol (mmol/l)	5.0	4.3	14%	4.4	4.2	5%
Average BMI (kg/m²)	31.8	30.3	5%	31.8	30.8	3%

Resources

- Bexley Diabetes website for various resources including information about patient and professional education. http://www.diabetesbexley.org.uk/

Further information

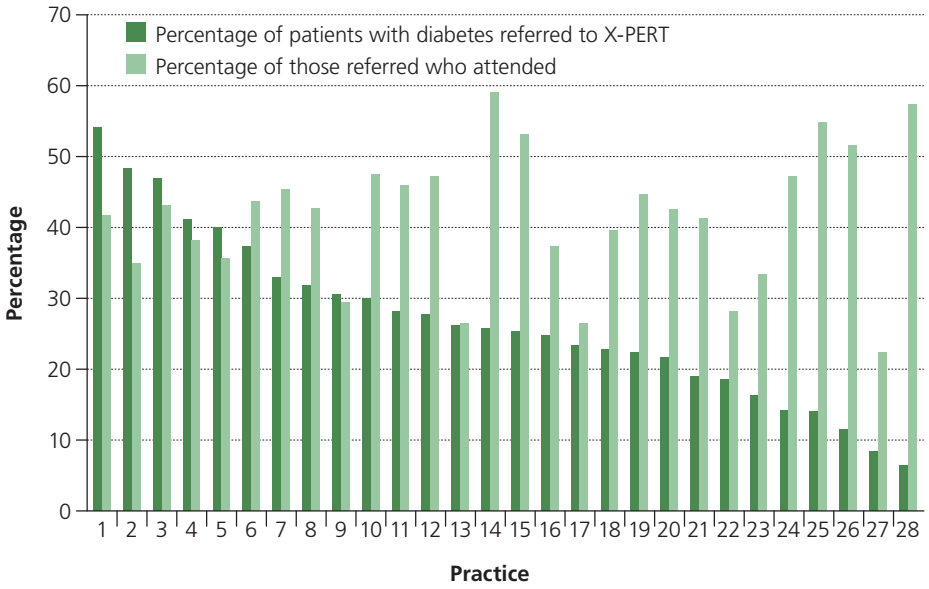
- Cotter B, Grumitt J (2011) GP commissioning: Shaping Diabetes Care in Bexley. *Diabetes & Primary Care* 13(6); 375-380.

Acknowledgements

This case-study is based on work done by the following people:

- Natasha Collett
- Anne Goodchild
- John Grumitt
- Suzanne Lucas
- Carol Winter

Figure CS2.1: Referrals to and attendance at X-PERT programme from 28 practices



Case-study 3: Supporting and improving self-care management[1]

The challenge

In partnership with Islington and Haringey PCTs, The Whittington Hospital applied to The Health Foundation to become a pilot site for the Co-Creating Health[2] initiative. The Whittington Hospital was selected as a pilot; it was required to set up and implement a self-care management programme that would deliver sustainable change and improvements in patient outcomes.

Aim

The aim of the project was:

- To support an holistic approach to self-management in which the clinician, patient and the services are committed to change and improving outcomes.

What was done?

The partnership received £150,000 funding from The Health Foundation, and used it to recruit a project manager and to pay for some clinician time. Additional funding was secured from both PCTs to cover the cost of any additional clinician time.

The project group included staff from the two PCTs and the hospital trust, in addition to GPs and practice nurses, a diabetes specialist nurse (DSN), patients, a diabetologist and the director of primary care.

The Health Foundation Co-Creating Health initiative consists of three distinct but linked parts:

- An advanced development programme (ADP) for clinicians, to help them develop the skills required to support and motivate patients to take an active role in their own health. This comprises three sessions, each lasting up to 3 hours, delivered by a clinical tutor and a lay tutor.
- A self-management programme (SMP) for patients to help them develop the knowledge and skills they require in order to manage their long-term condition and work in effective partnership with their clinicians. This comprises seven weekly sessions, delivered by a clinical tutor and a lay tutor.
- An organisational development programme (service improvement programme, SIP) to support patients and healthcare professionals, working together, to identify and implement new approaches to health service delivery that enable patients to take a more active role in their own health.

