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Managing diabetes in primary care: how does the configuration of the workforce affect quality of care?

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Summary

Research aim

This project continues a programme of work led by the NNRU that has sought to explore the relationship between workforce configuration in the health service and patient outcomes. In a nutshell we seek to address: what difference does it make who provides care and treatment to patients? The ramifications of different workforce models have been more thoroughly investigated in the acute sector, but there has been far less research undertaken to determine the impact of employing different combinations of staff in primary care.

As part of the Policy Research Programme funded by the Department of Health the NNRU began research in this field by using secondary data to see if the level of practice nurses employed bore any relationship with the quality of care provided in GP practices, as measured by the Quality and Outcomes Framework (QOF). Findings suggested that there was an association between level of practice nurse staffing and performance based on Doran's composite diabetes measure and certain QOF Diabetes Indicators (HbA1c ≤ 7.4%, HbA1c ≤ 10%, Total cholesterol ≤ 193mg/dl), (Griffiths et al, 2010b).

This led to an interest in pursuing the research further, focusing in depth on one particular condition using patient level data (as opposed to practice level quality scores) and more detailed workforce data. Thus the current study was commissioned to examine whether different workforce configurations (and activity) in primary care are associated with variation in control of diabetes as measured by haemoglobin A1c (HbA1c) level, a recognised and commonly used measure of diabetes control. We focussed in particular on the extent to which people with diabetes received care from nurses, as opposed to general practitioners, because there is strong advocacy for a 'policy' shift at provider level to pass much 'routine' chronic disease care from doctors to nurses.

Background: focus on diabetes

Diabetes is an important condition to focus on – not least because of the hugely increasing prevalence over the last ten years (described by some as an 'epidemic') and the cost associated with treating it. It is estimated to affect 3.6 million people in the UK and cost the NHS at least £10 billion a year. Understanding the ways in which the nursing contribution has impacted on the management of patients with diabetes has implications for the delivery of diabetes care in the future, and potentially the management of other chronic conditions in primary care.

To address this question, we needed to find ways of quantifying both inputs (in terms of who is doing what and the balance between nurses and doctors) and outcomes (variation in control of diabetes). Neither are straight forward.

Identifying outcome measures

After examination of the literature and discussion with clinical colleagues on the project team, glycaemic control (measured by Hb1Ac) was identified as a key outcome measure, in that it reflects how well controlled an individual's diabetes is, but also because poor control is associated with higher risk of complications and adverse health (such as Coronary Heart Disease, stroke, renal failure, visual impairment and neuropathy). To get a sense of how well a practice is doing in managing diabetes, the proportion of their patients with diabetes achieving a certain level of control is measured. A number of HbA1c thresholds have been used as performance metrics since QOF was introduced in 2004. These have included ≤ 7%, ≤ 7.4%, ≤ 8%, ≤ 9% and ≤ 10%. We chose the lower and upper thresholds for use in this study (≤ 7%, ≤ 10%). To make fair comparisons of the level of successful control between practices with different workforce configurations the many factors that affect the glycaemic control of diabetes patients need to be accounted for – hence the analyses needed to adjust for individual and population differences. To do this required us to use data generated directly from patient records to produce a 'case-mix' adjusted measure of glycaemic control achievement per practice population. We used 'THIN' data supplied by CEDEGIM which gives complete consultation records extracted from the database of a nationally representative sample of 556 general practices.

As well as capturing glycaemic control, the THIN data also provides details of each consultation patients received. These data were used to tell us about the number of consultations, who they were with, the proportion with nurses or doctors, and the types of activities undertaken.

Differences in glycaemic control were explored in two ways:

- by comparing change over time. We have a data set generated from patient records that spans ten years, from 2002 to 2012, and so can explore differences in glycaemic control over the years in relation to any differences observed in the proportions of consultations undertaken by different staff, or changes in the types of activity undertaken.
- by comparing practices within the current year: we examined how glycaemic control varies between practices and how much variation is associated with differences in the workforce configurations (staffing levels and mix). For 2012 we were able to identify the healthcare professional (GPs, practice nurses or specialist practice nurses) who typically lead the management of diabetes in each practice, through a survey undertaken in the spring of 2012 (covering 249 practices).

Glycaemic control is partly determined by a person's individual characteristics and partly by the way care is delivered in each practice. A multilevel modelling approach was therefore used to ascertain individual (through risk adjustment) and practice level (including workforce) effects upon control of diabetes.

The table below summarises the key measures this study uses and the data sources they are drawn from.

Table 1. Data sources used for quantifying inputs and outcomes

	Question	How measured	Source
Outcome	How well do practices manage patients with diabetes?	Proportion of patients with diabetes achieving glycaemic control (at two different levels) – adjusted to account for practice (e.g. location, postcode (socio-economic) variable indicators, prevalence) and individual differences (e.g. age, co-morbidity, obesity)	THIN patient records 2002-2012
Inputs	Staffing levels and mix	Size of workforce (patients per GP, patients per practice nurse), and mix (practice nurses as proportion of clinical workforce)	Practice survey 2012
	How much care is provided to patients with diabetes?	Number of consultations per year	THIN
	Who do patients see – GPs or practice nurses?	Average number of consultations per year by GPs and by practice nurses Proportion of all consultations that are held with practice nurses	THIN THIN
	Is specialist nursing input available?	Employing nurses with postgraduate qualification in diabetes	Practice survey
	What activities are undertaken (by whom)?	Activities coded within the consultation	THIN
	Who leads management of diabetes?	GPs or practice nurses (with or without specialist knowledge), shared with hospital/community based specialists	Practice survey

Key Findings

Diabetes and its management in the last ten years

Our data shows the prevalence of diabetes has increased by 66% over the last decade reflecting other national statistics. The average number of patients with diabetes in each practice has increased from 237 in 2002, to 375 in 2012. As a proportion of all patients, those with diabetes account for an average of 4.9% of total list size now, compared with 3.0% in 2002.

Important in understanding what this means for practice activity, is the fact that the clinical identification of patients with diabetes has also changed - people with diabetes are detected at a much earlier stage than in the past (because of more rigorous and regular review such as annual health checks) so there is an increased proportion of the 'diabetic' patient population that have less severe diabetes now, and are being helped to manage their diabetes earlier.

Glycaemic control (that is the percentage of patients with diabetes that have an Hb1Ac level below a certain threshold) improved considerably between 2002 and 2004. Since then improvement slowed and then plateaued in 2005 for the upper threshold (≤10% - reflecting 'loose' control of diabetes) and in 2009 for the lower (≤ 7% reflecting tighter control) of the two thresholds.

Primary care activity over the last ten years

Across all staff groups there has been an increase in activity, in that the annual number of consultations undertaken with patients with diabetes has increased by 13%. Practice nurses have increased their activity much more than doctors during this period – a 20% increase in annual consultations with people with diabetes compared with just 1% increase amongst GPs. The overall effect of these changes means that whilst in 2002 70% of consultations were undertaken by doctors, this has fallen to 64% in 2011/12. Meanwhile the average proportion of consultations undertaken by nurses in each practice has increased slightly (from 31% to 32%) and those by other healthcare professionals from less than 3% to 8%.

However, the amount of activity has not increased as sharply as the number of patients, so although both doctors and practice nurses are doing more consultations each year with people with diabetes patients, each person with diabetes is actually getting fewer consultations per year now than in 2002 (the average has fallen from 16 per year to 11.5). Practices with lower staffing levels (e.g. more patients per whole time equivalent GP or per whole time equivalent registered nurse) undertook fewer consultations with each individual person that had diabetes.

How does glycaemic control vary?

Glycaemic control is now much more uniformly achieved across practices, than was the case ten years ago. The amount of variation due to differences between practices as a proportion of all variation (people and practices) fell from 14% to 9% for HbA1c ≤ 7% and from 21% to 11% for HbA1c ≤ 10% from 2002 to 2011. Much of the variation that appears to exist between practices in ability to achieve glycaemic control is therefore related to differences in the patient populations served. Practice variation was even smaller for the 2011/12 patient (people with diabetes) data linked to the

practice survey (166 practices). This placed limitations on what could be achieved statistically in terms of testing associations between workforce variables from the practice survey and glycaemic control, however a consistent picture emerged over the ten-year period from the analysis of The Health Information Network (THIN) data. Practices where practice nurses delivered a high proportion of the diabetes care performed as well as those practices where doctors delivered most of the care. Indeed optimised DM care is just as good when predominantly provided by nurses compared to care which is mainly provided by GPs.

The primary care workforce

A key part of this research has been to establish in more detail the composition of the primary care workforce, and determine who is doing what in relation to care of patients with diabetes. Do practices vary in how they are staffed, and the way in which they manage and provide diabetes care?

Our survey (undertaken in Spring 2012, n=249 practices) showed that practices vary in the size and composition of their workforce. A 'typical' practice employs an average of 4 GPs, 2 registered nurses (RNs), 1 care support worker/assistant, a practice manager and 7 receptionists/admin staff (whole time equivalents). Nurses make up a third of the trained clinical staff (e.g. total GPs and RNs), but this varies considerably: 5% of practices have no registered nurses whilst in 12% of practices RNs make up more than half of the clinical staff.

Larger practices (5 or more WTE GPs) are more likely to employ experienced nurses (on higher pay-bands) and to employ nurses with post-graduate qualifications in diabetes, compared with smaller ones (less than 3 GPs). 84% of nurses in larger practices hold a post graduate qualification in diabetes compared with 44% in practices with less than 3 WTE GPs.

Who manages care of patients with diabetes in primary care?

A nurse (or nurses) who specialises in diabetes leads the management of care of people with diabetes in 58% of practices, and non-specialist practice nurses lead care in 11% of practices. 18% of practices say that the GP leads management of diabetes patients. 89% of practices that employ a nurse with postgraduate specialist qualification in diabetes report that care of patients with diabetes is generally managed by a nurses (or nurses) who is specialised in diabetes.

Smaller practices are more likely to say management of care is shared with hospital or community consultants (22% vs. 5% in medium or large), are slightly less likely to use their own practice nurses (61% vs. 71% of medium sized), and are less likely to have care in the hands of a designated GP or practice nurse with specialist knowledge (51% vs. 83% in larger practices).

In practices where nurses hold specialist postgraduate qualifications, the majority of diabetes care is provided through regularly held clinics specifically for people with diabetes (74% compared to 41% of cases where there is no specialist postgraduate trained diabetes nurse).

Practices in which nurses undertake a larger proportion of consultations with patients with diabetes (as defined from the patient records data) are more likely to report that nurses lead the management of diabetes care. In practices where nurses see a larger proportion of diabetes patients, doctors

spend nine minutes less a year (61 minutes vs. 70), but patients have 27 minute more contact time in total (132 minutes vs. 105 in the low nurse contact group).

What range of activities do staff undertake in consultations?

What activities staff undertake during consultations with patients with diabetes has also changed over the last ten years. Practice nurses have been doing a larger number and range of activities; in 2012 they were making 2.7 times more entries on patient records than doctors. Much more activity is focused on 'annual review' now than ten years ago, particularly by practice nurses. Statistical modelling suggests that where diabetes review and monitoring is happening more often, then glycaemic control is more likely to be achieved.

What difference does it make who manages diabetes care?

Whilst there has been an overall reduction in the number of consultations per patient, glycaemic control has been maintained. The changes were greatest between 2002 and 2005. After applying risk adjustment at the patient and practice level, practices in which people with diabetes had a higher proportion of practice nurse contact had significantly more patients meeting both the lower threshold (≤7%) and higher thresholds (≤10%) thresholds in 2003. The difference was close to significance in 2005 for the lower threshold only.

The more often people had their diabetes reviewed the greater the likelihood of glycaemic control being achieved. It did not seem to matter whether it is a doctor or practice nurse undertaking the review however the percentage of diabetes reviews undertaken by practice nurses has increased from 53% in 2002 to 65% in 2011. Therefore the role of practice nurses in the delivery of diabetes review could become a key factor in the further reduction of HbA1c levels and the achievement of diabetes control.

What are the cost implications?

The study findings indicate that whether doctors or practice nurses take the lead in delivery diabetes care (or whether they are specialists in diabetes care) has no discernible effect on the probability of a person reaching good diabetes control. The absence of a strong relationship, either positive or negative, indicates that practices which primarily use GPs to manage diabetes care could release significant resources by switching their service configuration towards nurse-led care. Practice nurses undertake more diabetes review, which is associated with better glycaemic control and practices may therefore wish to make even greater use of practice nurses. Currently practices that deliver a higher proportion of care for people with diabetes by nurses save on doctors' time but savings are not sufficient to cover the costs of additional nurse consultation time. Nurses are therefore providing an extra resource. The opportunity costs of using GPs to deliver additional care would be high as would be the costs of delivering the additional care in secondary settings. However, the benefits of the additional care are not demonstrated in terms of HbA1C control. The costs and benefits associated with changes remain uncertain and it should be borne in mind that confining an economic analysis to a short time window may not reveal all the costs going forward.

Conclusion

As diabetes has become increasingly prevalent, more care is being delivered and managed by practice nurses. The roles of doctors and nurses have changed: people with diabetes have fewer consultations per year, but more of them are undertaken by nurses, who increasingly do review activities (monitoring, follow-up, annual review). Regular diabetes review is associated with improved glycaemic control, and during the last decade glycaemic control across the practices has improved.

However whether looking longitudinally or within the latest year's data, little of the variation in practices' performance is found to relate specifically to differences in the way in which practices are organised or staffed. The vast majority of variation relates to differences between people with diabetes.

The study shows that where practice nurses undertake a higher proportion of consultations with diabetes patients, practices perform the same (in terms of glycaemic control) as practices where more of the consultations are done by doctors.

In this study practices that made more use of nurses reduced the amount of time patients spent with doctors but also delivered more care (as measured by consultation time) overall with equivalent outcomes. The savings in doctors' time does not appear to be offset by the additional costs of time spent with other practitioners, predominantly nurses. However there are opportunity costs associated with the use of GPs or secondary care to provide additional services. There is considerable scope to substitute nurses for GPs in delivering care for people with diabetes and to use nurses as a means of delivering enhanced care. The costs and benefits of this strategy remain uncertain but there is no evidence of harm. Indeed it is fair to say that optimised diabetes care is just as good when predominantly provided by nurses compared to care which is mainly provided by GPs. Other research suggests that patient satisfaction may be improved.

1. Introduction and background

1.1 Introduction

As the population ages, there is a pressing need to cost-effectively manage the care of increasing numbers of people with long-term conditions, and prevent unnecessary hospitalisation. Pressure to find cost-efficient solutions to the delivery of health care have been intensified by the recent global and national financial crisis.

Currently, it is estimated that as many as 3,636,000 people in the United Kingdom (excluding Northern Ireland) live with diabetes (Kanavos et al 2012). For some groups in the population, (for example black Caribbean and Indian men) the prevalence is over 10% (NICE 2008). The figure is rising as the incidence of type II diabetes mellitus, by far the most common form, increases. A diagnosis of Type II Diabetes Mellitus is associated with a significant increase in the utilisation of healthcare resources (Gulliford et al, 2008). The costs of diabetes are significant: a recent report estimated that approximately 10% of the NHS budget (£10 billion) was spent on diabetes in 2011 (Hex et al, 2012). A large proportion of this (66%) results from hospital care and treatment for complications that arise including CHD, stroke, renal failure, visual impairment and neuropathy (Kanavos et al 2012).

With good diabetes control many of these complications could be prevented or onset delayed (Burden, 2003) but the proportion of patients achieving tight control, as measured by HbA1C (glycosylated haemoglobin) ≤6.5% is low, and significant numbers do not achieve less tight but 'good' levels of control (HbA1C ≤7.5%) (Kanavos et al 2012). Primary care has become the focal point with more diabetes care now taking place in GP practices (NICE 2008 Forbes et al 2011).

In order to improve the quality of chronic disease management in primary care, a pay for performance scheme, the quality and outcomes framework (QOF), was introduced in 2004/5. This included targets and incentives for improving the quality of care for people with diabetes. In many practices much of the work involved in delivering results against the QOF indicators has been delegated by GPs to nurses (Leese, 2006) and over recent years there has been a steady increase in both the number of nurses employed in general practice and the proportion of consultations that are undertaken by them (Hippisley-Cox et al., 2007, The Information Centre, 2008), although increases in staff numbers have tailed off more recently.

Models of nurse-led diabetes care have been advocated and positively evaluated in a range of settings including primary care (Vrijhoef et al., 2002) and there is evidence of similar outcomes when people with diabetes are managed by non-specialist nurse practitioners in primary care (Mundinger et al., 2000). Some have argued that there is considerable scope to further increase the amount of primary care delivered by nurses (Sibbald, 2008a, Sibbald, 2008b) but the potential extent and desirability of substitution is contested (Knight, 2008). Evidence of the impact on the quality of diabetes care of a widespread and routine increased nursing contribution is scant and there is little if any data on which to plan optimal skill mix between nurses and GPs in general practice.

Researchers have previously attempted to quantify the impact of nurse staffing policies on patient outcomes (Rafferty et al 2007, Aiken et al., 2002, al-Haider and Wan, 1991, Blegen et al., 1998, Hartz et al., 1989, Knaus et al., 1986, Sochalski, 2001). The majority of studies have been performed within acute care (e.g. hospital setting) and report adverse patient outcomes and quality of care (Blegen et al., 1998, Sochalski, 2001). The types of adverse patient outcomes examined included medication errors, patient falls, infections, patient complaints and mortality.

A systematic review and meta-analysis of 96 studies confirmed these findings; increased nurse staffing was associated with lower odds of hospital related mortality and adverse patient outcomes (Kane, Shamliyan et al., 2007). The odds of hospital related mortality was 9 to 16% lower for each additional full time registered nurse per patient day while a curvilinear association between staffing and outcomes was demonstrated. Within the hospital setting, there appears to be consistent evidence that nurse staffing affects patient outcomes.

As part of the current programme of research we demonstrated that higher levels of practice nurse staffing is associated with improved practice performance (as measured by QOF) for certain long-term conditions including diabetes (Griffiths et al., 2010a). Our research suggested that the effect of practice nurse staffing remains after controlling for patient, practice, practitioner, and organisational factors (Griffiths et al., 2011) although practices with higher levels of nurse staffing are also associated with higher levels of admissions for diabetes, but not other conditions (Griffiths et al., 2010b).

1.2 Background

Diabetes and its management

Between 2006 and 2011 in England, there was a 25% increase in the number of people diagnosed with diabetes and it is estimated that there are 850,000 people with undiagnosed diabetes (Diabetes UK, 2012). If these current trends continue, it is anticipated that by 2025 there will be 5 million people in the UK with diabetes (Diabetes UK, 2012).

Diabetes is associated with significant mortality and morbidity. It can lead to cardiovascular disease (coronary heart disease and stroke), renal failure, retinopathy, peripheral neuropathy and limb amputation. For example, those with diabetes are 48% more likely to have a myocardial infarction than the rest of the population (Diabetes UK, 2012). Managing potentially preventable complications consumes as much as 80% of the money allocated to diabetes care. There is an increasing emphasis on the prevention of diabetes-related complications through screening and assessment services in the primary care environment. For example to minimise risk of coronary heart disease and stroke, regular cholesterol and blood pressure checks are advised (Diabetes UK, 2012).

Primary care can successfully manage chronic diseases such as diabetes and potentially reduce the need for hospitalisation due to complications (Basu et al., 2002, Zhan et al., 2004). However, the numbers of admissions for people with diabetes appears to be increasing in England (Bardsley et al., 2013).

Those with diabetes require on-going optimal management to ensure their diabetes is well-controlled and enable early detection of associated complications. A 6 to 20 year reduction in life expectancy is observed in those with poorly controlled diabetes (Seshasai et al., 2011). Hence the prevention of complications is closely linked to good glycaemic control.

Nine Key Care Processes were derived from the National Service Framework (NSF) and the National Institute for Health and Clinical Excellence (NICE) and aimed to enable healthcare professionals to agree actions with individuals on managing their diabetes. The agreed standards relate to:

Blood glucose level measurement

Kidney function testing (urine)

Blood pressure measurement

Kidney function testing (blood)

Cholesterol level measurement

Weight check

Retinal screening

Smoking status check

Foot and leg check

Two landmark studies, the Diabetes Control and Complications Trial (DCCT) and United Kingdom Prospective Diabetes Study (UKPDS) demonstrated that complications associated with diabetes are preventable or delayed through intensive glycaemic management (The Diabetes Control and Complications Trial Research Group (DCCT), 1993, UK Prospective Diabetes Study Group (UKPDS), 1998). However, the tight glycaemic control needed is not consistently replicated in clinical practice (Speight, 2013). One of the explanations put forward is the relatively low number of patients being offered structured diabetes education (Speight, 2012).

Although tight glycaemic control is not universally achieved, investigators have documented reductions in HbA1c in conjunction with blood pressure and plasma cholesterol reduction in several European studies (Cooper et al., 2009, Kloos et al., 2011, Mata-Cases et al., 2012). However in England there is large variation in the standard of care achieved against the nine standards of care set out by NICE. For example the proportion of individuals receiving their annual health checks ranged from 6% in some areas to 69% in others (NHS Information Centre for Health and Social Care, 2011). The majority of those with diabetes (91%) have their annual blood pressure checks but a recent audit reveals that 1.4 million have hypertension with only between 41 and 61% of people achieving the recommended levels.

Role of practice nurses

General Practices provide primary healthcare to the community usually employing general practitioners, practice nurses and other staff including administrative staff, phlebotomists, psychologists and other healthcare professionals. Practices vary in size from a single GP to large practices with five or six GPs and several practice nurses. As in acute care, some research attention has focussed on the efficacy (and cost-effectiveness) of different staffing configurations. A key question has been: can practice nurses deliver some aspects of care to levels comparative to general practitioners?

Several studies have outlined the changes to practice nurses' workload and their increased role in caring for those with chronic conditions such as diabetes (Gemmell et al., 2009, Laurant et al., 2005, Richardson, 1999). The findings suggest that nurses provide comparable high quality care that is complementary to that of their medical colleagues. One review stated that extending nursing roles within general practice was feasible at improving service capacity with no compromise of quality of care or health outcomes (Sibbald et al., 2006). However these studies typically focussed on nurse practitioners specifically as opposed to practice nurses and all examined services delivered within the tightly controlled parameters of clinical trials.

The workload of practice nurses has reportedly changed over the past decade with nursing now dealing with more complex patient care (Gemmell et al., 2009). Nurses are now more likely to provide patient care via a range of nurse-led clinics that allows for health promotion and surveillance of

chronic disease such as asthma, diabetes and chronic obstructive pulmonary disease (COPD). The cost implications of these changes however remain unclear (Laurant et al., 2005, Richardson, 1999)

Developments in the NHS

Over recent years the NHS has undergone radical reorganisation. The role of general practice in commissioning has been significantly increased and the nature of general practice itself is subject to substantial change with new opportunities for a range of providers to provide general practice services. While much of the management of people with diabetes has shifted from hospital based ambulatory settings to primary care management, with the support of community or hospital based specialists, the optimum model of care provision both within general practice the optimal method of delivering care remains unclear for both commissioners and providers.

Quality and Outcomes Framework (QOF)

The quality of primary care was difficult to quantify prior to the introduction of a new system of reimbursement linked to performance indicators known as the Quality and Outcomes Framework (QOF). Since the introduction of QOF in 2004, detailed descriptive information is now available (National Health Service Confederation, 2006). In 2004 QOF consisted of a total of 146 indicators that include measures on chronic disease management (76 indictors covering 11 chronic diseases including diabetes), practice organisation (56 indicators), patient experience (4 indicators) and additional services (10 indictors) and one indicator on access. The points are weighted and a score calculated for each practice with a maximum score of 1050 points (Department of Health, 2006). The QOF has allowed researchers to describe the quality of primary care and the relationship between social deprivation and other factors, such as practice characteristics (Ashworth and Armstrong, 2006). The study revealed that three variables were associated with higher QOF score: training practices, group practices and practices in less socially deprived areas. The conclusion was that practices in areas of higher social deprivation had a lower quality of care when measured using the QOF.

There is some evidence that higher QOF scores are associated with improved outcomes such as reductions in mortality, morbidity, hospital referrals and non-elective admissions (Bottle et al., 2008a, Bottle et al., 2008b, Downing et al., 2007, Srirangalingam et al., 2006).

One study used the GP Research Database to examine the quality of diabetes care at patient level from pre QOF (2000/01) to post QOF implementation (2006/07) in 148 practices (Kontopantelis et al., 2013). The authors recorded improvement in the first year post incentive compared to pre-incentive at 14.2%; this dropped to 7.3% in the third year but remained statistically significant. The variation in care between population groups decreased over time but in some instances remained substantial. Levels of care varied according to gender, age, years of previous care, co-morbidities and practice diabetes prevalence. The financial incentives for practices are significant. If diabetes targets are met, the average practice could earn £7,500 in the first year and £12,500 in subsequent years (NHS Information Centre for Health and Social Care, 2007) . Interestingly Kontopantelis and colleagues (2013) reported a decrease in emergency hospital admissions but this effect was not sustained.

Unfortunately, the paper did not provide details on which members of the practice undertook patient care.

Previous research by the National Nursing Research Unit used the Quality Outcomes Framework to examine long-term conditions such as diabetes, and found that higher levels of practice nurse staffing were associated with improved practice performance (Griffiths et al., 2010b). However, practices with more nurses also had higher rates of unplanned admission among people with diabetes.

But findings based on practice level data are constrained. Aggregated data can hide important relationships. There is limited ability to control for individual patient characteristics and no indication how the workforce is actually deployed to care for people with a particular condition. Thus there is no guarantee that findings based on aggregated data (e.g. practice) will be replicated when data (patients) are disaggregated. This led to an interest in pursuing the research further, focusing in depth in this study on one particular condition using patient level data (as opposed to practice level quality scores) and more detailed workforce data.

1.3 Aim

The aim of the current study is to examine whether different workforce configurations (and activity) in primary care are associated with variation in control of diabetes. We focussed in particular on the extent to which people with diabetes received care from practice nurses, as opposed to general practitioners, to explore the impact of the more general shift of chronic disease care from doctors to practice nurses in primary care.

Specifically the study seeks to address the following research questions:

What types of (diabetes related) activities are undertaken by doctors, practice nurses and other healthcare professionals; to what degree does this vary across practices and over time?

Do practices where practice nurses undertake a higher proportion of consultations with diabetes patients perform worse, the same, or better in terms of glycaemic control than practices where there is a different pattern of consultations amongst practice staff?

Are relationships previously found between practice nurse staffing and performance under QOF for diabetes replicated using patient level data?

Which workforce attributes (e.g. nurse led, specialism in diabetes) offer the most effective provision of care for people with diabetes in terms of health outcomes and costs?

Chapter 1 Summary

Diabetes is seen as an important condition to focus on due to its increasing prevalence over the last ten years and the costs associated with treating it: it is estimated to affect 3.6 million people in the UK and cost the NHS £10 billion a year.

Several studies have outlined the changes to practice nurses' workload and their increased role in caring for those with chronic conditions such as diabetes (Gemmell et al., 2009, Laurant et al., 2005, Richardson, 1999).

Understanding what difference increasing the nursing contribution has on the management of patients with diabetes may have implications for other conditions in primary care.

Previous research by the National Nursing Research Unit used the Quality Outcomes Framework to examine long-term conditions such as diabetes, and found that higher levels of practice nurse staffing were associated with improved practice performance.

The aim of the study is to examine whether different workforce configurations (and activity) in primary care are associated with variation in control of diabetes.

2. Methods

As set out in Chapter 1, the study aims to examine the nature of relationship between workforce configurations (and activity) in primary care and outcomes of patients with diabetes (as measured at the patient level).

The approach taken draws on two main data sources:

Patient level data on consultations with 319,649 people with diabetes from a nationally representative sample of 556 practices that indicates activities undertaken, who consultations were with, and outcomes. (The Health Information Network (THIN) data each year from 2002 to May 2012).

A survey of 249 practices contributing to the THIN database to profile their workforce and activities relating to management of diabetes.

These data are hierarchical. Medical records over time are nested within patients who are nested within practice. Data will therefore be analysed using a multilevel modelling approach (Goldstein, 1995). The amount of care delivered by practice nurses (and doctors) will be estimated by the proportion of consultations undertaken by practice nurses, and this will be related to the attainment of HbA1C targets and workforce configuration.

2.1 Patient level data set (THIN data set)

THIN Data is supplied by Cegedim Strategic Data Medical Research UK (CSD) and currently covers more than 3.7 million active patients (6.2% of all UK Patients) from 556 GP Practices in the United Kingdom (UK).

THIN data consists of anonymised data on the following: diagnoses, anonymised commentary written by the health physician, symptoms, prescriptions issued, tests and results, measurements and readings taken in the practice, demographic information, dates of entry in and out of the database such as information on death and outcomes of conditions and treatments. Medical conditions are recorded using the Read Clinical Classification Version 2 and 75% of THIN practices are now electronically linked to pathology laboratories and receive test results electronically.

THIN Data are gathered from practices that use an electronic clinical system called Vision for managing patients' data (http://www.inps4.co.uk/vision/vision/). Data are extracted using unobtrusive anonymous data collection software written by CSD's sister company, INPS. New practices joining THIN undergo a Full Data Collection, which includes all retrospective data. Incremental data are then downloaded automatically each month. Data collection commenced in November 2002.

England, Scotland, Wales and Northern Ireland all contribute GP practices to THIN although the majority are from England (Appendix A2.1). THIN Patients have a similar age, gender and medical

conditions profile to that found in the UK population. A Comparison of demographics, deprivation (Townsend), Quality and Outcomes Framework condition prevalence and deaths from THIN with national and QOF 2006/7 data found that demographics were similar although THIN had fewer people aged less than 25 years. Diabetes prevalence was similar (THIN 3.5% vs. National 3.7%). THIN patients tended live in more affluent areas (THIN 24% vs. National 20%). Adjusting for demographic and deprivation the 2006 THIN death rate was close to the national death rate (9.1 per 1000 vs. 9.4 per 1000)(Blak et al, 2011).

Patient records are regularly updated and therefore it is possible to track a patient longitudinally whilst they remain on the Vision system and registered in the same practice. **Figure 2.1 Structure of the THIN Data**
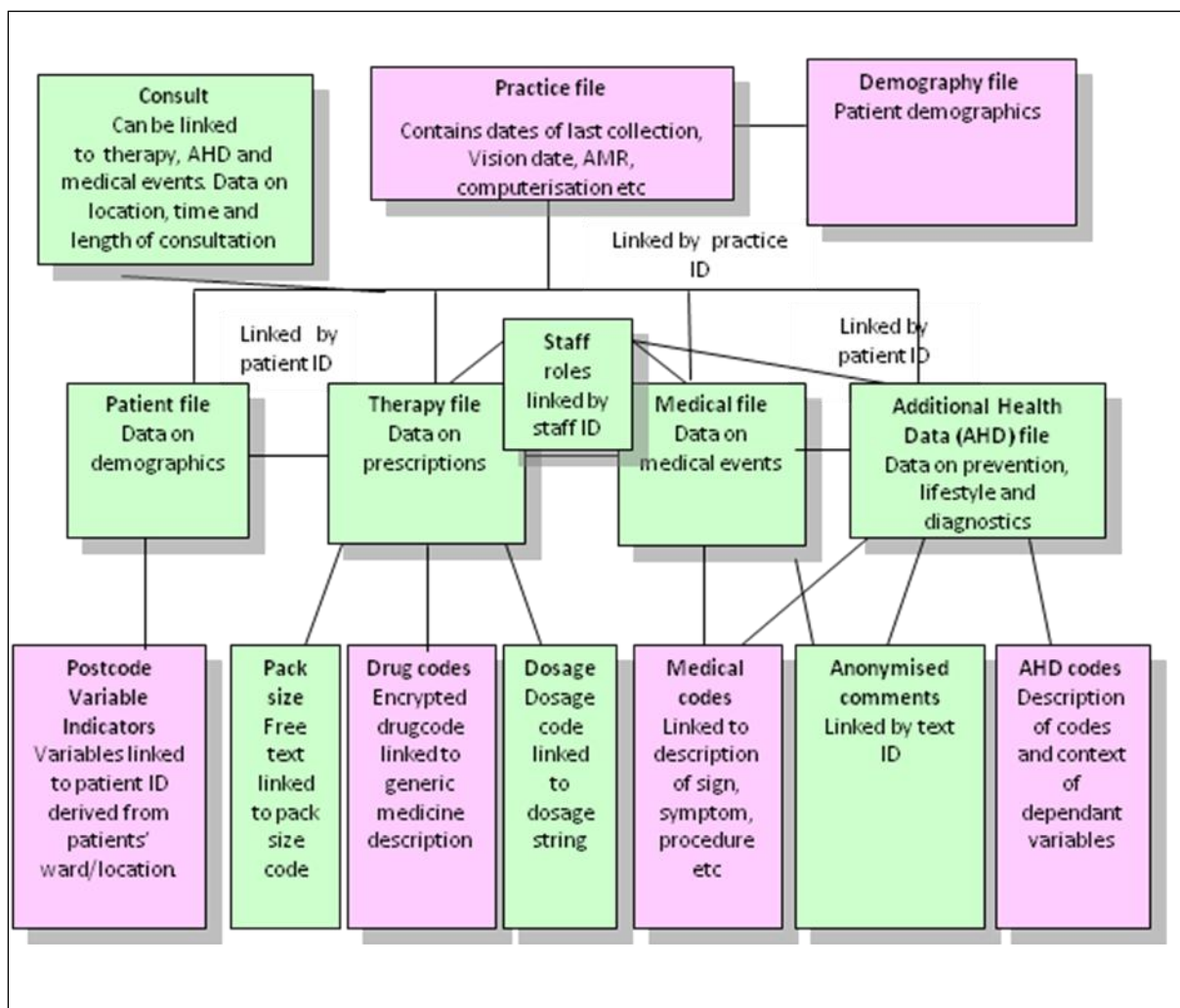
Source: THIN Data Guide for Researchers Version 2.6: 28 March 2013 (Cegedim Strategic Data Market Research UK)

Data can be linked across the three main THIN clinical datasets (Medical records, Additional Health Details, Therapy) using the practice, patient and the consultation IDs. Patient level postcode variable indicators for each patient can be linked to these datasets using the practice ID and patient ID.

Members of the practice staff can be linked to records on the three main datasets using the Staff ID. The Staff file contains the roles of each member of staff so it is possible to identify the role of the person (e.g. doctor, practice nurse, administrator) who entered or made a change to the patient's record. The Vision System allocates 'ownership' of the consultation record to one member of staff, usually the person who opens the record for the first time. It is possible that one or more other members of staff may add or make changes to the record. For example a practice nurse may see a patient initially but a doctor then subsequently prescribes a therapy. It is possible for more than one type of healthcare professional to be involved in a consultation.

The practice file holds information on three key dates: use of Vision, Computerisation and compliance with "Acceptable Mortality Reporting" (AMR). To enable the analyses to be undertaken, a dataset needed to be generated from the THIN database, selecting eligible patients and practices.

Patient and practice selection

Stage 1

Patients who fulfilled the following criteria were selected for inclusion into the study dataset:

- Be flagged with an A (Acceptable record) or C (Acceptable: transferred out deceased without additional death information) code on the patient file thereby confirming the patient is suitable for research.

- Have a code from the list of 612 Diabetes Readcodes in either their Additional Health Details or Medical Records files.

- The code must have been entered after the registration, Acceptable Mortality Reporting or Vision date.

The list of 612 diabetes 'Readcodes' (see Appendix A2.2) was created from pre-existing lists (CSD; Public Health Sciences, King's College London) and from an inspection of THIN Readcodes access database (supplied by CSD). These criteria resulted in 406,362 patients being selected from 556 GP practices. The size of the various datasets is shown in Table 2.1 below.

Table 2.1 Diabetes THIN datasets

File	Records
Patients	406,362
Medical	84,447,383
Additional Health Details	173,058,295
Therapy	199,877,160
Consultations	158,520,984
Postcode variable indicator	444,309
Staff	1,339,829

Stage 2

Patients with a Readcode that indicated gestational diabetes were excluded if they had no other diabetes Readcode in their patient record (n=168) reducing the population down to 406,195.

A second algorithm was then applied to the patient record to identify patients where the medical record, additional health details and therapy record gave a strong indication that the person was diabetic. This necessitated the classification of Readcodes into seven groups (A to G)(Appendix A2.3). Only groups A (diagnostic and label codes) and B (Annual review) were used in the algorithm for selection of people with diabetes. All groups were used when we compared medical record Vision system entries made by doctors and practice nurses to the medical record (section 4.3).

Algorithm for selecting people with diabetes

A person was included if they satisfied one, or more, of the following criteria applied in the sequence 1 to 6 (Note a person is only included in the first group they are allocated to. They may also have satisfied one or more of the other criteria further down the sequence):

1. One or more codes from Group A and one or more diabetic treatment prescribed (n= 273,169, 67.3%)

2. One or more codes from Group A and at least two from Group B with different event dates (n=33,431, 8.2%)

3. One or more diabetic treatments prescribed and at least two from Group B with different event dates (n=3,856, 1.0%)

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4. One or more codes from Group A and two HbA1c measurements at least 30 months apart (n=545, 0.1%)

5. A HbA1c value 6.5% or higher (n=7,657, 1.9%)

6. Two codes from Group A recorded at different dates (n=986, 0.2%)

(Criteria 5 and 6 were added after an initial review)

This captured 319,649 (79%) patients. Those people not selected have been grouped by whether they had a diagnosis Readcode, an annual review Readcode, had received diabetic therapy and had two HbA1c measurement less than 30 months apart (Table 2.2).

Table 2.2 People not selected by the algorithm

Diagnosis readcode	Annual review readcode	Diabetic Treatment code	Months between Hba1c measurement	No.	%
Absent	Absent	Absent	30 months or more	2397	2.8
			less than 30 months	27897	32.2
			No measurement	31542	36.4
		Present	30 months or more	182	0.2
			less than 30 months	1300	1.5
			No measurement	2161	2.5
	Present	Absent	30 months or more	2209	2.6
			less than 30 months	5454	6.3
			No measurement	9012	10.4
Present	Absent	Absent	less than 30 months	1430	1.7
			No measurement	2967	3.4
All				86551	100.0

Those patients not selected were subject to a further review. We sampled 10 patients from each category to see whether we were excluding certain patients unnecessarily. We were not, and based on this review we decided to not add any further categories. For the majority of these patients diabetic treatment, diagnosis of diabetes and annual review of diabetes was absent from their records. HbA1c may therefore have been measured for other reasons for example as part of an annual health check.

Stage 3: Selection of practices

1. No practice was included prior to it joining the Vision System.

2. No practice was included prior to AMR being attained.

3. 90% (or more) of all HbA1c measurements had to be recorded in, or could be transformed into, percentage units.

4. 90% (or more) of consultations could be associated with a member of practice staff whose staff role was known and was something other than administration. (In earlier periods, before the year 2000, records were entered more often by administrative staff on behalf of their healthcare professional colleagues)

The number of THIN practices meeting the eligibility criteria increased from 247 in 2002 to 471 in 2009. Since 2009 there has been fall to 434 in 2011/12 (see Appendix A2.1).

2.2 Defining staff consultations using THIN data

Each time a patient has a consultation with a healthcare professional a new record is opened on the Vision system. A member of practice staff can only open a record, or make changes to a record, if they are authorised to do so. Some of the records opened by practice staff do not necessarily relate to direct patient contact, for example the record might indicate that a letter has been written. We therefore restricted our definition of a consultation, or direct contact, to activities that took place in the GP surgery, or where there was contact with a healthcare professional outside of the surgery (e.g. a home visit). Phone conversations with a patient were also included in this definition. Below we have listed the types of contact (which may relate also to location of the contact) used:

- Surgery consultation
- Clinic (often by nurse)
- Follow-up/routine visit
- Home visit
- Acute Visit by GP to patients home, usually during normal working hours
- Night Visit (e.g. by practice doctor, locum GP, colleague, or deputising service) - often an emergency
- Out of Hours visit by practice doctor, often an emergency
- Telephone call to patient
- Co-op surgery consultation or home visit (collaborative out-of hours service by local GPs)
- Telephone consultation
- Children's home visit
- Twilight visit

The type of contact or location that is allocated when a consultation record is first opened remains consistent across the consultation, medical, additional health details and therapy datasets. Each member of practice staff allowed to enter records has their own unique staff ID. The Vision system allocates 'ownership' of the initial consultation record to one person. That person's staff ID, and no other, will appear in the consultations dataset for that consultation. Each time staff make changes to a patient's record (this could be to the medical, additional health details and therapy records) their staff ID is added. The medical, additional health details and therapy record for a consultation all share the same consultation ID. Therefore it is possible to link records from the same consultation and ascertain whether more than one member of staff has been involved. Although the consultation dataset holds a record of the duration of each consultation (i.e. the time between opening and closing the consultation record) it was not possible to apportion time between healthcare professionals when a consultation is shared.

Each staff ID can be linked to a staff group (e.g. doctor, practice nurse, pharmacist) using a lookup file. The depth of occupational coding has improved since 2002; the percentage of records coded to missing or administration has decreased for all four datasets (Medical record: 4.3% to 0.8%, Additional Heath Details: 7.0% to 1.2%, Therapy Record: 0.9% to 0.1%, Consultation file: 6.2% to 4.3%). We included administration in the calculation of this percentage because in the past administrators were often used to enter data on behalf of their medically trained colleagues, particularly doctors. As will become evident below this practice appears to have diminished over time.

In Table 2.3 we show how the staff group derived from the medical, AHD and therapy records, which could involve one or more members of staff compares with the single role allocated by the Vision system that appears on the consultations dataset only, for those consultations taking place in one of the locations listed above for 2002 and 2011 (Note this dataset also includes patients that were not selected by the algorithm in **Stage 2** Section 2.1 above). The congruence between the two sources for staff group is good.

Table 2.3 Occupational group allocation to consultations

Occupational Group		Vision allocated role group from the consultations file		Vision allocated role group also appears in either the medical, AHD or therapy record		Role group appears in either the medical, AHD or therapy record on its own or with other role groups	
		No.	%	No.	%	No.	%
Doctor		1634241	66.4	1631217	99.8	1818004	73.9
Practice Nurse		543476	22.1	526797	96.9	542612	22.0
Other nurses, midwives		40845	1.7	37106	90.8	38862	1.6
Other healthcare professionals		120692	4.9	113228	93.8	124425	5.1
Administration		120070	4.9	84580	70.4	96627	3.9
Unknown		1793	0.1	n/a	n/a	n/a	n/a
All		2461117	100.0				
Doctor		1478345	55.6	1474846	99.8	1678551	63.1
Practice Nurse		811421	30.5	797831	98.3	811541	30.5
Other nurses, midwives		64628	2.4	59713	92.4	61118	2.3
Other healthcare professionals		253049	9.5	233411	92.2	241434	9.1
Administration		51687	1.9	5077	9.8	7922	0.3
Unknown		1099	<0.01	n/a	n/a	n/a	n/a
All		2660229	100.0				

Measures of workforce activity

The activity of staff was calculated on the basis of all consultations undertaken in relation to the person with a diagnosis of diabetes, rather than restricting our study solely to activities that that were explicitly related to diabetes care. This approach was adopted to take account of the multiple system and diagnoses that are affected by diabetes (as shown in the literature). All consultations, tests, checks and treatments relating to comorbidites associated with diabetes were captured; for example hypertension, discussions about weight loss, diet, exercise etc. A considerable amount of care received by a person with diabetes may be directly, or indirectly, related to their diabetes, and is likely to be a factor in much of their care, even when it is not the primary activity coded to their consultation.

We were able to calculate the number of all types of consultation per annum for each person with diabetes, and the number of times they were seen by doctors, practice nurses and all healthcare professionals in total. We used two main measures of workforce activity: the average number of times people with diabetes were seen by a healthcare professional (per annum) and the percentage of consultations in that year involving practice nurses, divided into three levels: low (less than 26%), medium (26-35%) and high (over 35%) based on tertiles (three groups of equal or near equal size) derived from data for 2002 (the reference year). The percentage of diabetes reviews undertaken by practice nurses were similarly grouped into low (less than 34%), medium (35-77%), and high (over 77%).

2.3 Choice of outcome measure: using HbA1c as a measure of diabetes control

As the literature shows, good glycaemic control is key to managing diabetes and preventing complications. Glucose attaches to haemoglobin during the life span of a blood cell. HbA1c reflects average plasma glucose over 8 to 12 weeks and is widely used in the management of diabetes. Blood for the purposes of testing HbA1c can be taken at any time of day; fasting is not required.