What happened?

At the time of writing, 14 local sites are involved in the pilot across primary and secondary care, and 240 patients have completed the SMP. As funding from The Health Foundation completes in 2012, a business plan is being developed to secure the future of the project.

Outcomes have been measured using patient enablement questions (see Box CS.2). Significant improvements have been obtained:

- The proportion of clinician–patient relationships with a shared agenda increased from 43% to 88%;
- Goal-setting increased from 45% to 75%;
- Goal follow-up increased from 65% to 88%.

Box CS3.1: Key outcomes

- Overall patient enablement scores improved by 10%
- Patients' levels of HbA1c and LDL cholesterol were reduced over 6 months
- 88% of participating clinicians reported significant improvement in their knowledge of how to support patient self-management

1 NHS Diabetes. http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/self_care_management/supporting_and_improving_self_care_management/

2 The Health Foundation. Co-Creating Health – a large-scale demonstration programme which began in 2007 with 8 sites focussing on one of four clinical areas –diabetes, COPD, depression and musculo-skeletal pain. http://www.health.org.uk/areas-of-work/programmes/co-creating-health/

Case-study 4: Increasing day-case care for people with diabetes in Plymouth[1]

The challenge

The Diabetes Team at the Derriford Hospital in Plymouth, having successfully reduced the length of stay for non-elective inpatients with diabetes, wanted to increase the number of elective patients with diabetes being treated as day cases. The Diabetes Team anticipated that much could be done to improve care and save resources because as many as 20% of beds were occupied by people with diabetes and 50% of hospital beds were allocated to elective patients.

Aim

The ultimate aim of the project was:

- To increase the number of people with diabetes undergoing an elective procedure being treated as day cases rather than as inpatients.

To achieve this aim, the team set out:

- To provide diabetes expertise at as early a stage as possible in the elective care pathway;
- To improve the institutional plans for managing an individual with diabetes planning an elective procedure;
- To undertake a troubleshooting role as and when necessary;
- To facilitate early discharge by providing close outpatient supervision after the procedure.

What was done?

Funding for two additional posts was secured, one for a diabetes specialist nurse and one for a healthcare assistant. These new members of staff, together with the pre-existing diabetes team, worked closely with the surgical, anaesthetic and medical teams involved in elective admissions. The newly expanded team organised their work to focus on four key points in the care pathway:

1. Surgical pre-assessment – ensuring patients who had problems with glucose control and other complex needs were identified and referred to the specialist diabetes team pre-operatively.

2. Admission planning – plans and pathways were developed for common insulin and oral hypoglycaemic regimens and for different times of day of surgery and expected lengths of fast. Patients with complex needs had specific plans drawn up. Plans were communicated to pre-operative staff, and the diabetes team were on hand every day to deal with problems and to help to avoid the over-use of intravenous insulin infusions.

3. Post-operative care – the specialist team carried out daily reviews of relevant wards to identify and manage common post-operative problems, such as lack of appetite and post-operative insulin resistance, and to oversee adjustment of diabetes treatment, the stopping of intravenous insulin regimens, and the re-starting of subcutaneous regimens.

4. Discharge – to support timely discharge, patients were given the contact details of a diabetes specialist and, where necessary, follow-up clinic visits or telephone consultations were arranged.

What happened?

During the first year of the project:

- The total number of people with diabetes discharged on the same day as the procedure increased from 1080 to 1456;
- For the hospital population, the total number discharged on the same day as the procedure increased from 16,329 to 18,579.

These findings show an increase of 34.8% in day-case procedures for people with diabetes compared with an increase of 13.7% in day-case procedures for the entire hospital population.