Since 2002 HbA1c has been measured in % units (previously HbA1c was often measured using other units such as 'international units'. The unit of measurement is now changing to mmol/mol. There has been a transition period where Hba1c has been measured in both % and mmol/mol units. However, to enable consistency across the time period studies, the measurement as a percentage has been adopted. The thresholds against which glycaemic control is monitored have varied – both between organisations reporting it and over time. Nearly all practices (>98%) were using %HbA1c to measure glucose levels from 2003 onwards, making it a feasible indicator for this research.

The nearest HbA1c reading to the 1st July (mid point of the year) was selected for each person with diabetes for each calendar year from 2002 to 2011. When two Hba1c measures were equidistant either side of 1st July their mean was taken. For the 2011/12 analysis dataset the value nearest to the 16th May 2012 was chosen, in order to coincide with timing of the Practice Survey (undertaken in May 2012 to July 2012). Each percentage HbA1c reading was then categorised according to whether the particular threshold was met. We chose thresholds that spanned the full range previously used for QOF (≤ 7%, ≤ 8%, ≤ 9%, ≤ 10%)

2.4 Defining other variables

In order to examine the possible relationship between staffing inputs (in terms of workforce attributes and activity by staff group) and health outcomes for people with diabetes (glycaemic control as measured by HbA1c), a number of variables needed to be included in the analysis. The source and definition of each are outlined below.

Year of birth and gender for each person with diabetes was obtained from the THIN Patients file. The Townsend Score (socio-deprivation measure), ethnicity (percent white) and urban-rural classification were all taken from the THIN Postcode Variable Indicators (PVI) file. PVIs could alter if a person's place of residence changed. The most recent PVI, prior to the HbA1c reading was linked to that reading. Practice size was obtained from the midyear counts, available by calendar year from CSD. The UK nation (England, Northern Ireland, Scotland, Wales) in which the practice was located was taken from the THIN Practice file which also included 'Vision Date', 'Computerisation Date' and 'Acceptable Mortality Reporting Date'.

a) Age: Year of birth was used to calculate the age of the person at the time of their HbA1c readings.

b) Estimated date of diagnosis: Was based on either the date a person first received a diagnostic Readcode, when their first diabetic therapy was prescribed or when they first received an HbA1c reading ≥ 6.5%, whichever came first. Our study was confined to the period 2002 onwards. Not surprisingly very few people before 2002 had an HbA1c reading ≥ 6.5% that preceded their first diagnosis Readcode or first diabetic therapy. The estimated diagnosis date for 80% of people was determined from their first diagnosis Readcode (Table 2.4). Approximately equal proportions of estimated diagnosis dates were determined from either the person's first diabetic prescription or when HbA1c ≥ 6.5% for the first time, 10% and 9% respectively. On current trends HbA1c ≥ 6.5% could soon overtake the diagnosis Readcode in determining estimated diagnosis date based on this approach.

Table 2.4 Estimated year of diagnosis by source of diagnosis date

Estimated year of diagnosis		Diagnosis readcode	Diabetic therapy	HbA1c ≥ 6.5%	No.	%
			Source of diagnosis date		Total	
before 2002	No.	118991	16162	2722	137875	(43.1%)
	(%)	(86.3%)	(11.7%)	(2.0%)		
2002	No.	15116	2131	1172	18419	(5.8%)
	(%)	(82.1%)	(11.6%)	(6.4%)		
2003	No.	15200	1826	1633	18659	(5.8%)
	(%)	(81.5%)	(9.8%)	(8.8%)		
2004	No.	15628	1688	2053	19369	(6.1%)
	(%)	(80.7%)	(8.7%)	(10.6%)		
2005	No.	15257	1451	2100	18808	(5.9%)
	(%)	(81.1%)	(7.7%)	(11.2%)		
2006	No.	14560	1512	2134	18206	(5.7%)
	(%)	(80.0%)	(8.3%)	(11.7%)		
2007	No.	13953	1417	2218	17588	(5.5%)
	(%)	(79.3%)	(8.1%)	(12.6%)		
2008	No.	13514	1352	2402	17268	(5.4%)
	(%)	(78.3%)	(7.8%)	(13.9%)		
2009	No.	13035	1380	2797	17212	(5.4%)
	(%)	(75.7%)	(8.0%)	(16.3%)		
2010	No.	11415	1313	3505	16233	(5.1%)
	(%)	(70.3%)	(8.1%)	(21.6%)		
2011	No.	9354	1176	4414	14944	(4.7%)
	(%)	(62.6%)	(7.9%)	(29.5%)		
2012	No.	2555	330	2035	4920	(1.5%)
	(%)	(51.9%)	(6.7%)	(41.4%)		
Missing	No.	148	0	0	148	(0.0%)
	(%)	(100.0%)	(0.0%)	(0.0%)		
Total	No.	258726	31738	29185	319649	(100.0%)
	(%)	(80.9%)	(9.9%)	(9.1%)	(100.0%)	

†Data for 2012 covers the period up to 16[th]May

c) Prevalence: Estimated date of diagnosis, date of registration, date of transfer out or death were used to calculate the number of person years of diabetes for each GP practice for the period 2002 onwards by calendar year. These figures were divided by the practice list size for each GP practice to obtain prevalence.

2.5 Adjusting for co-morbidities

A primary care equivalent of the Charlson index was used as our measure of comorbidity (Khan et al, 2010). This index was time varying, and would increase as people acquired new conditions. Alongside this measure a time varying obesity indicator was derived. This was based on the QOF rule set for obesity. All records with inconceivable BMI measurements (age ≥ 16 and BMI <13 or BMI >150), where the weight was missing, the weight was zero or less and missing measurement dates were removed. An algorithm (see Appendix 5) for identifying outliers was applied to the data finishing with a final visual inspection of remaining suspected outliers. This process reduced the number of useable weight measurements by 3.7% from 4,706,621 to 4,534,221.

Under QOF, obesity has an age based exclusion rule and lapse in weight measurement rule is set at 15 months. The age rule excludes anybody under 16 however we did carry weight (BMI) measurements forward. For example if a person aged 15 years and 9 months had their weight measured and their BMI was 30 or over this was carried forward to their 17th birthday. If by their seventeenth birthday they had not been weighed again (to calculate BMI) they would no longer be classified as obese, since there would have been a lapse of 15 months since the last weight measurement.

A lapse in weight measurement at the end person's medical history could mean that the condition was no longer indicated. The last consultation date for that person was used to ascertain whether the time lapse since the last weight measurement (obesity) was 15 months or more.

2.6 Analytical approach (model)

The hierarchical nature of the data lends itself to a multilevel modelling approach. Each person with diabetes is registered with a single practice and has HbA1c measurements for all, or some of, the years during the period 2002 to 2011. Consideration was given to modelling the data over the full period. This required us to specify a three level hierarchical model: GP practice> person with diabetes>yearly HbA1c measurements for that person.

Each model included the same set of patient and practice level independent variables. These were as follows (the variable label used in the analysis tables is highlighted in bold):

Patient level

Age (calculated from date of birth on the THIN Patient File)

Gender (1 = Female, 0 = Male)

Primary care equivalent of the **Charlson** Index

Obesity (1= BMI > 30, 0=BMI ≤ 30)

Townsend score (Nationally derived quintiles 1=least deprived, 5=most deprived)

Percent White (Nationally derived quintiles 1=lowest, 5=highest)

Postcode indicator variables (**Townsend**, **Percent white**, **Urban-rural classification**) were derived for each census output area (~ 150 households) using 2001 census data and matched to the postcode of the patient.

Practice level

Practice list size (from the mid-year count supplied by CSD)

Prevalence (derived from the THIN data)

UK Country (in which the practice is located)

Workforce activity variables (practice level)

Average number of times a person had a consultation with a healthcare professional annually (label shortened to **Consultations per healthcare professional**)

Nurse contact; the percentage of all consultations involving or attributable to practice nurses categorised into tertiles: low, medium, high (See Section 2.2 Measures of workforce activity).

Average number of diabetic **Reviews with a healthcare professional** (annually)

% Practice nurse reviews; the percentage of all diabetic reviews involving or attributable to practice nurses categorised into tertiles: low, medium, high.

The following variables were used in the model in their standardised form (mean zero, standard deviation of one): Age, Charslon, Practice List Size, Prevalence, Consultations per healthcare professional and Reviews with a healthcare professional.

Before proceeding a test was performed to see whether the effect of the independent variables upon the outcome remained invariant over time. We attempted to fit this model - all independent variables and their interactions (multiplicative effects) with time (e.g. age x year, gender x year etc.) - using SAS Procedure GLIMMIX but this model failed to converge. It was also not possible to test individual interactions on a one-by-one basis using GLIMMIX due to model convergence issues. However we were able to test individual interactions using the package MLwiN. Nearly all interactions (see Table 2.5) were significant suggesting that effects were not time invariant therefore the data should be modelled separately for each year of the study. Another reason for analysing data for each year separately was because the nature of the population was changing over time due to earlier diagnosis and treatment. The model was also fitted the data covering the period 2011/12 using the HbA1c measurement closest to 16th May 2012. Models were fitted to a lower ($\leq$ 7%) and upper ($\leq$ 10%) HbA1c threshold, using a multilevel logistic regression model with random intercepts.

Table 2.5 Tests of interaction with Year (2002-2011)

Interaction with year	HbA1c ≤ 7%			HbA1c ≤ 10%		
	χ^2	Degrees of Freedom	p	χ^2	Degrees of Freedom	p
Age(linear) x Year	563.1	9	<.001	236.8	9	<.001
Age(quadratic) x Year	32.8	9	<.001	28.6	9	<.001
Gender x Year	105.9	9	<.001	8.7	9	.46
Charlson x Year	208.9	9	<.001	37.3	9	<.001
Obesity x Year	64.4	9	<.001	208.3	9	<.001
Townsend x Year	83.3	45	<.001	75.0	45	.003
Ethnicity x Year	194.6	45	<.001	141.2	45	<.001
Urban-Rural Classification x Year	149.9	54	<.001	150.4	54	<.001
Practice List Size x Year	29.3	9	<.001	18.7	9	0.028
Prevalence x Year	126.9	9	<.001	29.6	9	<.001
Country x Year	193.1	27	<.001	120.9	27	<.001
Consultations per healthcare professional x Year	185.4	9	<.001	377.0	9	<.001
Nurse contact x Year	94.3	18	<.001	80.9	18	<.001

2.7 Classification of diabetes Readcodes for the activity analysis

The aim of the classification of diabetic Readcodes was to see what doctors and nurses were doing in relation to diabetes care and more specifically to find out who was changing medication and performing the annual reviews. We also sought to identify how many people with diabetes in a practice were being referred onto specialist care or were part of intermediate/shared care. This classification was undertaken by a diabetes nurse on the project team and went through a number of iterations that resulted in fewer categories (e.g. eye screening, which was initially a separate category, was amalgamated with diabetes review)(see Appendix A2.3 'Readcode' classification). This allowed us to look at activity in broad terms and to identify trends both at the level of the category and by individual Readcode.

2.8 Ethics

Based on the information we provided to National Research Ethics Service (NRES), we were advised that this project was not considered to be research according to the NRES guidance and therefore it did not require ethical review by a NHS Research Ethics Committee.

Cegedim periodically audits it practices for administrative information. The instrument and database for the audit had previously received ethical approval. Inclusion of the additional questions (for the practice survey) did not require further ethical approval.

Chapter 2 Summary

The proportion of a practice's diabetic population that achieved glycaemic control (as defined at the 7% and 10% levels) was used as the main outcome measure, using data from patient records (THIN data covering approximately 320 thousand patients in 400 practices).

Differences in outcome (glycaemic control) were explored in two ways:

- by comparing change over time. We used data from 2002 to 2012, to explore variation in glycaemic control over the years in relation to any differences observed in the proportions of consultations undertaken by different staff (recorded by staff on patient records in THIN), or changes in the types of activity undertaken (coded under different groupings)
- by comparing practices within the current year to see how much glycaemic control varies between practices and what, if any variation relates to differences in the practices' – their workforce, and who leads management of diabetes. These variables were derived from a survey of practices undertaken in the spring of 2012 (covering 249 practices)

Workforce activity was captured through consultations as:

- the average number of times people with diabetes were seen by a healthcare professional (per annum)
- the percentage of consultations per year involving practice nurses, divided into three levels: low (less than 26%), medium (26-35%) and high (over 35%)

A multilevel modelling approach was used to explain variation in glycaemic control attributable to characteristics of the person (age, gender, comorbidity) and the practice (size, diabetes prevalence workforce activity measures).

3. Survey of practices in 2012 (workforce and diabetes care)

Between May and June of 2012, the THIN data supplier (CSD) undertook to survey practices to collect generic data on the practices they covered, and on behalf of the NNRU, also collected more detailed workforce data relating to how diabetes care was organised (see the Appendix 6 for the questionnaire). The survey was administered by CSD, who obtained responses from 249 practices. The survey asked background questions about the size and location of practices, and also covered questions on the total workforce (including nursing and support staff) and approaches to managing diabetes.

3.1 Background: practice size, location and type

Before we describe the nature of the nursing workforce available to provide care for people with diabetes, we start with some background information on the practices themselves.

243 out of 249 practices provided details of the number of whole time equivalent (WTE) GPs. The total ranged from one GP in 15 practices to 10 or more in five practices. The total number of GPs practicing across the 243 practices covered is just under 1000 with an average (mean) practice of 4.1 WTE GPs (median of 3.8). Practices have been grouped into 'small' (less than 3 WTE GPs), 'medium' (4-4.99 WTE GPs) and 'large' practices (5 or more WTE GPs). Figure 3.1 summarises these data. Just under a third of practices (30%) are in rural locations, 54% in urban locations, and 12% in inner city locations; 3% describe their location as 'combination' (perhaps where a practice has more than one surgery). Large practices are more likely to be found in urban locations (61% compared to 44% of small and 55% of medium practices). Larger proportions of small practices are found in inner city locations: 20%, compared to 11% of medium and 7% of large practices.

Nine in ten (89%) indicated that they are a 'dispensing' practice and this did not vary by size of practice. However, practices located in urban or inner city areas are more likely to be dispensing practices (99% compared to 70% of rural practices).

Just over half (56%), of all practices indicated that they are training practices. Large practices are more likely to be training practices than smaller ones; 24% of 'small' practices are training practices compared to 80% of 'large' practices.

3.2 Practice workforce

This section presents data on the total number of staff and the skill mix among GP practices covered in the survey. Only practices that were able to provide data for number of WTE staff and GPs are

included[1] (n=232). The total number of all staff (including GPs themselves) ranges from 3 to 54 WTE with a mean of 15.35. The average for 'small' practices is 8.4 WTE, for 'medium' is 14.0 WTE and in 'large' practices the mean is 29.6 WTE. Typically, GPs represent 27% of all practice staff and this figure varies from 11% of all staff to 84% of all staff. Table 3.1 and Figure 3.1 summarise these data.

Table 3.1. Workforce in GP practices: mean numbers and percentages (232 cases)

Whole time equivalents (WTE)	Mean no. staff	Total	% of all staff
Total GPs	4.10	950	27%
Total number of other staff (not GPs)	11.26	2612	73%
Practice nurses	1.85	429	12
Consultant nurse	0.01	1	<1
Nurse practitioner	0.24	56	2
Advanced nurse practitioner	0.08	18	1
Other registered nurse	0.08	18	1
Total RNs	2.26	522	15%
Total nursing assistant/HCA/support worker	0.78	180	5%
Dispensers	0.15	35	1
Phlebotomists/pharmacists	0.08	20	1
Total other clinical	0.23	55	2%
Practice manager (clinical)	0.08	17	<1
Practice manager (non-clinical)	0.95	221	6
Total Practice management	1.03	238	7%
Receptionist	5.41	1254	35
Other staff not specified	0.16	38	1
Admin staff (IT/assistant managers/secretaries)	1.36	316	9
Cleaners	0.03	6	<1
Total admin and other staff	6.96	1614	44%
All staff (inc. GPs)	15.35	3562	100%

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[1] If details of WTE equivalent for some staff groups are provided, 'blank' responses were treated as no staff employed. If all the staffing questions were blank, the responses are treated as missing and excluded from the analyses

Registered nurses (practice nurses, consultant nurses, nurse practitioners and advanced nurse practitioners and other registered nurses) account for 15% of all practice staff or 2.3 WTE on average. The average number of patients per RN is 3,800 with a minimum of 720 and maximum of 11,200.

Figure 3.1 GP workforce summary: Mean number WTEs, percentage of all staff
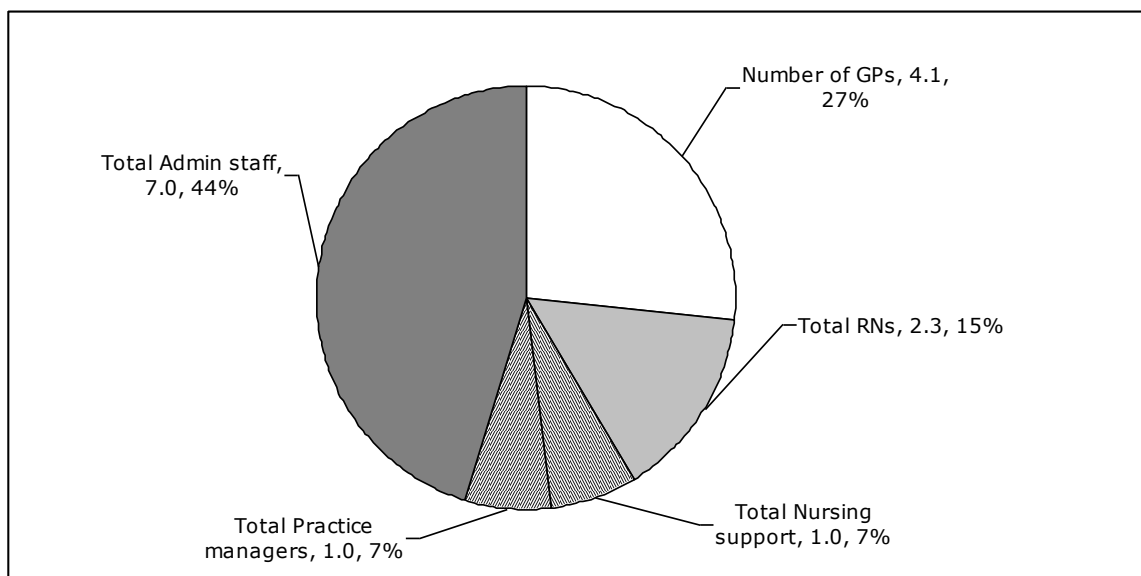
There is little difference between types of practice in the proportion of different staff groups employed in the practices covered by the survey. Larger practices tend to have slightly smaller proportions employed as practice management (5% compared to 12% in 'small' practices) and higher proportion employed as GPs (30% compared to 24% in 'small' practices). Dispensing practices are more likely to have higher proportion of clinical support workers (including pharmacists and phlebotomists – 14% compared to 5% in practices that are not dispensing).

Registered nurses account for 15% of the total primary care workforce. Whilst in relation to the clinical workforce (that is GPs and registered nurses together), RNs make up a third of the clinical workforce. Put another way, on average there is a ratio of one nurse to every two GPs. But this varies considerably, as shown in Figure 3.2. One in 20 practices report having no practice nurses whilst in 12% of practices, RNs make up more than half of the total clinical staff.

Figure 3.2 Registered Nurses as a percentage of all RNs and GPs
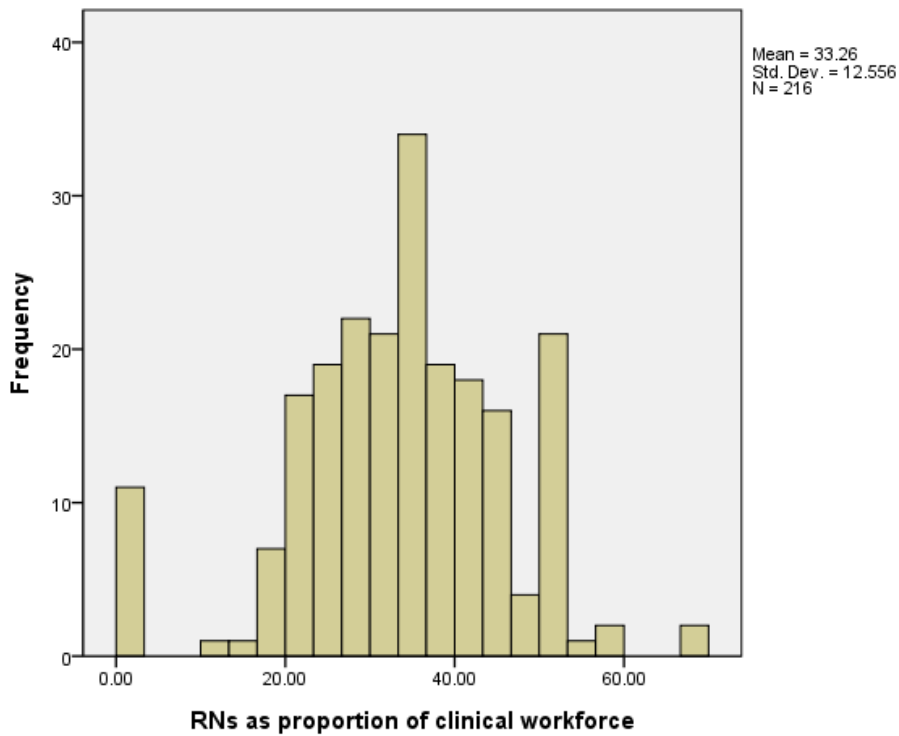
Most nursing staff (42%) are employed on Band 6, 24% are on Band 7 or 8 and 15% Band 5. One in five (20%) of staff are paid on the equivalent of Band 4 or lower (see Figure 3.3).

Figure 3.3 Nursing staff (RNs and assistants) by equivalent AFC pay band
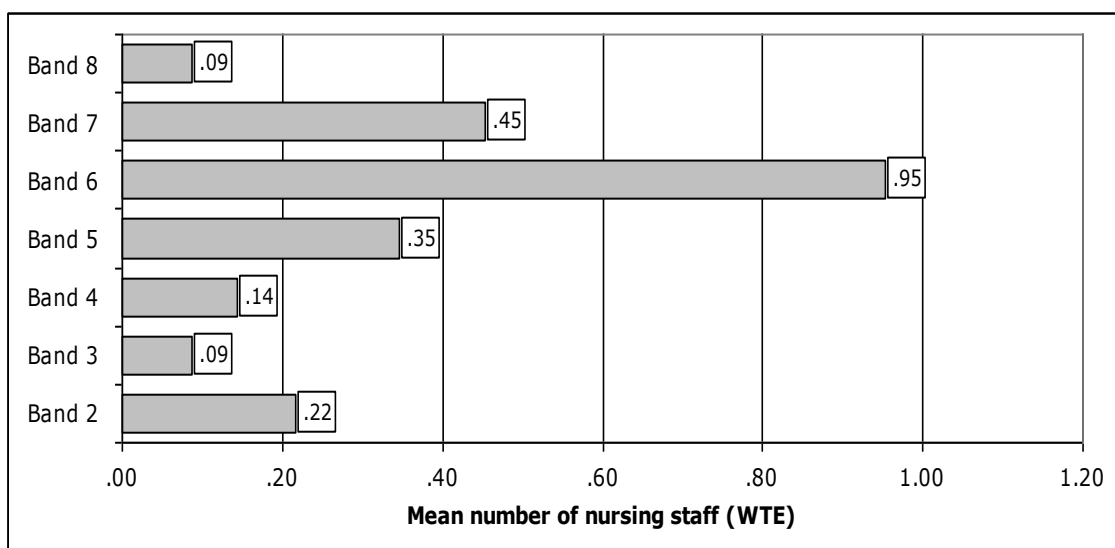
Grade mix of registered nurses varies by size of practice, with larger practices being more likely to employ nurses on Band 7/8 (33% compared to 21% in 'medium' sized practices and 15% in 'small' practices). Among the 207 practices providing data, 59% indicated that some nurses providing care to patients with diabetes hold a post graduate qualification relating to diabetic care from a higher education institute. One per cent of practices did not know whether or not they employed nurses with postgraduate qualifications in diabetes care. 'Large' practices (5 or more GPs) are more likely to employ nurses holding postgraduate qualifications in diabetes care: 84% do compared with 52% and 44% in 'medium' and 'small' practices respectively.

Figure 3.4 Percentage of practices who employ nurses holding postgraduate diabetes qualifications
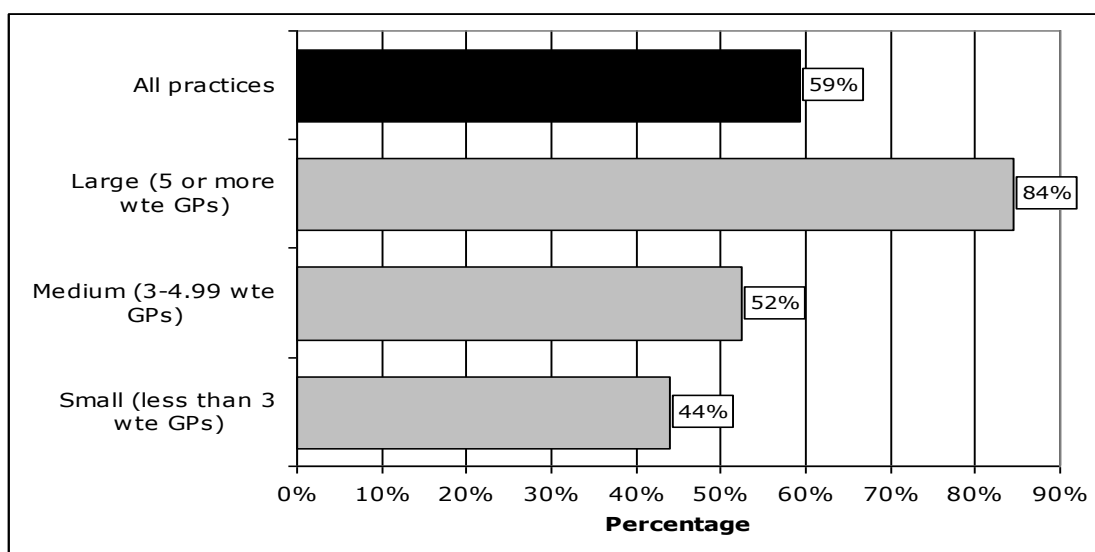
3.3 Approach to diabetes care

This section looks at how practices approach diabetes care. Figure 3.5 shows that the most frequently cited approach to diabetes care management is using nurse(s) specialised in diabetes care (73%). In practices that have nurses with postgraduate diabetes qualifications, this figure rises to 89%. In more than half of cases (57%) care is managed by GP(s) specialised in diabetes care and a similar proportion of respondents (54%) indicated that management of care is shared between the practice and hospital/community based consultants. In a third of cases (32%) care is managed by GP(s) with no diabetes specialism.

Figure 3.5 How care is managed by practices: percentages[2]
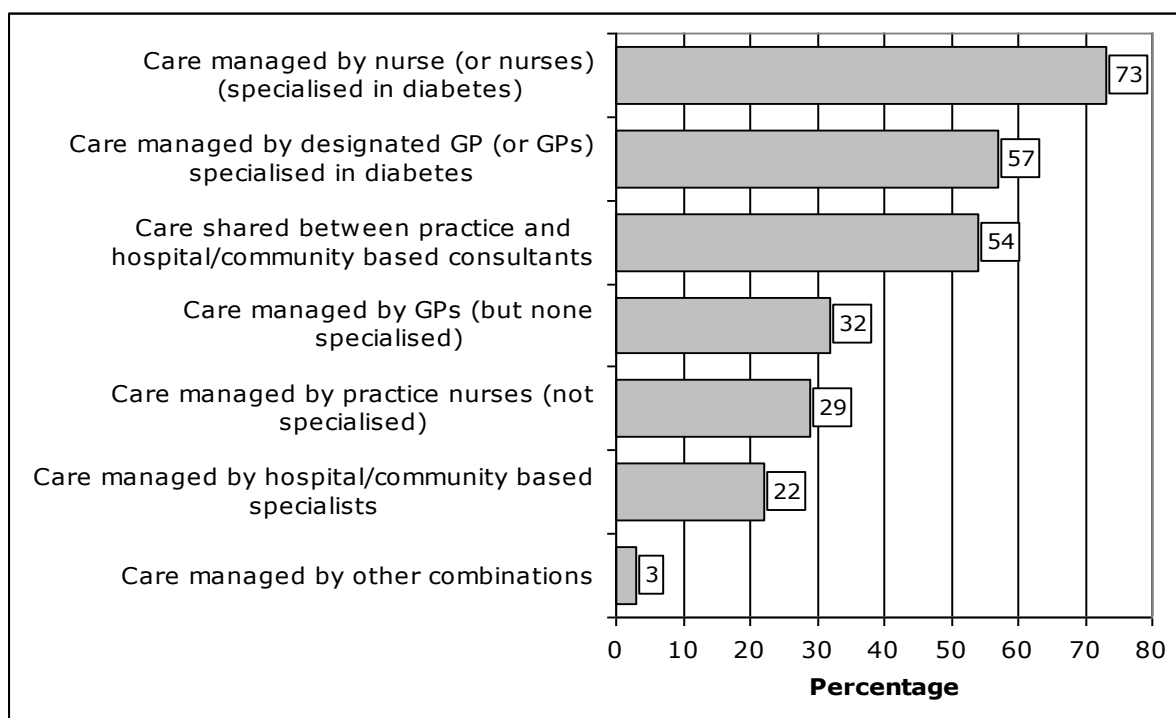
Large practices are where care is most likely to managed by diabetes specialists, be they GPs or nurses and in small practices it is more likely to be managed by GPs and nurses that are not specialised in diabetes. For example, in 88% of 'large' practices, employing 5 or more GPs care is managed by nurses with specialist diabetes training compared to 56% of 'small' practices.

When asked to indicate which is the main approach to managing care of people with diabetes using a 'designated nurse or nurses who specialises in diabetes' was indicated by more than half of all respondents (58%; this includes 5% that said they use a combination of GPs and nurses both specialised in diabetes care). In a further 11% of cases care is managed by nurses (but not specialists). (See Figure 3.6).

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[2] Respondents were allowed to indicate more than one management approach hence figures do not add up to 100%.

Figure 3.6 How care is managed by practices (main approach): percentages
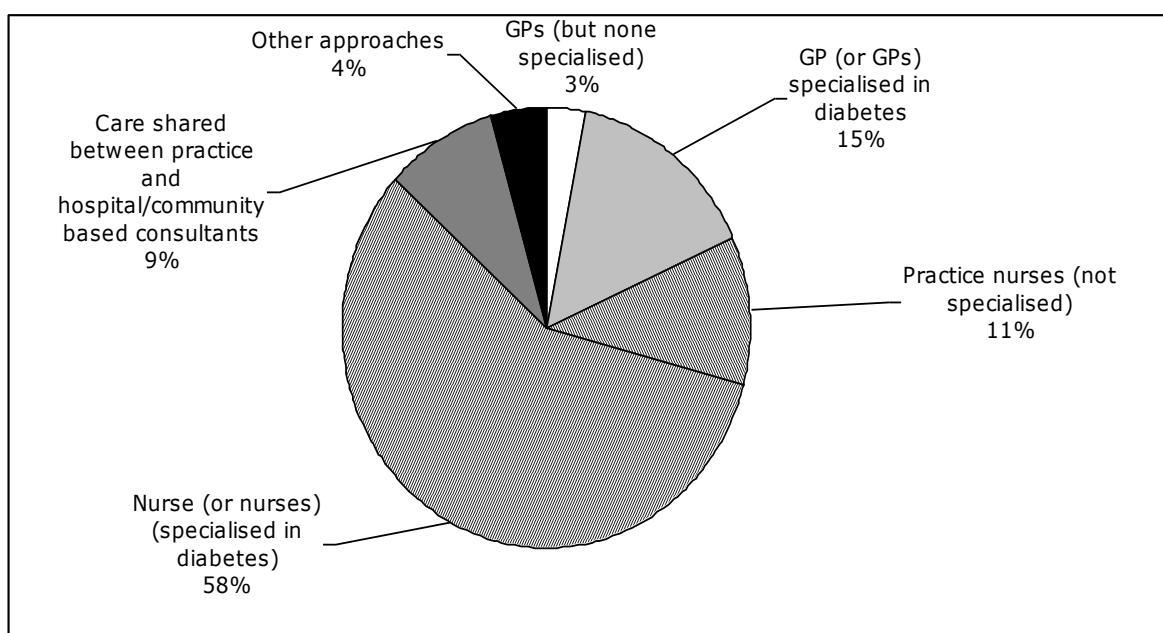
Smaller practices are more likely to say management of care is shared with hospital or community consultants (22% vs. 5% in medium or large), rather than led by their own nurse (61% vs. 71% of medium sized), and are less likely to have care in the hands of a designated GP or practice nurse with specialist knowledge (51% vs. 83% in larger practices).

In practices that have nurses with postgraduate qualifications in diabetes, 70% report the nurse specialists manage diabetes care, compared to 33% of practices where there are no nurses specialised in diabetes. However, this is still the most frequently used approach in these practices. Large practices are more likely to report that specialist diabetes nurses lead diabetes care management than smaller and medium sized practices.

People with diabetes typically receive most of their diabetes related care and assessment via regularly held clinics specifically for diabetic patients (61%) or through routinely scheduled appointments (52%). A third of practices say that they provide appointments as and when needed (32%) and five per cent use other approaches (again it should be noted that respondents could indicate more than one approach) to care provision.

Insulin treatment is initiated by a range of different practitioners. In 46% of cases the GP initiates treatment, in 36% of practices the practice nurse initiates treatment, in 32% of practices a community diabetic nurse specialist initiates treatment and in 40% of practices outpatient diabetes mellitus clinics initiate insulin treatment (8% of respondents indicated that other people or organisations initiate treatment).

In just over half the cases (53%) a single approach is used while in a third (34%) two strategies are deployed and in 13% of cases three or more approaches are used to initiate insulin treatment. Where a single approach is used, it is most likely to be using diabetes mellitus outpatient clinics.

In practices where nurses hold specialist postgraduate qualifications the majority of diabetes care is provided through regularly held clinics specifically for diabetic patients (74% compared to 41% of cases where there is no specialist postgraduate trained diabetic nurse). Larger practices are more likely to provide care in this way.

In large practices insulin treatment is more likely to be initiated by practice nurses (47% compared to 39% in medium sized practices and 19% in small practices) while small practices are more likely to use outpatient diabetes mellitus clinics (58% compared to 36% of medium sized practices and 29% of large practices).

Chapter 3 Summary

- A survey of 249 practices undertaken in Spring 2012 found that a 'typical' practice employs an average of 4 GPs, 2 registered nurses (RNs), 1 care support worker/assistant, a practice manager and 7 receptionists/admin staff (whole time equivalents).

- The findings show that overall there is substantial variation between practices in the composition of their workforce, how they deliver care to people with diabetes, and who leads that care.

- Nurses make up a third of the trained clinical staff (e.g. total GPs and RNs), but this varies considerably: 5% of practices have no registered nurses whilst in 12% RNs make up more than half of the clinical staff.

- Larger practices (5 or more WTE GPs) are more likely to employ experienced nurses (on higher pay-bands), and nurses that hold a post-graduate qualification in diabetes (84% do, compared with 44% in small practices (less than 3 WTE GPs)).

- A nurse (or nurses) who specialises in diabetes leads the management of care of patients with diabetes in 58% of practices, and generalist practice nurses lead care in 11% of practices.

- About one in five (18%) practices say that the GP leads management of diabetes patients. 89% of practices that employ a nurse with postgraduate specialist qualification in diabetes report that care of patients with diabetes is generally managed by a nurses (or nurses) who is specialised in diabetes.

- In practices where nurses hold specialist postgraduate qualifications the majority of diabetes care is provided through regularly held clinics specifically for diabetic patients (74% compared to 41% of cases where there is no specialist postgraduate trained diabetic nurse).

- In 46% of practices the GP generally initiates insulin treatment, and in 36% of practices the practice nurse initiates treatment.

4. Staff consultations and patient outcomes

This chapter presents analysis of primary care medical records from the THIN practices during the period 2002 to 2012. The number of practices included in the analysis increased over time, varying from 247 to 471. We start by profiling the patient population to consider factors that need to be taken into account when looking at the relationship between workforce and outcomes for people with diabetes. We then describe each of the two key areas of interest:

1. Outcomes in relation to their diabetes:

   a) What is the incidence and prevalence of diabetes in the THIN practice populations?

   b) How well controlled is their diabetes?

2. Staff activity related to diabetes care: based on the activities coded as part of their consultation with individual patients.

   a) Who is doing what (based on consultations)?

   b) What are the 'typical' mix of activities undertaken by doctors and nurses in treating and caring for people with diabetes in primary care?

   c) Does the nature of the roles performed by nurses and doctors vary between practices?

   d) How have these patterns of activity changed over the last ten years?

4.1 Patient Profile

Below we briefly describe the patient profile of those people with diabetes registered in the practices that met the study selection criteria.

- There has been a shift towards people with diabetes being older than they were ten years ago. In 2002, 8.4% were aged under 40, which has fallen to 6.6% in 2011/12. Conversely there has been an increase in the proportion of those people aged 80 and over from 12.5% in 2002 to 14.6% in 2011/12.

- There were more men with diabetes than women (55.2% vs. 44.8% in 2011/12).

- Using the Townsend score to measure socio-deprivation, the overall profile distribution has remained stable across the study period. The study population was less deprived than the national population.

- There were more people in the study sample who lived in areas where individuals described themselves as 'White' than is the national average.

- The majority of people in the study population lived in less sparse urban areas.

CSD has over the last decade acquired more THIN practices from the all four UK nations. The majority are from England although recent acquisition of practices has happened at a far faster rate for Scotland (Appendix A2.1). The proportion of practices that met the criteria for inclusion based on the Vision and AMR dates in 2011/12 by nation was England (336, 72%), Scotland (71, 15%), Wales (37, 8%) and Northern Ireland (22, 5%). In the study population the proportion of people registered with practices in Scotland has increased from 2.7% in 2002 to 13.8% in 2011/12.

There has been a steady increase in the proportion of people who have one or more comorbidities alongside their diabetes. In 2002 52.2% had one or more comorbidities. This figure has risen to 60.0% in 2011/12. The percentage of people with 5 or more comorbidities, at any one time, has risen from 2.3% to 6.5% over the study period.

Obesity has also increased considerably between 2002 and 2011/12 (Table 4.1). In 2002 fewer than 30% of all people with diabetes were morbidly obese; this has risen to almost 47% by 2011/12.

Table 4.1 Obesity (BMI ≥ 30) 2002 – 2011/12

Obesity		Year										
		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2011/12**
Absent	No.	36219	53062	55478	63436	67758	71169	76285	80026	82239	81730	79487
	%	70.3	67.6	63.9	61.4	59.4	57.6	56.3	55.8	55.5	54.5	53.3
Present	No.	15274	25440	31360	39955	46281	52335	59135	63303	65982	68293	69548
	%	29.7	32.4	36.1	38.6	40.6	42.4	43.7	44.2	44.5	45.5	46.7
Total	No.	51493	78502	86838	103391	114039	123504	135420	143329	148221	150023	149035

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

4.2 Prevalence of diabetes in the THIN practices 2002-2012

Table 4.2 describes the number of people with diabetes in each year since 2002 (as a number and as a proportion of all people). Whilst the average total number of patients registered per practice has changed little (from 8,617 patient in 2002 to 7,877 in 2011/12), the average number of patients with diabetes per practice has increased by 58% in the same period, and now account for one in 20 patients (4.9% vs. 3.0% in 2002). While national estimates of diabetes prevalence vary somewhat this figure is consistent with a recent estimate of 4.3% based on the QOF for 2010 (Kanavos et al., 2012), and 5.8% prevalence from QOF in 2011/12 (NHS Information Centre for Health and Social Care, 2012). These figures reveal the extent of the growing burden of care that has been placed on GP Practices.

Table 4.2 Practice registers and diabetes prevalence

Year	Practices (no.)	Practice (Mid-year count)			Estimated diabetic register size			Prevalence		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	8162	3878	1498 - 28455	237	115	40 - 719	3.0	0.6	1.0 - 5.7
2003	375	7541	3747	1482 - 28219	236	120	15 - 781	3.2	0.8	0.8 - 6.3
2004	386	7523	3826	1317 - 28373	254	132	31 - 841	3.4	0.8	0.9 - 6.6
2005	427	7525	3893	1333 - 28562	270	142	40 - 895	3.7	0.9	0.9 - 7.6
2006	441	7587	3951	1313 - 28856	288	153	47 - 957	3.9	0.9	1.0 - 7.5
2007	448	7686	3937	1349 - 29357	306	159	51 - 1003	4.1	0.9	1.2 - 7.9
2008	470	7655	3984	518 - 29929	318	167	10 - 1065	4.3	1.0	1.3 - 8.3
2009	471	7723	4033	1009 - 30440	335	176	20 - 1125	4.4	1.0	1.3 - 8.6
2010	466	7749	4073	1228 - 31157	350	185	37 - 1177	4.6	1.1	1.5 - 8.9
2011	445	7869	4130	1273 - 31441	370	194	57 - 1230	4.8	1.1	1.5 - 9.1
2011/2012[1]	434	7877	4111	1273 - 31441	375	197	60 - 1249	4.9	1.1	1.5 - 9.2
	%Change	-3.5%			58.3%			66.1%		

[1] Uses mid-year count for 2011 to calculate prevalence

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

4.3 Staff activity

Doctor and nurse consultation rates

We start by describing some of the key trends in care of people with diabetes that have taken place over the last ten years (2002 to 2011/12) in THIN GP practices.

There has been an increase in activity (across staff groups) as the numbers of patients with diabetes has increased. The average total number of consultations per practice of any type (e.g. both diabetic and non-diabetic care) involving a healthcare professional (based on the Vision system allocated role group) with people with diabetes has increased by 14% between 2002 and 2011/12. The equivalent figures for average total number of practice consultations derived from the medical, additional health details and therapy records are very similar, with an increase of 13% since 2002 (see Table 4.3). The increase in activity – as measured by consultations - is substantially lower than the increase in prevalence (66%).

Table 4.3 shows figures on consultations that involve one or more staff groups from the practice healthcare team. So, for example, we count any consultation that involves just a doctor and any that doctors shared with a healthcare professional from another staff role group (e.g. practice nurse, pharmacist). An alternative means of capturing consultation by staff group is to base it on either the Vision system allocation, or restrict consultations to those that belong exclusively to a single staff group – e.g. only doctor or only nurse. These alternatives were explored and any key differences are reported in the text below. (Full results using these approaches are found in the appendices along with a footnote defining the levels of nurse contact)

Table 4.3 Average number of consultations per practice of patients with diabetes

Year	Practices (no.)	All healthcare professionals (Derived[1])			Doctors (Any contact)			Practice nurses (Any contact)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	3900	2339	52 - 11641	2673	1539	21 - 8739	1205	857	0 - 4418
2003	375	3694	2403	3 - 14262	2515	1597	0 - 10698	1133	831	0 - 5094
2004	386	3874	2493	171 - 13850	2597	1605	107 - 10542	1202	894	1 - 5992
2005	427	3938	2541	350 - 15309	2590	1581	208 - 10929	1234	923	0 - 6576
2006	441	4043	2598	270 - 14412	2615	1561	72 - 9295	1277	968	0 - 5780
2007	448	4273	2734	133 - 14317	2700	1604	111 - 8289	1382	1055	0 - 6034
2008	470	4241	2724	53 - 14334	2654	1594	42 - 8497	1358	1051	0 - 6374
2009	471	4338	2788	215 - 15538	2659	1573	133 - 8569	1401	1088	0 - 7147
2010	466	4279	2759	246 - 15367	2641	1567	220 - 8469	1375	1076	0 - 6677
2011	445	4376	2805	219 - 15589	2662	1601	208 - 8703	1441	1095	0 - 6882
2011/2012	434	4423	2833	251 - 15674	2703	1628	246 - 9218	1449	1102	0 - 6561
	% Change	13.4%			1.1%			20.2%		

[1] Derived from the medical, AHD and therapy records

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

It appears that the increase in consultations with diabetic patients has largely been delivered by practice nurses. In the average GP practice, doctors were involved in 2673 consultations in 2002 which rose only marginally to 2703 in 2011/12 representing a 1% increase over then ten-year period. Over the same period there has been a 20% increase in the consultations involving practice nurses. Looking at practice nurse only consultations (no other staff group involved) suggests there has been an increase of 23% between 2002 and 2012. For both staff role groups there was a fall between 2002 and 2003 which coincides with an increase in eligible practices from 247 to 375. If 2003 is used as the reference year the increases were 7% and 27% respectively. Whichever figures are used, practice nurses have borne more of the increased workload than doctors based on this particular measure.