1 NHS Diabetes. http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/avoiding_admissions_and_improving_inpatient_care/increasing_day_case_care_in_plymouth/

Box CS4.1: Key outcomes

- An increase in same-day discharge for people with diabetes undergoing an elective procedure
- An estimated saving of £250,000 in bed-days set against increased staff costs of only £40,000
- Improved links between the Diabetes Team and the anaesthetists
- Established practice that people with diabetes have planned care prior to their admission

Case-study 5: Improving diabetes inpatient care[1]

The challenge

In Portsmouth, there are ≥27,000 people with diabetes. The specialist diabetes service at The Queen Alexandra Hospital identified that they were involved in the care of only 6–10% of people with diabetes who were being admitted to hospital, or attending for emergency care. The team were concerned this level of involvement was leading to poorer outcomes and increased lengths of stay across the different specialty wards in the hospital.

To make better use of the diabetes specialist team, a prospective and pro-active service for inpatients with diabetes and/or hyperglycaemia was required rather than relying on the traditional model in which involvement was only at the request of the host ward team.

Aims

The aims of the project were:

- To identify known patients with diabetes when they come into hospital in order to offer specialty input to all patients with diabetes to ensure optimal glycaemia
- To identify patients who present with hyperglycaemia with a view to improving their care and outcomes in a cost-effective way

What was done?

An audit was undertaken to assess inpatient diabetes care led by the diabetes consultant physician and diabetes specialist nurse, working with the diabetes multidisciplinary team (MDT). The audit was carried out in four key areas of the hospital:

- the 'emergency corridor' comprising A&E, the medical assessment and surgical assessment units;
- the department of medicine for older people (DMOP);
- the surgical service (vascular and gastro-intestinal including surgical high care);
- the regional renal unit.

For each of the hospital areas, baseline data were collected, including information on glycaemic control, length of stay, patient outcomes and complications, and evidence of diabetes therapy adjustment. The results of the audit highlighted several critical issues specific to each hospital area, for example:

- of the 21% of emergency corridor patients who were treated with intravenous insulin, 70% were treated inappropriately;
- 16% of patients in the department of medicine for older people experienced more than two hypoglycaemic episodes during their stay, each associated with an increased length of stay of 3 days.

Following the baseline audit, six-month intervention plans were drawn up to address the specific issues in each hospital area. In broad terms, two patterns of involvement were designed involving either direct care from the diabetes MDT on a regular basis or education of host teams and liaison management for problem situations. After six months, a repeat audit of the care of a consecutive patient dataset (n=50) was undertaken.

What happened?

The effect of all the interventions derived from the re-audit data was an overall reduction in lengths of stay of 1.43 days for the four areas audited within the hospital (see Box CS5.1 for key outcomes). This reduction in lengths of stay, combined with other reductions in diabetic complications, would yield a potential annual saving of £2,129,556 when extended across the Trust.

1 This case-study report is based on the one featured on the NHS Diabetes website, but it has been updated by the lead person responsible for the work (particularly the "What happened" section). http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/avoiding_admissions_and_improving_inpatient_care/improving_diabetes_inpatient_care_in_portsmouth/

The pilot intervention was achieved within the existing resources of the department already providing combination inpatient and outpatient specialty services. The additional resource required to extend this initiative across the Trust is two whole-time equivalent diabetes specialist nurses. This resource allocation was negotiated within the Trust and the wider healthcare environment, and at the time of writing the specialist diabetes service is in the process of extending this initiative throughout the Trust.

Box CS5.1: Key outcomes of the pilot intervention

- A reduction in admissions relating to diabetes: from 58% to 44% for the emergency corridor, and from 13% to 5% for department of medicine for older people
- In the department of medicine for older people, a decrease in the frequency of hypoglycaemic episodes from 16% to 8%
- A reduction in re-admission rates: from 30% to 10% for the emergency corridor, from 18% to 12% for department of medicine for older people, and by 50% for the regional renal unit
- When rolled-out, potential savings of over £2 million due to reduced lengths of stay for patients with diabetes

Case-study 6: An integrated diabetic footcare service[1]

The challenge

Over the last 15 years, the diabetic population served by Salford Community Health has doubled from 5000 in 1995 to 10,000 in 2010. The care pathway for people with diabetes was complex, with one service based in the community and one in the hospital. Rates for major amputations (defined as above the ankle) were above average at 24 per 100,000 population.