The proportion of consultations undertaken by each group has changed only slightly. Table 4.4 expresses the number of consultations by the two main staff role groups (Doctors, practice nurses) in terms of percentages. In 2002 70% of all consultations with people with diabetes were undertaken by doctors. By 2011/12 this had fallen to 64%. Amongst practice nurses there was a small increase from 31% to 32%. During this period the proportion of consultations involving healthcare professionals who were neither doctors nor nurses, increased from 3.4% to around 7.6%. The staff role of these entries was often recorded simply as 'Other Healthcare Professional', rather than to something more specific (e.g. pharmacist, dietician).

Table 4.4 Proportion of consultations with doctors and practice nurses (as a percentage of all healthcare professional staff

	Practices (no.)	Doctors (Any contact)			Practice nurses (Any contact)		
		Mean	SD	Range	Mean	SD	Range
2002	247	69.8	12.5	13.1 - 100.0	30.7	12.8	0.0 - 88.1
2003	375	69.1	13.0	0.0 - 99.9	31.0	13.5	0.0 - 100.0
2004	386	68.9	13.2	21.9 - 100.0	30.7	13.7	0.1 - 87.4
2005	427	68.0	13.4	35.4 - 99.9	30.9	13.9	0.0 - 76.5
2006	441	67.3	14.4	9.5 - 100.0	30.6	14.4	0.0 - 91.7
2007	448	66.2	14.7	18.5 - 100.0	31.2	14.5	0.0 - 92.2
2008	470	65.3	14.2	28.2 - 100.0	31.2	14.0	0.0 - 88.0
2009	471	64.4	14.9	10.9 - 99.8	31.5	14.5	0.0 - 96.7
2010	466	65.0	14.4	25.2 - 100.0	31.1	14.3	0.0 - 83.7
2011	445	63.8	14.3	29.7 - 100.0	32.2	14.1	0.0 - 77.0
2011/2012	434	63.9	14.3	31.0 - 100.0	32.0	14.2	0.0 - 71.6
	% Change	-8.4%			4.1%		

[1] Derived from the medical, AHD and therapy records

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Figure 4.1 presents the data graphically. The modal group based upon ten-percent banding is 30-39% for practice nurses for both 2002 and 2011/12. There are proportionally more practices in 40-49% (19.4% vs. 13.8%) and 50-59% bands (7.6% vs. 6.1%) than in 2002 for consultations involving any contact with a practice nurse. The modal band for doctors was 60-69% in 2002 and 50-59% in 2011/12. There are fewer practices in the 70-79% (18.2% vs. 29.6%) and 80-89% (7.4% vs. 16.2%) bands in 2011/12 than in 2002 for consultations involving any contact with a doctor however there has been a proportionate increase in the very highest band (90%+) from 2.5% to 5.2%. The percentage of all consultations involving practice nurses was subsequently categorised into low, medium and high (tertiles) for analysis purposes using 2002 as the reference year.

Figure 4.1 Consultations involving doctors and practice nurses 2002 vs. 2011/12
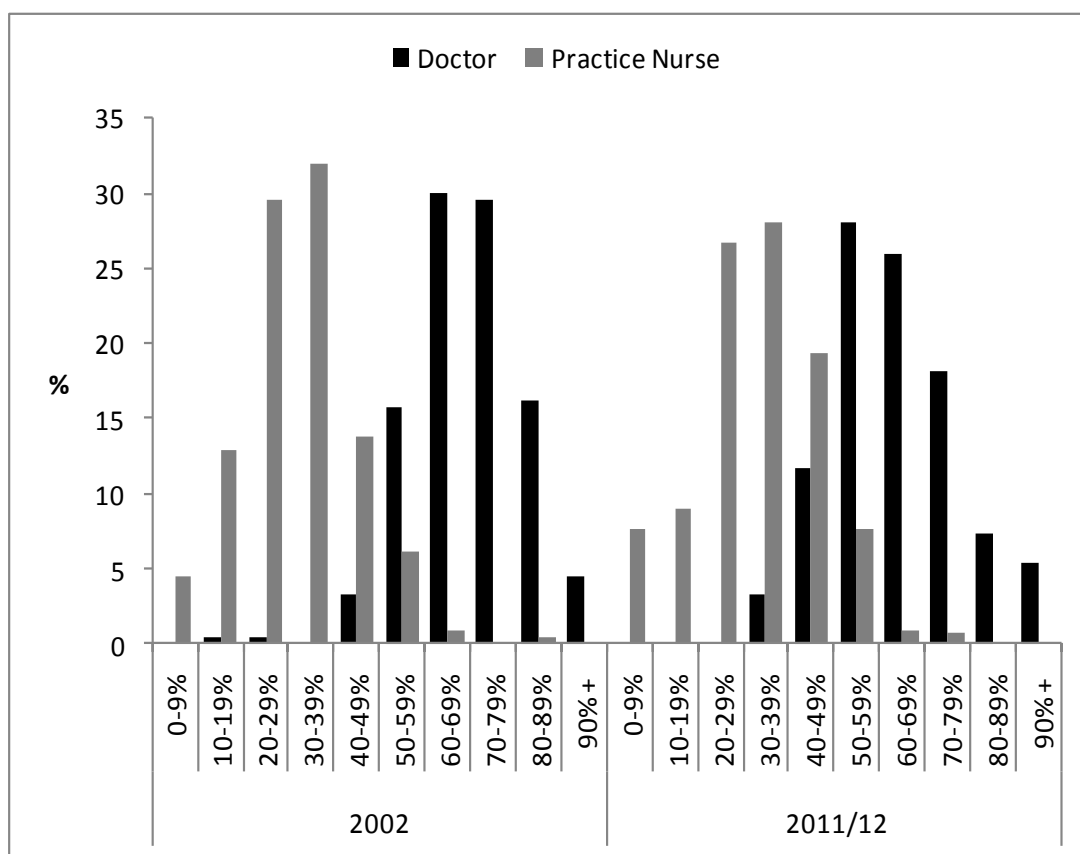
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The average number of consultations a person with diabetes had with a healthcare professional on an annual basis has dropped by 28% from 16.0 per annum in 2002 to 11.5 per annum in 2011/12 (Table 4.5). The average number of consultations with doctors fell by 36% from 11.1 to 7.1 and for practice nurses by 24% from 5.0 to 3.8 per annum over the same period.

Table 4.5 Number of consultations per person with diabetes (per annum) with all healthcare professionals, doctors and practice nurses

Year	Practices (no.)	All healthcare professionals			Doctors (Any contact)			Practice nurses (Any contact)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	16.0	5.4	0.6 - 35.4	11.1	3.5	0.2 - 23.8	5.0	2.7	0.0 - 15.2
2003	375	15.3	5.1	0.0 - 32.9	10.4	3.3	0.0 - 22.4	4.8	2.6	0.0 - 14.2
2004	386	14.9	4.6	1.6 - 32.2	10.1	2.9	1.4 - 22.0	4.7	2.5	0.0 - 15.0
2005	427	14.3	4.3	4.1 - 32.4	9.5	2.8	2.9 - 24.1	4.6	2.5	0.0 - 15.0
2006	441	13.8	4.2	2.1 - 30.6	9.1	2.6	0.4 - 24.5	4.4	2.4	0.0 - 12.3
2007	448	13.7	4.2	1.2 - 29.1	8.8	2.6	0.7 - 25.0	4.5	2.4	0.0 - 12.7
2008	470	13.1	4.2	0.4 - 44.3	8.3	2.5	0.3 - 23.0	4.3	2.5	0.0 - 25.6
2009	471	12.7	4.0	2.0 - 35.5	7.9	2.2	1.0 - 18.3	4.2	2.5	0.0 - 19.9
2010	466	12.0	3.6	3.5 - 22.8	7.5	2.1	2.2 - 18.6	3.9	2.2	0.0 - 12.6
2011	445	11.6	3.4	2.6 - 21.6	7.1	2.0	2.5 - 18.9	3.9	2.1	0.0 - 11.9
2011/2012	434	11.5	3.3	2.7 - 21.2	7.1	2.0	2.7 - 18.8	3.8	2.1	0.0 - 11.8
	% Change	-28.3%			-35.6%			-23.9%		

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The shift towards fewer consultations with doctors and practice nurses is shown graphically in Figure 4.2. People with diabetes are therefore seeing professionals from both these two groups less often in 2011/12 than they were a decade earlier in 2002.

Figure 4.2 Number of times people with diabetes are seen by doctors and practice nurses, 2002 vs. 2011/12
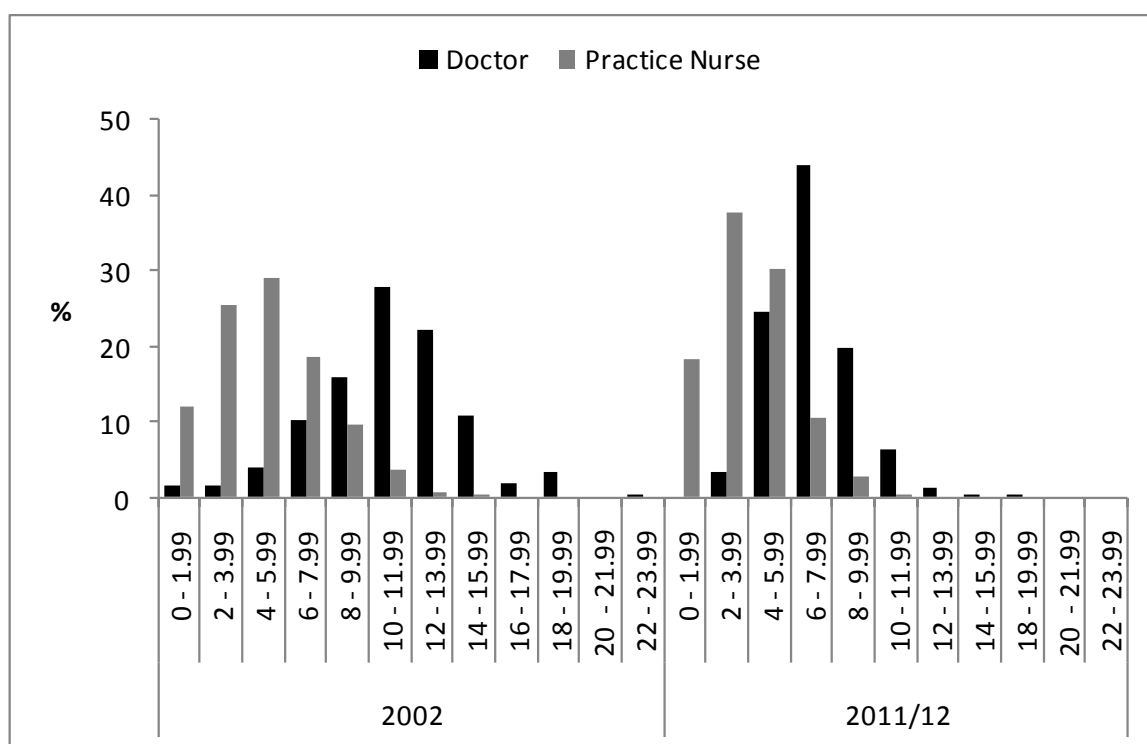
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

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The number of times people with diabetes saw a doctor in 2011/12 was negatively, and significantly, correlated (Pearson correlation -0.22, n==210, p=.001) with the list size per GP (that is the number of patients registered with a practice per WTE general practitioner). Similarly there was a negative correlation between number of people seeing a practice nurse (Pearson correlation, -0.22, n=207, p=.002) and list size per practice nurse. So as might be expected, the more people doctors and practice nurses had to care for, the less often people with diabetes received consultations.

We can conclude from these tables that there has been sharp increase in the prevalence of diabetes. The additional burden of care has been absorbed primarily by practice nurses and other healthcare professionals, rather than doctors, and people with diabetes are seeing healthcare professionals less often than in the past.

Types of activity undertaken by doctors and nurses

Since 2002 practice nurses have increasingly been recording more activities about those people with diabetes who they have contact with than doctors. Table 4.6 shows the average number of entries made by doctors and practice nurses that appear in the THIN medical records dataset. Individual Readcodes have been grouped according to the classification in Appendix A2.3. In 2002 the average number of entries per practice for both doctors and practice nurses (228 vs. 232). By 2011/2012 practice nurses were making 2.7 times as many entries as doctors.

Table 4.6 Activity categories 2002 - 2011/12: mean frequency per practice

Role Group	Readcode classification	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Doctor	Diagnosis or label	95.7	87.5	81.5	70.3	67.1	59.9	56.8	54.6	52.5	51.8	50.6
	Diabetes review	131.3	137.4	145.0	128.5	115.3	114.1	114.8	122.9	128.3	179.0	204.1
	Medication review	0.6	1.7	5.7	5.1	5.1	4.9	4.1	5.2	7.1	5.8	5.3
	Referral to another party	0.4	0.4	0.3	0.9	0.7	0.7	1.0	1.2	1.2	1.3	1.3
	Care for by secondary clinic	0.3	0.7	4.9	8.1	4.6	3.2	3.2	3.2	3.0	2.5	2.5
	Exemption codes	0.0	0.2	4.6	6.0	5.5	4.8	3.6	3.0	4.1	3.3	3.3
	Other	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.1	0.1	0.1
	All	228.4	227.9	242.0	218.9	198.3	187.8	183.8	190.2	196.3	243.8	267.1
Practice Nurse	Diagnosis or label	25.2	31.7	33.8	28.4	30.9	30.1	29.4	30.9	27.6	31.0	32.1
	Diabetes review	206.1	201.7	230.4	242.4	251.9	261.3	275.6	294.0	344.3	572.1	656.2
	Medication review	0.4	0.4	2.8	2.9	2.7	3.7	4.0	3.2	3.4	3.6	3.3
	Referral to another party	0.2	0.2	0.3	2.8	3.0	2.7	3.8	4.5	4.5	4.9	5.0
	Care for by secondary clinic	0.2	1.4	11.6	20.9	19.9	21.7	19.0	18.6	16.5	15.9	14.8
	Exemption codes	0.0	0.1	3.0	4.2	3.9	4.5	4.3	3.8	3.2	3.4	3.1
	Other	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.2	0.3
	All	232.0	235.5	281.7	301.6	312.2	324.0	336.2	355.1	399.6	631.2	714.8

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

A higher proportion of entries made by doctors relate to diagnosis or labelling than is the case for practice nurses (Table 4.7). In both groups the category "diagnosis or label" as a proportion of all entries has declined from 42% to 19% for doctors and from 11% to 4% for practice nurses. More entries made by doctors relate to annual review now than in the past rising from 58% of all doctors entries in 2002 to 76% in 2011/12. In particular there has been a dramatic increase in entries

concerning foot screening/examination from 0.1% in 2002 to 32% in 2011/12 (Appendix 4.1b). Entries for care or management plans have increased eightfold from 0.5% in 2002 to 4% in 2011/12.

Annual review has always been the dominant category for entries made by practice nurses representing consistently over 80% of all entries. The proportion fell from 89% in 2002 to 80% in 2005, but has steadily increased since then to 92% in 2011/12. Foot screening, examination or assessment entries have increased from 0% in 2002 to 43% in 2011/12 and care or management plans entries from 0.2% in 2002 to 2.2% in 2011/12 (Appendix 4.2b).

Table 4.7 Activity code classification: percentages for doctors and practice nurses

Role Group	Readcode classification	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/1
Doctor	Diagnosis or label	41.9	38.4	33.7	32.1	33.8	31.9	30.9	28.7	26.8	21.3	18.9
	Diabetes review	57.5	60.3	59.9	58.7	58.1	60.8	62.4	64.6	65.4	73.4	76.4
	Medication review	0.3	0.7	2.4	2.3	2.6	2.6	2.2	2.7	3.6	2.4	2.0
	Referral to another party	0.2	0.2	0.1	0.4	0.4	0.4	0.5	0.6	0.6	0.5	0.5
	Care for by secondary clinic	0.1	0.3	2.0	3.7	2.3	1.7	1.7	1.7	1.5	1.0	0.9
	Exemption codes	0.0	0.1	1.9	2.7	2.8	2.5	2.0	1.6	2.1	1.4	1.2
	Other	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
	All	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Practice Nurse	Diagnosis or label	10.9	13.5	12.0	9.4	9.9	9.3	8.7	8.7	6.9	4.9	4.5
	Diabetes review	88.8	85.6	81.8	80.4	80.7	80.6	82.0	82.8	86.2	90.6	91.8
	Medication review	0.2	0.2	1.0	1.0	0.9	1.2	1.2	0.9	0.9	0.6	0.5
	Referral to another party	0.1	0.1	0.1	0.9	0.9	0.8	1.1	1.3	1.1	0.8	0.7
	Care for by secondary clinic	0.1	0.6	4.1	6.9	6.4	6.7	5.6	5.2	4.1	2.5	2.1
	Exemption codes	0.0	0.0	1.1	1.4	1.2	1.4	1.3	1.1	0.8	0.5	0.4
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	All	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Further analysis was undertaken to explore activities coded under diabetic review in greater detail and to model the relationship between average number of reviews (per person) at the practice level and diabetes control. In Table 4.8 we can see the average number of diabetic reviews performed by practices over the period 2002 to 2011/12.

Table 4.8 Average number of total reviews undertaken by practices 2002 - 2011/12

Year	Practice (No.)	All reviews with a healthcare professional (No.)			Doctor reviews (No.)			Practice nurse reviews (No.)			% reviews by practice nurses[1]		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	300	256	0 - 1188	117	138	0 - 724	175	192	0 - 907	53	34	0 - 100
2003	375	298	281	0 - 1681	120	169	0 - 1616	172	196	0 - 1083	54	34	0 - 100
2004	386	330	318	1 - 1851	128	186	0 - 1839	195	220	0 - 1209	56	34	0 - 100
2005	427	332	333	0 - 2042	115	181	0 - 1792	205	229	0 - 1253	57	34	0 - 100
2006	441	335	344	0 - 2093	104	172	0 - 1710	216	247	0 - 1439	58	35	0 - 100
2007	448	342	345	0 - 1968	101	165	0 - 1387	225	258	0 - 1562	60	35	0 - 100
2008	470	352	358	0 - 2262	100	165	0 - 1316	233	265	0 - 1454	60	35	0 - 100
2009	471	372	372	0 - 2383	107	171	0 - 1350	240	269	0 - 1440	59	35	0 - 100
2010	466	402	377	0 - 2290	109	174	0 - 1750	266	272	0 - 1413	62	34	0 - 100
2011	445	496	406	1 - 2571	126	187	0 - 1828	334	302	0 - 1531	65	32	0 - 100
2011/12	434	513	417	0 - 2481	131	191	0 - 1709	342	306	0 - 1579	65	32	0 - 100

[1] only calculated for practices with one or more reviews; the maximum number of practices with no reviews in a particular year was 4.

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The average number of reviews per practice with a healthcare professional has increased by 69% from 300 in 2002 to 513 in 2011/12. This measure of activity varies considerably between practices, perhaps not surprising because practice characteristics, e.g. practice list size, people on the diabetic register, deprivation etc. are heterogeneous. The degree of variation (as measured by the standard deviation) has increased over the period of the study (from 256 to 417). The trends are however different for doctors and practice nurses.

Total number of reviews reached a peak for doctors in 2004, and then declined before rising again in 2009. For practice nurses' total number of reviews has risen every year, except for 2003, over the period from 175 in 2002 to 342 in 2011/12. The standard deviation has also increased over the period. In percentage terms practice nurses are undertaking proportionately more of the reviews than in the past increasing from 53% in 2002 to 65% in 2011/12. Variation between practices in the percentage of reviews undertaken by practice nurses, has remained quite stable (SD around 34-35%) although this has decreased since 2009.

What has been described so far however does not reveal how often, on average, people with diabetes were seen each year for a diabetic review in their practice. These figures are shown in Table 4.9.

Table 4.9 Average number of times people with diabetes were reviewed by practices 2002 - 2011/12

Year	Practice (No.)	All reviews with a healthcare professional			Doctor reviews			Practice nurse reviews		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	1.23	0.86	0.01 - 4.52	0.48	0.49	0.01 - 2.11	0.72	0.73	0.00 - 3.89
2003	375	1.18	0.84	0.01 - 4.60	0.46	0.52	0.00 - 2.92	0.70	0.68	0.00 - 3.54
2004	386	1.20	0.85	0.00 - 4.66	0.45	0.51	0.00 - 3.00	0.72	0.69	0.00 - 4.23
2005	427	1.15	0.87	0.01 - 4.38	0.38	0.47	0.00 - 2.97	0.73	0.71	0.00 - 4.27
2006	441	1.09	0.85	0.01 - 4.48	0.33	0.43	0.00 - 2.93	0.72	0.70	0.00 - 3.96
2007	448	1.05	0.81	0.00 - 3.74	0.31	0.42	0.00 - 2.43	0.70	0.69	0.00 - 3.39
2008	470	1.05	0.82	0.00 - 4.32	0.30	0.42	0.00 - 2.46	0.71	0.70	0.00 - 4.31
2009	471	1.06	0.81	0.00 - 4.88	0.30	0.41	0.00 - 2.34	0.70	0.68	0.00 - 4.88
2010	466	1.11	0.78	0.00 - 4.23	0.30	0.41	0.00 - 2.74	0.74	0.64	0.00 - 4.21
2011	445	1.31	0.77	0.00 - 5.46	0.33	0.41	0.00 - 2.62	0.90	0.67	0.00 - 4.86
2011/12	434	1.32	0.73	0.00 - 5.39	0.34	0.40	0.00 - 2.38	0.90	0.65	0.00 - 4.76

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The number of times people with diabetes were reviewed decreased from 1.23 times per year in 2002 to 1.05 in 2007 before rising to 1.32 in 2011/12. The variability between practices as measured by the standard deviation has fallen over the study period from 0.86 to 0.73. Doctors are seeing people with diabetes less often than in the past for review purposes falling from 0.48 in 2002 to 0.30 in 2008 with a small increase since then to 0.34 in 2011/12. Between 2002 and 2010 the number of time patients were reviewed by a practice nurse remained relatively stable at around 0.70 - 0.74 times per year. In 2011 this increased to 0.90. The standard deviation has been in the range 0.68 to 0.73 for most years except for 2010 and 2011/12 when it decreased to 0.64 and 0.65 respectively. Figure 4.3 shows how the distributions have shifted since 2002. The modal band in 2002 was 0.00 to 0.49 for reviews

undertaken by practice nurses, this had moved up one band by 2011/12. In 2002 63% of practices were in the lowest band for reviews by doctors. This percentage had increased to 75% by 2011/12.

Figure 4.3 Number of times patients were reviewed by doctors and practice nurses, 2002 vs. 2011/12
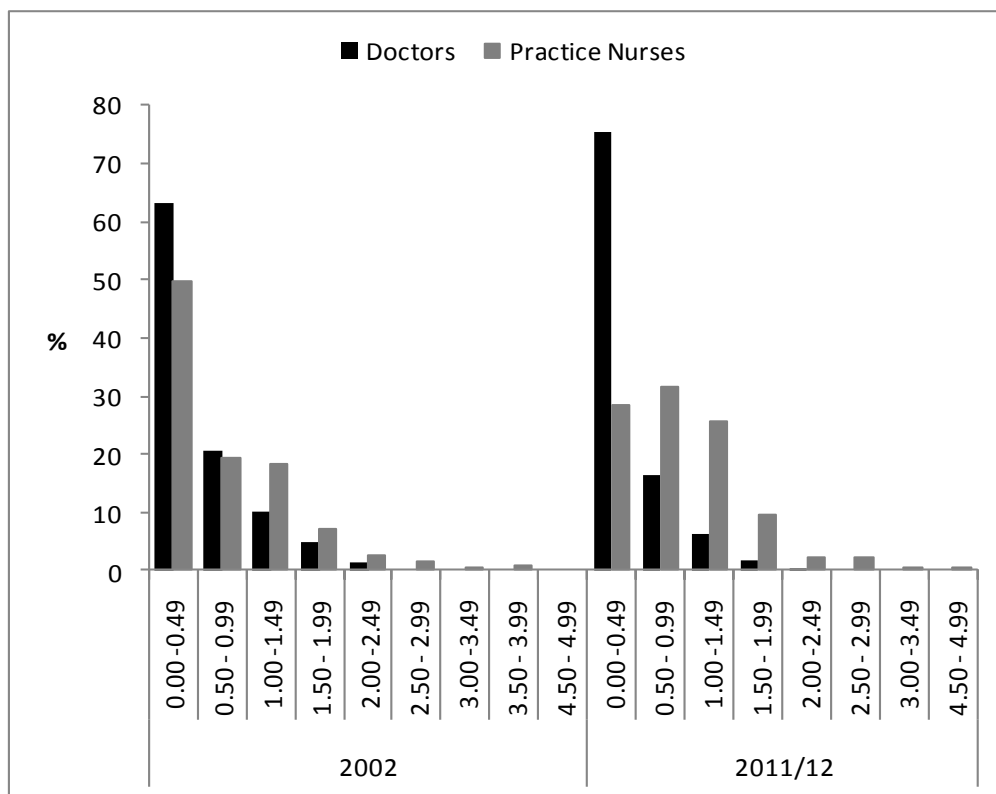
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Turning now to medication reviews Table 4.10 shows that practices are undertaking more medication reviews now than in the past.

Table 4.10 Average number of total medication reviews undertaken by practices 2002 - 2011/12

Year	Practice (No.)	All medication reviews with a healthcare professional (No.)			Doctor medication reviews (No.)			Practice nurse reviews (No.)			% Medication reviews by practice nurses[1]		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	1.0	4.0	0 - 41	0.6	3.1	0 - 41	0.3	2.3	0 - 27	23.9	39.8	0 -100
2003	375	2.2	6.4	0 - 68	1.6	4.7	0 - 61	0.4	2.3	0 - 34	14.7	30.2	0 -100
2004	386	8.3	22.0	0 - 244	5.5	15.2	0 - 218	2.7	15.1	0 - 241	23.3	36.4	0 -100
2005	427	8.1	26.2	0 - 337	4.9	16.0	0 - 266	2.9	17.9	0 - 329	26.4	39.1	0 -100
2006	441	7.7	29.4	0 - 394	5.0	18.9	0 - 250	2.6	18.4	0 - 334	25.8	38.9	0 -100
2007	448	8.6	35.7	0 - 500	4.8	19.2	0 - 298	3.7	25.4	0 - 410	27.4	39.3	0 -100
2008	470	8.1	35.8	0 - 518	4.0	15.9	0 - 242	3.9	27.8	0 - 404	28.8	40.7	0 -100
2009	471	8.3	32.6	0 - 574	5.1	20.6	0 - 276	3.1	16.8	0 - 298	31.7	41.0	0 -100
2010	466	10.5	35.5	0 - 661	7.0	26.4	0 - 464	3.4	13.6	0 - 197	31.9	41.3	0 -100
2011	445	9.4	40.8	0 - 810	5.7	26.3	0 - 503	3.6	17.0	0 - 307	38.0	42.1	0 -100
2011/12	434	8.5	40.4	0 - 804	5.2	25.2	0 - 481	3.2	17.0	0 - 323	38.9	43.1	0 -100

[1] only calculated for practices with one or more reviews; the number of practices with no medication reviews ranged from 106 to 198 over the study period.

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The average number of times people with diabetes had their medication reviewed by practices each year is shown in Table 4.11. There was a sharp increase in medication reviews from 0.004 to 0.031 between 2002 and 2004. From 2005 onwards the average decreased but has remained around the same level, since 2006. However, as indicated by the range, there are a small number of practices that are now reviewing medications on a much more regular basis, on average, one or more medication reviews every year for each person with diabetes.

Table 4.11 Average number of times people with diabetes had their medication reviewed by practices 2002 - 2011/12

Year	Practice (No.)	All reviews with a healthcare professional			Doctor reviews			Practice nurse reviews		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	0.004	0.019	0.00 - 0.236	0.003	0.018	0.00 - 0.236	0.001	0.006	0.00 - 0.074
2003	375	0.010	0.026	0.00 - 0.250	0.007	0.021	0.00 - 0.250	0.002	0.008	0.00 - 0.104
2004	386	0.031	0.068	0.00 - 0.573	0.020	0.047	0.00 - 0.527	0.010	0.045	0.00 - 0.495
2005	427	0.028	0.076	0.00 - 0.798	0.017	0.043	0.00 - 0.594	0.009	0.045	0.00 - 0.642
2006	441	0.024	0.069	0.00 - 0.833	0.016	0.051	0.00 - 0.734	0.007	0.037	0.00 - 0.606
2007	448	0.024	0.078	0.00 - 0.975	0.014	0.052	0.00 - 0.861	0.009	0.049	0.00 - 0.720
2008	470	0.021	0.070	0.00 - 0.961	0.012	0.041	0.00 - 0.661	0.009	0.050	0.00 - 0.693
2009	471	0.021	0.063	0.00 - 0.999	0.013	0.044	0.00 - 0.503	0.007	0.031	0.00 - 0.519
2010	466	0.027	0.068	0.00 - 1.109	0.018	0.052	0.00 - 0.779	0.009	0.029	0.00 - 0.331
2011	445	0.023	0.071	0.00 - 1.289	0.014	0.046	0.00 - 0.801	0.010	0.034	0.00 - 0.489
2011/12	434	0.020	0.067	0.00 - 1.235	0.012	0.042	0.00 - 0.739	0.008	0.031	0.00 - 0.496

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

In 2002 there were two practices (0.8%) where doctors were reviewing the medications of one in every ten people with diabetes. This increased to seventeen practices (3.6%) in 2010 before falling to 13 (2.9%) practices in 2011. For practice nurses no practices were reviewing the medications of at least one in ten people in 2002. By 2010 this had risen to eleven practices (2.3%) falling to ten in 2011 (2.2%). The figures for the 2011/12 were noticeably lower for both doctors and practice nurses (7 and 4 practices respectively) which may be explained by the fact that 2011/12 data covers two QOF reporting periods.

In 2002 doctors reviewed the medication of one or more people with diabetes in 41 (17%) practices. This increased to 259 (56%) of practices in 2010 falling to 214 (49%) in 2011/12. For practice nurses the corresponding figures were 16 (6%), 171 (38%) and 159 (37%) for 2002, 2010 and 2011/12 respectively.

Table 4.12 shows that practice nurses are becoming more involved in prescribing, although still at a low level. Almost 4% of consultations, where a therapy was prescribed that was described as 'acute' (e.g. not a repeat prescription), were undertaken by a practice nurse in 2011/12 compared to 0.1% in 2002. For prescriptions that were specifically for the treatment of diabetes this figure was 8.5% in 2011/12. (see Table 4.13).

Table 4.12 Consultations where an acute therapy (of any kind) was prescribed

		All healthcare professionals(No.)			Doctor(No.)			Practice nurse(No.)			Practice nurse (%)		
Year	Practices (no.)	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	246	1320	788	2 - 4552	1309	782	2 - 4552	1	20	0 - 304	0.1	1.1	0.0 - 16.4
2003	374	1186	791	19 - 5214	1176	787	19 - 5213	1	11	0 - 203	0.1	1.0	0.0 - 12.7
2004	386	1180	785	3 -5488	1169	779	3 -5488	2	18	0 - 209	0.1	1.1	0.0 - 15.0
2005	427	1190	792	7 - 5749	1177	784	7 - 5749	3	20	0 - 238	0.2	1.3	0.0 - 15.2
2006	441	1199	782	27 - 4740	1171	764	27 - 4740	17	51	0 - 414	1.2	3.1	0.0 - 20.5
2007	448	1261	819	28 - 4739	1215	785	28 - 4560	34	83	0 - 690	2.3	4.9	0.0 - 40.0
2008	470	1249	813	23 - 4889	1190	772	23 - 4889	47	100	0 - 681	3.3	6.7	0.0 - 70.7
2009	471	1235	785	32 - 4869	1174	745	24 - 4520	48	98	0 - 883	3.6	7.6	0.0 - 94.3
2010	466	1242	792	51 - 4714	1180	749	51 - 4318	53	100	0 - 829	3.6	6.2	0.0 - 38.3
2011	445	1255	794	43 - 4930	1192	751	43 - 4393	56	108	0 - 780	3.9	6.7	0.0 - 38.9
2011/12	434	1257	795	32 - 4914	1195	751	32 - 4522	56	109	0 - 841	3.9	6.6	0.0 - 40.1

Table 4.13 Consultations where an acute diabetes therapy[1] was prescribed

		All healthcare professionals(No.)			Doctor(No.)			Practice nurse(No.)			Practice nurse (%)		
Year	Practices (no.)	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	242	70	77	1 - 645	69	76	1 - 645	0	2	0 - 37	0.1	1.3	0.0 - 19.7
2003	370	57	79	1 - 782	56	79	1 - 782	0	3	0 - 49	0.2	1.8	0.0 - 25.0
2004	382	52	69	1 - 681	52	69	1 - 681	0	3	0 - 43	0.2	1.8	0.0 - 28.1
2005	424	55	77	1 - 844	54	76	1 - 844	0	4	0 - 66	0.4	3.5	0.0 - 57.9
2006	440	55	72	1 - 691	52	70	1 - 691	2	10	0 - 141	2.6	8.8	0.0 - 66.7
2007	442	60	78	1 - 814	55	74	0 - 808	4	16	0 - 222	5.1	13.2	0.0 - 84.4
2008	469	61	75	1 - 736	55	69	1 - 731	6	20	0 - 193	6.9	16.4	0.0 - 82.9
2009	471	66	77	1 - 801	58	69	1 - 800	7	24	0 - 292	7.2	16.8	0.0 - 97.3
2010	464	73	78	1 - 583	65	71	1 - 532	8	25	0 - 216	7.8	16.6	0.0 - 91.1
2011	444	74	77	1 - 612	65	68	1 - 539	9	29	0 - 358	8.5	17.8	0.0 - 90.7
2011/12	433	75	77	1 - 570	66	68	1 - 500	9	27	0 - 230	8.7	18.0	0.0 - 88.5

[1] this may include equipment such as syringes;

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Consultation duration and total contact time

The THIN data allows the duration of each consultation to be calculated. The proportion of consultations, by year, where it was not possible to calculate duration varied from 6.1 to 7.6% across the period of the study. Whilst the annual number of consultations per patient has fallen, the duration has increased, for both doctors (10.2 to 11.1 minutes) and practice nurses (11.2 to 13.0 minutes) over the period of the study and the duration is consistently lower for 'other nurses / other healthcare professionals' (since 2004 onwards) (Table 4.14).

Table 4.14 Duration (minutes) of consultations by staff group that first opened the consultation record on the Vision System

| Year | Consultation with: | No. | Mean | SD | Confidence | | Median | Percentiles | |
					L95%	U95%		25th	75th
2002	Doctor	556820	10.2	20.3	10.2	10.3	8	5	13
	Practice Nurse	284180	11.2	12.7	11.1	11.2	8	4	16
	Other Nurse	19580	7.3	12.5	7.1	7.5	4	2	9
	Other Healthcare Professional	39558	11.3	31.9	10.9	11.6	7	3	13
2003	Doctor	789606	10.4	23.6	10.3	10.4	8	5	13
	Practice Nurse	406462	11.5	12.5	11.5	11.6	9	4	16
	Other Nurse	32190	7.2	22.6	7.0	7.5	4	2	8
	Other Healthcare Professional	59487	10.7	26.7	10.5	10.9	7	3	12
2004	Doctor	828214	10.6	23.3	10.5	10.6	9	5	13
	Practice Nurse	445086	12.0	12.6	12.0	12.0	9	4	17
	Other Nurse	37067	6.9	11.2	6.8	7.1	4	2	9
	Other Healthcare Professional	75187	9.9	15.8	9.7	10.0	7	3	12
2005	Doctor	907039	10.4	18.2	10.4	10.4	9	5	13
	Practice Nurse	497874	12.2	13.1	12.2	12.2	9	4	17
	Other Nurse	41295	7.1	15.5	7.0	7.3	4	1	9
	Other Healthcare Professional	104256	9.5	12.3	9.5	9.6	7	3	12
2006	Doctor	949879	10.5	17.3	10.4	10.5	9	5	13
	Practice Nurse	529358	12.4	12.2	12.4	12.4	10	4	18
	Other Nurse	48665	7.5	13.7	7.4	7.7	4	2	9
	Other Healthcare Professional	120907	9.4	12.6	9.3	9.5	7	3	12
2007	Doctor	990854	10.5	16.6	10.5	10.5	9	5	13
	Practice Nurse	583854	12.3	12.5	12.3	12.4	9	4	17
	Other Nurse	54758	8.1	14.6	7.9	8.2	4	2	10
	Other Healthcare Professional	141465	9.1	11.5	9.0	9.1	6	3	11
2008	Doctor	1028604	10.6	15.8	10.5	10.6	9	5	14
	Practice Nurse	602084	12.6	13.0	12.5	12.6	10	4	18
	Other Nurse	56228	8.2	14.3	8.0	8.3	5	2	10
	Other Healthcare Professional	162280	9.1	14.1	9.0	9.2	7	4	11
2009	Doctor	1031518	10.7	17.5	10.6	10.7	9	5	14
	Practice Nurse	619438	12.3	13.0	12.3	12.4	9	4	17
	Other Nurse	52138	8.6	14.5	8.5	8.7	5	2	11
	Other Healthcare Professional	181704	8.9	10.4	8.8	8.9	7	4	11
2010	Doctor	1016966	10.8	18.5	10.8	10.9	9	5	14
	Practice Nurse	607544	12.7	13.2	12.7	12.7	10	4	18
	Other Nurse	47856	8.8	19.1	8.6	9.0	5	2	11
	Other Healthcare Professional	176392	9.0	11.7	8.9	9.0	7	4	11
2011	Doctor	979567	11.1	19.7	11.0	11.1	9	5	14
	Practice Nurse	608791	12.8	14.0	12.8	12.9	10	4	18
	Other Nurse	48058	8.9	14.5	8.8	9.0	5	2	11
	Other Healthcare Professional	174945	9.0	19.9	8.9	9.1	7	4	11
2011/12	Doctor	968790	11.1	19.2	11.1	11.1	9	5	14
	Practice Nurse	596775	13.0	13.3	12.9	13.0	10	4	18
	Other Nurse	45846	9.1	14.6	8.9	9.2	5	2	11
	Other Healthcare Professional	170361	9.0	13.9	8.9	9.0	7	4	11

Using the frequency of consultations and their duration, we can calculate the total time each patient with diabetes spent with practice staff (Table 4.15). In 2002, people with diabetes spent a total of 98 minutes in consultation with a doctor, which reduced to 67 minutes in 2011/12, a fall of 32%. The total time spent in consultations with a practice nurse has decreased by 13%, from an average of 54 minutes in 2002 to 47 minutes in 2011/12.

Table 4.15 Total annual amount of consultation time (minutes) per person with diabetes by year and staff role

Year	No.	All Healthcare Professionals			Doctors			Practice Nurses			Other Nurses			Other Healthcare Professionals		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	160.1	58.3	2.1 - 315.0	97.7	35.8	0.8 - 261.4	54.2	31.0	0.0 - 150.4	2.0	5.3	0.0 - 44.0	6.3	11.6	0.0 - 70.7
2003	375	154.7	59.1	0.3 - 493.0	92.2	38.7	0.0 - 412.1	53.9	31.0	0.0 - 152.2	2.4	6.5	0.0 - 49.9	6.1	12.1	0.0 - 94.8
2004	386	152.9	56.3	1.9 - 465.9	89.4	38.0	0.6 - 374.7	54.8	31.3	0.0 - 188.4	2.4	5.8	0.0 - 41.5	6.3	9.9	0.0 - 58.0
2005	427	145.8	51.1	3.9 - 301.6	83.3	32.5	0.0 - 269.8	53.1	31.4	0.0 - 180.4	2.2	6.1	0.0 - 55.3	7.2	10.0	0.0 -58.4
2006	441	142.0	48.5	18.8 - 297.5	79.6	29.6	0.2 - 229.5	52.1	30.4	0.0 - 174.6	2.6	8.0	0.0 - 104.4	7.7	10.5	0.0 - 56.3
2007	448	140.6	47.2	11.9 - 274.6	77.4	27.9	0.2 - 218.0	52.3	30.2	0.0 - 154.7	2.7	7.8	0.0 - 67.4	8.3	11.0	0.0 - 55.4
2008	470	136.8	50.7	3.1 - 586.7	74.1	27.7	0.0 - 268.6	51.4	32.3	0.0 - 320.1	2.6	6.7	0.0 - 49.7	8.7	11.8	0.0 - 84.9
2009	471	131.5	47.1	10.2 - 424.6	71.1	26.8	0.0 - 229.6	49.1	30.1	0.0 - 224.3	2.4	6.6	0.0 - 52.0	8.9	11.5	0.0 - 74.3
2010	466	126.8	44.4	1.3 - 407.1	69.1	25.7	1.1 - 187.3	47.1	27.6	0.0 - 192.1	2.1	6.2	0.0 - 55.2	8.5	10.5	0.0 - 53.1
2011	445	124.5	40.8	28.5 - 295.3	66.6	23.3	0.4 - 170.7	47.6	26.1	0.0 - 135.1	2.1	5.8	0.0 - 51.9	8.2	10.5	0.0 - 84.9
2011/12	434	124.1	39.6	12.1 - 276.7	66.6	23.2	0.0 - 174.4	47.3	25.8	0.0 - 142.1	2.1	6.1	0.0 - 54.9	8.1	10.1	0.0 - 53.9

The net effect of these changes is that the proportion of consultation time with a doctor has fallen from 61% (of a total of 160 minutes with all health care professionals) in 2002, to 54% (of 124 minutes) in 2012. Whilst proportionally, the time with a practice nurse has increased from 33% to 37%, and with other staff (other nurses and other health care professionals) from 6% to 9%.

Combining the times spent in consultation with all health care professionals, we can generate a total time per year per patient, and explore how contact time varies between practices, according to whether they have a low, medium or high level of nurse input (Table 4.16).

Table 4.16 Total annual amount of consultation time (minutes) per person with diabetes by staff role and nurse contact group, 2011/12

	Nurse contact (reference year 2002)	No.	Mean	SD	Minimum	Maximum
All Healthcare Professionals	<26.0%	135	104.7	41.6	12.1	241.6
	26.0-35.3%	117	134.2	32.5	45.0	209.6
	35.4% and over	182	131.9	37.3	44.9	276.7
Doctors	<26.0%	135	69.9	26.6	10.9	174.4
	26.0-35.3%	117	71.1	18.2	20.8	146.6
	35.4% and over	182	61.4	22.4	0.0	142.5
Practice Nurses	<26.0%	135	23.0	17.6	0.0	81.8
	26.0-35.3%	117	50.3	17.4	16.5	94.0
	35.4% and over	182	63.5	21.5	14.6	142.1
Other Nurses	<26.0%	135	3.0	8.7	0.0	54.9
	26.0-35.3%	117	2.2	6.0	0.0	44.1
	35.4% and over	182	1.3	3.0	0.0	15.1
Other Healthcare Professionals	<26.0%	135	8.9	11.3	0.0	53.9
	26.0-35.3%	117	10.6	10.5	0.0	39.7
	35.4% and over	182	5.8	8.1	0.0	34.0

The level of input per year from GPs varies only slightly; people with diabetes see a GP about 7 times a year, for an average of 11 minutes, whether they are in a practice with more or less nurse input (as classified in the three bands). On average they spend 67 minutes a year in consultation with each person with diabetes. In practices where nurses see a larger proportion of diabetic patients, doctors spend nine minutes less per patient a year (61 minutes in the high nurse contact group as opposed 70 in the low nurse contact group), but patients have 27 minutes per patient more contact time in total (132 minutes as opposed to 105 in the low nurse contact group). The level of input from nurses varies much more between practices; from seeing patients a total of 23 minutes a year (in the practices with least nursing contact) through to 50 minutes for the average, and 64 minutes in the practices with most nurse contact.

These findings imply that while there is some substitution of work between nurses and doctors in the 'high nurse contact' practices there may also be enhanced care being delivered although we cannot discount lower productivity as a partial explanation.

4.4 Practice population achievement of glycaemic control

We used Haemoglobin A1c (HbA1c), the study measure for glucose intolerance, to gauge the extent to which a person's diabetes is under control. The thresholds for QOF HbA1c indicators have ranged from 7% to 10% over the period of the study. At the start of QOF in 2004 there were two indicators for HbA1c level: 7.4% or less and 10% or less. The 10% threshold was last used as a QOF indicator in 2008/9. An HbA1c value of 6.5% is often used now as a potential indicator of the presence of diabetes. Findings are presented for four thresholds ≤ 7%, ≤ 8%, ≤ 9% and ≤ 10%.

We focus our attention on the upper (≤ 7%) and lower (≤ 10%) end of the QOF indicator range. The proportion of people meeting these thresholds increased noticeably during the early period in the last decade (see Table 4.17 and Figure 4.4). This has tapered off subsequently. The higher threshold (≤ 10%) peaked in 2006 whereas there were still small gains in the lower threshold (≤ 7%) until 2009. However there has been a small decrease in the proportions meeting the four thresholds since 2009/10.

Table 4.17 Population achievement for HbA1c by threshold

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
≤ 7%	30.7	35.0	37.6	38.9	42.2	42.4	43.2	43.5	43.5	42.7	41.7
≤ 8%	51.9	57.6	61.9	63.9	65.9	65.9	66.4	65.8	65.6	64.6	63.6
≤ 9%	64.8	71.0	75.4	77.1	77.6	77.4	77.8	77.3	77.3	76.4	75.6
≤ 10%	71.9	78.3	82.7	83.8	83.8	83.4	83.7	83.1	83.3	82.6	81.9

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Figure 4.4 Population achievement for HbA1c by threshold
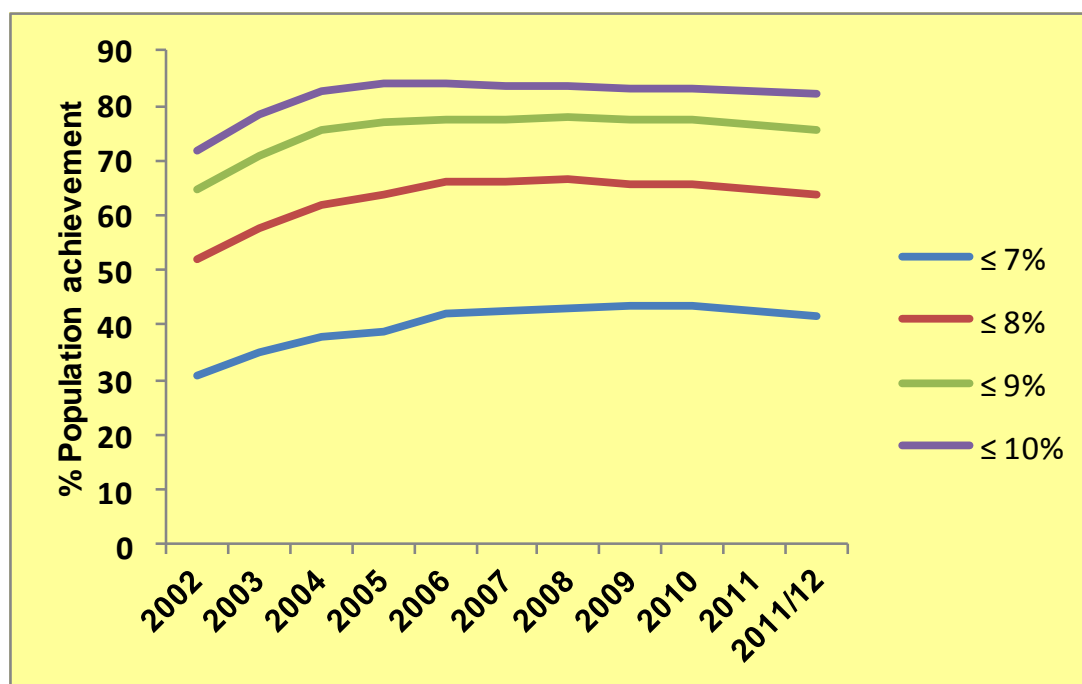
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The amount of variation between practices in meeting the four HbA1c thresholds (≤ 7%, ≤ 8%, ≤ 9%, ≤ 10%) is shown in Table 4.18, and is further emphasised in Figures 4.5 and 4.6.

The amount of variation between practices has decreased across all thresholds over time and more so for the highest threshold (≤10%).

Table 4.18 Percentage population achievement by HbA1c threshold - variation across practices 2002-2011/12

Year	Practice (no.)	≤ 7%			≤ 8%			≤ 9%			≤ 10%		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	30.1	10.0	0.0 - 54.6	51.1	13.8	0.0 - 75.2	63.9	15.8	0.0 - 85.7	71.1	16.9	0.0 - 92.6
2003	375	35.0	9.7	0.0 - 63.3	57.3	10.6	0.0 - 84.1	70.7	10.3	0.0 - 94.0	78.2	10.3	0.0 - 100.0
2004	386	37.4	9.4	0.0 - 67.5	61.6	9.1	0.0 - 82.0	75.2	8.2	0.0 - 92.9	82.6	7.5	0.0 - 97.3
2005	427	38.8	9.1	0.0 - 64.6	63.9	8.4	0.0 - 82.9	77.0	7.6	0.0 - 90.6	83.7	6.8	0.0 - 95.6
2006	441	42.3	9.2	0.0 - 68.6	65.9	8.3	0.0 - 83.2	77.6	7.4	0.0 - 93.3	83.8	6.9	0.0 - 96.0
2007	448	42.7	9.4	0.0 - 68.9	66.0	8.2	0.0 - 90.0	77.5	7.3	0.0 - 96.7	83.5	6.8	0.0 - 97.8
2008	470	43.3	9.2	0.0 - 71.6	66.3	8.2	0.0 - 83.3	77.8	7.0	0.0 - 92.5	83.8	6.6	0.0 - 100.0
2009	471	43.6	9.3	0.0 - 74.9	65.8	7.9	0.0 - 85.9	77.2	7.2	0.0 - 91.7	83.2	6.8	0.0 - 94.6
2010	466	43.8	8.6	0.0 - 72.2	65.6	7.5	0.0 - 83.3	77.4	6.8	0.0 - 90.0	83.4	6.4	0.0 - 94.7
2011	445	42.9	8.4	0.7 - 67.7	64.6	7.6	0.7 - 82.3	76.4	6.8	0.7 - 90.5	82.7	6.5	0.7 - 94.0
2011/12	434	41.9	8.3	0.3 - 66.2	63.5	7.6	0.3 - 83.4	75.5	7.1	0.3 - 91.0	81.9	6.7	0.3 - 94.5

Note: all people in one practice failed to meet any threshold during the period 2002-2010; 2011/12 covers the period May 17th 2011 to May 16th 2012

Figure 4.5 Percentage of practice population achieving HbA1c ≤ 7% (2002 vs. 2011/12)
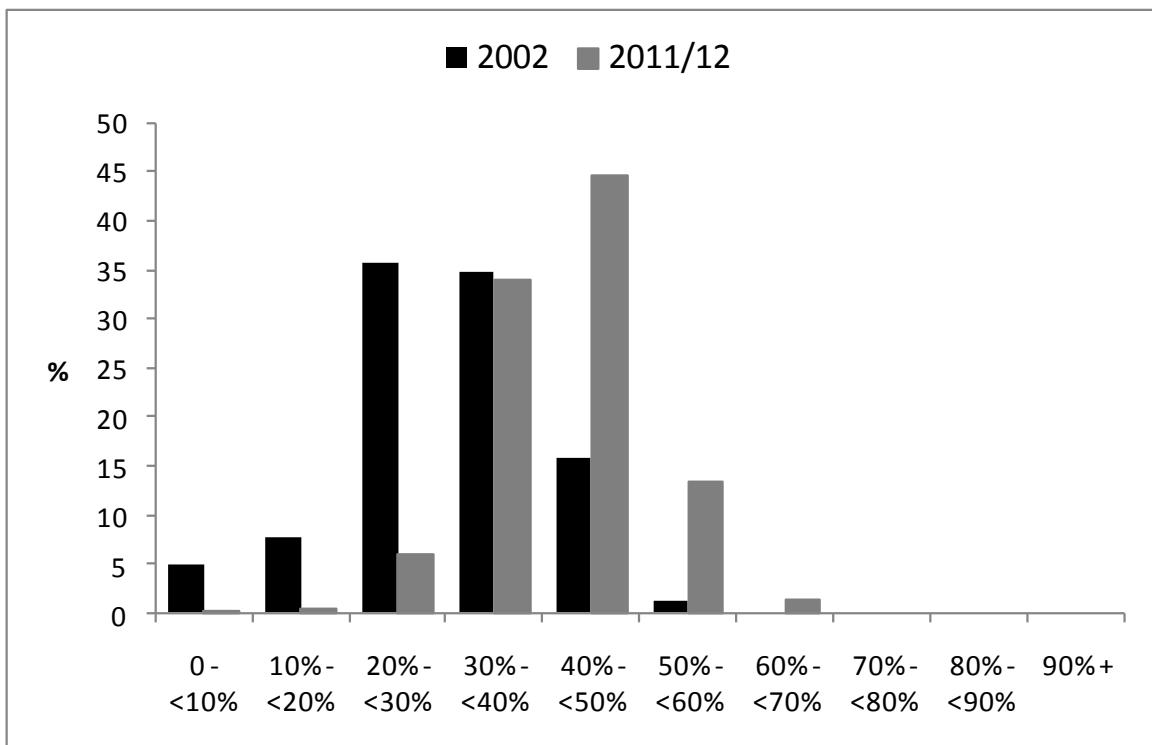
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Figure 4.6 Percentage of practice population achieving HbA1c ≤ 10% (2002 vs. 2011/12)
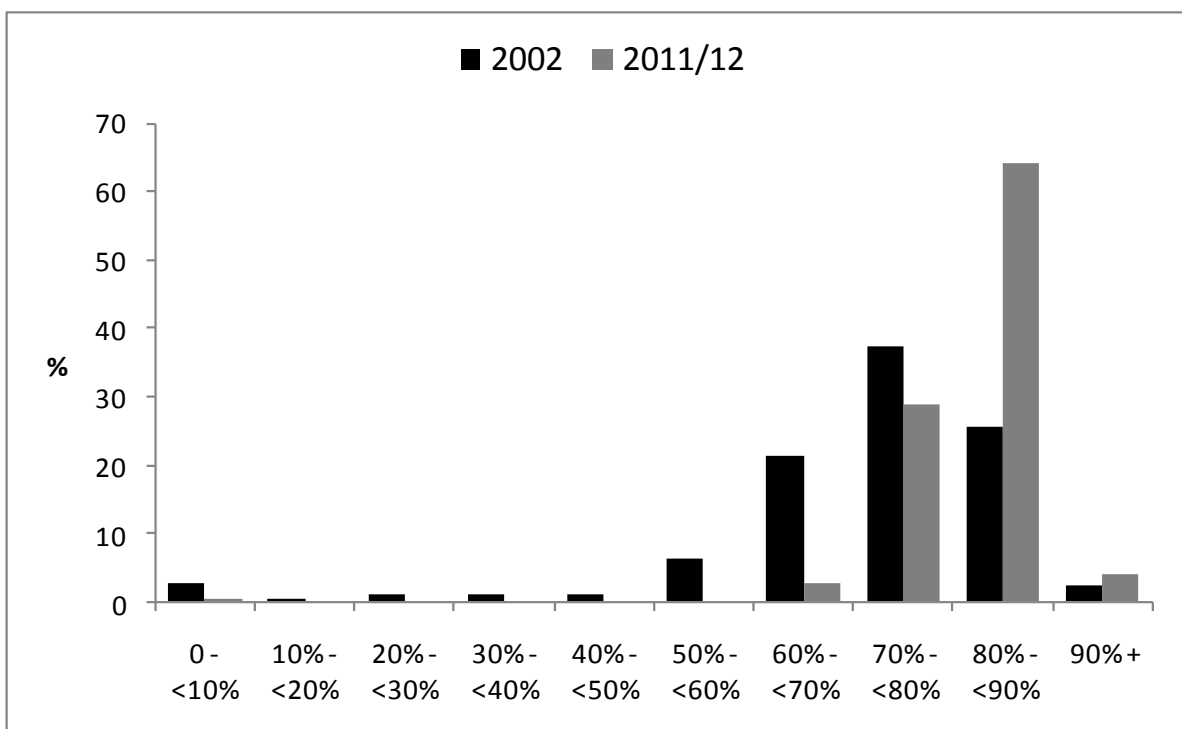
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

- The prevalence of diabetes has increased by 66% over the last decade and has increased steadily year on year (reflecting other national statistics). People with diabetes account for an average of 4.9% of average practice list now, compared with 3.0% in 2002.

- Because of a change in the threshold used to define diabetes, there is an increased proportion of the 'diabetic' patient population that have less severe diabetes now, and are being helped to manage their diabetes earlier.

- Glycaemic control (that is the percentage of patients with diabetes that have an Hb1Ac level below a certain threshold) improved considerably between 2002 and 2004. Since this time it has plateaued; roughly the same proportions of patients achieve control each year as the year before.

- There has been a 13% increase in the annual number of consultations undertaken in practices with people with diabetes.

- Practice nurses are doing more consultations each year, but as the increase in prevalence outstrips the increase in activity, each person is having fewer consultations now than in the past, although the average length of consultation with practice nurses is slightly longer (from 11 minutes in 2002 to 13 minutes in 2011/12).

- Practice nurses are increasingly undertaking more diabetes reviews and they are becoming more involved in prescribing.

- People with diabetes in practices with larger caseloads (more patients per GP or RN) receive fewer consultations.

- Nurses (and other healthcare professionals) have increased their activity much more than doctors during this period – a 20% increase in annual consultations by practice nurses compared with just 1% increase amongst GPs.

- In practices where nurses see a larger proportion of people with diabetes, doctors spend nine minutes less a year (61 minutes vs. 70), but patients have 27 minute more contact time in total (132 minutes vs. 105 in the low nurse contact group).

- Glycaemic control is now much more uniformly achieved in the population of people with diabetes across practices, than it was the case ten years ago.

5. Relationship between workforce and diabetes control

In this section we consider specifically how population achievement of glycaemic control varies by level of nurse contact (low, medium, high) and whether this variation changes after risk adjustment both at the patient and practice level. The analyses focus on the upper(≤ 10%) and lower thresholds(≤7%) ob HbA1c.

The contact with health professionals was captured through two variables: the average number of times people with diabetes were seen by a healthcare professional (of any sort) and the percentage of consultations involving practice nurses. For a more interpretable analysis we categorised the latter into tertiles (low – less than 26%, medium – 26-35%, and high – over 35%) using 2002 as our reference year (the start of the study period).

5.1 Health professional contact

The proportion of people attaining the tight (HbA1c ≤ 7%) and loose (HbA1c ≤ 10%) thresholds was consistently higher in practices with a high proportion of nurse contact for every year from 2002 to 2007. However, in absolute terms the differences were generally small. The difference between the high and low practice nurse contact tertiles for the higher threshold (HbA1c ≤ 10%) was more apparent with maximum advantage of 3.5% (2003) and consistently in excess of 1%, before 2007. (Table 5.1 and Figure 5.1).

Table 5.1 Population achievement for HbA1c by threshold and practice nurse contact (any involvement)

HbA1c threshold	Practice nurse contact	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
	Low	30.8	33.9	37.5	37.7	42.2	41.8	43.6	42.9	43.0	42.5	41.4
≤ 7%	Medium	30.3	34.6	37.3	38.6	41.2	42.6	43.1	43.9	43.7	42.0	41.6
	High	31.0	36.6	38.1	40.3	43.1	42.8	42.8	43.6	43.8	43.4	42.0
	Low	71.6	76.9	81.7	83.2	83.2	83.1	84.0	82.8	82.8	82.0	81.6
≤ 10%	Medium	70.4	77.5	82.8	83.6	83.2	83.5	84.0	83.7	83.3	82.8	81.6
	High	74.1	80.4	83.5	84.5	84.8	83.7	83.3	83.0	83.6	82.9	82.4

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

Figure 5.1 Population achievement for HbA1c by threshold and level of practice nurse contact (any involvement)
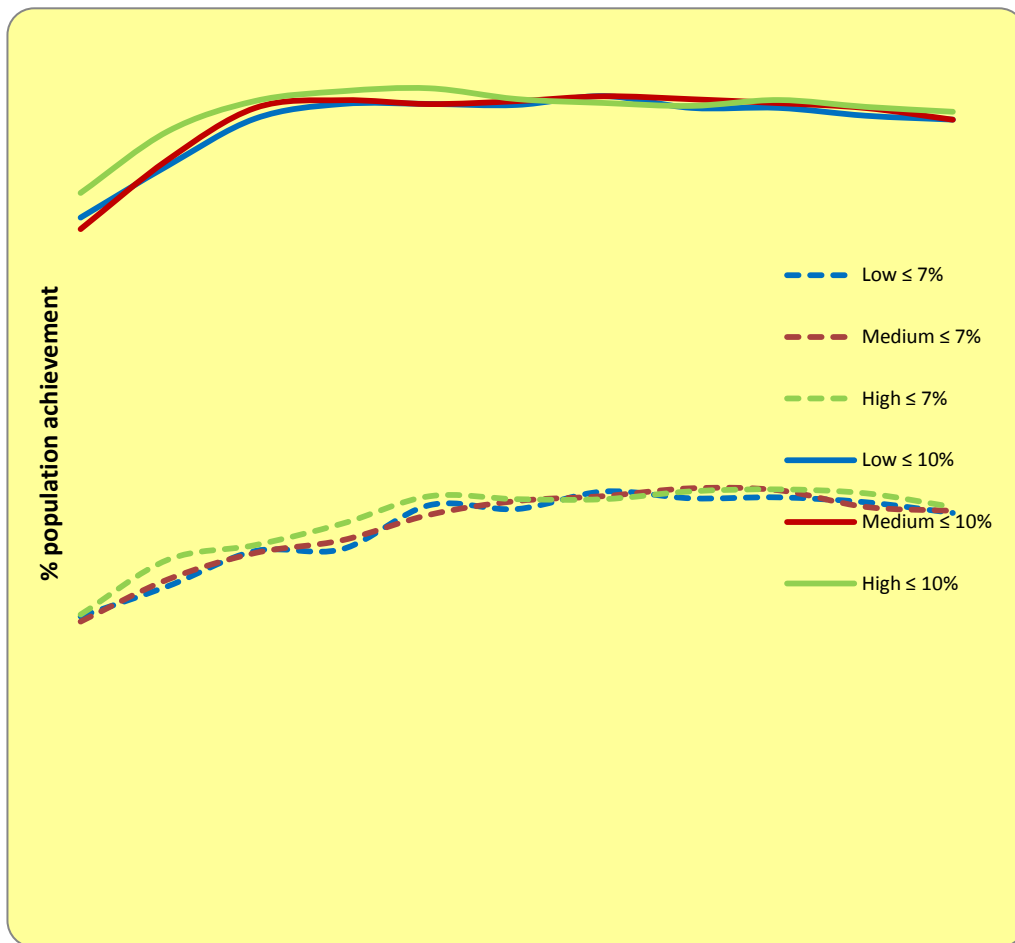
Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The previous chapter indicated that there has been an overall reduction in the number of consultations per person, but a larger proportion of them are undertaken by practice nurses, and that this has been accompanied by better glycaemic control. The changes were greatest between 2002 and 2005, since which time levels of both activity and glycaemic control has plateaued. Multi-level modelling allowed the relationships between staffing activity and glycaemic control to be tested further, adjusting for the individual characteristics of the person and other socio-demographic factors. Table 5.2 shows that the amount of practice level variance as a proportion of the sum of both the person and practice level variance (known as the variance partition coefficient (VPC) or intra-class correlation coefficient), obtained by fitting the intercept only multi-level model, has fallen from 14% in 2002 to 9% in 2011/12 for the HbA1c ≤7% threshold and from 21% to 11% for the HbA1c ≤10% threshold. Therefore most of the variation observed in these two variables is attributable to people with diabetes, although there is still variation between practices that requires explanation.

Table 5.2 Variation at the practice level

Year	≤ 7% Residual variance	VPC	≤ 10% Residual variance	VPC
2002	0.530	14%	0.897	21%
2003	0.403	11%	0.552	14%
2004	0.384	10%	0.450	12%
2005	0.362	10%	0.405	11%
2006	0.362	10%	0.422	11%
2007	0.377	10%	0.419	11%
2008	0.355	10%	0.410	11%
2009	0.368	10%	0.419	11%
2010	0.338	9%	0.388	11%
2011	0.337	9%	0.392	11%
2011/12	0.333	9%	0.393	11%

Note: 2011/12 covers the period May 17th 2011 to May 16th 2012

The results for the ≤7% level and ≤10% HbA1c thresholds, from the multi-level model, are presented in Tables 5.3 and 5.4. After risk adjustment at the person and practice level, practices in which people had a higher proportion of nurse contact had significantly more patients meeting the lower threshold of ≤7% in 2003. The difference was close to significance in 2005 (p=.052, full results are found in the Appendices A3.8 and A3.9).

Table 5.3 Multilevel model, HbA1c ≤ 7% - Findings for workforce variables (including nurse contact based on any involvement)

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	-0.110	0.045	0.015	-0.047	0.024	0.047	-0.032	0.022	0.156	-0.035	0.020	0.080	-0.021	0.019	0.258
Nurse Contact - any involvement															
Low	0.042	0.091	0.646	-0.154	0.054	0.004	-0.047	0.051	0.360	-0.104	0.047	0.028	-0.032	0.047	0.493
Medium	-0.067	0.088	0.445	-0.113	0.056	0.045	-0.037	0.053	0.484	-0.090	0.047	0.054	-0.073	0.046	0.113
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.526	0.030		0.394	0.018		0.382	0.017		0.358	0.015		0.362	0.015	
Global Test (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - any involvement (2df)	1.547		0.461	8.853		0.012	0.941		0.625	5.929		0.052	2.516		0.284

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	0.005	0.021	0.827	0.017	0.015	0.263	0.022	0.015	0.147	0.030	0.017	0.066	0.043	0.018	0.020	0.027	0.017	0.110
Nurse Contact - any involvement																		
Low	-0.063	0.048	0.195	0.008	0.044	0.850	-0.064	0.046	0.158	-0.040	0.042	0.339	-0.051	0.042	0.227	-0.018	0.043	0.672
Medium	-0.018	0.047	0.701	0.010	0.045	0.831	0.012	0.046	0.800	-0.016	0.043	0.710	-0.048	0.043	0.266	-0.035	0.044	0.427
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.364	0.014		0.376	0.014		0.347	0.014		0.341	0.014		0.339	0.014	
Global Test (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - any involvement (2df)	1.717		0.424	0.057		0.972	2.878		0.237	0.917		0.632	1.936		0.380	0.645		0.724

Table 5.4 Multilevel model, HbA1c ≤ 10% - Findings for workforce variables (including nurse contact based on any involvement)

	2002 β	SE(β)	prob<t	2003 β	SE(β)	prob<t	2004 β	SE(β)	prob<t	2005 β	SE(β)	prob<t	2006 β	SE(β)	prob<t
Consultations per healthcare professional	-0.192	0.071	0.007	-0.107	0.030	<.001	-0.042	0.025	0.090	-0.024	0.022	0.273	-0.015	0.022	0.490
Nurse Contact - any involvement															
Low	-0.029	0.145	0.844	-0.189	0.070	0.007	-0.094	0.058	0.108	-0.070	0.052	0.176	-0.089	0.054	0.100
Medium	-0.191	0.140	0.174	-0.174	0.073	0.018	-0.035	0.060	0.563	-0.052	0.052	0.311	-0.081	0.053	0.130
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.865	0.044		0.518	0.023		0.421	0.019		0.379	0.017		0.405	0.017	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - any involvement (2df)	2.173		0.337	9.046		0.011	2.621		0.270	2.027		0.363	3.455		0.178

	2007 β	SE(β)	prob<t	2008 β	SE(β)	prob<t	2009 β	SE(β)	prob<t	2010 β	SE(β)	prob<t	2011 β	SE(β)	prob<t	2011/12 β	SE(β)	prob<t
Consultations per healthcare professional	-0.011	0.023	0.643	-0.001	0.017	0.938	-0.012	0.017	0.489	-0.008	0.018	0.657	0.005	0.021	0.813	-0.022	0.020	0.276
Nurse Contact - any involvement																		
Low	-0.011	0.053	0.834	0.043	0.050	0.382	0.000	0.050	0.993	-0.022	0.047	0.640	-0.052	0.048	0.284	-0.022	0.049	0.661
Medium	0.023	0.052	0.664	0.073	0.050	0.142	0.069	0.050	0.169	0.014	0.047	0.761	-0.008	0.049	0.873	-0.060	0.050	0.232
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.391	0.016		0.400	0.016		0.371	0.016		0.378	0.016		0.382	0.016	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - any involvement (2df)	0.383		0.826	2.225		0.329	2.328		0.312	0.537		0.765	1.235		0.539	1.428		0.490

While there was some modest evidence of improved glycaemic control being associated with a high proportion of nurse contacts, the relationship between average the number of times people with diabetes were seen by any healthcare professional at the practice level (consultations per healthcare professional in Table 5.3) and meeting the threshold, was negative and statistically significant in 2002. However, towards the end of the period the relationship had become positive and statistically significant, or close to significance (2010, 2011).

The residual variance that remained after fitting the model declined noticeably between 2002 and 2003 from 0.526 to 0.394 but has not changed fundamentally since then, although there was a small step-down from 0.376 in 2009 to 0.347 in 2010.

The findings at the higher threshold were similar; there was a statistically significant and positive association between the proportion of people meeting the threshold and a higher proportion of practice nurse contact in 2003 only. The average number of times people with diabetes were seen by a healthcare professional at the practice level was negatively associated with meeting the threshold for most years. For the first two years of the period (2002, 2003) this association was statistically significant. The residual variance decreased between 2002 and 2005 from 0.865 to 0.379, increasing to 0.405 in 2006 and has remained close to that level (0.371 to 0.400) since then. The inclusion of a person's reading from the previous year (e.g. meeting the threshold or not) in the model did not change the main findings to any great degree nor did the using nurse contact based on sole involvement or Vision allocation (Appendices 3.4-3.7, 3.20-3.23).

Restricting the analysis to practices who met the inclusion criteria for all years of the study period (n=183) also did not change the effect of nurse contact noticeably (Appendices 3.24-3.27). For the higher threshold (≤ 10%), during the second half of the period (2008, 2009, 2011), practices with a medium level of practice nurse contact were more likely than those with a high level of contact to meet the threshold. The effect of consultations per healthcare professional was positive and stronger than for the unrestricted analysis for the lower threshold (≤ 7%) from 2007 onwards (except for 2010).

5.2 Diabetic review

The data on diabetic review have been modelled utilising most of the independent variables used previously except that *consultations per healthcare professional* has been replaced by *average number of reviews with a healthcare professional*, and *practice nurse contact* by *percentage of reviews with a practice nurse* where practice percentages have been categorised into low (less than 34%), medium (35-77%), and high (over 77%).

During the early part of the period (2002-2003) practices that reviewed and monitored people's diabetes more often performed better in terms of meeting the HbA1c ≤ 7% threshold (Table 5.5). After 2003, this effect was no longer as strong although it was statistically significant one final time in 2005. There was no significant association between the proportion of these reviews undertaken by nurses and the proportion of patients achieving the threshold, except in 2006 when the likelihood of meeting

the threshold was higher amongst those practices that made greater use of practice nurses in reviewing people's diabetes.

Similarly, practices that reviewed and monitored people's diabetes more often performed better in terms of meeting the HbA1c ≤ 10% threshold (Table 5.6) in the early period (2002-2003) and although this effect was less strong after 2003, it has still remained statistically significant. Whether these reviews were undertaken more often by doctors or practice nurses was not significantly associated with patients achieving the threshold.

Table 5.5 Multilevel model, HbA1c ≤7% - effect of diabetic review

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Reviews with a healthcare professional	0.131	0.034	<.001	0.082	0.023	<.001	0.038	0.021	0.064	0.040	0.018	0.029	0.006	0.019	0.760
% Practice nurse reviews															
Low	0.139	0.087	0.113	-0.026	0.055	0.640	-0.046	0.054	0.393	-0.077	0.050	0.118	-0.133	0.049	0.006
Medium	0.029	0.086	0.732	0.062	0.055	0.262	0.031	0.052	0.551	0.001	0.046	0.989	-0.090	0.045	0.044
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.501	0.029		0.389	0.018		0.379	0.017		0.356	0.015		0.360	0.015	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
% Practice nurse reviews(2df)	2.729		0.256	2.481		0.289	1.982		0.371	3.028		0.220	8.593		0.014

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Reviews with a healthcare professional	-0.021	0.020	0.285	-0.002	0.019	0.904	0.001	0.019	0.966	-0.009	0.019	0.617	-0.004	0.019	0.823	-0.004	0.020	0.842
% Practice nurse reviews																		
Low	-0.083	0.050	0.097	-0.042	0.047	0.362	-0.054	0.047	0.242	-0.005	0.044	0.901	-0.033	0.047	0.477	-0.041	0.046	0.375
Medium	-0.001	0.047	0.979	-0.032	0.044	0.462	-0.030	0.045	0.513	-0.056	0.042	0.180	-0.063	0.041	0.121	-0.072	0.040	0.073
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.365	0.014		0.378	0.015		0.347	0.014		0.342	0.014		0.336	0.014	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
% Practice nurse reviews(2df)	3.174		0.205	1.014		0.602	1.413		0.493	1.917		0.383	2.459		0.292	3.307		0.191

Table 5.6 Multilevel model, HbA1c ≤10% - effect of diabetic review

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Reviews with a healthcare professional	0.268	0.053	<.001	0.183	0.029	<.001	0.081	0.024	0.001	0.071	0.020	<.001	0.073	0.022	0.001
% Practice nurse reviews															
Low	0.110	0.136	0.419	0.029	0.070	0.677	0.006	0.061	0.922	0.058	0.054	0.288	0.008	0.056	0.890
Medium	-0.040	0.134	0.765	0.075	0.071	0.285	-0.021	0.058	0.724	0.006	0.050	0.911	0.008	0.051	0.877
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.809	0.043		0.497	0.022		0.416	0.019		0.372	0.017		0.398	0.017	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
% Practice nurse reviews(2df)	1.255		0.534	1.149		0.563	0.213		0.899	1.285		0.526	0.031		0.984

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Reviews with a healthcare professional	0.064	0.022	0.004	0.074	0.021	<.001	0.092	0.021	<.001	0.056	0.021	0.007	0.082	0.021	<.001	0.091	0.023	<.001
% Practice nurse reviews																		
Low	0.072	0.054	0.182	0.058	0.051	0.254	0.087	0.050	0.081	0.058	0.049	0.230	-0.043	0.052	0.402	-0.007	0.053	0.898
Medium	0.048	0.051	0.346	0.072	0.048	0.136	0.056	0.049	0.250	0.022	0.046	0.638	-0.047	0.045	0.300	-0.026	0.046	0.574
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.401	0.017		0.386	0.016		0.391	0.016		0.368	0.016		0.369	0.015		0.375	0.016	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
% Practice nurse reviews(2df)	2.003		0.367	2.611		0.271	3.305		0.192	1.449		0.485	1.353		0.508	0.321		0.852

Chapter 5 Summary

- Whilst there has been an overall reduction in the number of consultations per person, a larger proportion of them are undertaken by practice nurses, and this has been accompanied by better glycaemic control.

- After risk adjustment at the person and practice level, multi-level modelling showed that practices in which people with diabetes had a higher proportion of nurse contact had significantly more people meeting the lower threshold of ≤7% in 2003. The difference was close to significance in 2005.

- Overall however, after risk adjustment at the individual level, there is much less variation between practices in recent years (post QOF) than there was in 2003.

- There was some practice level variation in the data but this diminished over time and was very low in the 2011/12 dataset that linked THIN data with the practice survey. Multilevel modelling indicates that most of the variation in likelihood of diabetes control is explained by person level characteristics rather than practice level characteristics.

- There is evidence that those practices that place more effort on diabetes review have better performance in terms of control of diabetes. This activity is being increasingly undertaken by practice nurses.

- In earlier years, just before, and soon after, QOF was introduced, there was some evidence that those practices where people with diabetes were most likely to be seen by a practice nurse had a higher proportion of people with good control, although the association was not strong and not consistently significant.

6. Service configurations and economic implications

The purpose of this part of the analysis was to understand the effect of workforce variables and service configuration on the rate of diabetes control within primary care together with the economic or financial implications of these. To this end, additional data were collected by the NNRU from 249 GP practices through a practice survey (described in Chapter 3). The survey collected data on the size and mix of the workforce, and approach to the management of care for people with diabetes. For example, 73% of responding practices indicated that nurses (including those specially trained in diabetes care) were involved in the management of diabetes, and 58% of practices reported that nurses were primarily responsible for this care. A full set of descriptive statistics of this survey were presented in Chapter 3. In this section we report on the relationships between the workforce and service configuration variables and the management of diabetes, building upon the multilevel regression models used in Chapter 5.

6.1 The data

The NNRU practice survey dataset was successfully matched to THIN data for 222 GP practices surveyed, containing 74,143 patients. After removing practices with missing data for the variables of interest[3] we were left with 166 practices and 55,037 diabetes patients. Included and excluded practices were compared and there was very little difference, none which was statistically significant, between the two sets of practices. As the NNRU practice survey was undertaken in May 2012, THIN data for the year 17th May 2011 to 16th May 2012, referred to subsequently as the 2011/12 data, were matched to the survey. Analysis of the 2011/12 THIN data are reported in chapters 4 and 5 alongside calendar years (2002 – 2011). As this analysis is based upon a subset of the data used in the rest of the report it is worthwhile to compare the descriptive statistics between this and the full sample. As Table 6.1 indicates, the data in the full 2011/12 dataset and the subset of practices which responded to the GP survey are similar in relation to the mean value of the key variables. Although not reported here, the standard deviations were also virtually identical. It appears that there was no selection bias for the sub-sample participating in the GP survey.

Additional variables from the GP survey which were included in this analysis included:

- Whether the practice employed any nursing staff with a postgraduate qualification in diabetes care from a higher education institution.

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[3] The variables of interest for this section of the analysis relate to the service configuration and the workforce so practices were excluded if they had missing data for questions 18, 20 or 22. Please refer to the appendix for the complete questionnaire.

- Whether nurses commence insulin for patients with diabetes.

- Who is primarily responsible for managing diabetes care in the practice. This was coded as a factor variable in two different ways. First, to capture whether the distinction between nurse, doctor or 'other' (usually secondary care referrals) was important. Second, whether the distinction between specialist, non-specialist or 'other' other' (usually secondary care referrals) was important.

- Nurse staffing levels as measured by all people registered with a practice (not just people with diabetes) per whole time equivalent registered nurse.

- Doctor staffing levels as measured by all people registered with a practice (not just people with diabetes per whole time equivalent GP.

Together these variables were chosen to reflect the service configuration and skill mix adopted by the practice for managing diabetes care. It captures the degree of staff specialism in diabetes care and the doctor/nurse split.

Table 6.1 Comparison of practices responding to the survey and all THIN practices (means)

Variable	Full Dataset 2011/12	Practices participating in the survey
Diabetic Control		
HBA1c < 10%	0.82	0.81
HBA1c < 9%	0.76	0.75
HBA1c < 8%	0.64	0.63
HBA1c < 7%	0.42	0.42
Patient Level Variables		
Townsend Index (quintiles)	3.07	2.76
Age	64.57	64.78
Charlson Score	1.53	1.57
Obesity Index	0.47	0.46
Male	0.55	0.56
Country		
England	0.75	0.68
Northern Ireland	0.03	0.04
Scotland	0.14	0.19
Wales	0.08	0.09
Percent White - Quintiles		
Percent White – 1	0.19	0.24
Percent White – 2	0.26	0.21
Percent White – 3	0.19	0.19
Percent White – 4	0.14	0.14
Percent White - 5	0.11	0.10
Percent White - Unknown	0.11	0.12

Urban-Rural Classification		
Urban - sparse	0.01	0.00
Town & Fringe - sparse	0.06	0.00
Village/Hamlet - sparse	0.05	0.00
Urban - less sparse	0.65	0.63
Town & Fringe - less sparse	0.09	0.08
Village/Hamlet - less sparse	0.05	0.04
Unknown	0.19	0.24
Other Practice Level Variables		
Diabetes prevalence	5.01	5.00
Practice List Size	9807.16	9442.34
Patients per HCP	431.96	445.12
Nurse Contact - Low Tertile	0.33	0.31
Nurse Contact - Medium Tertile	0.36	0.34
Nurse Contact - High Tertile	0.31	0.35

6.2 Analysis and results

The baseline regression reported in column 1 of Table 6.2, is a simple intercept only hierarchical random effects model[4] which nests patients within their practice. There are 55,037 people with diabetes patients nested within 166 practices with an average cluster of 332 people with diabetes patients in each practice (range: 63-899). The intercept (-0.393) represents the log-odds of diabetic compliance below the HbA1c ≤ 7% threshold, which can be exponentiated to give the odds of compliance as 0.72 to 1, which confirms the marginal probability of compliance of 0.42% across all people in all practices. This is the same result that was found in the full dataset for 2012 and indicates that there is no bias generated by dropping practices that did not complete the GP practice survey or those that returned the survey with missing data.

In column 2 of Table 6.2, the person level fixed effects are included and in column 3 the practice level fixed effects are included, in columns 4-6, the variables from the GP survey are added.

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[4] All analysis undertaken in this section used Stata 12 SE and xtmelogit, xtlogit and logit models.

Table 6.2 Multilevel Regression Model for HbA1c <7%

	Model 1 B (se)	Model 2 B (se)	Model 3 B (se)	Model 4a B (se)	Model 4b B (se)	Model 5 B (se)
Patient Level Variables						
Age - linear		0.098***	0.098***	0.098***	0.098***	0.097***
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Age- Quadratic		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Male		-0.046*	-0.046*	-0.046*	-0.046*	-0.040*
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Charlson Score		-0.097***	-0.097***	-0.097***	-0.097***	-0.096***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Obesity Index		-0.114***	-0.114***	-0.114***	-0.114***	-0.115***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Townsend Quintiles						
1st		0.103	0.14	0.14	0.14	0.13
		(0.065)	(0.09)	(0.09)	(0.09)	(0.09)
2nd		0.061	0.098	0.098	0.098	0.077
		(0.065)	(0.09)	(0.09)	(0.09)	(0.09)
3rd		0.105	0.14	0.14	0.14	0.13
		(0.064)	(0.09)	(0.09)	(0.09)	(0.09)
4th		0.07	0.105	0.104	0.105	0.105
		(0.064)	(0.09)	(0.09)	(0.09)	(0.09)
5th		0.079	0.114	0.114	0.115	0.106
		(0.066)	-(0.09)	(0.09)	(0.09)	(0.09)
Practice Level Variables						
Percent White Quintiles						
1			-0.282*	-0.279*	-0.279*	-0.269*
			(0.14)	(0.14)	(0.14)	(0.14)
2			-0.175	-0.173	-0.175	-0.164
			(0.14)	(0.14)	(0.14)	(0.14)
3			-0.144	-0.142	-0.145	-0.137
			(0.14)	(0.14)	(0.14)	(0.14)
4			-0.137	-0.136	-0.138	-0.132
			(0.14)	(0.14)	(0.14)	(0.14)
5			-0.076	-0.074	-0.077	-0.062
			(0.14)	(0.14)	(0.14)	(0.14)

Country				
Reference: England				
Northern Ireland	-0.247	-0.264	-0.288	-0.224
	(0.18)	(0.18)	(0.18)	(0.18)
Scotland	-0.08	-0.065	-0.07	-0.121
	(0.14)	(0.14)	(0.14)	(0.15)
Wales	0.078	0.079	0.085	0.097
	(0.11)	(0.11)	(0.11)	(0.11)
Urban-Rural Classification				
Reference: Unknown				
Urban - sparse	0.016	0.035	0.028	0.006
	(0.43)	(0.43)	(0.43)	(0.43)
Town & Fringe - sparse	-0.229	-0.215	-0.213	-0.257
	(0.29)	(0.29)	(0.29)	(0.29)
Village or Hamlet - sparse	-0.294	-0.283	-0.273	-0.322
	(0.28)	(0.28)	(0.28)	(0.28)
Urban - less sparse	0.145*	0.143*	0.144*	0.138*
	(0.06)	(0.06)	(0.06)	(0.06)
Town & Fringe - less sparse	0.058	0.059	0.059	0.060
	(0.06)	(0.06)	(0.06)	(0.06)
Village or Hamlet - less sparse	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Diabetes Prevalence	0.006	0.008	0.002	0.001
	(0.03)	(0.03)	(0.03)	(0.03)
Practice List Size	0.000	0.000	0.000	0.000
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Consultations per HCP	0.000*	0.000*	0.000*	
	(<0.001)	(<0.001)	(<0.001)	
Proportion of consultations undertaken by a nurse				
Reference: Low (<26%)				
Medium (26-35%)	0.033	0.044	0.031	0.022
	(0.08)	(0.08)	(0.08)	(0.08)
High (over 35%)	0.057	0.075	0.07	0.02
	(0.07)	(0.07)	(0.07)	(0.08)
Practice Survey Variables				

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Nurse with PG Education				-0.085	-0.063	
				(0.06)	(0.07)	
Nurse starts Insulin				-0.013	-0.004	
				(0.06)	(0.06)	-
Nurse Configuration						
Doctor primary lead				-0.103		
				(0.10)		
Nurse primary lead				-0.086		
				(0.08)		
Specialist Configuration						
Non-specialist primary lead					-0.038	
					(0.11)	
Specialist primary lead					-0.129	
					(0.09)	
People per WTE nurse						-66.5
						(238.5)
People per WTE GP						158.57
						(188.08)
Constant	-0.328***	-4.288***	-4.343***	-4.269***	-4.228***	-4.209***
	(0.029)	(0.15)	(0.25)	(0.25)	(0.25)	(0.26)
Random Effect Variance	0.121	0.135	0.120	0.116	0.117	0.1126
Log-Likelihood	-36958	-35448	-35435	-35432	-35433	-34243

Understanding the variance at each level of analysis (patient vs. practice) is critical to understanding the contribution of this research to the literature. The practice level variance of 0.12 is relatively small which is confirmed by an interclass correlation coefficient (rho) of 3.6%. This indicates that almost all (96.4%) of the variation in diabetes control is explained at the individual person level rather than at the practice level. The variation in control rates across practices is ± 8.7% around the gross mean of 42%. Further evidence of the lack of practice level variation can be seen in Table 6.3 which compares the regression coefficients for a pooled and multilevel model. Altogether, this indicates that the data could be pooled without loss of generality and that a multilevel (hierarchical) or separated regression model will add little to our understanding. However, for completeness we continue to model the data as a simple two level (people nested in practices) multilevel mixed effects model with a random intercept and all other coefficients set as fixed effects.

Table 6.3 Regression Results Comparing Pooled and Multilevel Structure

	Pooled	Multilevel
Age - linear	0.097	0.098
Age- Quadratic	-0.001	-0.001
Male	-0.045	-0.047
Charlson Score	-0.089	-0.097
Obesity Index	-0.093	-0.114
Townsend Quintiles		
1	0.128	0.139
2	0.115	0.097
3	0.142	0.139
4	0.127	0.103
5	0.163	0.113
Unknown	0.000	0.000
Percent White Quintiles		
1	-0.392	-0.277
2	-0.235	-0.171
3	-0.281	-0.141
4	-0.277	-0.135
5	-0.144	-0.073
Unknown	0.000	0.000
Country		
Northern Ireland	-0.318	-0.265
Scotland	-0.081	-0.060
Wales	0.098	0.087
England	0.000	0.000
Urban-Rural Classification		
1	0.092	0.032
2	-0.206	-0.222
3	-0.265	-0.295
4	0.235	0.144
5	0.057	0.059
6	(omitted)	(omitted)
Unknown	0.000	0.000
Diabetes Prevalence	0.009	0.008
Practice List Size	0.000	0.000
Patients per HCP	0.000	0.000
Nurse PG Education	-0.082	-0.078

Nurse Starts Insulin	-0.006		-0.006	
Nurse Configuration				
Doctor lead	-0.115		-0.108	
Nurse lead	-0.103		-0.084	
Other lead	0.000		0.000	
Constant	-4.135		-4.222	

In each case a Chi-Squared test on the change in the deviance (LR test) shows that the models are an improvement on the previous model, although the inclusion of the GP survey variables provides a marginally statistically significant improvement in model fit (one-sided p=0.04). However, there is no statistically significant difference (p=0.15) in the deviance for the two different workforce configuration specifications – 4a (nurse vs. doctor) and 4b (specialist vs. non-specialist). This is supported by statistically insignificant coefficients in both formulations.