Aims

The aims of the project were:

- To re-organise and streamline the footcare pathway for people with diabetes
- For community and secondary care to act as one service rather than two

What was done?

Changes to the service began in 1995 when a Diabetic Foot Steering Group was established, and a high-risk liaison podiatrist was appointed to work across both community and secondary care. The Steering Group comprised a consultant diabetologist, the high-risk liaison podiatrist (who led the project), the community and acute podiatry managers and an audit project worker. The district nursing team was also involved.

The team agreed on three pre-requisites for project success:

- A re-designed footcare pathway: the new pathway was designed using an escalator approach so that patients can transfer smoothly and quickly through community to acute care and back to community care according to their clinical condition.
- A paper-based patient record carried by the patient and presented to the podiatry services at appointments. The record of the attendances was filled out in triplicate: one for the patient record, one for the clinical notes and one was sent for audit purposes. The record is now electronically based.
- A re-organised case-load for the podiatry services: clinically stable patients were transferred from the acute to the community service, thereby releasing places for patients who required more acute care. Patients attending the community podiatry service were reviewed and discharged as appropriate.

The service now offers patients:

- daily footcare clinics, together with specialist services such as at-home intravenous antibiotic therapy, in conjunction with the intravenous therapy team and microbiology;
- orthotics and foot wear;
- preventative footcare for those at medium and high risk of ulcers;
- access to vascular and orthopaedic surgeons.

The team run educational events for community and primary care staff, and podiatrists visit hospital wards to raise awareness of the footcare service. Email alerts are sent to wards when patients known to be at risk of foot ulcers are admitted.

What changed?

Over the course of the project:

- The rate of major amputations per 100,000 population fell from 24 in 2006 to 8 in 2010;
- The number of foot ulcers fell from 900 in 2006 to 600 in 2010, suggesting a potential saving of over £1 million (assuming a cost per ulcer of £3,500).

1 This case-study report is based on the one featured on the NHS Diabetes website, but minor amendments have been made by the point of contact for the work. http://www.diabetes.nhs.uk/our_publications/diabetes_success_stories/footcare/an_intregrated_footcare_service/

Box CS6.1: Key outcomes

- Major amputation rates have fallen by two-thirds over four years
- Number of foot ulcers has decreased by one-third over four years
- Savings of over £1 million have been estimated over four years

Glossary of Terms Relating to Diabetes

Acute kidney injury (AKI)

See also ***Chronic kidney disease*** *and* ***Renal replacement therapy***

Acute kidney injury (AKI), previously known as acute renal failure, occurs over a period of hours or days. There are many causes of AKI, but it is more common in people with long-term conditions, such as diabetes, and in older people. It is classified on the basis of five functional criteria (RIFLE), indicating the degree of injury to the kidneys: risk, injury, failure, loss of kidney function, end-stage kidney disease. The kidneys can fail as a result of AKI, which may lead to an irreversible loss of function, known as established renal failure (ERF). Patients with ERF need some form of renal replacement therapy (RRT).

Angiotensin-converting enzyme (ACE) inhibitor

An angiotensin-converting enzyme (ACE) inhibitor is a type of drug used to lower blood pressure. The results of studies indicate that ACE inhibitors may also help to prevent or slow the progression of kidney disease in people with diabetes.

Angiotensin-receptor blocker (ARB)

An angiotensin-receptor blocker (ARB) is a type of drug used to lower blood pressure.

Atherosclerosis

Atherosclerosis is the hardening of arteries (blood vessels carrying oxygenated blood). It occurs when fat, cholesterol and other substances build up in the walls of the arteries and form hard structures called plaques. If it occurs in the arteries of the brain it can lead to a stroke, and if it occurs in the arteries of the heart it can lead to a myocardial infarction (heart attack).

Blood glucose

Glucose is the main sugar the body produces from the ingestion of food. Glucose is a source of energy for the body's cells and is carried to them by the bloodstream. Cells cannot generate energy from glucose in the absence of sufficient insulin.