One potential explanation may be the collinearity or association between the existing nurse staffing variable (nurse consultations as a proportion of all consultations with healthcare professionals) and the service configuration variable (Mainly managed by nurse, doctor or other). A Pearson Chi-Squared test is reported in Table 6.4 and indicates that those practices with a higher level of nurse contact relative to all healthcare professional contact in the THIN data are more likely to report nurses managing diabetes care. Despite this strong association (p=0.001), dropping one of the two factor variables does not make the remaining variable statistically significant, nor does the deviance improve significantly.

Table 6.4 Association between THIN Survey and GP Practice Survey Measures of Staffing and Configuration

		Service Configuration (Practice Survey)			
		Other Lead	Doctor Lead	Nurse Lead	RowTotal
Nurse Contact: proportion of diabetic consultations with patients undertaken by a nurse (Tertiles based on THIN data)	Lowest Tertile	2,633	3,700	10,623	16,956
		5%	7%	19%	31%
	Middle Tertile	3,407	3,634	11,899	18,940
		6%	7%	22%	34%
	Highest Tertile	2,741	2,499	13,901	19,141
		5%	5%	25%	35%
	Column Totals	8,781	9,833	36,423	55,037
		16%	18%	66%	100%

The regression coefficients and their statistical significance are broadly similar to those reported for the full dataset in chapter 5 and this will not be duplicated here. The main difference being that the percentage of the local population that is white (recorded as quintiles) is not statistically significant in these models. While the regression coefficients are very close to those obtained using the full dataset, the standard errors are twice as large due to the much smaller dataset. The relatively small impact of the practice level variables in the model is evidenced by the lack of statistical significance on their regression coefficients and the relatively small reduction in the random effect (intercept) variance from 0.12 in the null model (column 1) to 0.11 in the full model (columns 4a&b). This can be seen most clearly in Figure 6.1 which plots the combined mean intercept and random effect for each practice. There is relatively little variation in this unexplained practice level average 'effect' and the absolute size of these effects is very small.

Figure 6.1: Practice level effect odds (intercept & random effect)
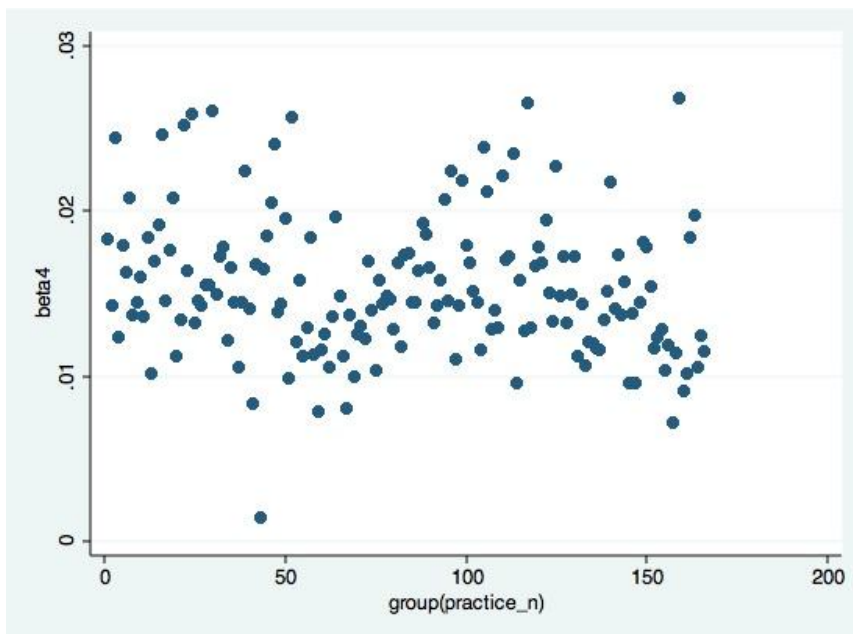
We focus instead on the new variables included in models 4a and 4b. Model 4a and 4b both include the dummy variable for postgraduate training in diabetes care and the dummy variable for whether nurses start patients on insulin. The difference between models 4a and 4b are in relation to the service configuration variables. In model 4a, the model compares the performance of practices which manage care led by nurses and doctors in comparison to 'others'. In model 4b, the comparison is between specialist, non-specialist and 'others'. None of these variables are statistically significant. While the regression coefficients (and odds ratios) are quite small, they are similar in magnitude to the remainder of the variables in the models. However, the standard errors on these practice level variables are relatively large. This is likely the result of having only 166 practices in the dataset, and

this may go some way to explaining why the other practice level variables are also largely insignificant. It is interesting, however, that the signs on all of the survey related coefficients are negative which indicates odds ratios of less than one. This implies that, for example, having nurses trained in diabetes care would reduce, *ceteris paribus*, the likelihood of diabetic control. Given the statistical insignificance of these variables and the relatively small variation attributable to practice level characteristics, these findings are of little importance.

Considering model 5, the general staffing levels of the practice are included through the inclusion of two new variables which measure the number of patients per WTE GP and nurse in each practice. The measures of service configuration (as used in models 4a and 4b) are excluded but the proportion of consultations undertaken by nurses is retained. Again, we see no statistically significant relationships between this staffing level variables and diabetes control as measured by HbA1c less than 7 % readings.

The analysis was repeated using HbA1c of less than 10% which represents an extreme threshold above which patients (and their healthcare practitioners) are having severe difficulty controlling their diabetes. The results of this analysis are reported in Table 6.5 and they are broadly similar to those found when modelling HbA1c of less than 7%. We will therefore concentrate on the differences between the two sets of findings.

While age, gender, Charlson score and obesity all remain strongly statistically significant predictors of diabetes control at the HbA1c 10% level, the coefficients are slightly weaker. However, more interestingly is that the first three quintiles of the Townsend score and the first two quintiles of the ethnicity variable (proportion of ethnically white people in the local population) are all statistically significant. Thus in comparison to patients from an area classified as "unknown deprivation", being a patient from the first three most affluent areas increases the probability of compliance at the 10% level. Similarly, being from areas with relatively low proportions of ethnically white people reduces the probability of reaching the HbA1c of less than 10% threshold, when compared to "unknown." Intuitively this makes sense: people with higher socioeconomic status are more likely to comply with medical instructions and less likely to engage in behaviour that is detrimental to their health. Finally, the coefficient on the number of people per GP is strongly statistically significant and has a large effect: having more people per WTE GP increases the likelihood of reaching the HbA1c of less than 10% threshold. While this may appear counterintuitive as it implies lower GP staffing is better it may be capturing a 'scale' effect or 'expertise' effect which may occur in much larger practices. Given the lack of significance found among the plethora of staffing variables included in the many different regression models that have been run we must be cautious not to put too much emphasis on this singular finding. The remaining results are almost identical to those found for HbA1c less than 7%, and most importantly are also statistically insignificant.

Table 6.5 Multilevel Regression Model for HbA1c <10%

	Model 1 b (SE)	Model 2 b (SE)	Model3 b (SE)	Model4a b (SE)	Model4b b (SE)	Model 5 b (SE)
Patient Level Variables						
Age - linear		0.086***	0.086***	0.086***	0.086***	0.084***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age- Quadratic		-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male		0.142***	0.143***	0.143***	0.143***	0.144***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Charlson Score		-0.053***	-0.053***	-0.052***	-0.053***	-0.053***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Obesity Index		0.057*	0.057*	0.057*	0.057*	0.051*
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Townsend Quintiles Reference: Unknown		0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
1st		0.364***	0.463***	0.461***	0.462***	0.453***
		(0.08)	(0.10)	(0.10)	(0.10)	(0.10)
2nd		0.258***	0.355***	0.354***	0.354***	0.334**
		(0.07)	(0.10)	(0.10)	(0.10)	(0.10)
3rd		0.175*	0.270**	0.269**	0.269**	0.259*
		(0.07)	(0.10)	(0.10)	(0.10)	(0.10)
4th		0.094	0.189	0.188	0.188	0.180
		(0.07)	(0.10)	(0.10)	(0.10)	(0.10)
5th		-0.001	0.094	0.094	0.094	0.095
		(0.08)	(0.10)	(0.10)	(0.10)	(0.10)
Practice Level Variables						
Percent White Quintiles Reference: Unknown						
1			-0.424**	-0.422**	-0.419*	-0.430**
			(0.16)	(0.16)	(0.16)	(0.17)
2			-0.341*	-0.338*	-0.341*	-0.349*
			(0.16)	(0.16)	(0.16)	(0.17)
3			-0.275	-0.274	-0.276	-0.285
			(0.16)	(0.16)	(0.16)	(0.16)
4			-0.247	-0.246	-0.249	-0.263
			(0.16)	(0.16)	(0.16)	(0.16)
5			-0.149	-0.147	-0.149	-0.150
			(0.16)	(0.16)	(0.16)	(0.17)
Country Reference: England						
Northern Ireland			-0.179	-0.190	-0.227	-0.155
			(0.23)	(0.23)	(0.23)	(0.23)
Scotland			-0.170	-0.158	-0.153	-0.300
			(0.17)	(0.17)	(0.17)	(0.17)
Wales			0.014	0.022	0.046	0.067
			(0.15)	(0.15)	(0.15)	(0.15)
Urban-Rural Classification Reference: Unknown						
Urban - sparse			1.346	1.393	1.319	1.332
			(1.08)	(1.07)	(1.08)	(1.07)
Town & Fringe - sparse			-0.137	-0.091	-0.149	-0.158
			(0.38)	(0.38)	(0.38)	(0.38)
Village or Hamlet - sparse			0.029	0.076	0.030	0.014
			(0.38)	(0.37)	(0.38)	(0.37)

	(1)	(2)	(3)	(4)	(5)	(6)
Urban - less sparse			0.158*	0.160*	0.158*	0.170*
			(0.08)	(0.08)	(0.08)	(0.08)
Town & Fringe - less sparse			0.033	0.035	0.035	0.029
			(0.08)	(0.08)	(0.08)	(0.08)
Village or Hamlet - less sparse			Omitted	Omitted	Omitted	Omitted
Diabetes Prevalence			-0.053	-0.056	-0.064	-0.055
			(0.04)	(0.04)	(0.04)	(0.04)
Practice List Size			-0.000	-0.000	-0.000	0.000
			(0.00)	(0.00)	(0.00)	(0.00)
People per HCP			0.000	0.000	0.000	
			(0.00)	(0.00)	(0.00)	
Proportion of Consultations undertaken by nurse - Tertiles Reference: Low						
Medium			-0.014	0.008	-0.008	-0.031
			(0.11)	(0.10)	(0.10)	(0.10)
High			0.110	0.138	0.124	0.121
			(0.10)	(0.10)	(0.10)	(0.10)
GP Practice Survey Variables						
Nurse with PG Education				-0.145	-0.113	
				(0.09)	(0.09)	
Nurse starts Insulin				0.088	0.092	
				(0.09)	(0.09)	
Nurse Configuration Reference: Other						
Doctor primary lead				0.049		
				(0.13)		
Nurse primary lead				-0.083		
				(0.11)		
Specialist Configuration Reference: other						
Non-specialist primary lead					0.089	
					(0.15)	
Specialist primary lead					-0.107	
					(0.12)	
People per WTE nurse						-236.576
						(313.10)
Patients per WTE GP						842.751***
						(253.73)
Constant	1.535***	-2.116***	-1.805***	-1.736***	-1.704***	-2.140***
	(0.04)	(0.13)	(0.29)	(0.29)	(0.30)	(0.30)
Random Effect Variance	0.234	0.243	0.233	0.224	0.223	
Log-Likelihood	-25706	-24469	-24457	-24454	-24454	

6.3 Discussion

The purpose of this section was to model the relationship between the workforce and diabetes control in primary care, including questions related to skill mix and service configuration. However, the multilevel modelling indicates that virtually all (ca. 96%) of the variation in diabetes control is explained by patient level characteristics rather than practice level characteristics.

Practices in which nurses deliver higher proportions of the care of people with diabetes perform neither better nor worse, than those where nurse input is less. There is a similar finding for the use of nurses as the lead clinician for people with diabetes. Similarly, there appears to be no statistically significant return to the use of specialist healthcare professionals whether they be GPs or nurses although we were unable to ascertain the precise nature of training and preparation for specialism.

The absence of a strong relationship, either positive or negative, indicates that practices which primarily use GPs to manage diabetes care could release significant resources by switching their service configuration towards nurse-led care.

There are a number of limitations to the findings presented in this section of the study. Primarily, we have only one year of data and a small subset (166) of GP practices in this dataset. This has resulted in great uncertainty around the parameter estimates in the model and has limited the generalisability of the findings. It is also not possible to model the differences between getting a person below threshold and maintaining them below threshold. It seems plausible that the former is harder than the latter. This notwithstanding, it is interesting that very little variation is attributable to the practice level in the models.

A more significant weakness is that although the survey provides additional information on service configurations, there remains limited data on exactly who does what within diabetes care. This makes it difficult to be certain about the effects of staffing and service configuration on diabetes outcomes, and more importantly to determine the true cost of different service configurations.

However, the current findings indicate that service configuration has no effect on the probability of a person reaching diabetes control and therefore supports the supposition that cost savings in the care of diabetes can be achieved by substituting doctors for nurses. However, we observed in chapter 4 that patients in practices where a high proportion of care is delivered by nurses receive 27 minutes more time in total with health care professionals in the practice each per year, whilst GPs spend 9 minutes less per patient (per year) when compared to practices where a low proportion of care is delivered by nurses. This suggests that in addition to substitution for doctors there is also enhancement to care although lower productivity by nurses may also be a partial explanation as has been noted above and in the literature.

Given the absence of any clear difference in outcome this has implications for cost effectiveness. It must be noted that we have only measured a single outcome here and enhancements in care may have other quantifiable benefits. Also there may be savings through lower use of secondary care.

Clearly releasing doctors to attend to other patients has a positive impact on opportunity costs which we cannot quantify.

If unquantified benefits are ignored, in effect, 9 minutes of doctors time is 'saved' at the 'expense' of 36 minutes of other professionals time, mainly practice nurses. The costs of the increased time spent on care is critically dependant on pay differentials. Because most GPs are not salaried it is not entirely straightforward to make comparisons. However, an approximation can be made by using pay rates for salaried GPs of between £53,781 and £81,158[5]. A band 6 nurse (the group most frequently employed) earns between £25,783 and £34,530. Taking the mid-point of each pay scale gives a salary differential of £30,156.5 for nurses compared to £67,469.5 for GPs. The actual differences are likely to be higher because of additional employment costs including pensions at 14% giving a difference of £34378.41 compared to £76915.23.

This gives an approximate estimate that using doctors is 2.24 times more expensive than using nurses. Based on this it is clearly cheaper to use nurses to provide additional care than it is to use doctors. However the time saved by doctors (9 minutes) would only 'pay' for 20 minutes of nurse time whereas an 'additional' 36 minutes is being provided. While the figures provided here give a very rough estimate our assumptions would have to be significantly incorrect to change the basic conclusion. The cost of consultations (in terms of staff time) is likely to be higher in practices that provide a high proportion of care for people with diabetes but the opportunity costs of using GPs to deliver additional care would also be high as would be the costs of delivering the additional care in secondary settings.

Chapter 6 Summary

- Variation between practices within the 2011/12 data set were explored in relation to key workforce variables and approaches to the management of diabetes (from the practice survey).
- Practices in which nurses undertake larger proportion of consultations with people with diabetes (as defined from the patient records data) are more likely to report that nurses lead the management of diabetes care (as captured in the survey).
- Because of the low level of practice variation (coupled with relatively small sample), no distinct effect related to different workforce configurations, or approaches to managing diabetes have been discernible.
- The absence of a strong relationship, either positive or negative, indicates that practices which primarily use GPs to manage diabetes care could release significant resources by switching their service configuration towards nurse-led care.

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[5] http://www.nhscareers.nhs.uk/explore-by-career/doctors/pay-for-doctors/

- Service configuration has no effect on the probability of a person's diabetes being controlled. This therefore supports the supposition that, in relation to diabetes care, cost savings can be achieved by substituting doctors for nurses.
- Currently practices that deliver a higher proportion of care for people with diabetes by nurses save on doctors' time but savings are not sufficient to cover the costs of additional nurse consultation time. Nurses are providing an extra resource.

7. Discussion & Recommendations

7.1 Introduction

The contribution of practice nurses to chronic disease management has gained increasing attention over the last two decades. The introduction of a new GP contract in 1990 gave financial rewards for providing certain types of care, such as offering chronic disease clinics. In 2004 the revised GP contract rewarded practices for meeting specific targets, for example related to the management of long-term chronic conditions such as CHD, asthma, COPD, and diabetes. Nurse-led chronic disease clinics have been found to be as effective as hospital outpatient clinics and GP delivered care under the right conditions (Sibbald et al, 2006). This presented opportunities for increased delegation from doctors to nurses, and for nurses in primary care to lead care, for example, around the management of diabetes. As a result, GP practices increased the numbers of practice nurses they employed (Sibbald et al, 2006). The study reported here explores the impact of practice nurses in the management of chronic diseases in primary care. We focus specifically on diabetes for several reasons.

Firstly, the prevalence of diabetes has been rising relentlessly particularly over the last decade not only in the UK but in many countries in the Western World. Around 10% of the NHS budget is now devoted to the treatment of people with diabetes and this burden on the NHS is expected to increase unless solutions are found. Bringing blood glucose down to safe levels has long-term benefits, and will delay and reduce the accumulation of both macro-vascular (e.g. stroke, myocardial infarction) and micro-vascular (retinopathy, neuropathy) comorbidities, the costs of which place a substantial burden on the NHS.

Secondly, diabetes is one of the chronic conditions that practice nurses have an increasing level of involvement in. The new GP contract in 2004 brought with it new electronic database systems in GP practices. The use of these systems may have facilitated the delegation of certain types of work to non-medical colleagues who are "more bound and responsive to the 'system'" (Checkland et al, 2007). However, the detailed analysis of consultations presented here suggests that changes over the past decade have not been as dramatic as sometimes supposed and much of the change observed is because nurses are providing additional care in some practices, relative to those where nurses are used less. There is impetus behind wanting healthcare professionals to expand their skills to provide effective care to people with chronic conditions and previous research suggests that GP workload could be substantially reduced by delegating certain activities to nurses (Dubois and Singh, 2009). There is evidence here that this has occurred in some practices and our findings suggest there is no adverse effects for people with diabetes.

Thirdly, diabetes has been regarded as a tracer condition for overall quality of care delivered by general practices and provides a potential model for other chronic conditions (Graffy and Griffin, 2008).

Whilst a potential benefit of delegating routine care management activity to nurses is that it may free up doctors' time that can be spent on more complex cases, there has nonetheless been concern as to whether nurses can deliver these activities to the same standard as GPs. In the USA it was argued that nurse practitioners would not replace doctors in primary care but would increase level of access to healthcare (The Board of Directors of the National Organization of Nurses Practitioner Faculties, 2000). A systematic review in 2002 (Horrocks et al, 2002) suggested that nurses matched doctors in terms of quality of care provided and in some areas, e.g. patient satisfaction, they outperformed doctors. Our study was only able to explore a single outcome but confirms equivalent clinical outcome in terms of control of HbA1C.

One of the success stories of QOF, has been the improvement of diabetes care (Heath et al, 2007). Previous work using routinely available QOF data found an association between level of practice nurse staffing and performance based on a composite QOF measure for diabetes and certain QOF Diabetes Indicators (HbA1c ≤ 7.4%, HbA1c ≤ 10%, total cholesterol ≤ 193mg/dl), (Griffiths et al, 2010a).

However this earlier work relied on using data aggregated at the practice level, rather than individual patient records. Flaws in using aggregated data have been widely discussed in the literature and is regularly referred to using a variety of different terms e.g. ecological fallacy, ecological bias, isomorphism (Arceneaux and Nickeson, 2009), aggregate bias and cross-level bias (Lancaster et al, 2006). Robinson (1950) concluded that correlations calculated using data on individuals do not necessarily translate to the group level and vice versa.

This study aimed to examine whether different workforce configurations (and activity) in primary care are associated with variation in the glycaemic control of patients with diabetes, using patient level data.

7.2 Achievement of glycaemic control over the last 10 years

There is some evidence that diabetes care was improving prior to QOF and after its introduction there was significant further improvement in performance that was above the pre-existing trend until 2005 (Campbell et al, 2009). Our data shows that peak performance measured using the HbA1c ≤ 10% threshold was reached in 2005 but for the lower threshold (HbA1c ≤ 7%) there was continuing but slow improvement until 2009. Most of the improvement, in both cases, has taken place between 2002 and 2004.

Overall, in terms of QOF performance many practices that were predicted to get scores of 700-750 were achieving scores of 950 very early on (Checkland et al, 2007). Changes to the pay-per-performance scheme have occurred along the way with the introduction of higher thresholds. This was one of the reasons we have analysed the data for each year separately, to be able to examine the findings in relation to changes to crucial contextual factors since 2002. The HbA1c ≤ 10% threshold was last used by QOF in 2008/9, in subsequent years the highest threshold was ≤ 9%, and this may explain why our figures show a dip in performance with the percentage of people with

diabetes achieving that threshold falling from 83.7% in 2008 to 81.9% in 2011/12. There has been some criticism of the influence of QOF, in creating a more mechanistic approach that focuses on specific targets at the expense of overall care quality and continuity.

The importance of diabetic review is made evident in the regression analysis which shows a positive association between average number of reviews per annum conducted by practices and the proportion of people meeting the QOF thresholds. This association was stronger for the higher (HbA1c ≤ 10%) than the lower threshold (HbA1c ≤ 7%) and in the earlier part of the study period (2002-2004), although for the higher threshold there is a suggestion that this association is starting to gain strength again. The importance of regular review, which is increasingly undertaken by practice nurses has workforce implications, if this level of activity is to be sustained and the occurrence of comorbidities minimised.

7.3 Workforce activity in managing diabetes

The proportion of people with diabetes seen by doctors in this study has fallen from 70% in 2002 to 64% in 2011/12, but has hovered between 31% and 32% for practice nurses and increased from 3% to 8% for other healthcare professionals. In 2006 about 62% of consultations with all patients registered with a practice were undertaken by GPs and 34% by all types of nurses (Hippisley-Cox, Fenty and Heaps, 2007). This compares with 67% and 31% for doctors and practice nurses respectively found in this study for consultations specifically with people with diabetes.

The amount of work (measured through total number of consultations) undertaken by practice nurses increased by 20% over the period of the study (2002 to 2011/12) whereas workload measured in these terms has remained static for doctors. Meanwhile prevalence continues to increase sharply, from 3.0% to 4.9% (based on the THIN Diabetes population), although some of this increase has been attributed to earlier diagnosis and the rise in obesity.

In spite of this increase in the overall volume of consultations undertaken by practice nurses the number of times patients with diabetes were seen on average each year has declined from 16.0 to 11.5 over the study period. This could be partly explained by the fact that people with diabetes are being diagnosed earlier, when the condition is less severe, is more treatable and therefore they do not need the same level of attention that more severe cases of diabetes require. GP practices may also have become better at dealing with multi-morbidity in a single but longer consultation. The regression models for the early part of the period found a negative relationship between this measure of workforce activity and achieving glycaemic control. One explanation is that some practices needed to devote more workforce capacity to meet the new QOF targets because the diabetes of people registered with their practice was less well controlled, whilst practices where diabetes was already better controlled could redirect their efforts to those who were more difficult to treat. This relationship became positive and significant for the lower HbA1c threshold (≤ 7%) in 2011.

Practice nurses have made more entries in peoples' medical records over this period. This might be because they are more responsive to the "system" but it may also reflect a greater involvement in

diabetes care. The proportion of consultation time with a doctor has gone from 61% (of a total of 160 minutes with all health care professionals per person per year) in 2002, to 54% (of 124 minutes) in 2012. Whilst proportionally the time spent with a practice nurse has increased from 33% to 37%, and with other staff (other nurses and other health care professionals) from 6% to 9%.

Since 2002 practice nurses have undertaken more review activities (annual review, monitoring etc.) than doctors suggesting that their involvement had already become embedded, perhaps in preparation for QOF and by other initiatives prior to QOF. Doctors have become less involved in review, declining from an average of 0.49 reviews per person with diabetes in 2002 to 0.30 in 2008. This decline has now ceased and a small increase to 0.34 was observed in 2011/12. Review activity remained quite static for practice nurses until 2011 when it increased, primarily due to an increase in foot screening. Over the period, the proportion of reviews performed by practice nurses has increased from 64% to 73%.

The role of nurses in 2012 is confirmed by the practice survey, which found that diabetes care was most frequently "managed by nurse (or nurses) specialised in diabetes", and that this was more common than "care managed by doctor (or doctors) specialised in diabetes". There are clear indications that practice nurses are taking the lead responsibility for the management of care for many people with diabetes.

Specifically practice nurses are undertaking more of the diabetes reviews, which could be an indication that they are increasingly becoming the first point of contact. A quasi-experimental study in the Netherlands found that a shared care model resulted in improved glycaemic control with equivalent outcomes in other areas when compared to the GP as the main provider (Vrijhoef et al, 2002).

Other research has flagged the importance of practice staff being able to provide early diagnosis of people with diabetes, to treat them as quickly as possible and when oral diabetes drugs are no longer effective, to commence insulin at the earliest opportunity (Leibl, 2009). Our research suggests that practice nurses are becoming more involved in medication review although the absolute numbers of medication reviews recorded (by any staff group) is low. Although still on a very small scale in 2011/12 practice nurses had reviewed the medication of one or more people with diabetes in 37% of practices (rising from 6% in 2002). The corresponding figures for doctors were an increase from 17% in 2002 to 49% in 2011/12. Converting to insulin therapy is known to have considerable benefits for people, yet in the past nurses reported fears around lack of training, support and litigation when converting patients from oral hyperglycaemic agents to injected insulin within primary care (Greaves et al, 2003). The fact that more practice nurses are now engaging in medication review suggests that some of these fears have lessened although evidence from this study suggests that there remains considerable scope to increase nurses' role in medication review and initiation of insulin therapy, provided of course that there is proper training. In this study the practice survey found that in 46% of practices the GP generally initiates insulin treatment, and in 36% of practices the practice nurse initiates treatment.

While a majority (89%) of practices employed at least one nurse with a postgraduate qualification in diabetes care, roughly one it ten did not. Practice nurses play a pivotal role in making sure that, through the vehicle of annual health checks and other forms of medical review, people are diagnosed at an early stage. Recent research suggests that intensive treatment (e.g. insulin) on its own is not sufficient to reduce long-term risk of comorbidities because of the failure to achieve blood glucose control early on in the course of diabetes (Leibl, 2009).

7.4 Performance and cost

At the beginning of the last decade it was widely advocated that for certain chronic diseases (including diabetes) care that had traditionally been delivered by doctors, could be undertaken by staff with less training (Bagley, 2000). There is still an ongoing debate about whether primary care should be nurse led or not (Sibbald and Knight, 2008).

Issues remain around economic efficiency. Some evidence suggests that nurses tend to hold longer consultations and instigate more investigations although both of these factors might result in better long-term outcomes for the person with diabetes. This study found that over the last decade nurse consultations have typically been one or two minutes longer than doctors (e.g. in 2011/12 the average GP consultation was 11 minutes compared to 13 minutes for practice nurses).

There also may be hidden costs such as greater levels of unproductive time, lower capacity to act independently, and greater risks to the patient (Dubios and Singh, 2009). The economic benefits of substitution are critically dependent upon wage differentials (Goryakin et al, 2011), although large differentials between nurses' salaries and GP income suggests that the case for substitution in the UK, is unlikely to be highly sensitive to differences in efficiency unless they are dramatic. A recent study found that higher practice nurse staffing was associated with higher admission rates for diabetes although the authors of that study advised against making simple causal interpretations (Griffiths et al, 2010b).

In this study those GP practices where practice nurses had greater contact and involvement with people with diabetes performed as well as practices where most of the care was delivered by doctors based on HbA1c levels (≤ 7% and ≤ 10%). In the earlier years of the study there was some evidence that practices where practice nurse contact was high outperformed those where nurse contact was low. It appears that using practice nurses to provide higher proportions of care for people with diabetes is associated with the same level of performance as providing more care by doctors on this single, but highly important measure, of diabetes control.

Previous research has found that nurse practitioners cost the same as GPs once clinical care and service costs are accounted for (Venning, 2000). There is also the issue of nurse practitioner training which is less well integrated, and perceived as inferior, to GP training (Burke, 2009). Despite this, nurse practitioner training typically produces a person who is able to deliver safe care. In the practice survey the average number of practice nurses was 1.85 per practice; the average was far lower for nurse practitioners at 0.24 but 73% of the diabetes care was managed by a nurse who specialised in

diabetes. In this study, practices that made more use of nurses reduced the amount of time people spent with doctors but also delivered more care (as measured by consultation time) overall. The savings in doctors' time does not appear to be offset by the additional costs of time spent with other practitioners, predominantly nurses. However there are opportunity costs associated with the use of GPs or secondary care to provide additional services. The costs and benefits associated with changes remain uncertain and it should be borne in mind that confining an economic analysis to a short time window may not reveal all the costs going forward.

7.5 Strengths and limitations

The initial selection of people with diabetes was based on a list of 612 Readcodes. A Readcode field appears both in the medical record and additional health details. Filtering by these THIN data fields will have captured most people who could have diabetes. It is possible however that we might have missed people with diabetes who did not have a diabetes Readcode anywhere in their THIN record, for example, people who were receiving a diabetic therapy or with a high HbA1c value (HbA1c > 6.5%). The number of people to whom this applies is unlikely to be large. A further algorithm was applied to the THIN extract which reduced the sample by 21% suggesting that our initial list was, as intended, broadly inclusive. We are confident that we have captured most of the people with diabetes registered with THIN practices.

In terms of consultations, we have constructed our own definition of a consultation based on where the contact with the person took place and using the THIN consultations dataset. Attribution of the consultation to a particular staff role group has been defined in two ways:

- By the role group linked to the staff ID allocated by the Vision system to the 'consultation' record that appears in the THIN consultation dataset.

- By the role group that links to the staff ID present on records from the medical, additional health details and therapy datasets which are all linked together via the same consultation ID.

From the second definition we were able to ascertain whether a particular staff role group (e.g. practice nurses) shared the consultation with another staff role group (e.g. doctors) or whether they had sole ownership of the consultation record. So it was not possible for us to definitively ascribe overall ownership of the consultation to one person when more than one person was involved nor could we apportion consultation time between healthcare professionals when the consultation was shared between more than one person.

As far as diabetes control: a single HbA1c value closest to July 1st was selected for each person for each year they were registered with a practice (for 2011/12 we used the value closest to the 16th May 2012 to coincide with the practice survey). A single value may not in all cases provide a precise indication that a person's diabetes is under control or not. In QOF the last HbA1c value in the preceding 15 months is always used so there are parallels between the two approaches except that we chose a date not wedded to the QOF reporting period (e.g. 1st July rather than the 31st March).

Further research is required to determine the reliability of single HbA1c measures as an indicator of diabetes control. When blood glucose is under control, fewer measurements will be taken and when it is not, more will be taken until that person's diabetes is brought under control again. Therefore deciding what is meant by control under the latter circumstances is more complex. Nonetheless in a large sample the error induced by this variation is unlikely to dramatically affect estimates of control at a practice level or introduce measurement error sufficient to substantially limit the power of the study to demonstrate differences.

We believe there was a sufficient conceptual match between our research questions and the data that were available to us to answer those questions. Fortunately we were in a position to collect additional survey data via Cedegim - the company providing the THIN patient level data. Although this additional data collection was part of a routine audit and was thus limited in scale and scope, it did allow us to add and ask some specific questions about the management of diabetes care in those practices who participated. The survey was our only source for information about nursing qualifications in diabetes care and GP interest in diabetes. The THIN data currently only provides very limited information on each member of staff (role and gender). A significant limitation to this work is the absence of detailed information on the general practice workforce at a practice level. While information of numbers and demographic characteristics of doctors in general practice are readily available, no similar data on the numbers of other professionals are available from the Information Centre at the practice level. The ability to examine the general practice level workforce in detail, at the level of the practice, is vital for future work in this area. Increasingly, diabetes care is taking place outside general practice through nurse led teams commissioned by CCGs who monitor their diabetes performance across all their practices. This work would not appear in our study.

Our findings for prevalence and for consultation rates are in accord with those found by other researchers (Kanavos et al, 2012; Hippisley-Cox, Fenty and Heaps, 2007) and health information providers (NHS Information Centre for Health and Social Care, 2012). The proportion of people meeting the HbA1c thresholds for this study are lower than national figures (http://www.gpcontract.co.uk/ *accessed 28th March 2013*) because we opted for population achievement, rather than reported achievement, therefore all people were included in the analysis and the denominators (i.e. there was no exception reporting). Our figures are closer to those reported by Calvert and colleagues who excluded diabetes exception reporting codes that did not give a reason for the exception (Calvert et al, 2009).

The limitations of our economic analysis have been fully outlined on pages 88-89. In summary we have a small subset of data limited to 166 GP practices and one year of person level data. We are also limited in our understanding of service configurations – e.g. exactly who does what within diabetes care and we are therefore limited to the direct workforce implications of changes in consultation patterns and a single outcome at one point in time. Other outcomes, long term outcomes, other treatment costs, opportunity costs and savings occurring elsewhere in the health system have

not been considered. Judgements about the economic case are likely to be highly sensitive to these issues and further research is required.

Previous work by NNRU found an association between practice nurse staffing and non-elective hospital admissions (Griffiths et al, 2010b). Providers of practice level data are now able to link GP practice data with Hospital Episodes Statistics creating a primary and secondary care medical history for each person. These data, once they become available, will allow researchers to study and more effectively understand the interface between primary and secondary care in relation to diabetes, and at the level of the individual, that would have not been possible in the past. This should also be a priority for future research.

7.6 Conclusion

This study aimed to examine whether different workforce configurations (and activity) in primary care are associated with variation in control of diabetes. We sought to determine whether the relationships previously found between practice nurse staffing and performance under QOF for diabetes, were still found when using person level data.

The data shows that the prevalence of diabetes has increased year on year over the last ten years, and that there has been an increasing reliance on practice nurses. The role and activities of nurses in primary care in relation to diabetes has shifted: they undertake more of the consultations with people with diabetes and most practices now deliver care led by nurses. Practice nurses are increasingly undertaking review activities (monitoring, follow-up, annual review), which is linked to greater likelihood of glycaemic control. During the last ten years glycaemic control has improved.

However, whether looking longitudinally or within the latest year, there is little variation in glycaemic control that is found to relate specifically to differences in the way in which practices are organised or staffed (the vast majority of variation relates to differences between people with diabetes).

The study shows that practices where practice nurses undertake a higher proportion of consultations with people with diabetes and where nurses are the lead clinician for managing diabetes perform the same (in terms of glycaemic control) as practices where there is a different pattern of consultations. Because there is relatively little variation between practices in terms of their glycaemic control, there is scope to substitute nurses for GPs in delivering care for people with diabetes and to use nurses as a means of delivering enhanced care. Given the salary differential, using nurses to deliver enhanced care appears to be an efficient strategy although more evidence is required to show long term benefits. The costs and benefits of this strategy remain uncertain but there is no evidence of harm. Indeed what we can say is that optimised diabetes care is just as good when predominantly provided by nurses compared to care which is mainly provided by GPs. Other research suggests that patient satisfaction may be improved.

This conclusion can inform both commissioners and providers seeking to optimise care for people with diabetes. While the specific training of practitioners to provide care for people with diabetes is a

hugely important issue, it does not appear that the professional group of those providing routine care is a source of variable quality. Thus the available evidence suggests that moves toward the further development of nurse led services, with appropriate specialist support, are compatible with the delivery of quality diabetes care.

The THIN data, and specific datasets that were created for this study, provide an extremely rich source of information about the population of people with diabetes in the UK, and avoids many of the limitations and pitfalls associated with using aggregate data. Further research on GP practice service and workforce configuration should focus on other diabetes related measures (e.g. blood pressure, cholesterol levels, foot and eye screening), diabetes related comorbidities both at the macro-vascular (stroke, myocardial infarction) and micro-vascular (neuropathy, retinopathy) level. The impact on nurse activity and diabetes structured patient education of the dramatic increase in people diagnosed with type 2 diabetes who are insulin dependent requires further consideration and research. . This list is not meant to be exhaustive because the potential of these data is vast. The ability of GP practices to identify diabetes at an earlier stage before the condition has become too severe, less easy and more expensive to treat will be crucial going forward. The obvious benefits will be longer life expectancy, fewer comorbidities and a reduced burden upon the state economically. Research on this topic should therefore be encouraged

7.7 Recommendations

From this research a number of recommendations can be identified, which relate to different communities. Key recommendations for each are:

Research community: Further research is required regarding the following:

- the economic analysis of substituting doctors for nurses which would need to take account of long term outcomes, other treatment costs, opportunity costs and savings occurring elsewhere in the health system.

- the dramatic increase in people diagnosed with type 2 diabetes and impact on nurse activity and the effects of diabetes structured patient education.

- the extent to which GP practices can identify diabetes at an early stage before the condition has become too severe.

- the links between workforce and patient outcomes over time which includes other key outcome measures (BP, BMI, lipids etc.).

- the management of other long-term conditions, and how this affects patient outcomes.

Policy: the Quality and Outcomes Framework should continue to focus on specific care provided as well as the structural characteristics relating to training and competence.

Policy: Health Education England and CfWi: Better general practice workforce data is needed. In particular systematic collection and collation of more detailed primary care workforce and skill-mix

data on nursing and non-nursing staff is required. We recommend that consideration is given to the implications for national minimum datasets to map and describe primary care workforce, to avoid piecemeal data collection (and assist policy and workforce planning).

Policy: Health Education England: The requirements for post registration training in diabetes for doctors but also specifically for nurses (where historically budgets have been lower) needs to be addressed through educational commissioning.

Health Education England and Higher Education Institutions:

Nurses undertake most of the diabetes care so CPPD training in diabetes for practice nurses is essential to ensure a high standard of care and that QoF targets are achieved.

Ensure practice and specialist nurses have competence training on foot assessment and collaborative care planning, for example, to ensure effective behaviour change and self-management are essential and may increase the proportion of patients achieving targets, reduce long term risk, ambulance call out rates and hospital admissions.

Policy: CCGs and NHS England: responsibility for diabetes care is shared; CCGs who are responsible for care in the community and via secondary care and NHS England for GP provided services. These organisations therefore need to work closely together to ensure joined up thinking in commissioning services and care delivery.

Policy: CCGs and NHS England: should consider fully the implications of this research which suggests optimised diabetes care is just as good when predominantly provided by nurses compared to care which is mainly provided by GPs. The results of this study suggest there is scope to substitute nurses for GPs in delivering diabetes care and for nurses to deliver enhanced care and that this can result in cost savings.

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Appendix 1 Project group members

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Appendix 2 Technical details: THIN

A2.1 Practices meeting the inclusion criteria by nation

Year	Meeting Vision date and AMR inclusion criteria					Meeting all the inclusion criteria including depth of staff coding and ≥90% use of %HbA1c units					Percentage of practices who met Vision date and AMR inclusion criteria who also met the additional criteria				
	England	Northern Ireland	Scotland	Wales	Total	England	Northern Ireland	Scotland	Wales	Total	England	Northern Ireland	Scotland	Wales	Total
2002	312	17	24	22	375	220	6	7	14	247	71%	35%	29%	64%	66%
2003	337	20	31	25	413	308	18	27	22	375	91%	90%	87%	88%	91%
2004	345	21	32	30	428	312	18	28	28	386	90%	86%	88%	93%	90%
2005	374	23	33	33	463	346	21	30	30	427	93%	91%	91%	91%	92%
2006	380	23	35	35	473	353	22	32	34	441	93%	96%	91%	97%	93%
2007	382	23	43	35	483	350	21	43	34	448	92%	91%	100%	97%	93%
2008	383	21	62	38	504	353	19	61	37	470	92%	90%	98%	97%	93%
2009	374	22	69	38	503	346	20	68	37	471	93%	91%	99%	97%	94%
2010	362	23	70	39	494	337	21	70	38	466	93%	91%	100%	97%	94%
2011	348	23	73	37	481	317	21	73	34	445	91%	91%	100%	92%	93%
2011/12	336	22	71	37	466	308	21	71	34	434	92%	95%	100%	92%	93%

Note: only practices that meet the criteria for a complete calendar year were included in the count

A2.2 Diabetes Readcodes used to identify people who may have diabetes

READCODE	Description	READCODE	Description
13AB.00	Diabetic lipid lowering diet	66A7100	Frequency of GP or paramedic treated hypoglycaemia
13AC.00	Diabetic weight reducing diet	66A8.00	Has seen dietician - diabetes
13B1.00	Diabetic diet	66A9.00	Understands diet - diabetes
1434.00	H/O: diabetes mellitus	66AA.11	Injection sites - diabetic
14F4.00	H/O: Admission in last year for diabetes foot problem	66AD.00	Fundoscopy - diabetic check
14P3.00	H/O: insulin therapy	66AG.00	Diabetic drug side effects
2BBF.00	Retinal abnormality - diabetes related	66AH.00	Diabetic treatment changed
2BBL.00	O/E - diabetic maculopathy present both eyes	66AH000	Conversion to insulin
2BBP.00	O/E - right eye background diabetic retinopathy	66AI.00	Diabetic - good control
2BBQ.00	O/E - left eye background diabetic retinopathy	66AJ.00	Diabetic - poor control
2BBR.00	O/E - right eye preproliferative diabetic retinopathy	66AJ.11	Unstable diabetes
2BBS.00	O/E - left eye preproliferative diabetic retinopathy	66AJ000	Chronic hyperglycaemia
2BBT.00	O/E - right eye proliferative diabetic retinopathy	66AJ100	Brittle diabetes
2BBV.00	O/E - left eye proliferative diabetic retinopathy	66AJ200	Loss of hypoglycaemic warning
2BBW.00	O/E - right eye diabetic maculopathy	66AJ300	Recurrent severe hypos
2BBX.00	O/E - left eye diabetic maculopathy	66AJz00	Diabetic - poor control NOS
2BBk.00	O/E - right eye stable treated prolif diabetic retinopathy	66AK.00	Diabetic - cooperative patient
2BBl.00	O/E - left eye stable treated prolif diabetic retinopathy	66AL.00	Diabetic-uncooperative patient
2BBo.00	O/E - sight threatening diabetic retinopathy	66AM.00	Diabetic - follow-up default
2G51000	Foot abnormality - diabetes related	66AN.00	Date diabetic treatment start
2G5A.00	O/E - Right diabetic foot at risk	66AO.00	Date diabetic treatment stopp.
2G5B.00	O/E - Left diabetic foot at risk	66AP.00	Diabetes: practice programme
2G5C.00	Foot abnormality - diabetes related	66AQ.00	Diabetes: shared care programme
2G5D.00	Foot abnormality - non-diabetes	66AR.00	Diabetes management plan given
2G5E.00	O/E - Right diabetic foot at low risk	66AS.00	Diabetic annual review
2G5F.00	O/E - Right diabetic foot at moderate risk	66AT.00	Annual diabetic blood test
2G5G.00	O/E - Right diabetic foot at high risk	66AU.00	Diabetes care by hospital only
2G5H.00	O/E - Right diabetic foot - ulcerated	66AV.00	Diabetic on insulin and oral treatment
2G5I.00	O/E - Left diabetic foot at low risk	66AW.00	Diabetic foot risk assessment
2G5J.00	O/E - Left diabetic foot at moderate risk	66AX.00	Diabetes: shared care in pregnancy - diabetol and obstet
2G5K.00	O/E - Left diabetic foot at high risk	66AY.00	Diabetic diet - good compliance
2G5L.00	O/E - Left diabetic foot - ulcerated	66AZ.00	Diabetic monitoring NOS
2G5V.00	O/E - right chronic diabetic foot ulcer	66Aa.00	Diabetic diet - poor compliance
2G5W.00	O/E - left chronic diabetic foot ulcer	66Ab.00	Diabetic foot examination
3881.00	Education score - diabetes	66Ac.00	Diabetic peripheral neuropathy screening
3882.00	Diabetes well being questionnaire	66Af.00	Patient diabetes education review
3883.00	Diabetes treatment satisfaction questionnaire	66Ag.00	Insulin needles changed daily
42W..00	Hb. A1C - diabetic control	66Ah.00	Insulin needles changed for each injection
42WZ.00	Hb. A1C - diabetic control NOS	66Ai.00	Diabetic 6 month review
42c..00	HbA1 - diabetic control	66Aj.00	Insulin needles changed less than once a day
43Gk.00	Insulin antibody level	66Ak.00	Diabetic monitoring - lower risk albumin excretion
43WQ.00	Insulin IgE antibody level	66Al.00	Diabetic monitoring - higher risk albumin excretion
43WR.00	Insulin IgG antibody level	66Am.00	Insulin dose changed
43Yu.00	Bovine insulin RAST test	66An.00	Diabetes type 1 review
43Yv.00	Human insulin RAST test	66Ao.00	Diabetes type 2 review
44V3.00	Glucose tol. test diabetic	66Ap.00	Insulin treatment initiated
66A..00	Diabetic monitoring	66Aq.00	Diabetic foot screen
66A1.00	Initial diabetic assessment	6761.00	Diabetic pre-pregnancy counselling
66A2.00	Follow-up diabetic assessment	679L.00	Health education - diabetes
66A3.00	Diabetic on diet only	679R.00	Patient offered diabetes structured education programme
66A4.00	Diabetic on oral treatment	68A7.00	Diabetic retinopathy screening
66A5.00	Diabetic on insulin	68A9.00	Diabetic retinopathy screening offered
66A7000	Frequency of hospital treated hypoglycaemia	68AB.00	Diabetic digital retinopathy screening offered

A2.2 Diabetes Readcodes used to identify people who could have diabetes

READCODE	Description	READCODE	Description
7276.00	Pan retinal photocoagulation for diabetes	9N1v.00	Seen in diabetic eye clinic
7L10000	Continuous subcutaneous infusion of insulin	9N2i.00	Seen by diabetic liaison nurse
7L19800	Subcutaneous injection of insulin	9N4I.00	DNA - Did not attend diabetic clinic
889A.00	Diab mellit insulin-glucose infus acute myocardial infarct	9N4p.00	Did not attend diabetic retinopathy clinic
8A12.00	Diabetic crisis monitoring	9NM0.00	Attending diabetes clinic
8A13.00	Diabetic stabilisation	9NN9.00	Under care of diabetes specialist nurse
8B3l.00	Diabetes medication review	9NND.00	Under care of diabetic foot screener
8BL2.00	Patient on maximal tolerated therapy for diabetes	9NiA.00	Did not attend diabetes structured education programme
8CA4100	Pt advised re diabetic diet	9NiC.00	Did not attend DAFNE diabetes structured education programme
8CE0.00	Diabetic leaflet given	9NiD.00	Did not attend DESMOND diabetes structured education program
8CP2.00	Transition of diabetes care options discussed	9NiE.00	Did not attend XPERT diabetes structured education programme
8CR2.00	Diabetes clinical management plan	9NI4.00	Seen by general practitioner special interest in diabetes
8CS0.00	Diabetes care plan agreed	9OL..00	Diabetes monitoring admin.
8H2J.00	Admit diabetic emergency	9OL..11	Diabetes clinic administration
8H3O.00	Non-urgent diabetic admission	9OL1.00	Attends diabetes monitoring
8H4e.00	Referral to diabetes special interest general practitioner	9OL2.00	Refuses diabetes monitoring
8H7C.00	Refer, diabetic liaison nurse	9OL3.00	Diabetes monitoring default
8H7f.00	Referral to diabetes nurse	9OL4.00	Diabetes monitoring 1st letter
8H7r.00	Refer to diabetic foot screener	9OL5.00	Diabetes monitoring 2nd letter
8HBG.00	Diabetic retinopathy 12 month review	9OL6.00	Diabetes monitoring 3rd letter
8HBH.00	Diabetic retinopathy 6 month review	9OL7.00	Diabetes monitor.verbal invite
8HHy.00	Referral to diabetic register	9OL8.00	Diabetes monitor.phone invite
8HTe.00	Referral to diabetes preconception counselling clinic	9OL9.00	Diabetes monitoring deleted
8HTi.00	Referral to multidisciplinary diabetic clinic	9OLA.00	Diabetes monitor. check done
8HTk.00	Referral to diabetic eye clinic	9OLA.11	Diabetes monitored
8Hg4.00	Discharged from care of diabetes specialist nurse	9OLB.00	Attended diabetes structured education programme
8Hj0.00	Referral to diabetes structured education programme	9OLC.00	Family/carer attended diabetes structured education prog
8Hj1.00	Family/carer referral to diabetes structured education prog	9OLD.00	Diabetic patient unsuitable for digital retinal photography
8Hj3.00	Referral to DAFNE diabetes structured education programme	9OLF.00	Diabetes structured education programme completed
8Hj4.00	Referral to DESMOND diabetes structured education programme	9OLG.00	Attended XPERT diabetes structured education programme
8Hj5.00	Referral to XPERT diabetes structured education programme	9OLH.00	Attended DAFNE diabetes structured education programme
8Hl1.00	Referral for diabetic retinopathy screening	9OLJ.00	DAFNE diabetes structured education programme completed
8Hl4.00	Referral to community diabetes specialist nurse	9OLK.00	DESMOND diabetes structured education programme completed
8I3W.00	Diabetic foot examination declined	9OLL.00	XPERT diabetes structured education programme completed
8I3X.00	Diabetic retinopathy screening refused	9OLM.00	Diabetes structured education programme declined
8I3k.00	Insulin therapy declined	9OLZ.00	Diabetes monitoring admin.NOS
8I57.00	Patient held diabetic record declined	9Oy..00	Diabetes screening administration
8I6F.00	Diabetic retinopathy screening not indicated	9Oy0.00	Diabetes screening invitation
8I6G.00	Diabetic foot examination not indicated	9h4..00	Exception reporting: diabetes quality indicators
8I81.00	Did not complete diabetes structured education programme	9h41.00	Excepted from diabetes qual indicators: Patient unsuitable
8I82.00	Did not complete DAFNE diabetes structured education program	9h42.00	Excepted from diabetes quality indicators: Informed dissent
8I83.00	Did not complete DESMOND diabetes structured educat program	9kL..00	Insulin initiation - enhanced services administration
8I84.00	Did not complete XPERT diabetes structured education program	9m0..00	Diabetic retinopathy screening administrative status
9360.00	Patient held diabetic record issued	9m00.00	Eligible for diabetic retinopathy screening
93C4.00	Patient consent given for addition to diabetic register	9m01.00	Ineligible for diabetic retinopathy screening
9M00.00	Informed consent for diabetes national audit	9m04.00	Excluded from diabetic retinopathy screening
9M10.00	Informed dissent for diabetes national audit	9m05.00	Excluded from diabetic retinopathy screening as moved away
9N0m.00	Seen in diabetic nurse consultant clinic	9m0A.00	Declined diabetic retinop scrn
9N0n.00	Seen in community diabetes specialist clinic	9m0C.00	Excluded frm diabetic retinopathy screen as terminal illness
9N0o.00	Seen in community diabetes specialist nurse clinic	9m0D.00	Excluded from diabetic retinopthy screen as learn disability
9N1Q.00	Seen in diabetic clinic	9m0E.00	Excluded from diabetic retinopathy screen physical disorder
9N1i.00	Seen in diabetic foot clinic	C10..00	Diabetes mellitus
9N1o.00	Seen in multidisciplinary diabetic clinic	C100.00	Diabetes mellitus with no mention of complication

READCODE	Description	READCODE	Description
C100000	Diabetes mellitus, juvenile type, no mention of complication	C108000	Insulin-dependent diabetes mellitus with renal complications
C100011	Insulin dependent diabetes mellitus	C108011	Type I diabetes mellitus with renal complications
C100100	Diabetes mellitus, adult onset, no mention of complication	C108012	Type 1 diabetes mellitus with renal complications
C100111	Maturity onset diabetes	C108100	Insulin-dependent diabetes mellitus with ophthalmic comps
C100112	Non-insulin dependent diabetes mellitus	C108111	Type I diabetes mellitus with ophthalmic complications
C100z00	Diabetes mellitus NOS with no mention of complication	C108112	Type 1 diabetes mellitus with ophthalmic complications
C101.00	Diabetes mellitus with ketoacidosis	C108200	Insulin-dependent diabetes mellitus with neurological comps
C101000	Diabetes mellitus, juvenile type, with ketoacidosis	C108211	Type I diabetes mellitus with neurological complications
C101100	Diabetes mellitus, adult onset, with ketoacidosis	C108212	Type 1 diabetes mellitus with neurological complications
C101y00	Other specified diabetes mellitus with ketoacidosis	C108300	Insulin dependent diabetes mellitus with multiple complicatn
C101z00	Diabetes mellitus NOS with ketoacidosis	C108311	Type I diabetes mellitus with multiple complications
C102.00	Diabetes mellitus with hyperosmolar coma	C108312	Type 1 diabetes mellitus with multiple complications
C102000	Diabetes mellitus, juvenile type, with hyperosmolar coma	C108400	Unstable insulin dependent diabetes mellitus
C102100	Diabetes mellitus, adult onset, with hyperosmolar coma	C108411	Unstable type I diabetes mellitus
C102z00	Diabetes mellitus NOS with hyperosmolar coma	C108412	Unstable type 1 diabetes mellitus
C103.00	Diabetes mellitus with ketoacidotic coma	C108500	Insulin dependent diabetes mellitus with ulcer
C103000	Diabetes mellitus, juvenile type, with ketoacidotic coma	C108511	Type I diabetes mellitus with ulcer
C103100	Diabetes mellitus, adult onset, with ketoacidotic coma	C108512	Type 1 diabetes mellitus with ulcer
C103y00	Other specified diabetes mellitus with coma	C108600	Insulin dependent diabetes mellitus with gangrene
C103z00	Diabetes mellitus NOS with ketoacidotic coma	C108611	Type I diabetes mellitus with gangrene
C104.00	Diabetes mellitus with renal manifestation	C108612	Type 1 diabetes mellitus with gangrene
C104.11	Diabetic nephropathy	C108700	Insulin dependent diabetes mellitus with retinopathy
C104000	Diabetes mellitus, juvenile type, with renal manifestation	C108711	Type I diabetes mellitus with retinopathy
C104100	Diabetes mellitus, adult onset, with renal manifestation	C108712	Type 1 diabetes mellitus with retinopathy
C104y00	Other specified diabetes mellitus with renal complications	C108800	Insulin dependent diabetes mellitus - poor control
C104z00	Diabetes mellitis with nephropathy NOS	C108811	Type I diabetes mellitus - poor control
C105.00	Diabetes mellitus with ophthalmic manifestation	C108812	Type 1 diabetes mellitus - poor control
C105000	Diabetes mellitus, juvenile type, + ophthalmic manifestation	C108900	Insulin dependent diabetes maturity onset
C105100	Diabetes mellitus, adult onset, + ophthalmic manifestation	C108911	Type I diabetes mellitus maturity onset
C105y00	Other specified diabetes mellitus with ophthalmic complicatn	C108912	Type 1 diabetes mellitus maturity onset
C105z00	Diabetes mellitus NOS with ophthalmic manifestation	C108A00	Insulin-dependent diabetes without complication
C106.00	Diabetes mellitus with neurological manifestation	C108A11	Type I diabetes mellitus without complication
C106.11	Diabetic amyotrophy	C108A12	Type 1 diabetes mellitus without complication
C106.12	Diabetes mellitus with neuropathy	C108B00	Insulin dependent diabetes mellitus with mononeuropathy
C106.13	Diabetes mellitus with polyneuropathy	C108B11	Type I diabetes mellitus with mononeuropathy
C106000	Diabetes mellitus, juvenile, + neurological manifestation	C108B12	Type 1 diabetes mellitus with mononeuropathy
C106100	Diabetes mellitus, adult onset, + neurological manifestation	C108C00	Insulin dependent diabetes mellitus with polyneuropathy
C106y00	Other specified diabetes mellitus with neurological comps	C108C11	Type I diabetes mellitus with polyneuropathy
C106z00	Diabetes mellitus NOS with neurological manifestation	C108C12	Type 1 diabetes mellitus with polyneuropathy
C107.00	Diabetes mellitus with peripheral circulatory disorder	C108D00	Insulin dependent diabetes mellitus with nephropathy
C107.11	Diabetes mellitus with gangrene	C108D11	Type I diabetes mellitus with nephropathy
C107.12	Diabetes with gangrene	C108D12	Type 1 diabetes mellitus with nephropathy
C107000	Diabetes mellitus, juvenile +peripheral circulatory disorder	C108E00	Insulin dependent diabetes mellitus with hypoglycaemic coma
C107100	Diabetes mellitus, adult, + peripheral circulatory disorder	C108E11	Type I diabetes mellitus with hypoglycaemic coma
C107200	Diabetes mellitus, adult with gangrene	C108E12	Type 1 diabetes mellitus with hypoglycaemic coma
C107300	IDDM with peripheral circulatory disorder	C108F00	Insulin dependent diabetes mellitus with diabetic cataract
C107400	NIDDM with peripheral circulatory disorder	C108F11	Type I diabetes mellitus with diabetic cataract
C107y00	Other specified diabetes mellitus with periph circ comps	C108F12	Type 1 diabetes mellitus with diabetic cataract
C107z00	Diabetes mellitus NOS with peripheral circulatory disorder	C108G00	Insulin dependent diab mell with peripheral angiopathy
C108.00	Insulin dependent diabetes mellitus	C108G11	Type I diabetes mellitus with peripheral angiopathy
C108.11	IDDM-Insulin dependent diabetes mellitus	C108G12	Type 1 diabetes mellitus with peripheral angiopathy
C108.12	Type 1 diabetes mellitus	C108H00	Insulin dependent diabetes mellitus with arthropathy
C108.13	Type I diabetes mellitus	C108H11	Type I diabetes mellitus with arthropathy

A2.2 Diabetes Readcodes used to identify people who could have diabetes

READCODE	Description	READCODE	Description
C108H12	Type 1 diabetes mellitus with arthropathy	C109F00	Non-insulin-dependent d m with peripheral angiopath
C108J00	Insulin dependent diab mell with neuropathic arthropathy	C109F11	Type II diabetes mellitus with peripheral angiopathy
C108J11	Type I diabetes mellitus with neuropathic arthropathy	C109F12	Type 2 diabetes mellitus with peripheral angiopathy
C108J12	Type 1 diabetes mellitus with neuropathic arthropathy	C109G00	Non-insulin dependent diabetes mellitus with arthropathy
C108y00	Other specified diabetes mellitus with multiple comps	C109G11	Type II diabetes mellitus with arthropathy
C108z00	Unspecified diabetes mellitus with multiple complications	C109G12	Type 2 diabetes mellitus with arthropathy
C109.00	Non-insulin dependent diabetes mellitus	C109H00	Non-insulin dependent d m with neuropathic arthropathy
C109.11	NIDDM - Non-insulin dependent diabetes mellitus	C109H11	Type II diabetes mellitus with neuropathic arthropathy
C109.12	Type 2 diabetes mellitus	C109H12	Type 2 diabetes mellitus with neuropathic arthropathy
C109.13	Type II diabetes mellitus	C109J00	Insulin treated Type 2 diabetes mellitus
C109000	Non-insulin-dependent diabetes mellitus with renal comps	C109J11	Insulin treated non-insulin dependent diabetes mellitus
C109011	Type II diabetes mellitus with renal complications	C109J12	Insulin treated Type II diabetes mellitus
C109012	Type 2 diabetes mellitus with renal complications	C109K00	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C109100	Non-insulin-dependent diabetes mellitus with ophthalm comps	C10A.00	Malnutrition-related diabetes mellitus
C109111	Type II diabetes mellitus with ophthalmic complications	C10A000	Malnutrition-related diabetes mellitus with coma
C109112	Type 2 diabetes mellitus with ophthalmic complications	C10A100	Malnutrition-related diabetes mellitus with ketoacidosis
C109200	Non-insulin-dependent diabetes mellitus with neuro comps	C10A200	Malnutrition-related diabetes mellitus with renal complicatn
C109211	Type II diabetes mellitus with neurological complications	C10A300	Malnutrit-related diabetes mellitus wth ophthalmic complicat
C109212	Type 2 diabetes mellitus with neurological complications	C10A400	Malnutrit-related diabetes mellitus wth neuro complicatns
C109300	Non-insulin-dependent diabetes mellitus with multiple comps	C10A500	Malnutritn-relat diabetes melitus wth periph circul complctn
C109311	Type II diabetes mellitus with multiple complications	C10A600	Malnutrition-related diabetes mellitus with multiple comps
C109312	Type 2 diabetes mellitus with multiple complications	C10A700	Malnutrition-related diabetes mellitus without complications
C109400	Non-insulin dependent diabetes mellitus with ulcer	C10AW00	Malnutrit-related diabetes mellitus with unspec complics
C109411	Type II diabetes mellitus with ulcer	C10AX00	Malnutrit-relat diabetes mellitus with other spec comps
C109412	Type 2 diabetes mellitus with ulcer	C10B.00	Diabetes mellitus induced by steroids
C109500	Non-insulin dependent diabetes mellitus with gangrene	C10B000	Steroid induced diabetes mellitus without complication
C109511	Type II diabetes mellitus with gangrene	C10C.00	Diabetes mellitus autosomal dominant
C109512	Type 2 diabetes mellitus with gangrene	C10C.11	Maturity onset diabetes in youth
C109600	Non-insulin-dependent diabetes mellitus with retinopathy	C10C.12	Maturity onset diabetes in youth type 1
C109611	Type II diabetes mellitus with retinopathy	C10D.00	Diabetes mellitus autosomal dominant type 2
C109612	Type 2 diabetes mellitus with retinopathy	C10D.11	Maturity onset diabetes in youth type 2
C109700	Non-insulin dependent diabetes mellitus - poor control	C10E.00	Type 1 diabetes mellitus
C109711	Type II diabetes mellitus - poor control	C10E.11	Type I diabetes mellitus
C109712	Type 2 diabetes mellitus - poor control	C10E.12	Insulin dependent diabetes mellitus
C109800	Reaven's syndrome	C10E000	Type 1 diabetes mellitus with renal complications
C109900	Non-insulin-dependent diabetes mellitus without complication	C10E011	Type I diabetes mellitus with renal complications
C109911	Type II diabetes mellitus without complication	C10E012	Insulin-dependent diabetes mellitus with renal complications
C109912	Type 2 diabetes mellitus without complication	C10E100	Type 1 diabetes mellitus with ophthalmic complications
C109A00	Non-insulin dependent diabetes mellitus with mononeuropathy	C10E111	Type I diabetes mellitus with ophthalmic complications
C109A11	Type II diabetes mellitus with mononeuropathy	C10E112	Insulin-dependent diabetes mellitus with ophthalmic comps
C109A12	Type 2 diabetes mellitus with mononeuropathy	C10E200	Type 1 diabetes mellitus with neurological complications
C109B00	Non-insulin dependent diabetes mellitus with polyneuropathy	C10E211	Type I diabetes mellitus with neurological complications
C109B11	Type II diabetes mellitus with polyneuropathy	C10E212	Insulin-dependent diabetes mellitus with neurological comps
C109B12	Type 2 diabetes mellitus with polyneuropathy	C10E300	Type 1 diabetes mellitus with multiple complications
C109C00	Non-insulin dependent diabetes mellitus with nephropathy	C10E311	Type I diabetes mellitus with multiple complications
C109C11	Type II diabetes mellitus with nephropathy	C10E312	Insulin dependent diabetes mellitus with multiple complicat
C109C12	Type 2 diabetes mellitus with nephropathy	C10E400	Unstable type 1 diabetes mellitus
C109D00	Non-insulin dependent diabetes mellitus with hypoglyca coma	C10E411	Unstable type I diabetes mellitus
C109D11	Type II diabetes mellitus with hypoglycaemic coma	C10E412	Unstable insulin dependent diabetes mellitus
C109D12	Type 2 diabetes mellitus with hypoglycaemic coma	C10E500	Type 1 diabetes mellitus with ulcer
C109E00	Non-insulin depend diabetes mellitus with diabetic cataract	C10E511	Type I diabetes mellitus with ulcer
C109E11	Type II diabetes mellitus with diabetic cataract	C10E512	Insulin dependent diabetes mellitus with ulcer
C109E12	Type 2 diabetes mellitus with diabetic cataract	C10E600	Type 1 diabetes mellitus with gangrene

A2.2 Diabetes Readcodes used to identify people who could have diabetes

READCODE	Description	READCODE	Description
C10E611	Type I diabetes mellitus with gangrene	C10F011	Type II diabetes mellitus with renal complications
C10E612	Insulin dependent diabetes mellitus with gangrene	C10F100	Type 2 diabetes mellitus with ophthalmic complications
C10E700	Type 1 diabetes mellitus with retinopathy	C10F111	Type II diabetes mellitus with ophthalmic complications
C10E711	Type I diabetes mellitus with retinopathy	C10F200	Type 2 diabetes mellitus with neurological complications
C10E712	Insulin dependent diabetes mellitus with retinopathy	C10F211	Type II diabetes mellitus with neurological complications
C10E800	Type 1 diabetes mellitus - poor control	C10F300	Type 2 diabetes mellitus with multiple complications
C10E811	Type I diabetes mellitus - poor control	C10F311	Type II diabetes mellitus with multiple complications
C10E812	Insulin dependent diabetes mellitus - poor control	C10F400	Type 2 diabetes mellitus with ulcer
C10E900	Type 1 diabetes mellitus maturity onset	C10F411	Type II diabetes mellitus with ulcer
C10E911	Type I diabetes mellitus maturity onset	C10F500	Type 2 diabetes mellitus with gangrene
C10E912	Insulin dependent diabetes mellitus maturity onset	C10F511	Type II diabetes mellitus with gangrene
C10EA00	Type 1 diabetes mellitus without complication	C10F600	Type 2 diabetes mellitus with retinopathy
C10EA11	Type I diabetes mellitus without complication	C10F611	Type II diabetes mellitus with retinopathy
C10EA12	Insulin-dependent diabetes without complication	C10F700	Type 2 diabetes mellitus - poor control
C10EB00	Type 1 diabetes mellitus with mononeuropathy	C10F711	Type II diabetes mellitus - poor control
C10EB11	Type I diabetes mellitus with mononeuropathy	C10F800	Reaven's syndrome
C10EB12	Insulin dependent diabetes mellitus with mononeuropathy	C10F811	Metabolic syndrome X
C10EC00	Type 1 diabetes mellitus with polyneuropathy	C10F900	Type 2 diabetes mellitus without complication
C10EC11	Type I diabetes mellitus with polyneuropathy	C10F911	Type II diabetes mellitus without complication
C10EC12	Insulin dependent diabetes mellitus with polyneuropathy	C10FA00	Type 2 diabetes mellitus with mononeuropathy
C10ED00	Type 1 diabetes mellitus with nephropathy	C10FA11	Type II diabetes mellitus with mononeuropathy
C10ED11	Type I diabetes mellitus with nephropathy	C10FB00	Type 2 diabetes mellitus with polyneuropathy
C10ED12	Insulin dependent diabetes mellitus with nephropathy	C10FB11	Type II diabetes mellitus with polyneuropathy
C10EE00	Type 1 diabetes mellitus with hypoglycaemic coma	C10FC00	Type 2 diabetes mellitus with nephropathy
C10EE11	Type I diabetes mellitus with hypoglycaemic coma	C10FC11	Type II diabetes mellitus with nephropathy
C10EE12	Insulin dependent diabetes mellitus with hypoglycaemic coma	C10FD00	Type 2 diabetes mellitus with hypoglycaemic coma
C10EF00	Type 1 diabetes mellitus with diabetic cataract	C10FD11	Type II diabetes mellitus with hypoglycaemic coma
C10EF11	Type I diabetes mellitus with diabetic cataract	C10FE00	Type 2 diabetes mellitus with diabetic cataract
C10EF12	Insulin dependent diabetes mellitus with diabetic cataract	C10FE11	Type II diabetes mellitus with diabetic cataract
C10EG00	Type 1 diabetes mellitus with peripheral angiopathy	C10FF00	Type 2 diabetes mellitus with peripheral angiopathy
C10EG11	Type I diabetes mellitus with peripheral angiopathy	C10FF11	Type II diabetes mellitus with peripheral angiopathy
C10EG12	Insulin dependent diab mell with peripheral angiopathy	C10FG00	Type 2 diabetes mellitus with arthropathy
C10EH00	Type 1 diabetes mellitus with arthropathy	C10FG11	Type II diabetes mellitus with arthropathy
C10EH11	Type I diabetes mellitus with arthropathy	C10FH00	Type 2 diabetes mellitus with neuropathic arthropathy
C10EH12	Insulin dependent diabetes mellitus with arthropathy	C10FH11	Type II diabetes mellitus with neuropathic arthropathy
C10EJ00	Type 1 diabetes mellitus with neuropathic arthropathy	C10FJ00	Insulin treated Type 2 diabetes mellitus
C10EJ11	Type I diabetes mellitus with neuropathic arthropathy	C10FJ11	Insulin treated Type II diabetes mellitus
C10EJ12	Insulin dependent diab mell with neuropathic arthropathy	C10FK00	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C10EK00	Type 1 diabetes mellitus with persistent proteinuria	C10FL00	Type 2 diabetes mellitus with persistent proteinuria
C10EK11	Type I diabetes mellitus with persistent proteinuria	C10FL11	Type II diabetes mellitus with persistent proteinuria
C10EL00	Type 1 diabetes mellitus with persistent microalbuminuria	C10FM00	Type 2 diabetes mellitus with persistent microalbuminuria
C10EL11	Type I diabetes mellitus with persistent microalbuminuria	C10FM11	Type II diabetes mellitus with persistent microalbuminuria
C10EM00	Type 1 diabetes mellitus with ketoacidosis	C10FN00	Type 2 diabetes mellitus with ketoacidosis
C10EM11	Type I diabetes mellitus with ketoacidosis	C10FN11	Type II diabetes mellitus with ketoacidosis
C10EN00	Type 1 diabetes mellitus with ketoacidotic coma	C10FP00	Type 2 diabetes mellitus with ketoacidotic coma
C10EN11	Type I diabetes mellitus with ketoacidotic coma	C10FP11	Type II diabetes mellitus with ketoacidotic coma
C10EP00	Type 1 diabetes mellitus with exudative maculopathy	C10FQ00	Type 2 diabetes mellitus with exudative maculopathy
C10EP11	Type I diabetes mellitus with exudative maculopathy	C10FQ11	Type II diabetes mellitus with exudative maculopathy
C10EQ00	Type 1 diabetes mellitus with gastroparesis	C10FR00	Type 2 diabetes mellitus with gastroparesis
C10ER00	Latent autoimmune diabetes mellitus in adult	C10FS00	Maternally inherited diabetes mellitus
C10F.00	Type 2 diabetes mellitus	C10G.00	Secondary pancreatic diabetes mellitus
C10F.11	Type II diabetes mellitus	C10G000	Secondary pancreatic diabetes mellitus without complication
C10F000	Type 2 diabetes mellitus with renal complications	C10H.00	Diabetes mellitus induced by non-steroid drugs

A2.2 Diabetes Readcodes used to identify people who could have diabetes)

READCODE	Description
C10H000	DM induced by non-steroid drugs without complication
C10J.00	Insulin autoimmune syndrome
C10J000	Insulin autoimmune syndrome without complication
C10K.00	Type A insulin resistance
C10K000	Type A insulin resistance without complication
C10L.00	Fibrocalculous pancreatopathy
C10L000	Fibrocalculous pancreatopathy without complication
C10M.00	Lipoatrophic diabetes mellitus
C10M000	Lipoatrophic diabetes mellitus without complication
C10N.00	Secondary diabetes mellitus
C10N000	Secondary diabetes mellitus without complication
C10N100	Cystic fibrosis related diabetes mellitus
C10y.00	Diabetes mellitus with other specified manifestation
C10y000	Diabetes mellitus, juvenile, + other specified manifestation
C10y100	Diabetes mellitus, adult, + other specified manifestation
C10yy00	Other specified diabetes mellitus with other spec comps
C10yz00	Diabetes mellitus NOS with other specified manifestation
C10z.00	Diabetes mellitus with unspecified complication
C10z000	Diabetes mellitus, juvenile type, + unspecified complication
C10z100	Diabetes mellitus, adult onset, + unspecified complication
C10zy00	Other specified diabetes mellitus with unspecified comps
C10zz00	Diabetes mellitus NOS with unspecified complication
C113.00	Postsurgical hypoinsulinaemia
C113000	Postpancreatectomy hyperglycaemia
C113z00	Postsurgical hyperglycaemia NOS
C116000	Post-prandial hypoglycaemia
C11y000	Steroid induced diabetes
C11y100	Drug-induced hypoglycaemia without coma
C1A..00	Insulin resistance
C350011	Bronzed diabetes
Cyu2.00	[X]Diabetes mellitus
Cyu2000	[X]Other specified diabetes mellitus
Cyu2100	[X]Malnutrit-relat diabetes mellitus with other spec comps
Cyu2200	[X]Malnutrit-related diabetes mellitus with unspec complics
Cyu2300	[X]Unspecified diabetes mellitus with renal complications
F171100	Autonomic neuropathy due to diabetes
F345000	Diabetic mononeuritis multiplex
F35z000	Diabetic mononeuritis NOS
F372.00	Polyneuropathy in diabetes
F372.11	Diabetic polyneuropathy
F372.12	Diabetic neuropathy
F372000	Acute painful diabetic neuropathy
F372100	Chronic painful diabetic neuropathy
F372200	Asymptomatic diabetic neuropathy
F381300	Myasthenic syndrome due to diabetic amyotrophy
F381311	Diabetic amyotrophy
F3y0.00	Diabetic mononeuropathy
F420.00	Diabetic retinopathy
F420000	Background diabetic retinopathy
F420100	Proliferative diabetic retinopathy
F420200	Preproliferative diabetic retinopathy
F420300	Advanced diabetic maculopathy
F420400	Diabetic maculopathy

READCODE	Description
F420500	Advanced diabetic retinal disease
F420600	Non proliferative diabetic retinopathy
F420700	High risk proliferative diabetic retinopathy
F420800	High risk non proliferative diabetic retinopathy
F420z00	Diabetic retinopathy NOS
F440700	Diabetic iritis
F464000	Diabetic cataract
G73y000	Diabetic peripheral angiopathy
K01x100	Nephrotic syndrome in diabetes mellitus
K01x111	Kimmelstiel - Wilson disease
Kyu0300	[X]Glomerular disorders in diabetes mellitus
L180000	Diabetes mellitus - unspec whether in pregnancy/puerperium
L180500	Pre-existing diabetes mellitus, insulin-dependent
L180600	Pre-existing diabetes mellitus, non-insulin-dependent
L180700	Pre-existing malnutrition-related diabetes mellitus
L180X00	Pre-existing diabetes mellitus, unspecified
L180z00	Diabetes mellitus in pregnancy/childbirth/puerperium NOS
Lyu2900	[X]Pre-existing diabetes mellitus, unspecified
M037200	Cellulitis in diabetic foot
M21yC00	Insulin lipohypertrophy
M21yC11	Insulin site lipohypertrophy
M271000	Ischaemic ulcer diabetic foot
M271100	Neuropathic diabetic ulcer - foot
M271200	Mixed diabetic ulcer - foot
N030000	Diabetic cheiroarthropathy
N030011	Diabetic cheiropathy
N030100	Diabetic Charcot arthropathy
R054200	[D]Gangrene of toe in diabetic
R054300	[D]Widespread diabetic foot gangrene

A2.3 'Readcode' classification

A. Diagnostic and label codes

These types of labels (e.g. Type 1,Type 2, NIDDIM, IDDM) might be applied at diagnosis and then again whenever a patient is seen for a routine visit. Someone might come for an annual review and be given a code for 'type two diabetes' to indicate they had type 2 at this annual review. Another common use is for someone who has been treated with oral hypoglycaemic agents (OHA) for years and then starts insulin so they suddenly get a type 1 code which was more commonplace in the past but probably happens less often now.

B. Diabetes review

Any code which might be used for an annual review, an episode of assessment or diabetes monitoring. This includes O/E and codes that might suggest an assessment of some kind. Here we distinguish between a 'diagnostic or label' that would belong under group A and those that are about assessing a complication e.g. Type 1 with retinopathy. This category includes eye and foot screening, and indications of good and bad control.

C. Medication review

A code that suggests a change in medication, medication review, conversion to insulin or whether maximal tolerated therapy has been reached.

D. Referral to another party

A code where an assessment has been made and it's considered that the person may need to be seen by a specialist, sent for education (e.g. DESMOND diabetes structured education) or an action to happen outside the surgery.

E. Cared for by secondary care clinic

A code which suggests the surgery has handed over care to a third party (e.g. shared care programme, community diabetes specialist clinic).

F. Exemption codes

For example a person is unsuitable for digital retinal photography, foot examination not indicated or they have been excluded from diabetes QOF indicators.

G. Other: All other Readcodes not categorised under A to F.

Appendix 3 Additional tables

A3.1 Consultations with doctors and practice nurses based on Vision allocation or Sole contact

Year	Practices (no.)	Doctors (Vision)			Practice nurses (Vision)			Doctors (Sole contact)			Practice nurses (Sole contact)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	2350	1351	14 - 7672	1236	877	0 - 4625	2425	1380	15 - 7602	977	714	0 - 3561
2003	375	2223	1416	0 - 10402	1160	848	0 - 5182	2282	1448	0 - 10319	918	692	0 - 4084
2004	386	2287	1419	12 -9402	1225	905	0 - 6032	2339	1448	56 - 9431	964	743	0 - 4949
2005	427	2266	1387	173 - 9468	1251	931	0 - 6571	2312	1417	177 - 9222	982	760	0 - 5436
2006	441	2298	1368	5 - 7941	1290	980	0 - 5745	2335	1394	10 - 7889	1028	800	0 - 4737
2007	448	2357	1376	31 - 6804	1395	1073	0 - 5987	2413	1424	35 - 7387	1125	878	0 - 4996
2008	470	2336	1384	11 - 6835	1369	1069	0 - 6278	2381	1423	41 - 7435	1115	882	0 - 5068
2009	471	2348	1379	37 - 7212	1409	1098	0 - 7057	2395	1415	39 - 7851	1167	926	0 - 5595
2010	466	2334	1363	58 - 7021	1378	1081	0 - 6658	2383	1411	189 - 7592	1147	924	0 - 5735
2011	445	2353	1388	9 - 7461	1442	1099	0 - 6869	2394	1436	205 - 8120	1204	940	0 - 5666
2011/2012	434	2387	1405	0 -7919	1451	1107	0 - 6518	2432	1458	240 - 8583	1209	943	0 - 5268
	% Change	1.6%			17.4%			0.3%			23.8%		

A3.2 Consultations with doctors and practice nurses (based on Vision allocation or Sole contact) as a percentage of all healthcare professional staff

Year	Practices (no.)	Doctors (Vision)			Practice nurses (Vision)			Doctors (Sole contact)			Practice nurses (Sole contact)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	61.8	14.2	8.8 - 100.0	31.7	13.4	0.0 - 88.1	63.8	13.6	9.4 - 100.0	25.1	11.5	0.0 - 84.4
2003	375	61.4	14.8	0.0 - 100.0	31.9	14.0	0.0 - 100.0	63.0	14.3	0.0 - 99.8	25.2	12.1	0.0 - 100.0
2004	386	61.0	15.3	1.4 - 100.0	31.4	14.3	0.0 - 94.7	62.3	14.9	11.5 - 99.9	24.5	11.7	0.0 - 76.8
2005	427	60.1	15.6	17.7 - 100.0	31.5	14.4	0.0 - 74.7	61.0	15.2	18.8 - 99.5	24.5	11.6	0.0 - 63.9
2006	441	59.9	16.5	0.7 - 100.0	31.0	15.0	0.0 - 98.2	60.7	16.0	1.3 - 99.8	24.6	12.3	0.0 - 83.6
2007	448	58.7	16.8	5.2 - 100.0	31.5	15.1	0.0 - 92.8	59.7	16.2	5.8 - 99.5	25.4	12.5	0.0 - 79.5
2008	470	58.1	15.9	7.2 - 100.0	31.5	14.6	0.0 - 90.9	59.1	15.5	10.6 - 99.8	25.6	12.3	0.0 - 70.3
2009	471	57.6	16.7	2.3 - 100.0	31.6	14.9	0.0 - 97.7	58.5	16.3	2.5 - 99.7	26.1	12.7	0.0 - 78.9
2010	466	58.1	16.2	4.0 - 100.0	31.2	14.9	0.0 - 96.1	59.0	15.7	16.3 - 100.0	25.8	12.4	0.0 - 68.9
2011	445	57.1	16.0	0.6 - 100.0	32.2	14.7	0.0 - 99.3	57.8	15.5	20.6 - 100.0	26.8	12.5	0.0 - 62.3
2011/2012	434	57.3	16.1	8.8 - 100.0	32.1	14.8	0.0 - 100.0	58.0	15.5	20.4 - 99.9	26.7	12.5	0.0 - 59.6
	% Change	-7.3%			1.1%			-9.1%			6.4%		

A3.3 Number of times people with diabetes are seen per annum by doctors, practice nurses and healthcare professionals (based on Vision allocation or Sole contact)

	Practices (no.)	All healthcare professionals (Vision)			Doctors (Vision)			Practice nurses (Vision)			Doctors (Sole contact)			Practice nurses (Sole contact)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
2002	247	15.9	5.4	0.6 - 35.4	9.8	3.2	0.1 - 22.0	5.2	2.8	0.0 - 15.2	10.1	3.2	0.1 - 21.8	4.1	2.4	0.0 - 14.3
2003	375	15.2	5.1	0.0 - 32.9	9.2	3.0	0.0 - 21.8	5.0	2.7	0.0 - 14.5	9.5	3.0	0.0 - 22.5	3.9	2.2	0.0 - 11.7
2004	386	14.9	4.6	1.6 - 32.2	8.9	2.7	0.1 - 19.6	4.8	2.5	0.0 - 15.1	9.1	2.8	0.7 - 19.9	3.8	2.1	0.0 - 12.4
2005	427	14.3	4.3	4.1 - 32.4	8.4	2.7	2.1 - 23.7	4.6	2.5	0.0 - 15.0	8.5	2.7	2.3 - 23.6	3.6	2.1	0.0 - 12.4
2006	441	13.8	4.2	2.1 - 30.6	8.0	2.5	0.0 - 24.3	4.5	2.5	0.0 - 12.2	8.1	2.5	0.1 - 23.9	3.6	2.1	0.0 - 10.2
2007	448	13.6	4.2	1.2 - 29.1	7.7	2.4	0.2 - 24.9	4.5	2.5	0.0 - 12.7	7.9	2.5	0.2 - 24.1	3.6	2.1	0.0 - 11.6
2008	470	13.1	4.2	0.4 - 44.3	7.4	2.3	0.1 - 22.7	4.3	2.6	0.0 - 26.2	7.5	2.4	0.3 - 21.7	3.5	2.2	0.0 - 21.3
2009	471	12.7	4.0	2.0 - 35.5	7.0	2.1	0.2 - 17.3	4.2	2.5	0.0 - 21.1	7.2	2.2	0.2 - 16.5	3.5	2.2	0.0 - 17.0
2010	466	11.9	3.6	3.5 - 22.8	6.7	2.0	0.2 - 16.9	3.9	2.2	0.0 - 12.6	6.8	2.0	1.0 - 17.2	3.3	1.9	0.0 - 12.4
2011	445	11.5	3.4	2.6 - 21.6	6.4	1.9	0.0 - 17.4	3.9	2.1	0.0 - 11.9	6.4	1.9	1.4 - 17.4	3.3	1.9	0.0 - 11.5
2011/2012	434	11.5	3.3	2.7 - 21.2	6.4	1.9	0.0 - 17.3	3.8	2.1	0.0 - 11.8	6.5	1.9	1.4 - 17.2	3.2	1.9	0.0 - 11.0
% Change		-28.1%			-34.9%			-25.6%			-36.0%			-21.1%		

A3.4 Multilevel model, HbA1c ≤7% - Findings for workforce variables (using nurse contact based on sole involvement[1])

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Patients per healthcare professional	-0.107	0.045	0.017	-0.049	0.024	0.038	-0.031	0.022	0.163	-0.033	0.020	0.109	-0.022	0.019	0.233
Nurse Contact - Sole involvement															
Low	0.025	0.090	0.780	-0.115	0.055	0.035	-0.097	0.053	0.064	-0.115	0.047	0.015	-0.025	0.047	0.589
Medium	-0.123	0.089	0.167	-0.123	0.056	0.029	-0.074	0.053	0.159	-0.073	0.047	0.124	-0.071	0.046	0.124
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.523	0.030		0.395	0.018		0.380	0.017		0.358	0.015		0.363	0.015	
Global Tests	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p
Nurse Contact -Sole involvement	3.280		0.194	6.290		0.043	3.728		0.155	6.141		0.046	2.409		0.300

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Patients per healthcare professional	0.004	0.021	0.833	0.019	0.015	0.216	0.019	0.015	0.204	0.030	0.017	0.070	0.045	0.019	0.015	0.028	0.017	0.105
Nurse Contact - Sole involvement																		
Low	-0.089	0.049	0.066	-0.011	0.045	0.816	-0.090	0.047	0.055	-0.015	0.043	0.733	-0.059	0.045	0.186	-0.029	0.045	0.527
Medium	-0.084	0.048	0.077	0.015	0.044	0.728	-0.109	0.045	0.015	0.017	0.042	0.686	-0.020	0.042	0.628	-0.029	0.042	0.494
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.382	0.015		0.363	0.014		0.375	0.014		0.347	0.014		0.341	0.014		0.339	0.014	
Global Tests	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p	$\chi^2_{(2df)}$		p
Nurse Contact -Sole involvement	4.522		0.104	0.321		0.852	6.940		0.031	0.506		0.777	1.753		0.416	0.623		0.732

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.5 Multilevel model, HbA1c ≤10% - Findings for workforce variables (using nurse contact based on sole involvement[1])

	2002			2003			2004			2005			2006				
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t		
Consultations per healthcare professional	-0.187	0.071	0.008	-0.103	0.031	0.001	-0.040	0.025	0.107	-0.025	0.022	0.266	-0.014	0.022	0.523		
Nurse Contact - Sole involvement																	
Low	-0.067	0.143	0.638	-0.145	0.071	0.042	-0.092	0.060	0.125	-0.050	0.052	0.338	-0.113	0.054	0.037		
Medium	-0.203	0.141	0.152	-0.094	0.073	0.202	0.010	0.060	0.866	-0.040	0.052	0.451	-0.085	0.053	0.114		
High	0.000			0.000			0.000			0.000			0.000				
Random Variance																	
Practice	0.864	0.044		0.522	0.023		0.420	0.019		0.379	0.017		0.404	0.017			
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p		
Nurse Contact - Sole involvement (2df)	2.158		0.340	4.267		0.118	3.589		0.166	1.030		0.598	4.827		0.090		

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	-0.011	0.023	0.628	-0.002	0.017	0.905	-0.015	0.017	0.373	-0.008	0.018	0.645	0.010	0.021	0.634	-0.016	0.020	0.420
Nurse Contact - Sole involvement																		
Low	-0.017	0.054	0.747	0.017	0.051	0.734	-0.032	0.052	0.537	-0.026	0.048	0.587	-0.088	0.050	0.082	-0.053	0.052	0.307
Medium	0.012	0.052	0.826	0.009	0.049	0.858	-0.067	0.050	0.178	-0.001	0.047	0.975	0.006	0.048	0.900	-0.025	0.048	0.600
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.392	0.016		0.400	0.016		0.371	0.016		0.376	0.016		0.382	0.016	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - Sole involvement (2df)	0.271		0.873	0.116		0.944	1.823		0.402	0.353		0.838	3.867		0.145	1.059		0.589

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.6 Multilevel model, HbA1c ≤7% - Findings for workforce variables (using nurse contact based on Vision allocation[1])