Blood pressure

Blood pressure is the force of the blood against the artery walls. Two levels of blood pressure are measured:

- the systolic, or highest, pressure occurs when the heart pumps blood into the blood vessels;
- the diastolic, or lowest, pressure occurs when the heart is at rest.

Body mass index (BMI)

The body mass index (BMI) is a measure used to gauge total body fat. It takes into account a person's weight and height. Adults with a BMI of 30 or more are considered to be obese. For children and young people aged 2–20 years, proper determination of BMI involves the use of a BMI table that enables a comparison of their weight and height with growth charts. The risk of developing additional health problems increases as BMI increases.

Cardiac failure

Cardiac, or heart, failure occurs when the heart is unable to pump sufficient blood around the body to meet the needs of the body's tissues. Cardiac failure usually happens when the heart muscle has become too weak or stiff to work properly.

Cholesterol

Cholesterol is a substance similar to fat. It is found in the blood, muscles, liver, brain, and other body tissues. The body produces and needs a certain amount of cholesterol. However, increased levels of cholesterol can cause fats to adhere to the walls of the arteries and precipitate atherosclerosis, a disease that decreases or can stop circulation.

Chronic kidney disease

See also ***Acute kidney injury*** *and* ***Renal replacement therapy***

Chronic kidney disease (CKD) is a progressive condition that occurs over a period of months or years. There are many causes of CKD, but the commonest is diabetes. The kidneys can fail as a result of CKD, which may lead to an irreversible loss of function, known as established

renal failure (ERF). Patients with ERF need some form of renal replacement therapy (RRT).

Complications of diabetes, *see* ***Diabetic complications***

Diabetes

See also ***Type 1 diabetes***, ***Type 2 diabetes*** *and* ***Gestational diabetes mellitus***

Diabetes is the short form of the disease known as diabetes mellitus. Diabetes occurs when the body cannot utilise blood glucose as energy because:

- The level of insulin is too low;
- The cells are unable to use insulin.

Diabetic complications

Diabetic complications are harmful effects that can occur when a person has diabetes. Some effects, such as hypoglycaemia (low blood sugar), can happen at any time. Other effects develop when a person has had diabetes for a long time, including damage to:

- the retina of the eye (retinopathy);
- the blood vessels (angiopathy);
- the nervous system (neuropathy);
- the kidneys (nephropathy).

The results of studies show that maintaining blood-glucose levels as close to the normal, non-diabetic range as possible may help to prevent, slow or delay harmful effects to the eyes, kidneys and nerves.

Diabetic eye disease, *see* ***Diabetic retinopathy***

Diabetic ketoacidosis (DKA)

Diabetic ketoacidosis is characterised by high blood-glucose levels and the presence of ketones in the urine and bloodstream. It is often caused by taking too little insulin or during illness.

Diabetic kidney disease (DKD) or Diabetic nephropathy

Diabetic kidney disease (DKD) or diabetic nephropathy involves damage to the cells and/or blood vessels of the kidney in people with diabetes. It develops as a result of poor control of a person's diabetes over the long term.

A typical form is known as diabetic glomerulosclerosis, which is characterised by large amounts of protein in the urine, and high blood pressure (hypertension), and is slowly progressive. This condition can be delayed with improved blood-glucose control.

The best laboratory test for early detection of DKD or diabetic nephropathy is the measurement of micro-albumin in the urine.

Diabetic nerve damage or Diabetic neuropathy

Diabetic nerve damage or diabetic neuropathy involves damage to the nerves in people with diabetes. Nerve damage may affect the feet and hands, as well as major organs.

Diabetic retinopathy

Diabetic retinopathy is a disease of the small blood vessels of the retina of the eye in people with diabetes. When retinopathy first starts, the tiny blood vessels in the retina become swollen, and they leak a little fluid into the centre of the retina. The person's sight may become blurred. This condition is also known as background retinopathy. About 80% of people with background retinopathy never have serious vision problems, and the disease never goes beyond this first stage.

If retinopathy progresses, serious harm to sight can occur. Many new, tiny blood vessels grow out and across the eye, known as neovascularisation. The vessels may break and bleed into the clear gel that fills the centre of the eye, blocking vision. Scar tissue may also form near the retina, pulling it away from the back of the eye. This stage is called proliferative retinopathy, and it can lead to impaired vision and even blindness.

End-stage kidney disease

See also ***Diabetic kidney disease*** *or* ***Diabetic nephropathy***

End-stage kidney disease, also known as end-stage renal disease (ESRD), is the final phase of kidney disease, resulting from poor control of a person's diabetes over the long term. It is treated by renal replacement therapy – dialysis or kidney transplantation.

Gestational diabetes mellitus (GDM)

Gestational diabetes mellitus (GDM) can occur when a woman is pregnant. In the second half of the pregnancy, the woman may have higher than normal blood-glucose levels. Although gestational diabetes usually subsides after pregnancy, many women who have had gestational diabetes develop Type 2 diabetes later in life.

Glucose

Glucose is a sugar in the blood, and a source of energy for the body.

Glucose intolerance

Glucose intolerance is a term used to describe a group of metabolic conditions that result in high blood-glucose levels or hyperglycaemia.

Glucose tolerance test

The glucose tolerance test is a blood test used in the diagnosis of diabetes, including gestational diabetes.

Haemoglobin

Haemoglobin is a substance in the red blood cells that carries oxygen to the body's cells.

Haemoglobin A1c (HbA1c) test

The haemoglobin A1c (HbA1c) test shows the average amount of glucose in the blood over the previous 8–12 weeks. The result indicates whether a person's blood-glucose level is under control.

Heart attack, *see* ***Myocardial infarction***

High blood glucose, *see* ***Hyperglycaemia***

High blood pressure, *see* ***Hypertension***

Hyperglycaemia

Hyperglycaemia, or high blood glucose, is a condition that occurs in people with diabetes when blood-glucose levels are too high. Symptoms include:

- needing to urinate often;
- being very thirsty;
- losing weight.

Hypertension

Hypertension, or high blood pressure, is a condition in which the blood circulates through the arteries with too much force. The effects of hypertension are:

- to harm the arteries;
- to increase the risk of a heart attack, a stroke and kidney problems;
- to cause dilatation and damage to the heart, which can lead to cardiac or heart failure (when the heart is unable to supply effectively the body with blood).

Hypoglycaemia

Hypoglycaemia, or low blood glucose, is a condition that occurs in people with diabetes when blood-glucose levels are too low. Low blood-glucose levels can occur when a person with diabetes has injected too much insulin, eaten too little food, or exercised without eating extra food. Symptoms include:

- feeling anxious or confused;
- shaking or feeling weak or dizzy;
- sweating;
- headache, blurred vision, and hunger.

Taking small amounts of sugar, sweet juice, or food with sugar will usually help the person to feel better within 10–15 minutes.

Incidence

The incidence of a disease is the number of new cases of a disease in a population or group of people over a particular period of time.

Insulin

Insulin is a hormone produced by the beta cells in the pancreas. It helps the body to utilise blood glucose for energy. When people with diabetes cannot produce sufficient insulin, they may require replacement insulin via injection.

Ischaemic heart disease

Ischaemic heart disease, also known as coronary artery disease (CAD), is a condition in which fatty deposits (atheroma) build up on the walls of the coronary arteries, causing the arteries to narrow resulting in reduced blood flow to the heart muscle. Atheroma can cause an obstruction to the blood flow of the coronary arteries, and as a consequence inadequate levels of oxygen reach the heart muscle rendering it ischaemic. Ischaemia can also occur from coronary artery spasm, or when the heart is enlarged from increased strain, such as in high blood pressure (hypertension) or tightness at the root of the main blood vessel leading from the heart (aortic stenosis).

Kidney disease, *see* ***Nephropathy***

See also ***Diabetic kidney disease or Diabetic nephropathy***

Kidneys

The kidneys are two organs in the lower back that filter some of the body's waste products and other harmful substances from the blood. The kidneys also control the level of some biochemicals in the blood such as hydrogen, sodium, potassium and phosphate.