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	-0.112	0.045	0.012	-0.047	0.024	0.048	-0.033	0.022	0.144	-0.034	0.020	0.092	-0.021	0.019	0.258
Nurse Contact - Vision															
Low	0.102	0.091	0.263	-0.140	0.055	0.011	-0.027	0.053	0.606	-0.084	0.048	0.079	-0.024	0.047	0.609
Medium	-0.077	0.089	0.384	-0.114	0.055	0.040	-0.035	0.053	0.510	-0.042	0.047	0.370	-0.071	0.046	0.126
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.523	0.030		0.394	0.018		0.382	0.017		0.360	0.015		0.363	0.015	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - Vision (2df)	4.123		0.127	7.434		0.024	0.481		0.786	3.099		0.212	2.412		0.299

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	0.005	0.021	0.812	0.017	0.015	0.277	0.018	0.015	0.233	0.029	0.017	0.079	0.043	0.019	0.020	0.030	0.017	0.081
Nurse Contact - Vision																		
Low	-0.056	0.049	0.256	0.017	0.045	0.711	-0.012	0.046	0.793	-0.003	0.043	0.944	-0.053	0.043	0.216	-0.029	0.043	0.500
Medium	0.002	0.047	0.963	0.009	0.045	0.848	0.020	0.046	0.666	0.012	0.043	0.786	-0.043	0.043	0.318	-0.002	0.043	0.966
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.363	0.014		0.377	0.015		0.348	0.014		0.341	0.014		0.339	0.014	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - Vision (2df)	1.741		0.419	0.137		0.934	0.459		0.795	0.126		0.939	1.796		0.408	0.533		0.766

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.7 Multilevel model, HbA1c ≤10% - Findings for workforce variables (using nurse contact based on Vision allocation[1])

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	-0.197	0.071	0.005	-0.107	0.031	0.001	-0.045	0.025	0.076	-0.023	0.022	0.306	-0.015	0.022	0.489
Nurse Contact - Vision															
Low	0.051	0.145	0.724	-0.171	0.071	0.017	-0.082	0.060	0.175	-0.049	0.053	0.352	-0.071	0.055	0.192
Medium	-0.197	0.142	0.164	-0.172	0.072	0.017	-0.070	0.060	0.239	-0.003	0.052	0.947	-0.054	0.054	0.313
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.862	0.044		0.519	0.023		0.421	0.019		0.379	0.017		0.406	0.017	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - Vision (2df)	3.493		0.174	7.769		0.021	2.168		0.338	1.067		0.586	1.881		0.391

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Consultations per healthcare professional	-0.012	0.023	0.585	-0.003	0.017	0.846	-0.016	0.017	0.346	-0.009	0.018	0.628	0.006	0.021	0.761	-0.019	0.020	0.335
Nurse Contact - Vision																		
Low	0.010	0.054	0.850	0.056	0.050	0.266	0.051	0.050	0.311	0.021	0.047	0.651	-0.058	0.048	0.234	-0.026	0.050	0.596
Medium	0.032	0.052	0.531	0.058	0.050	0.247	0.067	0.051	0.186	0.061	0.048	0.207	0.012	0.049	0.810	-0.030	0.050	0.546
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.391	0.016		0.400	0.016		0.371	0.016		0.377	0.016		0.383	0.016	
Global Tests (degrees of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Nurse Contact - Vision (2df)	0.409		0.815	1.744		0.418	1.948		0.378	1.624		0.444	2.134		0.344	0.453		0.797

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.8 Multilevel model, HbA1c ≤7%, nurse contact based on any involvement[1], 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.719	0.198		-0.296	0.124		-0.567	0.111		-0.590	0.101		-0.454	0.097	
Age															
linear	0.510	0.014	<.001	0.495	0.010	<.001	0.524	0.010	<.001	0.528	0.009	<.001	0.530	0.008	<.001
quadratic	-0.108	0.012	<.001	-0.095	0.008	<.001	-0.096	0.008	<.001	-0.084	0.007	<.001	-0.104	0.007	<.001
Gender (Female)	-0.120	0.021	<.001	-0.088	0.016	<.001	-0.066	0.015	<.001	-0.018	0.014	0.194	-0.011	0.013	0.381
Charlson	-0.175	0.012	<.001	-0.166	0.009	<.001	-0.162	0.009	<.001	-0.179	0.008	<.001	-0.148	0.007	<.001
Obesity	0.124	0.023	<.001	0.069	0.017	<.001	0.044	0.016	0.005	0.010	0.014	0.467	0.000	0.013	0.976
Townsend															
1st - lowest	0.285	0.228	0.211	0.135	0.118	0.253	0.132	0.109	0.223	0.105	0.101	0.300	0.062	0.096	0.519
2nd	0.212	0.228	0.351	0.099	0.117	0.400	0.104	0.108	0.338	0.041	0.101	0.686	0.025	0.096	0.793
3th	0.198	0.228	0.385	0.066	0.117	0.575	0.054	0.108	0.620	0.042	0.100	0.676	-0.001	0.096	0.989
4th	0.130	0.228	0.568	0.044	0.117	0.706	0.046	0.108	0.673	-0.011	0.100	0.910	-0.053	0.096	0.576
5th - highest	0.146	0.228	0.521	0.036	0.117	0.757	0.013	0.108	0.906	-0.008	0.101	0.938	-0.052	0.096	0.585
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.318	0.254	0.211	-0.155	0.141	0.272	-0.001	0.133	0.996	0.079	0.123	0.524	0.001	0.118	0.992
2nd	-0.229	0.253	0.366	-0.135	0.141	0.340	0.021	0.133	0.877	0.107	0.123	0.387	0.030	0.118	0.798
3th	-0.338	0.253	0.182	-0.188	0.141	0.182	-0.011	0.132	0.935	0.069	0.123	0.573	0.004	0.118	0.973
4th	-0.289	0.254	0.255	-0.186	0.141	0.186	0.025	0.132	0.853	0.060	0.123	0.623	0.002	0.118	0.988
5th - highest	-0.245	0.254	0.333	-0.141	0.141	0.317	-0.002	0.133	0.986	0.087	0.123	0.480	0.014	0.118	0.905
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.020	0.261	0.940	-0.092	0.217	0.671	-0.048	0.204	0.812	-0.221	0.193	0.253	0.157	0.185	0.396
Town & Fringe – Sparse	0.059	0.268	0.826	0.041	0.196	0.835	-0.135	0.158	0.392	-0.389	0.150	0.010	0.214	0.122	0.081
Village, Hamlet & Isolated dwellings – Sparse	0.068	0.202	0.736	-0.170	0.153	0.268	-0.055	0.134	0.684	-0.296	0.127	0.020	0.005	0.117	0.968
Urban >10k - Less sparse	0.098	0.058	0.089	0.043	0.044	0.337	0.034	0.043	0.428	-0.004	0.039	0.924	0.051	0.037	0.171
Town & Fringe – Less sparse	-0.023	0.059	0.700	-0.023	0.045	0.608	-0.014	0.042	0.731	-0.038	0.040	0.339	0.004	0.038	0.924
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.032	0.041	0.436	-0.015	0.027	0.571	-0.013	0.025	0.588	-0.017	0.022	0.436	-0.037	0.021	0.082
Prevalence	0.188	0.063	0.003	0.135	0.034	<.001	0.112	0.031	0.000	0.085	0.025	0.001	0.082	0.024	0.001
Country															
England	0.098	0.157	0.533	-0.098	0.097	0.313	0.033	0.085	0.695	0.086	0.077	0.263	0.135	0.072	0.062
Northern Ireland	-0.184	0.378	0.626	-0.276	0.186	0.138	-0.050	0.174	0.773	0.322	0.156	0.040	0.315	0.150	0.036
Scotland	-0.564	0.362	0.120	-0.133	0.180	0.460	0.077	0.167	0.644	0.094	0.154	0.542	0.055	0.147	0.706
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.110	0.045	0.015	-0.047	0.024	0.047	-0.032	0.022	0.156	-0.035	0.020	0.080	-0.021	0.019	0.258
Nurse Contact - any involvement															
Low	0.042	0.091	0.646	-0.154	0.054	0.004	-0.047	0.051	0.360	-0.104	0.047	0.028	-0.032	0.047	0.493
Medium	-0.067	0.088	0.445	-0.113	0.056	0.045	-0.037	0.053	0.484	-0.090	0.047	0.054	-0.073	0.046	0.113
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.526	0.030		0.394	0.018		0.382	0.017		0.358	0.015		0.362	0.015	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	23.166		<.001	15.983		0.007	23.704		0.000	30.940		<.001	36.939		<.001
Percent White (5df)	10.554		0.032	4.212		0.378	2.146		0.709	3.125		0.537	1.901		0.754
Urban-Rural Classification (5df)	6.043		0.302	4.652		0.460	2.568		0.766	8.751		0.119	6.996		0.221
Country (3df)	4.423		0.219	2.599		0.458	1.108		0.775	6.034		0.110	8.969		0.030
Nurse Contact - any involvement (2df)	1.547		0.461	8.853		0.012	0.941		0.625	5.929		0.052	2.516		0.284

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.9 Multilevel model, HbA1c ≤7%, nurse contact based on any involvement[1] 2007-2011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.470	0.096		-0.400	0.087		-0.402	0.087		-0.383	0.082		-0.363	0.084		-0.393	0.083	
Age																		
linear	0.584	0.008	<.001	0.590	0.008	<.001	0.593	0.008	<.001	0.596	0.008	<.001	0.596	0.007	<.001	0.570	0.008	<.001
quadratic	-0.094	0.007	<.001	-0.109	0.006	<.001	-0.107	0.006	<.001	-0.123	0.006	<.001	-0.111	0.006	<.001	-0.122	0.006	<.001
Gender (Female)	0.000	0.012	0.993	0.027	0.012	0.022	0.041	0.011	0.000	0.052	0.011	<.001	0.030	0.011	0.007	0.052	0.011	<.001
Charlson	-0.121	0.006	<.001	-0.125	0.006	<.001	-0.131	0.005	<.001	-0.141	0.005	<.001	-0.153	0.005	<.001	-0.149	0.005	<.001
Obesity	0.000	0.013	0.983	0.002	0.012	0.881	-0.004	0.012	0.747	-0.009	0.011	0.449	-0.050	0.011	<.001	-0.119	0.011	<.001
Townsend																		
1st - lowest	0.041	0.080	0.607	-0.015	0.073	0.840	-0.014	0.067	0.829	0.104	0.064	0.106	0.106	0.061	0.081	0.118	0.061	0.051
2nd	0.011	0.080	0.889	-0.073	0.072	0.312	-0.060	0.066	0.367	0.083	0.064	0.192	0.077	0.060	0.201	0.093	0.060	0.122
3th	-0.016	0.080	0.845	-0.076	0.072	0.293	-0.088	0.066	0.186	0.044	0.064	0.494	0.068	0.060	0.261	0.090	0.060	0.137
4th	-0.027	0.080	0.734	-0.104	0.072	0.150	-0.105	0.066	0.115	0.012	0.064	0.854	0.052	0.060	0.386	0.069	0.060	0.251
5th - highest	-0.070	0.080	0.380	-0.122	0.072	0.092	-0.140	0.067	0.036	0.003	0.064	0.960	-0.006	0.061	0.926	0.036	0.061	0.555
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.057	0.103	0.582	0.032	0.095	0.733	-0.028	0.089	0.756	-0.208	0.086	0.016	-0.251	0.082	0.002	-0.244	0.082	0.003
2nd	-0.023	0.103	0.825	0.031	0.095	0.745	-0.012	0.089	0.890	-0.161	0.086	0.062	-0.192	0.083	0.020	-0.164	0.082	0.046
3th	-0.005	0.102	0.959	0.037	0.094	0.695	0.014	0.088	0.877	-0.156	0.086	0.069	-0.204	0.082	0.013	-0.183	0.081	0.025
4th	-0.021	0.102	0.839	0.036	0.094	0.704	-0.019	0.089	0.831	-0.154	0.086	0.073	-0.169	0.082	0.039	-0.163	0.082	0.046
5th - highest	-0.022	0.103	0.835	0.043	0.095	0.653	0.010	0.089	0.907	-0.159	0.086	0.065	-0.174	0.082	0.035	-0.162	0.082	0.048
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	0.190	0.182	0.296	0.234	0.176	0.185	-0.247	0.239	0.302	-0.181	0.230	0.431	-0.300	0.235	0.202	0.061	0.226	0.787
Town & Fringe – Sparse	0.067	0.121	0.578	0.098	0.119	0.408	0.144	0.122	0.235	-0.003	0.118	0.976	0.008	0.119	0.948	0.063	0.118	0.591
Village, Hamlet & Isolated dwellings – Sparse	0.120	0.113	0.288	0.159	0.110	0.147	0.077	0.114	0.500	0.000	0.111	1.000	-0.050	0.124	0.685	-0.029	0.123	0.813
Urban >10k - Less sparse	0.061	0.036	0.091	0.070	0.034	0.044	0.036	0.034	0.285	0.105	0.034	0.002	0.121	0.034	0.000	0.118	0.034	0.001
Town & Fringe – Less sparse	0.053	0.036	0.150	0.052	0.035	0.137	0.035	0.034	0.300	0.072	0.033	0.030	0.037	0.034	0.278	0.030	0.035	0.383
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.043	0.022	0.054	-0.044	0.020	0.030	-0.032	0.021	0.122	-0.050	0.019	0.009	-0.034	0.019	0.082	-0.033	0.019	0.086
Prevalence	0.061	0.023	0.009	0.068	0.021	0.001	0.050	0.021	0.018	0.041	0.019	0.029	0.049	0.018	0.006	0.045	0.018	0.011
Country																		
England	0.162	0.076	0.033	0.088	0.069	0.206	0.200	0.071	0.005	0.159	0.066	0.015	0.123	0.068	0.070	0.097	0.067	0.150
Northern Ireland	0.294	0.147	0.045	0.081	0.143	0.572	0.235	0.140	0.094	0.084	0.130	0.519	0.024	0.128	0.849	-0.078	0.127	0.538
Scotland	0.163	0.133	0.219	0.132	0.118	0.265	0.144	0.115	0.208	-0.026	0.108	0.812	-0.033	0.106	0.755	-0.076	0.105	0.469
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.005	0.021	0.827	0.017	0.015	0.263	0.022	0.015	0.147	0.030	0.017	0.066	0.043	0.018	0.020	0.027	0.017	0.110
Nurse Contact - any involvement																		
Low	-0.063	0.048	0.195	0.008	0.044	0.850	-0.064	0.046	0.158	-0.040	0.042	0.339	-0.051	0.042	0.227	-0.018	0.043	0.672
Medium	-0.018	0.047	0.701	0.010	0.045	0.831	0.012	0.046	0.800	-0.016	0.043	0.710	-0.048	0.043	0.266	-0.035	0.044	0.427
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.364	0.014		0.376	0.014		0.347	0.014		0.341	0.014		0.339	0.014	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	25.193		<.001	31.185		<.001	41.467		<.001	36.497		<.001	29.351		<.001	17.911		0.003
Percent White (5df)	2.749		0.601	0.139		0.998	3.263		0.515	4.287		0.369	8.341		0.080	11.675		0.020
Urban-Rural Classification (5df)	3.993		0.550	5.822		0.324	4.558		0.472	11.269		0.046	17.228		0.004	14.997		0.010
Country (3df)	6.246		0.100	2.001		0.572	8.696		0.034	10.095		0.018	6.294		0.098	6.080		0.108
Nurse Contact - any involvement (2df)	1.717		0.424	0.057		0.972	2.878		0.237	0.917		0.632	1.936		0.380	0.645		0.724

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.10 Multilevel model, HbA1c ≤10%, nurse contact based on any involvement[1], 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.024	0.292		1.513	0.156		1.441	0.127		1.445	0.115		1.606	0.115	
Age															
linear	0.411	0.013	<.001	0.403	0.011	<.001	0.437	0.012	<.001	0.470	0.011	<.001	0.466	0.011	<.001
quadratic	-0.134	0.010	<.001	-0.095	0.007	<.001	-0.068	0.007	<.001	-0.070	0.007	<.001	-0.081	0.007	<.001
Gender (Female)	-0.154	0.022	<.001	-0.107	0.019	<.001	-0.163	0.019	<.001	-0.148	0.018	<.001	-0.167	0.017	<.001
Charlson	-0.069	0.013	<.001	-0.070	0.011	<.001	-0.034	0.011	0.002	-0.073	0.010	<.001	-0.063	0.009	<.001
Obesity	0.467	0.026	<.001	0.424	0.021	<.001	0.360	0.021	<.001	0.348	0.019	<.001	0.353	0.018	<.001
Townsend															
1st - lowest	0.350	0.217	0.107	0.202	0.131	0.122	0.267	0.134	0.047	0.396	0.125	0.002	0.186	0.126	0.139
2nd	0.281	0.217	0.195	0.175	0.130	0.180	0.223	0.134	0.096	0.330	0.125	0.008	0.158	0.126	0.207
3th	0.209	0.217	0.336	0.066	0.130	0.611	0.119	0.134	0.372	0.196	0.125	0.116	0.062	0.125	0.621
4th	0.146	0.217	0.501	-0.014	0.130	0.914	0.038	0.133	0.775	0.110	0.125	0.378	-0.044	0.125	0.725
5th - highest	0.096	0.217	0.659	-0.064	0.130	0.624	-0.101	0.133	0.450	0.001	0.125	0.992	-0.145	0.125	0.248
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.332	0.249	0.182	-0.150	0.159	0.346	-0.213	0.163	0.191	-0.295	0.153	0.054	-0.139	0.153	0.365
2nd	-0.251	0.248	0.313	-0.089	0.160	0.578	-0.109	0.163	0.501	-0.208	0.153	0.175	-0.060	0.153	0.696
3th	-0.284	0.248	0.253	-0.111	0.159	0.486	-0.136	0.162	0.402	-0.192	0.153	0.209	-0.081	0.153	0.596
4th	-0.286	0.249	0.250	-0.091	0.160	0.570	-0.100	0.162	0.538	-0.171	0.152	0.261	-0.073	0.153	0.634
5th - highest	-0.277	0.250	0.267	0.031	0.160	0.847	0.002	0.163	0.992	-0.092	0.153	0.547	0.029	0.154	0.852
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.535	0.309	0.084	0.129	0.270	0.633	0.120	0.249	0.630	-0.128	0.238	0.590	-0.111	0.248	0.654
Town & Fringe – Sparse	0.614	0.328	0.061	0.038	0.255	0.881	-0.093	0.203	0.646	-0.254	0.192	0.185	0.022	0.175	0.898
Village, Hamlet & Isolated dwellings – Sparse	0.045	0.215	0.833	-0.187	0.190	0.326	-0.159	0.161	0.324	-0.054	0.160	0.734	-0.139	0.152	0.361
Urban >10k - Less sparse	0.071	0.063	0.262	0.009	0.054	0.864	0.028	0.055	0.615	0.053	0.053	0.315	0.009	0.050	0.864
Town & Fringe – Less sparse	0.043	0.066	0.514	0.064	0.057	0.257	-0.041	0.057	0.475	-0.043	0.055	0.430	-0.021	0.053	0.684
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.059	0.064	0.361	0.003	0.034	0.934	-0.014	0.028	0.621	-0.002	0.024	0.932	-0.022	0.024	0.376
Prevalence	0.094	0.099	0.339	0.027	0.044	0.542	0.022	0.035	0.531	-0.007	0.028	0.791	0.037	0.027	0.169
Country															
England	0.238	0.249	0.339	-0.030	0.126	0.814	0.243	0.096	0.011	0.246	0.084	0.004	0.186	0.083	0.025
Northern Ireland	-0.186	0.508	0.715	-0.067	0.228	0.768	0.230	0.201	0.254	0.191	0.181	0.289	0.247	0.183	0.178
Scotland	-0.803	0.488	0.100	0.129	0.218	0.555	0.265	0.197	0.178	0.173	0.180	0.336	0.196	0.181	0.278
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.192	0.071	0.007	-0.107	0.030	<.001	-0.042	0.025	0.090	-0.024	0.022	0.273	-0.015	0.022	0.490
Nurse Contact - any involvement															
Low	-0.029	0.145	0.844	-0.189	0.070	0.007	-0.094	0.058	0.108	-0.070	0.052	0.176	-0.089	0.054	0.100
Medium	-0.191	0.140	0.174	-0.174	0.073	0.018	-0.035	0.060	0.563	-0.052	0.052	0.311	-0.081	0.053	0.130
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.865	0.044		0.518	0.023		0.421	0.019		0.379	0.017		0.405	0.017	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	48.381		<.001	85.321		<.001	129.013		<.001	180.686		<.001	146.102		<.001
Percent White (5df)	3.094		0.542	12.508		0.014	16.809		0.002	15.475		0.004	13.774		0.008
Urban-Rural Classification (5df)	7.266		0.202	4.166		0.526	3.808		0.577	6.828		0.234	1.653		0.895
Country (3df)	6.725		0.081	1.452		0.693	6.556		0.088	8.667		0.034	5.253		0.154
Nurse Contact - any involvement (2df)	2.173		0.337	9.046		0.011	2.621		0.270	2.027		0.363	3.455		0.178

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.11 Multilevel model, HbA1c ≤10%, nurse contact based on any involvement[1], 2007-2011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.463	0.109		1.456	0.100		1.498	0.099		1.513	0.094		1.431	0.097		1.509	0.095	
Age																		
linear	0.483	0.010	<.001	0.480	0.010	<.001	0.484	0.010	<.001	0.510	0.009	<.001	0.547	0.009	<.001	0.500	0.009	<.001
quadratic	-0.076	0.006	<.001	-0.075	0.006	<.001	-0.089	0.006	<.001	-0.086	0.006	<.001	-0.081	0.006	<.001	-0.116	0.006	<.001
Gender (Female)	-0.154	0.016	<.001	-0.148	0.016	<.001	-0.155	0.015	<.001	-0.142	0.015	<.001	-0.152	0.014	<.001	-0.132	0.014	<.001
Charlson	-0.017	0.008	0.040	-0.026	0.008	0.001	-0.047	0.007	<.001	-0.039	0.007	<.001	-0.069	0.007	<.001	-0.071	0.007	<.001
Obesity	0.308	0.017	<.001	0.339	0.016	<.001	0.286	0.016	<.001	0.293	0.015	<.001	0.207	0.015	<.001	0.040	0.015	0.006
Townsend																		
1st - lowest	0.382	0.102	<.001	0.236	0.095	0.013	0.237	0.087	0.007	0.315	0.082	<.001	0.268	0.075	<.001	0.285	0.073	<.001
2nd	0.306	0.101	0.003	0.208	0.094	0.028	0.188	0.087	0.030	0.266	0.081	0.001	0.238	0.075	0.001	0.237	0.072	0.001
3th	0.251	0.101	0.013	0.111	0.094	0.238	0.077	0.087	0.376	0.135	0.081	0.095	0.135	0.074	0.070	0.121	0.072	0.093
4th	0.143	0.101	0.155	-0.025	0.094	0.789	-0.033	0.086	0.703	0.014	0.081	0.865	0.016	0.074	0.834	0.020	0.072	0.780
5th - highest	0.018	0.101	0.861	-0.077	0.094	0.415	-0.133	0.087	0.123	-0.050	0.081	0.540	-0.129	0.074	0.083	-0.049	0.072	0.496
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.333	0.129	0.010	-0.162	0.121	0.182	-0.212	0.114	0.062	-0.344	0.108	0.001	-0.159	0.102	0.118	-0.224	0.099	0.023
2nd	-0.254	0.129	0.050	-0.097	0.122	0.424	-0.119	0.114	0.298	-0.281	0.108	0.009	-0.121	0.102	0.235	-0.198	0.099	0.045
3th	-0.256	0.129	0.047	-0.093	0.121	0.441	-0.071	0.113	0.533	-0.242	0.108	0.024	-0.137	0.101	0.175	-0.187	0.098	0.056
4th	-0.209	0.129	0.105	-0.075	0.121	0.533	-0.076	0.113	0.502	-0.268	0.108	0.013	-0.103	0.101	0.309	-0.134	0.098	0.173
5th - highest	-0.195	0.130	0.133	-0.052	0.122	0.668	-0.060	0.114	0.599	-0.193	0.108	0.075	-0.086	0.102	0.400	-0.143	0.099	0.148
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	-0.037	0.235	0.874	-0.128	0.230	0.577	-0.247	0.308	0.422	0.119	0.308	0.699	0.257	0.306	0.400	0.463	0.300	0.122
Town & Fringe – Sparse	0.021	0.166	0.898	0.309	0.170	0.070	-0.027	0.164	0.867	0.194	0.158	0.220	0.255	0.163	0.118	-0.038	0.152	0.804
Village, Hamlet & Isolated dwellings – Sparse	0.049	0.155	0.750	0.126	0.154	0.412	-0.143	0.156	0.360	0.027	0.148	0.853	0.189	0.170	0.265	0.062	0.158	0.694
Urban >10k - Less sparse	0.053	0.048	0.273	0.048	0.046	0.295	0.085	0.045	0.061	0.193	0.044	<.0001	0.110	0.044	0.012	0.154	0.043	0.000
Town & Fringe – Less sparse	0.027	0.050	0.587	0.016	0.048	0.738	0.028	0.047	0.542	0.118	0.045	0.009	0.008	0.046	0.861	0.092	0.046	0.043
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.030	0.024	0.222	-0.032	0.023	0.161	-0.032	0.023	0.155	-0.043	0.021	0.042	-0.030	0.022	0.177	-0.006	0.022	0.779
Prevalence	-0.007	0.026	0.782	0.025	0.024	0.296	0.015	0.023	0.526	-0.002	0.021	0.931	0.004	0.020	0.838	-0.003	0.020	0.868
Country																		
England	0.202	0.083	0.015	0.149	0.077	0.053	0.120	0.078	0.124	0.110	0.073	0.131	0.157	0.077	0.041	0.134	0.077	0.081
Northern Ireland	0.127	0.169	0.452	0.047	0.168	0.780	0.117	0.163	0.472	0.040	0.151	0.793	0.213	0.150	0.155	0.116	0.147	0.433
Scotland	0.071	0.155	0.646	0.208	0.142	0.142	0.178	0.136	0.188	0.103	0.127	0.419	0.188	0.124	0.132	0.145	0.122	0.237
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.011	0.023	0.643	-0.001	0.017	0.938	-0.012	0.017	0.489	-0.008	0.018	0.657	0.005	0.021	0.813	-0.022	0.020	0.276
Nurse Contact - any involvement																		
Low	-0.011	0.053	0.834	0.043	0.050	0.382	0.000	0.050	0.993	-0.022	0.047	0.640	-0.052	0.048	0.284	-0.022	0.049	0.661
Medium	0.023	0.052	0.664	0.073	0.050	0.142	0.069	0.050	0.169	0.014	0.047	0.761	-0.008	0.049	0.873	-0.060	0.050	0.232
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.391	0.016		0.400	0.016		0.371	0.016		0.378	0.016		0.382	0.016	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	170.533		<.001	181.318		<.001	232.099		<.001	254.749		<.001	281.854		<.001	217.407		<.001
Percent White (5df)	10.179		0.038	6.410		0.171	15.752		0.003	12.703		0.013	3.655		0.455	5.043		0.283
Urban-Rural Classification (5df)	1.399		0.925	5.335		0.376	6.024		0.304	20.399		0.001	10.952		0.052	15.370		0.009
Country (3df)	6.710		0.082	5.619		0.132	2.876		0.411	2.615		0.455	4.457		0.216	3.143		0.370
Nurse Contact - any involvement (2df)	0.383		0.826	2.225		0.329	2.328		0.312	0.537		0.765	1.235		0.539	1.428		0.490

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.12 Multilevel model, HbA1c ≤7%, nurse contact based on sole involvement, 2002-2006[1]

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.697	0.196		-0.310	0.125		-0.533	0.112		-0.597	0.100		-0.465	0.096	
Age															
linear	0.510	0.014	<.001	0.495	0.010	<.001	0.524	0.010	<.001	0.528	0.009	<.001	0.530	0.008	<.001
quadratic	-0.108	0.012	<.001	-0.095	0.008	<.001	-0.096	0.008	<.001	-0.084	0.007	<.001	-0.104	0.007	<.001
Gender (Female)	-0.120	0.021	<.001	-0.088	0.016	<.001	-0.066	0.015	<.001	-0.018	0.014	0.195	-0.011	0.013	0.386
Charlson	-0.175	0.012	<.001	-0.166	0.009	<.001	-0.162	0.009	<.001	-0.179	0.008	<.001	-0.148	0.007	<.001
Obesity	0.124	0.023	<.001	0.069	0.017	<.001	0.044	0.016	0.005	0.010	0.014	0.471	0.000	0.013	0.980
Townsend															
1st - lowest	0.284	0.228	0.213	0.128	0.118	0.278	0.129	0.108	0.236	0.109	0.101	0.279	0.061	0.096	0.525
2nd	0.211	0.228	0.353	0.092	0.117	0.433	0.100	0.108	0.354	0.045	0.101	0.651	0.024	0.096	0.799
3th	0.197	0.228	0.388	0.059	0.117	0.616	0.050	0.108	0.641	0.047	0.100	0.643	-0.002	0.096	0.981
4th	0.129	0.228	0.572	0.037	0.117	0.750	0.042	0.108	0.694	-0.006	0.100	0.950	-0.053	0.096	0.577
5th - highest	0.146	0.228	0.523	0.029	0.117	0.802	0.010	0.108	0.927	-0.003	0.101	0.979	-0.053	0.096	0.579
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.313	0.254	0.217	-0.151	0.141	0.286	-0.001	0.132	0.997	0.071	0.123	0.564	0.004	0.118	0.973
2nd	-0.226	0.253	0.373	-0.127	0.141	0.369	0.019	0.133	0.886	0.098	0.123	0.427	0.032	0.118	0.788
3th	-0.335	0.253	0.185	-0.179	0.141	0.204	-0.012	0.132	0.930	0.061	0.123	0.621	0.005	0.118	0.966
4th	-0.287	0.254	0.258	-0.178	0.141	0.207	0.023	0.132	0.865	0.052	0.123	0.671	0.002	0.118	0.988
5th - highest	-0.245	0.253	0.333	-0.132	0.141	0.350	-0.005	0.132	0.972	0.079	0.123	0.522	0.014	0.118	0.907
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.016	0.261	0.951	-0.083	0.217	0.703	-0.051	0.203	0.800	-0.235	0.194	0.226	0.160	0.185	0.385
Town & Fringe – Sparse	0.055	0.268	0.837	0.054	0.196	0.782	-0.138	0.157	0.381	-0.387	0.150	0.010	0.217	0.122	0.076
Village, Hamlet & Isolated dwellings – Sparse	0.066	0.202	0.744	-0.160	0.153	0.297	-0.055	0.134	0.679	-0.295	0.127	0.020	0.006	0.117	0.956
Urban >10k - Less sparse	0.099	0.058	0.087	0.045	0.045	0.315	0.034	0.043	0.420	-0.003	0.039	0.936	0.050	0.037	0.182
Town & Fringe – Less sparse	-0.023	0.059	0.691	-0.023	0.045	0.600	-0.015	0.042	0.718	-0.038	0.040	0.333	0.002	0.038	0.960
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.033	0.041	0.416	-0.015	0.027	0.583	-0.012	0.025	0.624	-0.018	0.022	0.415	-0.037	0.021	0.083
Prevalence	0.180	0.063	0.004	0.137	0.034	<.001	0.115	0.031	<.001	0.087	0.025	0.001	0.082	0.024	0.001
Country															
England	0.085	0.156	0.586	-0.089	0.097	0.363	0.039	0.085	0.649	0.100	0.077	0.194	0.146	0.072	0.043
Northern Ireland	-0.182	0.377	0.628	-0.249	0.187	0.181	-0.043	0.173	0.802	0.315	0.156	0.044	0.319	0.150	0.034
Scotland	-0.531	0.360	0.140	-0.146	0.181	0.419	0.076	0.167	0.650	0.088	0.153	0.566	0.056	0.147	0.703
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.107	0.045	0.017	-0.049	0.024	0.038	-0.031	0.022	0.163	-0.033	0.020	0.109	-0.022	0.019	0.233
Nurse Contact -sole involvement															
Low	0.025	0.090	0.780	-0.115	0.055	0.035	-0.097	0.053	0.064	-0.115	0.047	0.015	-0.025	0.047	0.589
Medium	-0.123	0.089	0.167	-0.123	0.056	0.029	-0.074	0.053	0.159	-0.073	0.047	0.124	-0.071	0.046	0.124
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.523	0.030		0.395	0.018		0.380	0.017		0.358	0.015		0.363	0.015	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	23.103		<.001	15.931		0.007	23.411		<.001	30.743		<.001	36.529		<.001
Percent White (5df)	10.438		0.034	4.225		0.376	2.030		0.730	3.047		0.550	1.863		0.761
Urban-Rural Classification (5df)	6.154		0.292	4.791		0.442	2.699		0.746	8.773		0.119	7.087		0.214
Country (3df)	3.825		0.281	1.949		0.583	1.049		0.790	6.136		0.105	9.636		0.022
Nurse Contact - any involvement (2df)	3.280		0.194	6.290		0.043	3.728		0.155	6.141		0.046	2.409		0.300

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.13 Multilevel model, HbA1c ≤7%, nurse contact based on sole involvement[1], 2007-2011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.437	0.095		-0.397	0.087		-0.351	0.087		-0.398	0.082		-0.376	0.084		-0.392	0.083	
Age																		
linear	0.584	0.008	<.001	0.590	0.008	<.001	0.593	0.008	<.001	0.596	0.008	<.001	0.596	0.007	<.001	0.570	0.008	<.001
quadratic	-0.094	0.007	<.001	-0.109	0.006	<.001	-0.107	0.006	<.001	-0.123	0.006	<.001	-0.111	0.006	<.001	-0.122	0.006	<.001
Gender (Female)	0.000	0.012	0.997	0.027	0.012	0.022	0.041	0.011	<.001	0.052	0.011	<.001	0.030	0.011	0.008	0.052	0.011	<.001
Charlson	-0.121	0.006	<.001	-0.125	0.006	<.001	-0.131	0.005	<.001	-0.141	0.005	<.001	-0.153	0.005	<.001	-0.149	0.005	<.001
Obesity	0.000	0.013	1.000	0.002	0.012	0.886	-0.004	0.012	0.738	-0.009	0.011	0.450	-0.050	0.011	<.001	-0.119	0.011	<.001
Townsend																		
1st - lowest	0.038	0.080	0.639	-0.014	0.073	0.844	-0.014	0.067	0.831	0.104	0.064	0.106	0.106	0.061	0.079	0.119	0.061	0.049
2nd	0.008	0.080	0.923	-0.073	0.072	0.316	-0.060	0.066	0.366	0.083	0.064	0.193	0.078	0.060	0.196	0.094	0.060	0.118
3th	-0.019	0.080	0.812	-0.075	0.072	0.299	-0.088	0.066	0.187	0.044	0.064	0.495	0.069	0.060	0.255	0.091	0.060	0.131
4th	-0.031	0.080	0.700	-0.103	0.072	0.155	-0.105	0.066	0.115	0.012	0.064	0.855	0.053	0.060	0.378	0.070	0.060	0.242
5th - highest	-0.073	0.080	0.358	-0.121	0.072	0.094	-0.140	0.067	0.036	0.003	0.064	0.964	-0.005	0.061	0.937	0.037	0.061	0.539
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.050	0.103	0.629	0.031	0.095	0.744	-0.029	0.089	0.748	-0.208	0.086	0.016	-0.252	0.082	0.002	-0.245	0.082	0.003
2nd	-0.017	0.103	0.868	0.029	0.095	0.761	-0.013	0.089	0.881	-0.160	0.086	0.063	-0.192	0.083	0.020	-0.166	0.082	0.043
3th	0.000	0.102	0.999	0.035	0.094	0.712	0.013	0.088	0.884	-0.155	0.086	0.072	-0.204	0.082	0.013	-0.185	0.081	0.024
4th	-0.016	0.102	0.875	0.034	0.094	0.720	-0.020	0.089	0.817	-0.153	0.086	0.076	-0.170	0.082	0.039	-0.165	0.082	0.044
5th - highest	-0.017	0.103	0.865	0.041	0.095	0.668	0.008	0.089	0.931	-0.157	0.086	0.068	-0.174	0.082	0.035	-0.165	0.082	0.044
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	0.175	0.182	0.337	0.232	0.176	0.189	-0.272	0.239	0.255	-0.177	0.230	0.442	-0.300	0.235	0.201	0.055	0.227	0.810
Town & Fringe – Sparse	0.069	0.121	0.566	0.096	0.119	0.420	0.142	0.122	0.242	-0.002	0.118	0.985	0.008	0.119	0.948	0.059	0.118	0.620
Village, Hamlet & Isolated dwellings – Sparse	0.120	0.113	0.288	0.157	0.109	0.153	0.076	0.114	0.503	0.001	0.111	0.995	-0.051	0.125	0.685	-0.034	0.123	0.783
Urban >10k - Less sparse	0.063	0.036	0.082	0.070	0.034	0.044	0.037	0.034	0.274	0.105	0.034	0.002	0.120	0.034	0.000	0.117	0.034	0.001
Town & Fringe – Less sparse	0.053	0.036	0.145	0.052	0.035	0.133	0.034	0.034	0.319	0.072	0.033	0.030	0.037	0.034	0.276	0.031	0.035	0.376
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.039	0.022	0.082	-0.044	0.020	0.029	-0.026	0.021	0.205	-0.051	0.019	0.008	-0.035	0.019	0.064	-0.035	0.019	0.067
Prevalence	0.061	0.023	0.009	0.069	0.021	0.001	0.051	0.021	0.014	0.039	0.019	0.034	0.052	0.018	0.004	0.046	0.018	0.009
Country																		
England	0.157	0.075	0.037	0.090	0.069	0.193	0.195	0.071	0.006	0.155	0.066	0.018	0.128	0.068	0.059	0.098	0.067	0.146
Northern Ireland	0.289	0.146	0.048	0.078	0.143	0.583	0.212	0.140	0.129	0.086	0.130	0.508	0.028	0.128	0.828	-0.087	0.127	0.491
Scotland	0.155	0.133	0.242	0.132	0.118	0.266	0.131	0.115	0.254	-0.028	0.108	0.798	-0.036	0.107	0.739	-0.081	0.106	0.446
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.004	0.021	0.833	0.019	0.015	0.216	0.019	0.015	0.204	0.030	0.017	0.070	0.045	0.019	0.015	0.028	0.017	0.105
Nurse Contact -sole involvement																		
Low	-0.089	0.049	0.066	-0.011	0.045	0.816	-0.090	0.047	0.055	-0.015	0.043	0.733	-0.059	0.045	0.186	-0.029	0.045	0.527
Medium	-0.084	0.048	0.077	0.015	0.044	0.728	-0.109	0.045	0.015	0.017	0.042	0.686	-0.020	0.042	0.628	-0.029	0.042	0.494
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.382	0.015		0.363	0.014		0.375	0.014		0.347	0.014		0.341	0.014		0.339	0.014	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	25.072		<.001	30.814		<.001	41.540		<.001	36.637		<.001	29.285		<.001	17.778		<.001
Percent White (5df)	2.574		0.632	0.138		0.998	3.265		0.515	4.463		0.347	8.352		0.080	11.487		0.022
Urban-Rural Classification (5df)	4.028		0.545	5.786		0.328	4.847		0.435	11.245		0.047	17.048		0.004	14.816		0.011
Country (3df)	6.112		0.106	2.092		0.554	8.231		0.042	9.809		0.020	6.880		0.076	6.425		0.093
Nurse Contact - any involvement (2df)	4.522		0.104	0.321		0.852	6.940		0.031	0.506		0.777	1.753		0.416	0.623		0.732

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.14 Multilevel model, HbA1c ≤10%, nurse contact based on sole involvement[1], 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.024	0.289		1.458	0.157		1.410	0.128		1.432	0.114		1.612	0.114	
Age															
linear	0.411	0.013	<.001	0.403	0.011	<.001	0.437	0.012	<.001	0.470	0.011	<.001	0.466	0.011	<.001
quadratic	-0.134	0.010	<.001	-0.095	0.007	<.001	-0.068	0.007	<.001	-0.070	0.007	<.001	-0.081	0.007	<.001
Gender (Female)	-0.154	0.022	<.001	-0.107	0.019	<.001	-0.163	0.019	<.001	-0.148	0.018	<.001	-0.167	0.017	<.001
Charlson	-0.069	0.013	<.001	-0.070	0.011	<.001	-0.034	0.011	0.002	-0.073	0.010	<.001	-0.063	0.009	<.001
Obesity	0.467	0.026	<.001	0.424	0.021	<.001	0.360	0.021	<.001	0.349	0.019	<.001	0.353	0.018	<.001
Townsend															
1st - lowest	0.351	0.217	0.107	0.197	0.131	0.133	0.259	0.135	0.054	0.397	0.125	0.002	0.215	0.125	0.086
2nd	0.282	0.217	0.194	0.169	0.131	0.196	0.215	0.134	0.109	0.331	0.125	0.008	0.186	0.125	0.135
3th	0.210	0.217	0.334	0.060	0.130	0.645	0.111	0.134	0.406	0.197	0.125	0.114	0.090	0.124	0.472
4th	0.147	0.217	0.499	-0.020	0.130	0.878	0.030	0.134	0.822	0.111	0.125	0.371	-0.016	0.124	0.895
5th - highest	0.097	0.217	0.655	-0.070	0.130	0.591	-0.109	0.134	0.415	0.002	0.125	0.984	-0.116	0.124	0.350
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.330	0.249	0.185	-0.148	0.159	0.353	-0.203	0.163	0.213	-0.297	0.153	0.052	-0.165	0.153	0.281
2nd	-0.250	0.248	0.315	-0.084	0.160	0.597	-0.099	0.163	0.542	-0.210	0.153	0.170	-0.087	0.153	0.567
3th	-0.284	0.248	0.253	-0.106	0.160	0.505	-0.126	0.162	0.437	-0.193	0.153	0.206	-0.109	0.152	0.474
4th	-0.287	0.249	0.249	-0.086	0.160	0.592	-0.090	0.162	0.578	-0.173	0.152	0.256	-0.102	0.152	0.502
5th - highest	-0.280	0.250	0.262	0.038	0.161	0.813	0.011	0.163	0.948	-0.093	0.153	0.542	0.000	0.153	0.998
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.531	0.309	0.086	0.137	0.270	0.612	0.128	0.249	0.608	-0.135	0.238	0.572	-0.160	0.248	0.520
Town & Fringe – Sparse	0.616	0.328	0.060	0.052	0.255	0.839	-0.085	0.202	0.676	-0.250	0.192	0.192	0.017	0.175	0.923
Village, Hamlet & Isolated dwellings – Sparse	0.045	0.215	0.835	-0.177	0.191	0.354	-0.152	0.161	0.345	-0.053	0.160	0.740	-0.140	0.152	0.357
Urban >10k - Less sparse	0.070	0.063	0.268	0.010	0.054	0.857	0.030	0.055	0.594	0.053	0.053	0.316	0.008	0.050	0.881
Town & Fringe – Less sparse	0.043	0.066	0.518	0.065	0.057	0.250	-0.040	0.057	0.488	-0.044	0.055	0.426	-0.025	0.053	0.642
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.061	0.064	0.342	-0.001	0.035	0.978	-0.017	0.028	0.553	-0.003	0.024	0.886	-0.022	0.024	0.367
Prevalence	0.084	0.099	0.396	0.033	0.044	0.449	0.025	0.035	0.479	-0.007	0.028	0.797	0.039	0.027	0.150
Country															
England	0.240	0.249	0.334	-0.001	0.127	0.991	0.260	0.096	0.007	0.251	0.084	0.003	0.194	0.083	0.019
Northern Ireland	-0.154	0.507	0.762	-0.044	0.229	0.847	0.247	0.201	0.218	0.184	0.181	0.309	0.217	0.182	0.235
Scotland	-0.746	0.486	0.125	0.132	0.220	0.549	0.283	0.197	0.151	0.168	0.179	0.349	0.162	0.180	0.367
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.187	0.071	0.008	-0.103	0.031	0.001	-0.040	0.025	0.107	-0.025	0.022	0.266	-0.014	0.022	0.523
Nurse Contact -sole involvement															
Low	-0.067	0.143	0.638	-0.145	0.071	0.042	-0.092	0.060	0.125	-0.050	0.052	0.338	-0.113	0.054	0.037
Medium	-0.203	0.141	0.152	-0.094	0.073	0.202	0.010	0.060	0.866	-0.040	0.052	0.451	-0.085	0.053	0.114
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.864	0.044		0.522	0.023		0.420	0.019		0.379	0.017		0.404	0.017	
Global Tests (degrees of Freedom)	χ²		p	χ²		p	χ²		p	χ²		p	χ²		p
Townsend (5df)	48.227		<.001	85.400		<.001	129.114		<.001	180.410		<.001	146.075		<.001
Percent White (5df)	3.057		0.548	13.113		0.011	16.753		0.002	15.487		0.004	13.358		0.010
Urban-Rural Classification (5df)	7.231		0.204	4.138		0.530	3.781		0.581	6.816		0.235	1.832		0.872
Country (3df)	6.188		0.103	1.068		0.785	7.485		0.058	9.154		0.027	5.688		0.128
Nurse Contact - any involvement (2df)	2.158		0.340	4.267		0.118	3.589		0.166	1.030		0.598	4.827		0.090