Low blood glucose, *see* ***Hypoglycaemia***

Macrovascular disease

See also ***Diabetic complications***

Macrovascular disease is a disease of the large blood vessels that sometimes occurs when a person has had diabetes for a long time. Fat and blood clots build up in the large blood vessels and adhere to the vessel walls. There are three kinds of macrovascular disease:

- coronary disease;
- cerebrovascular disease;
- peripheral vascular disease.

Metabolic syndrome, *previously known as* ***Syndrome X***

Metabolic syndrome, previously known as Syndrome X, is the term used to describe a combination of factors that place a person at increased risk of heart disease (3-fold) and of diabetes (5-fold):

- overweight, particularly around the abdomen;
- decreased levels of HDL cholesterol (beneficial cholesterol);
- increased blood triglyceride (a form of fat) levels;
- increased blood pressure;
- increased blood-glucose level.

If a person has been diagnosed with three of the above features, they are considered to have Metabolic Syndrome. Impaired action of insulin (insulin resistance) is an important feature of Metabolic Syndrome, which results in high levels of glucose remaining in the bloodstream and can contribute to the development of Type 2 diabetes. There are several definitions of Metabolic Syndrome in the literature, including the WHO definition, the ATP III definition and the International Diabetes Federation consensus on the definition.[1]

Metformin

Metformin is a drug used in the treatment of Type 2 diabetes; it belongs to a class of drugs known as biguanides.

Micro-albumin

Micro-albumin is a protein found in blood plasma and urine. The presence of micro-albumin in the urine, known as micro-albuminuria, can be a sign of kidney disease.

Microvascular disease

See also ***Diabetic complications*** *and* ***Diabetic retinopathy***

Microvascular disease is a disease of the smallest blood vessels that sometimes occurs when a person has had diabetes for a long time. The walls of the blood vessels become abnormally thick but weak, and they bleed, leak protein, and slow the flow of blood through the body. As a consequence, some cells, for example, those in the centre of the eye, may not receive enough blood and become damaged. The leakage from the blood vessels can also cause visual impairment.

Myocardial infarction (MI)

A myocardial infarction (MI), or heart attack, results from permanent damage to an area of heart muscle. This happens when the blood supply to the muscle is interrupted because of narrowed or blocked blood vessels as a result of atherosclerosis or hardening of the arteries.

Nephropathy

See also ***Diabetic kidney disease or Diabetic nephropathy***

Nephropathy or kidney disease is a term that can be used to describe several chronic conditions caused by damage to the cells and blood vessels of the kidney. It can occur in people who have had diabetes for a long time, in which cases it is known as diabetic nephropathy or diabetic kidney disease.

Obesity

Obesity is a condition in which people have 20% (or more) additional body fat for their age, height, sex and bone structure. Fat counteracts the action of insulin. Additional body fat is thought to be a risk factor for diabetes.

Pancreas

The pancreas is an organ that produces insulin which enables the body to utilise glucose for energy. The pancreas also produces enzymes that help the body to digest food.

1 http://www.som.soton.ac.uk/research/sites/metabolicsyndrome/definition/ and http://www.som.soton.ac.uk/research/sites/metabolicsyndrome/simple/

Peripheral arterial disease

Peripheral arterial disease (PAD), also known as peripheral vascular disease, is a condition in which a build-up of fatty deposits (atheroma) in the arteries restricts the blood supply to the arm and leg muscles.

Peripheral neuropathy

Peripheral neuropathy is a condition in which there is damage to the nerves in the peripheral nervous system, which is all parts of the nervous system outside of the central nervous system (brain and spinal cord) and includes the sensory and the motor nerves. Symptoms include:

- numbness and tingling in the feet and hands;
- burning, stabbing or shooting pain;
- loss of coordination in the affected body parts;
- muscle weakness.

In England, diabetes is the most common cause of peripheral neuropathy. Over time, the high blood-glucose levels associated with diabetes can damage the nerves. This type of nerve damage is known as diabetic polyneuropathy. Some neurologists now prefer to use the term "polyneuropathy" rather than peripheral neuropathy.

Prevalence

The prevalence of a disease is the number of people in a given group or population reported to have a disease at a particular point in time.

Renal

Renal is a term that means pertaining to the kidneys.

Renal replacement therapy (RRT)

Renal replacement therapy (RRT) is designed to take over the function of the kidneys when a patient is in established renal failure (ERF). The most common types of RRT are:

- haemodialysis;
- peritoneal dialysis;
- kidney transplantation.

Retinopathy

See also ***Diabetic retinopathy*** *and* ***Microvascular disease***

Retinopathy is a disease of the small blood vessels in the retina of the eye.

Self-monitoring of blood glucose

Self-monitoring of blood glucose is a way for people with diabetes to find out how much glucose is in their blood. A drop of blood from the fingertip is placed on a special coated strip of paper that "reads" (often through an electronic meter) the amount of glucose in the blood.

Stroke

A stroke is the rapid loss of brain function(s) due to disturbance in the blood supply to the brain, which can be due to:

- lack of blood flow caused by a blockage (atherosclerosis, or a clot from elsewhere in the body);
- a haemorrhage (leakage of blood from the blood vessels into the tissues).

Poor control of a person's diabetes over the long term can increase the risk of blockage of the arteries in the brain, and elsewhere in the body.

Syndrome X, *see* ***Metabolic syndrome***

Type 1 diabetes

Type 1 diabetes is a condition in which the pancreas does not produce sufficient insulin for the body to utilise blood glucose as energy. Type 1 diabetes occurs most often in people younger than 30 years of age, and must be controlled by daily insulin injections.

Type 2 diabetes

Type 2 diabetes is a condition in which the pancreas does not produce sufficient insulin or the body is unable to use the insulin the pancreas does produce to utilise blood glucose as energy. Type 2 diabetes occurs most often in people older than 40 years of age, and can often be controlled through meal plans and physical activity plans. Some people with Type 2 diabetes have to take tablets (see Metformin) or insulin via injection.

Valvular heart disease

Valvular heart disease is a condition in which there is damage to, or a defect in, one of the four valves in the heart.

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.

Coefficient of variation (CoV)

The ratio of the standard deviation over the mean, which can be multiplied by 100 to present the ratio as a percentage. It is another method of measuring spread with the advantage that it is insensitive to the mean and population size.

- A CoV of 0% represents no difference among PCTs;
- As the CoV increases, the degree of variation among PCTs increases.

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).

Deprivation

See also ***Index of Multiple Deprivation (IMD) 2010***

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.

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. Health Systems Strengthening Glossary. http://www.who.int/healthsystems/hss_glossary/en/index.html

Index of Multiple Deprivation (IMD) 2010

See also ***Deprivation***

The Index of Multiple Deprivation 2010 combines 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: Department of Communities and Local Government. http://www.communities.gov.uk/communities/research/indicesdeprivation/deprivation10/

Inequalities in health

Inequalities in health are objectively measured differences in health status, healthcare access and outcome.

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.

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.

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 and Outcome***

Output, *see* ***Input, Output and Outcome***

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.

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.

Quality

The degree to which a service meets pre-set standards of goodness.

Source: Donabedian A, personal communication.

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.

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.

System

A system is a set of activities with a common set of objectives for which an annual report is produced.

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.

Variation

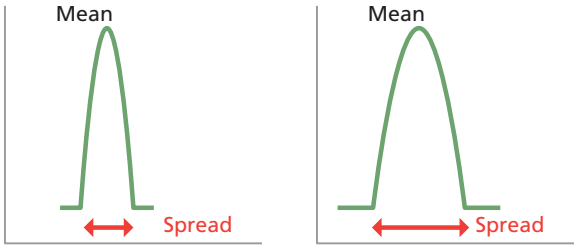
Everything we observe or measure varies. Some variation in healthcare is desirable, even essential, since each patient is different and should be cared for uniquely. New and better treatments, and improvements in care processes result in beneficial variation.

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.

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