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.15 Multilevel model, HbA1c ≤10%, nurse contact based on sole involvement[1], 2007-2011/12

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.470	0.109		1.484	0.101		1.554	0.099		1.522	0.094		1.427	0.097		1.486	0.096	
Age																		
linear	0.483	0.010	<.001	0.480	0.010	<.001	0.484	0.010	<.001	0.510	0.009	<.001	0.547	0.009	<.001	0.500	0.009	<.001
quadratic	-0.076	0.006	<.001	-0.075	0.006	<.001	-0.089	0.006	<.001	-0.086	0.006	<.001	-0.082	0.006	<.001	-0.116	0.006	<.001
Gender (Female)	-0.154	0.016	<.001	-0.148	0.016	<.001	-0.155	0.015	<.001	-0.142	0.015	<.001	-0.152	0.014	<.001	-0.132	0.014	<.001
Charlson	-0.017	0.008	0.040	-0.026	0.008	0.001	-0.047	0.007	<.001	-0.039	0.007	<.001	-0.069	0.007	<.001	-0.071	0.007	<.001
Obesity	0.308	0.017	<.001	0.339	0.016	<.0001	0.286	0.016	<.001	0.293	0.015	<.001	0.207	0.015	<.001	0.040	0.015	0.006
Townsend																		
1st - lowest	0.380	0.102	<.001	0.237	0.095	0.013	0.238	0.087	0.006	0.315	0.082	<.001	0.268	0.075	<.001	0.272	0.073	<.001
2nd	0.305	0.101	0.003	0.208	0.094	0.028	0.189	0.087	0.030	0.266	0.081	0.001	0.239	0.075	0.001	0.224	0.073	0.002
3rd	0.249	0.101	0.014	0.112	0.094	0.236	0.078	0.087	0.368	0.135	0.081	0.094	0.136	0.074	0.068	0.109	0.072	0.133
4th	0.142	0.101	0.160	-0.025	0.094	0.793	-0.032	0.086	0.712	0.014	0.081	0.862	0.017	0.074	0.824	0.008	0.072	0.916
5th - highest	0.016	0.101	0.872	-0.076	0.094	0.417	-0.133	0.087	0.126	-0.049	0.081	0.542	-0.128	0.074	0.085	-0.061	0.072	0.398
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.331	0.129	0.010	-0.162	0.122	0.182	-0.213	0.114	0.062	-0.346	0.108	0.001	-0.159	0.102	0.119	-0.213	0.099	0.031
2nd	-0.252	0.129	0.051	-0.098	0.122	0.423	-0.119	0.114	0.296	-0.282	0.108	0.009	-0.121	0.102	0.237	-0.187	0.099	0.059
3rd	-0.255	0.129	0.048	-0.094	0.121	0.436	-0.071	0.113	0.534	-0.244	0.108	0.024	-0.137	0.101	0.175	-0.174	0.098	0.076
4th	-0.206	0.129	0.109	-0.078	0.121	0.521	-0.078	0.114	0.495	-0.270	0.107	0.012	-0.103	0.101	0.307	-0.121	0.098	0.219
5th - highest	-0.193	0.130	0.136	-0.055	0.122	0.655	-0.063	0.114	0.585	-0.194	0.108	0.072	-0.087	0.102	0.395	-0.127	0.099	0.197
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	-0.049	0.235	0.834	-0.137	0.230	0.554	-0.265	0.308	0.389	0.118	0.308	0.703	0.263	0.306	0.389	0.444	0.299	0.138
Town & Fringe – Sparse	0.017	0.166	0.918	0.311	0.170	0.068	-0.027	0.165	0.870	0.193	0.158	0.222	0.258	0.163	0.114	-0.040	0.152	0.792
Village, Hamlet & Isolated dwellings – Sparse	0.045	0.155	0.772	0.127	0.154	0.410	-0.140	0.156	0.370	0.027	0.148	0.857	0.191	0.170	0.262	0.049	0.158	0.754
Urban >10k - Less sparse	0.052	0.048	0.275	0.048	0.046	0.295	0.086	0.045	0.058	0.193	0.044	<.001	0.109	0.044	0.014	0.156	0.043	<.001
Town & Fringe – Less sparse	0.027	0.050	0.586	0.015	0.048	0.749	0.026	0.047	0.571	0.117	0.045	0.009	0.007	0.046	0.883	0.096	0.046	0.036
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.030	0.025	0.223	-0.027	0.023	0.227	-0.026	0.023	0.254	-0.042	0.021	0.046	-0.028	0.022	0.187	-0.009	0.022	0.679
Prevalence	-0.007	0.026	0.795	0.026	0.024	0.276	0.016	0.023	0.500	-0.002	0.021	0.934	0.007	0.020	0.724	0.000	0.020	0.983
Country																		
England	0.200	0.083	0.015	0.151	0.077	0.050	0.115	0.078	0.141	0.109	0.073	0.135	0.166	0.077	0.031	0.152	0.077	0.049
Northern Ireland	0.129	0.169	0.446	0.038	0.168	0.821	0.093	0.163	0.566	0.031	0.151	0.836	0.214	0.149	0.152	0.153	0.148	0.299
Scotland	0.072	0.155	0.641	0.211	0.142	0.137	0.171	0.136	0.207	0.098	0.127	0.440	0.185	0.125	0.137	0.173	0.123	0.159
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.011	0.023	0.628	-0.002	0.017	0.905	-0.015	0.017	0.373	-0.008	0.018	0.645	0.010	0.021	0.634	-0.016	0.020	0.420
Nurse Contact -sole involvement																		
Low	-0.017	0.054	0.747	0.017	0.051	0.734	-0.032	0.052	0.537	-0.026	0.048	0.587	-0.088	0.050	0.082	-0.053	0.052	0.307
Medium	0.012	0.052	0.826	0.009	0.049	0.858	-0.067	0.050	0.178	-0.001	0.047	0.975	0.006	0.048	0.900	-0.025	0.048	0.600
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.392	0.016		0.400	0.016		0.371	0.016		0.376	0.016		0.382	0.016	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	170.303		<.001	180.955		<.001	231.849		<.001	254.704		<.001	281.635		<.001	216.514		<.001
Percent White (5df)	10.149		0.038	6.189		0.186	15.695		0.004	12.745		0.013	3.571		0.467	5.331		0.255
Urban-Rural Classification (5df)	1.419		0.922	5.476		0.361	6.243		0.283	20.459		0.001	10.870		0.054	15.687		0.008
Country (3df)	6.617		0.085	5.993		0.112	2.805		0.423	2.624		0.453	4.868		0.182	4.008		0.261
Nurse Contact - any involvement (2df)	0.271		0.873	0.116		0.944	1.823		0.402	0.353		0.838	3.867		0.145	1.059		0.589

[1] Nurse contact – sole involvement low <21%, medium 22-28%, high 29% and over

A3.16 Multilevel model, HbA1c ≤7%, nurse contact based on Vision allocation[1], 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.729	0.197		-0.311	0.123		-0.573	0.112		-0.616	0.102		-0.458	0.097	
Age															
linear	0.510	0.014	<.001	0.495	0.010	<.001	0.524	0.010	<.001	0.528	0.009	<.001	0.530	0.008	<.001
quadratic	-0.108	0.012	<.001	-0.095	0.008	<.001	-0.096	0.008	<.001	-0.084	0.007	<.001	-0.104	0.007	<.001
Gender (Female)	-0.120	0.021	<.001	-0.088	0.016	<.001	-0.066	0.015	<.001	-0.018	0.014	0.197	-0.011	0.013	0.383
Charlson	-0.175	0.012	<.001	-0.166	0.009	<.001	-0.162	0.009	<.001	-0.179	0.008	<.001	-0.148	0.007	<.001
Obesity	0.124	0.023	<.001	0.069	0.017	<.001	0.044	0.016	0.005	0.010	0.014	0.470	0.000	0.013	0.977
Townsend															
1st - lowest	0.285	0.228	0.211	0.127	0.118	0.281	0.135	0.109	0.215	0.107	0.101	0.290	0.057	0.096	0.549
2nd	0.212	0.228	0.351	0.091	0.117	0.436	0.106	0.108	0.326	0.043	0.101	0.671	0.020	0.096	0.831
3th	0.198	0.228	0.385	0.058	0.117	0.619	0.056	0.108	0.603	0.044	0.100	0.664	-0.006	0.096	0.952
4th	0.130	0.228	0.568	0.037	0.117	0.755	0.048	0.108	0.656	-0.009	0.100	0.925	-0.058	0.096	0.545
5th - highest	0.146	0.228	0.522	0.029	0.117	0.807	0.015	0.108	0.888	-0.006	0.101	0.953	-0.057	0.096	0.555
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.317	0.254	0.211	-0.149	0.141	0.292	-0.002	0.133	0.986	0.075	0.123	0.545	0.008	0.118	0.946
2nd	-0.227	0.253	0.370	-0.126	0.141	0.371	0.020	0.133	0.881	0.103	0.123	0.402	0.037	0.118	0.756
3th	-0.336	0.253	0.184	-0.178	0.141	0.207	-0.011	0.132	0.932	0.067	0.123	0.588	0.010	0.118	0.930
4th	-0.286	0.254	0.259	-0.175	0.141	0.214	0.024	0.133	0.856	0.059	0.123	0.630	0.008	0.118	0.948
5th - highest	-0.243	0.254	0.339	-0.131	0.141	0.354	-0.003	0.133	0.984	0.086	0.123	0.486	0.020	0.118	0.866
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.023	0.261	0.930	-0.088	0.217	0.686	-0.043	0.204	0.833	-0.217	0.194	0.263	0.153	0.185	0.407
Town & Fringe – Sparse	0.058	0.268	0.829	0.043	0.196	0.826	-0.131	0.158	0.406	-0.377	0.151	0.012	0.211	0.122	0.085
Village, Hamlet & Isolated dwellings – Sparse	0.068	0.202	0.737	-0.168	0.153	0.273	-0.053	0.134	0.694	-0.287	0.128	0.025	0.002	0.117	0.985
Urban >10k - Less sparse	0.099	0.058	0.088	0.043	0.045	0.329	0.033	0.043	0.433	-0.003	0.039	0.940	0.050	0.037	0.178
Town & Fringe – Less sparse	-0.024	0.059	0.681	-0.023	0.045	0.600	-0.015	0.042	0.719	-0.038	0.040	0.343	0.003	0.038	0.946
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.031	0.041	0.447	-0.014	0.027	0.603	-0.013	0.025	0.592	-0.020	0.022	0.375	-0.037	0.021	0.079
Prevalence	0.186	0.063	0.003	0.133	0.034	<.001	0.110	0.031	<.001	0.083	0.025	0.001	0.082	0.024	0.001
Country															
England	0.088	0.156	0.574	-0.088	0.097	0.363	0.031	0.085	0.714	0.092	0.077	0.234	0.136	0.072	0.060
Northern Ireland	-0.215	0.377	0.568	-0.252	0.186	0.176	-0.055	0.173	0.752	0.319	0.157	0.042	0.325	0.150	0.031
Scotland	-0.601	0.362	0.096	-0.114	0.180	0.526	0.072	0.167	0.666	0.096	0.154	0.534	0.059	0.147	0.686
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.112	0.045	0.012	-0.047	0.024	0.048	-0.033	0.022	0.144	-0.034	0.020	0.092	-0.021	0.019	0.258
Nurse Contact - Vision															
Low	0.102	0.091	0.263	-0.140	0.055	0.011	-0.027	0.053	0.606	-0.084	0.048	0.079	-0.024	0.047	0.609
Medium	-0.077	0.089	0.384	-0.114	0.055	0.040	-0.035	0.053	0.510	-0.042	0.047	0.370	-0.071	0.046	0.126
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.523	0.030		0.394	0.018		0.382	0.017		0.360	0.015		0.363	0.015	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	23.174		<.001	15.900		0.007	23.777		<.001	31.023		<.001	36.893		<.001
Percent White (5df)	10.697		0.030	4.039		0.401	2.160		0.706	3.035		0.552	1.897		0.755
Urban-Rural Classification (5df)	6.156		0.291	4.739		0.449	2.532		0.772	8.293		0.141	6.924		0.226
Country (3df)	4.711		0.194	2.223		0.527	1.081		0.782	5.902		0.117	9.303		0.026
Nurse Contact - any involvement (2df)	4.123		0.127	7.434		0.024	0.481		0.786	3.099		0.212	2.412		0.299

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.17 Multilevel model, HbA1c ≤7%, nurse contact based on Vision allocation, 2007-2011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.481	0.096		-0.403	0.088		-0.419	0.088		-0.396	0.083		-0.365	0.084	<.0001	-0.399	0.083	
Age																		
linear	0.584	0.008	<.001	0.590	0.008	<.001	0.593	0.008	<.001	0.596	0.008	<.001	0.596	0.007	<.001	0.570	0.008	<.001
quadratic	-0.094	0.007	<.001	-0.109	0.006	<.001	-0.107	0.006	<.001	-0.123	0.006	<.001	-0.111	0.006	<.001	-0.122	0.006	<.001
Gender (Female)	0.000	0.012	0.990	0.027	0.012	0.022	0.041	0.011	<.001	0.052	0.011	<.001	0.030	0.011	0.007	0.052	0.011	<.001
Charlson	-0.121	0.006	<.001	-0.125	0.006	<.001	-0.131	0.005	<.001	-0.141	0.005	<.001	-0.153	0.005	<.001	-0.149	0.005	<.001
Obesity	0.000	0.013	0.989	0.002	0.012	0.892	-0.004	0.012	0.751	-0.008	0.011	0.461	-0.050	0.011	<.001	-0.119	0.011	<.001
Townsend																		
1st - lowest	0.042	0.080	0.603	-0.014	0.073	0.842	-0.016	0.067	0.809	0.118	0.064	0.067	0.108	0.061	0.075	0.119	0.061	0.050
2nd	0.012	0.080	0.885	-0.073	0.072	0.310	-0.062	0.066	0.351	0.097	0.064	0.128	0.079	0.060	0.189	0.094	0.060	0.119
3th	-0.015	0.080	0.848	-0.076	0.072	0.295	-0.090	0.066	0.178	0.057	0.064	0.368	0.070	0.060	0.246	0.090	0.060	0.134
4th	-0.027	0.080	0.735	-0.103	0.072	0.153	-0.106	0.066	0.109	0.025	0.064	0.693	0.055	0.060	0.364	0.070	0.060	0.246
5th - highest	-0.070	0.080	0.384	-0.122	0.072	0.092	-0.142	0.067	0.033	0.017	0.064	0.796	-0.003	0.061	0.956	0.036	0.061	0.552
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.057	0.103	0.577	0.032	0.095	0.732	-0.026	0.089	0.773	-0.231	0.086	0.007	-0.255	0.082	0.002	-0.246	0.082	0.003
2nd	-0.022	0.103	0.828	0.031	0.095	0.745	-0.009	0.089	0.919	-0.184	0.086	0.033	-0.166	0.083	0.018	-0.166	0.082	0.043
3th	-0.005	0.102	0.958	0.037	0.094	0.694	0.018	0.088	0.841	-0.178	0.086	0.038	-0.207	0.082	0.012	-0.184	0.081	0.024
4th	-0.020	0.102	0.844	0.036	0.094	0.704	-0.015	0.089	0.868	-0.176	0.086	0.041	-0.172	0.082	0.036	-0.164	0.082	0.044
5th - highest	-0.020	0.103	0.845	0.043	0.095	0.651	0.014	0.089	0.873	-0.181	0.086	0.036	-0.177	0.082	0.032	-0.163	0.082	0.046
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	0.193	0.182	0.290	0.235	0.176	0.183	-0.245	0.239	0.305	-0.126	0.230	0.582	-0.290	0.235	0.216	0.058	0.226	0.797
Town & Fringe – Sparse	0.070	0.121	0.566	0.098	0.118	0.407	0.146	0.122	0.230	0.025	0.118	0.832	0.011	0.119	0.925	0.062	0.118	0.600
Village, Hamlet & Isolated dwellings – Sparse	0.122	0.113	0.281	0.159	0.109	0.146	0.079	0.114	0.486	0.024	0.111	0.826	-0.046	0.124	0.712	-0.031	0.123	0.801
Urban >10k - Less sparse	0.061	0.036	0.089	0.070	0.034	0.043	0.037	0.034	0.282	0.110	0.034	0.001	0.121	0.034	0.000	0.119	0.034	0.001
Town & Fringe – Less sparse	0.053	0.036	0.143	0.052	0.035	0.137	0.035	0.034	0.305	0.076	0.033	0.023	0.037	0.034	0.273	0.031	0.035	0.368
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.044	0.022	0.047	-0.044	0.020	0.029	-0.034	0.021	0.108	-0.050	0.019	0.009	-0.034	0.019	0.076	-0.036	0.019	0.060
Prevalence	0.060	0.023	0.010	0.068	0.021	0.001	0.048	0.021	0.023	0.040	0.019	0.032	0.050	0.018	0.005	0.046	0.018	0.010
Country																		
England	0.165	0.076	0.029	0.087	0.069	0.209	0.195	0.071	0.006	0.156	0.066	0.018	0.125	0.068	0.065	0.096	0.067	0.151
Northern Ireland	0.296	0.146	0.043	0.080	0.143	0.574	0.237	0.140	0.091	0.073	0.130	0.573	0.027	0.128	0.835	-0.079	0.127	0.536
Scotland	0.166	0.132	0.212	0.131	0.118	0.268	0.145	0.115	0.207	-0.045	0.108	0.677	-0.033	0.106	0.755	-0.079	0.105	0.454
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.005	0.021	0.812	0.017	0.015	0.277	0.018	0.015	0.233	0.029	0.017	0.079	0.043	0.019	0.020	0.030	0.017	0.081
Nurse Contact - Vision																		
Low	-0.056	0.049	0.256	0.017	0.045	0.711	-0.012	0.046	0.793	-0.003	0.043	0.944	-0.053	0.043	0.216	-0.029	0.043	0.500
Medium	0.002	0.047	0.963	0.009	0.045	0.848	0.020	0.046	0.666	0.012	0.043	0.786	-0.043	0.043	0.318	-0.002	0.043	0.966
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.363	0.014		0.377	0.015		0.348	0.014		0.341	0.014		0.339	0.014	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	25.207		<.001	31.091		<.001	41.583		<.001	37.121		<.001	29.274		<.001	17.984		0.003
Percent White (5df)	2.807		0.591	0.146		0.998	3.404		0.493	4.426		0.351	8.376		0.079	11.755		0.019
Urban-Rural Classification (5df)	4.070		0.539	5.871		0.319	4.586		0.469	11.550		0.042	17.056		0.004	15.224		0.009
Country (3df)	6.425		0.093	1.976		0.577	8.271		0.041	10.622		0.014	6.535		0.088	6.175		0.103
Nurse Contact - any involvement (2df)	1.741		0.419	0.137		0.934	0.459		0.795	0.126		0.939	1.796		0.408	0.533		0.766

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.18 Multilevel model, HbA1c ≤10%, nurse contact based on Vision allocation[1], 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.005	0.290		1.492	0.155		1.460	0.128		1.415	0.115		1.596	0.116	
Age															
linear	0.411	0.013	<.001	0.403	0.011	<.001	0.437	0.012	<.001	0.470	0.011	<.001	0.466	0.011	<.001
quadratic	-0.134	0.010	<.001	-0.095	0.007	<.001	-0.068	0.007	<.001	-0.070	0.007	<.001	-0.081	0.007	<.001
Gender (Female)	-0.154	0.022	<.001	-0.107	0.019	<.001	-0.163	0.019	<.001	-0.148	0.018	<.001	-0.167	0.017	<.001
Charlson	-0.069	0.013	<.001	-0.070	0.011	<.001	-0.034	0.011	0.002	-0.073	0.010	<.001	-0.063	0.009	<.001
Obesity	0.467	0.026	<.001	0.424	0.021	<.001	0.360	0.021	<.001	0.349	0.019	<.001	0.353	0.018	<.001
Townsend															
1st - lowest	0.350	0.217	0.107	0.194	0.131	0.139	0.272	0.134	0.042	0.396	0.125	0.002	0.223	0.125	0.075
2nd	0.281	0.217	0.195	0.166	0.131	0.203	0.228	0.134	0.088	0.330	0.125	0.008	0.194	0.125	0.120
3th	0.209	0.217	0.336	0.058	0.130	0.658	0.125	0.133	0.350	0.196	0.125	0.115	0.097	0.124	0.437
4th	0.146	0.217	0.501	-0.023	0.130	0.862	0.044	0.133	0.743	0.110	0.125	0.377	-0.009	0.124	0.939
5th - highest	0.096	0.217	0.660	-0.073	0.130	0.578	-0.095	0.133	0.475	0.002	0.125	0.989	-0.109	0.124	0.379
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.332	0.249	0.182	-0.143	0.159	0.369	-0.222	0.163	0.172	-0.297	0.153	0.052	-0.175	0.153	0.251
2nd	-0.249	0.248	0.316	-0.080	0.160	0.617	-0.118	0.163	0.466	-0.209	0.153	0.173	-0.096	0.153	0.530
3th	-0.282	0.248	0.255	-0.100	0.160	0.529	-0.144	0.162	0.374	-0.191	0.152	0.210	-0.117	0.152	0.444
4th	-0.285	0.249	0.253	-0.078	0.160	0.626	-0.109	0.162	0.501	-0.171	0.152	0.262	-0.108	0.152	0.476
5th - highest	-0.276	0.250	0.269	0.043	0.160	0.788	-0.008	0.163	0.962	-0.091	0.153	0.554	-0.006	0.153	0.970
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.536	0.309	0.083	0.132	0.270	0.626	0.121	0.249	0.629	-0.121	0.238	0.610	-0.152	0.248	0.541
Town & Fringe – Sparse	0.617	0.328	0.060	0.037	0.255	0.884	-0.096	0.203	0.636	-0.242	0.192	0.208	0.019	0.175	0.912
Village, Hamlet & Isolated dwellings – Spa	0.046	0.215	0.829	-0.184	0.190	0.332	-0.161	0.161	0.317	-0.046	0.160	0.773	-0.141	0.152	0.354
Urban >10k - Less sparse	0.070	0.063	0.263	0.011	0.054	0.834	0.029	0.055	0.598	0.054	0.053	0.307	0.008	0.050	0.866
Town & Fringe – Less sparse	0.041	0.066	0.531	0.066	0.057	0.247	-0.041	0.057	0.470	-0.044	0.055	0.427	-0.023	0.053	0.668
Village, Hamlet & Isolated dwelling – Less	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.060	0.065	0.355	0.005	0.035	0.883	-0.011	0.028	0.702	-0.004	0.024	0.874	-0.023	0.024	0.352
Prevalence	0.090	0.099	0.365	0.026	0.044	0.551	0.018	0.035	0.604	-0.009	0.028	0.754	0.037	0.027	0.176
Country															
England	0.228	0.248	0.357	-0.013	0.126	0.917	0.233	0.095	0.015	0.252	0.084	0.003	0.184	0.083	0.027
Northern Ireland	-0.226	0.508	0.656	-0.039	0.228	0.864	0.212	0.201	0.292	0.190	0.181	0.294	0.208	0.183	0.254
Scotland	-0.847	0.488	0.083	0.155	0.218	0.479	0.249	0.197	0.205	0.178	0.180	0.321	0.156	0.180	0.386
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.197	0.071	0.005	-0.107	0.031	0.001	-0.045	0.025	0.076	-0.023	0.022	0.306	-0.015	0.022	0.489
Nurse Contact - Vision															
Low	0.051	0.145	0.724	-0.171	0.071	0.017	-0.082	0.060	0.175	-0.049	0.053	0.352	-0.071	0.055	0.192
Medium	-0.197	0.142	0.164	-0.172	0.072	0.017	-0.070	0.060	0.239	-0.003	0.052	0.947	-0.054	0.054	0.313
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.862	0.044		0.519	0.023		0.421	0.019		0.379	0.017		0.406	0.017	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	48.369		<.001	85.435		<.001	128.877		<.001	180.791		<.001	146.793		<.001
Percent White (5df)	3.181		0.528	12.888		0.012	16.768		0.002	15.943		0.003	13.994		0.007
Urban-Rural Classification (5df)	7.302		0.199	4.165		0.526	3.956		0.556	6.774		0.238	1.804		0.876
Country (3df)	7.116		0.068	1.437		0.697	6.053		0.109	9.155		0.027	5.073		0.167
Nurse Contact - any involvement (2df)	3.493		0.174	7.769		0.021	2.168		0.338	1.067		0.586	1.881		0.391

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.19 Multilevel model, HbA1c ≤10%, nurse contact based on Vision allocation[1], 2007-2011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.452	0.109		1.457	0.101		1.483	0.100		1.488	0.094		1.423	0.097		1.483	0.096	
Age																		
linear	0.483	0.010	<.001	0.480	0.010	<.001	0.484	0.010	<.001	0.510	0.009	<.001	0.547	0.009	<.001	0.500	0.009	<.001
quadratic	-0.076	0.006	<.001	-0.075	0.006	<.001	-0.089	0.006	<.001	-0.086	0.006	<.001	-0.082	0.006	<.001	-0.116	0.006	<.001
Gender (Female)	-0.154	0.016	<.001	-0.148	0.016	<.001	-0.155	0.015	<.001	-0.142	0.015	<.001	-0.152	0.014	<.001	-0.132	0.014	<.001
Charlson	-0.017	0.008	0.040	-0.026	0.008	0.001	-0.047	0.007	<.001	-0.039	0.007	<.001	-0.069	0.007	<.001	-0.071	0.007	<.001
Obesity	0.308	0.017	<.001	0.339	0.016	<.001	0.286	0.016	<.001	0.293	0.015	<.001	0.207	0.015	<.001	0.040	0.015	0.006
Townsend																		
1st - lowest	0.380	0.102	<.001	0.238	0.095	0.012	0.236	0.087	0.007	0.315	0.082	<.001	0.268	0.075	<.001	0.272	0.073	<.001
2nd	0.305	0.101	0.003	0.209	0.094	0.027	0.187	0.087	0.031	0.266	0.081	0.001	0.238	0.075	0.001	0.224	0.073	0.002
3th	0.249	0.101	0.014	0.113	0.094	0.230	0.076	0.087	0.381	0.135	0.081	0.095	0.135	0.074	0.069	0.109	0.072	0.133
4th	0.142	0.101	0.160	-0.023	0.094	0.806	-0.034	0.086	0.694	0.013	0.081	0.867	0.016	0.074	0.830	0.007	0.072	0.919
5th - highest	0.016	0.101	0.874	-0.075	0.094	0.426	-0.134	0.087	0.120	-0.050	0.081	0.535	-0.129	0.074	0.083	-0.062	0.072	0.392
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.331	0.129	0.011	-0.164	0.121	0.177	-0.212	0.114	0.062	-0.344	0.108	0.001	-0.160	0.102	0.117	-0.212	0.099	0.031
2nd	-0.252	0.129	0.052	-0.099	0.122	0.417	-0.117	0.114	0.306	-0.279	0.108	0.010	-0.122	0.102	0.233	-0.186	0.099	0.060
3th	-0.255	0.129	0.048	-0.095	0.121	0.432	-0.068	0.113	0.550	-0.240	0.108	0.026	-0.138	0.101	0.173	-0.174	0.098	0.076
4th	-0.205	0.129	0.111	-0.078	0.121	0.520	-0.073	0.113	0.521	-0.265	0.108	0.014	-0.104	0.101	0.307	-0.120	0.098	0.221
5th - highest	-0.192	0.130	0.139	-0.054	0.122	0.658	-0.057	0.114	0.617	-0.189	0.108	0.081	-0.086	0.102	0.399	-0.127	0.099	0.198
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	-0.037	0.235	0.876	-0.120	0.230	0.604	-0.260	0.308	0.398	0.129	0.308	0.674	0.245	0.305	0.421	0.457	0.299	0.127
Town & Fringe – Sparse	0.022	0.166	0.894	0.316	0.170	0.064	-0.031	0.164	0.849	0.195	0.158	0.215	0.254	0.163	0.119	-0.037	0.152	0.806
Village, Hamlet & Isolated dwellings – Spars	0.051	0.155	0.743	0.133	0.154	0.388	-0.141	0.156	0.368	0.027	0.148	0.853	0.186	0.170	0.274	0.055	0.158	0.729
Urban >10k - Less sparse	0.053	0.048	0.273	0.049	0.046	0.289	0.087	0.045	0.056	0.193	0.044	<.001	0.110	0.044	0.013	0.157	0.043	<.001
Town & Fringe – Less sparse	0.028	0.050	0.580	0.016	0.048	0.741	0.029	0.047	0.542	0.118	0.045	0.008	0.007	0.046	0.870	0.096	0.046	0.035
Village, Hamlet & Isolated dwelling – Less sp	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.030	0.024	0.215	-0.031	0.023	0.176	-0.034	0.023	0.138	-0.046	0.021	0.030	-0.030	0.022	0.165	-0.009	0.022	0.679
Prevalence	-0.008	0.026	0.769	0.025	0.024	0.288	0.013	0.023	0.569	-0.004	0.021	0.864	0.006	0.020	0.774	-0.002	0.020	0.914
Country																		
England	0.200	0.083	0.015	0.148	0.077	0.055	0.113	0.078	0.147	0.103	0.073	0.156	0.161	0.077	0.036	0.150	0.077	0.051
Northern Ireland	0.134	0.169	0.428	0.043	0.167	0.797	0.111	0.162	0.494	0.041	0.151	0.785	0.219	0.150	0.143	0.150	0.148	0.309
Scotland	0.073	0.155	0.637	0.205	0.142	0.149	0.178	0.136	0.190	0.101	0.127	0.426	0.191	0.124	0.124	0.178	0.123	0.148
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.012	0.023	0.585	-0.003	0.017	0.846	-0.016	0.017	0.346	-0.009	0.018	0.628	0.006	0.021	0.761	-0.019	0.020	0.335
Nurse Contact - Vision																		
Low	0.010	0.054	0.850	0.056	0.050	0.266	0.051	0.050	0.311	0.021	0.047	0.651	-0.058	0.048	0.234	-0.026	0.050	0.596
Medium	0.032	0.052	0.531	0.058	0.050	0.247	0.067	0.051	0.186	0.061	0.048	0.207	0.012	0.049	0.810	-0.030	0.050	0.546
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.405	0.017		0.391	0.016		0.400	0.016		0.371	0.016		0.377	0.016		0.383	0.016	
Global Tests (degrees of Freedom)	χ²		p	χ²		p	χ²		p	χ²		p	χ²		p	χ²		p
Townsend (5df)	170.700		<.001	181.350		<.001	232.534		<.001	255.251		<.001	281.404		<.001	216.947		<.001
Percent White (5df)	10.352		0.035	6.443		0.168	16.484		0.002	13.243		0.010	3.665		0.453	5.318		0.256
Urban-Rural Classification (5df)	1.395		0.925	5.468		0.361	6.240		0.284	20.430		0.001	10.880		0.054	15.892		0.007
Country (3df)	6.632		0.085	5.553		0.136	2.702		0.440	2.300		0.513	4.702		0.195	3.978		0.264
Nurse Contact - any involvement (2df)	0.409		0.815	1.744		0.418	1.948		0.378	1.624		0.444	2.134		0.344	0.453		0.797

[1] Nurse contact – Vision allocation low <26%, medium 26-37%, high 38% and over

A3.20 Multilevel model (including whether previous years threshold was achieved), HbA1c ≤7%,

nurse contact based on any involvement[1], 2003-2007

	2003			2004			2005			2006			2007		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-1.190	0.127		-1.589	0.117		-1.627	0.106		-1.530	0.102		-1.544	0.100	
Age															
linear	0.409	0.013	<.001	0.423	0.012	<.001	0.401	0.011	<.001	0.399	0.010	<.001	0.451	0.010	<.001
quadratic	-0.055	0.011	<.001	-0.054	0.010	<.001	-0.059	0.009	<.001	-0.091	0.009	<.001	-0.064	0.008	<.001
Gender (Female)	-0.053	0.021	0.011	-0.037	0.018	0.044	0.013	0.017	0.451	0.009	0.016	0.592	0.005	0.015	0.732
Charlson	-0.099	0.012	<.001	-0.083	0.010	<.001	-0.106	0.009	<.001	-0.067	0.008	<.001	-0.063	0.007	<.001
Obesity	0.022	0.022	0.326	-0.001	0.019	0.956	-0.011	0.018	0.550	-0.022	0.016	0.181	-0.004	0.016	0.794
Townsend															
1st - lowest	-0.070	0.158	0.659	0.115	0.130	0.374	-0.020	0.120	0.871	0.030	0.116	0.793	-0.017	0.097	0.864
2nd	-0.053	0.158	0.738	0.114	0.129	0.380	-0.069	0.120	0.568	0.018	0.116	0.875	-0.038	0.096	0.695
3th	-0.087	0.158	0.583	0.071	0.129	0.580	-0.049	0.120	0.681	-0.013	0.115	0.914	-0.042	0.096	0.664
4th	-0.085	0.158	0.589	0.065	0.129	0.615	-0.091	0.120	0.446	-0.028	0.116	0.805	-0.023	0.096	0.814
5th - highest	-0.053	0.158	0.738	0.057	0.129	0.658	-0.061	0.120	0.614	-0.017	0.116	0.883	-0.068	0.096	0.477
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.021	0.183	0.908	0.030	0.157	0.848	0.162	0.147	0.269	-0.085	0.142	0.551	-0.029	0.124	0.816
2nd	-0.014	0.183	0.939	0.032	0.157	0.837	0.176	0.146	0.230	-0.051	0.142	0.721	0.001	0.124	0.994
3th	-0.031	0.183	0.864	0.035	0.156	0.823	0.161	0.146	0.269	-0.059	0.141	0.677	0.032	0.123	0.793
4th	-0.015	0.182	0.935	0.065	0.156	0.677	0.136	0.146	0.351	-0.042	0.141	0.767	0.013	0.123	0.913
5th - highest	-0.019	0.182	0.916	-0.010	0.157	0.948	0.179	0.146	0.220	-0.038	0.142	0.786	0.015	0.123	0.900
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	-0.222	0.245	0.366	-0.149	0.232	0.522	-0.327	0.219	0.137	0.177	0.212	0.404	0.284	0.207	0.169
Town & Fringe – Sparse	0.103	0.227	0.651	-0.177	0.177	0.318	-0.300	0.170	0.078	0.350	0.140	0.012	-0.126	0.140	0.367
Village, Hamlet & Isolated dwellings – Sparse	-0.242	0.179	0.177	-0.109	0.153	0.479	-0.442	0.145	0.002	0.062	0.135	0.648	0.175	0.129	0.177
Urban >10k - Less sparse	0.026	0.055	0.640	-0.017	0.051	0.736	-0.046	0.047	0.331	0.065	0.045	0.149	0.014	0.043	0.754
Town & Fringe – Less sparse	-0.045	0.057	0.423	-0.022	0.051	0.661	-0.046	0.049	0.340	0.004	0.046	0.935	0.017	0.044	0.709
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.025	0.025	0.317	0.000	0.024	0.999	-0.003	0.021	0.889	-0.038	0.020	0.062	-0.038	0.021	0.072
Prevalence	0.130	0.033	<.001	0.081	0.031	0.008	0.056	0.025	0.024	0.048	0.023	0.034	0.025	0.022	0.261
Country															
England	-0.075	0.093	0.423	0.076	0.083	0.361	0.090	0.075	0.232	0.163	0.070	0.020	0.110	0.072	0.123
Northern Ireland	-0.212	0.216	0.326	-0.023	0.185	0.901	0.539	0.167	0.001	0.235	0.162	0.147	0.195	0.153	0.203
Scotland	0.074	0.208	0.722	-0.012	0.182	0.947	0.142	0.167	0.396	0.048	0.161	0.768	0.137	0.143	0.336
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.041	0.024	0.086	0.010	0.022	0.635	-0.037	0.020	0.065	-0.028	0.018	0.124	0.022	0.020	0.259
Nurse Contact - any involvement															
Low	-0.101	0.052	0.052	-0.055	0.050	0.278	-0.090	0.046	0.050	0.047	0.045	0.298	-0.018	0.046	0.687
Medium	-0.051	0.054	0.348	-0.030	0.052	0.565	-0.094	0.045	0.039	0.006	0.044	0.899	0.027	0.045	0.540
High	0.000			0.000			0.000			0.000			0.000		
Hba1c ≤ 7% (previous year)	2.072	0.022	<.001	2.133	0.019	<.001	2.229	0.017	<.001	2.291	0.016	<.001	2.259	0.015	<.001
Random Variance															
Practice	0.344	0.018		0.352	0.017		0.326	0.015		0.328	0.015		0.343	0.015	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	2.100		0.835	5.972		0.309	7.664		0.176	6.543		0.257	4.445		0.487
Percent White (5df)	0.245		0.993	3.469		0.483	1.793		0.774	1.643		0.801	2.655		0.617
Urban-Rural Classification (5df)	5.272		0.384	1.226		0.942	9.650		0.086	9.719		0.084	6.108		0.296
Country (3df)	4.526		0.210	1.206		0.752	16.830		0.001	8.373		0.039	2.884		0.410
Nurse Contact - any involvement (2df)	3.792		0.150	1.187		0.552	5.581		0.061	1.230		0.541	0.922		0.631

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.21 Multilevel model (including whether previous years threshold was achieved), HbA1c ≤7%,

nurse contact based on any involvement[1], 2008-2011

	2008			2009			2010			2011		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-1.457	0.088		-1.523	0.090		-1.463	0.081		-1.486	0.082	
Age												
linear	0.436	0.010	<.001	0.426	0.009	<.001	0.430	0.009	<.001	0.434	0.009	<.001
quadratic	-0.097	0.008	<.001	-0.083	0.008	<.001	-0.102	0.008	<.001	-0.080	0.008	<.001
Gender (Female)	0.034	0.014	0.019	0.051	0.014	<.001	0.054	0.014	<.001	0.009	0.014	0.496
Charlson	-0.070	0.007	<.001	-0.073	0.007	<.001	-0.083	0.006	<.001	-0.097	0.006	<.001
Obesity	-0.027	0.015	0.071	-0.043	0.014	0.003	-0.034	0.014	0.016	-0.069	0.014	<.001
Townsend												
1st - lowest	-0.066	0.090	0.461	-0.032	0.083	0.703	0.124	0.079	0.119	0.049	0.076	0.520
2nd	-0.130	0.090	0.148	-0.049	0.083	0.551	0.136	0.079	0.086	0.032	0.075	0.666
3th	-0.112	0.090	0.210	-0.086	0.083	0.295	0.107	0.079	0.175	0.046	0.075	0.540
4th	-0.129	0.089	0.148	-0.090	0.082	0.276	0.070	0.079	0.378	0.060	0.075	0.426
5th - highest	-0.121	0.090	0.179	-0.118	0.083	0.155	0.098	0.079	0.219	0.001	0.076	0.992
Unknown	0.000			0.000			0.000			0.000		
Percent White												
1st - lowest	0.118	0.116	0.310	0.032	0.110	0.772	-0.276	0.105	0.009	-0.166	0.102	0.103
2nd	0.102	0.116	0.383	0.035	0.110	0.748	-0.228	0.105	0.030	-0.145	0.102	0.154
3th	0.090	0.116	0.439	0.065	0.109	0.550	-0.235	0.105	0.025	-0.172	0.101	0.090
4th	0.081	0.116	0.484	0.027	0.109	0.803	-0.226	0.105	0.031	-0.120	0.101	0.236
5th - highest	0.111	0.116	0.340	0.061	0.110	0.579	-0.247	0.105	0.019	-0.102	0.101	0.312
Unknown	0.000			0.000			0.000			0.000		
Urban-Rural Classification												
Urban >10k – Sparse	0.006	0.194	0.975	-0.413	0.274	0.131	0.038	0.254	0.880	-0.377	0.260	0.147
Town & Fringe – Sparse	-0.069	0.132	0.602	0.004	0.137	0.974	-0.136	0.129	0.290	0.079	0.128	0.536
Village, Hamlet & Isolated dwellings – Sparse	0.038	0.123	0.756	-0.071	0.131	0.586	0.005	0.122	0.970	0.028	0.134	0.835
Urban >10k - Less sparse	0.059	0.041	0.147	-0.024	0.040	0.558	0.145	0.040	<.001	0.084	0.040	0.034
Town & Fringe – Less sparse	0.052	0.043	0.223	-0.029	0.041	0.485	0.089	0.040	0.027	-0.010	0.041	0.807
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000		
Practice List Size	-0.033	0.018	0.067	-0.015	0.019	0.432	-0.039	0.016	0.015	-0.026	0.016	0.103
Prevalence	0.064	0.019	0.001	0.028	0.019	0.151	0.022	0.016	0.162	0.032	0.015	0.035
Country												
England	0.004	0.061	0.954	0.185	0.065	0.004	0.066	0.055	0.230	0.084	0.056	0.134
Northern Ireland	-0.067	0.146	0.649	0.313	0.145	0.031	-0.045	0.130	0.730	-0.045	0.127	0.725
Scotland	0.155	0.127	0.224	0.144	0.124	0.245	-0.145	0.113	0.201	-0.028	0.111	0.800
Wales	0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.010	0.014	0.479	0.012	0.014	0.391	0.029	0.014	0.036	0.030	0.015	0.051
Nurse Contact - any involvement												
Low	0.029	0.039	0.453	-0.042	0.042	0.317	-0.014	0.035	0.688	-0.054	0.035	0.122
Medium	-0.009	0.039	0.812	0.021	0.042	0.612	-0.009	0.035	0.809	-0.035	0.036	0.324
High	0.000			0.000			0.000			0.000		
Hba1c ≤ 7% (previous year)	2.300	0.014	<.001	2.303	0.014	<.001	2.308	0.014	<.001	2.331	0.014	<.001
Random Variance												
Practice	0.294	0.013		0.324	0.014		0.262	0.012		0.256	0.012	
Global Tests (degrees of Freedom)	χ²		p	χ²		p	χ²		p	χ²		p
Townsend (5df)	11.956		0.035	14.813		0.011	11.365		0.045	6.944		0.225
Percent White (5df)	1.536		0.820	2.449		0.654	3.441		0.487	5.202		0.267
Urban-Rural Classification (5df)	3.143		0.678	2.922		0.712	16.702		0.005	11.704		0.039
Country (3df)	6.356		0.096	11.134		0.011	6.472		0.091	3.624		0.305
Nurse Contact - any involvement (2df)	0.972		0.615	2.075		0.354	0.166		0.920	2.545		0.280

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.22 Multilevel model (including whether previous years threshold was achieved), HbA1c ≤10%,

nurse contact based on any involvement[1], 2003-2007

	2003			2004			2005			2006			2007		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.178	0.158		1.112	0.127		1.056	0.115		1.242	0.119		1.069	0.112	
Age															
linear	0.351	0.013	<.001	0.378	0.013	<.001	0.391	0.012	<.001	0.384	0.011	<.001	0.387	0.011	<.001
quadratic	-0.094	0.009	<.001	-0.054	0.008	<.001	-0.064	0.008	<.001	-0.084	0.007	<.001	-0.069	0.007	<.001
Gender (Female)	-0.097	0.021	<.001	-0.159	0.021	<.001	-0.166	0.020	<.001	-0.164	0.019	<.001	-0.171	0.018	<.001
Charlson	-0.024	0.012	0.055	0.013	0.012	0.288	-0.029	0.011	0.009	-0.022	0.010	0.029	0.018	0.009	0.044
Obesity	0.423	0.025	<.001	0.329	0.023	<.001	0.332	0.021	<.001	0.340	0.020	<.001	0.314	0.019	<.001
Townsend															
1st - lowest	0.136	0.158	0.390	0.274	0.142	0.053	0.412	0.135	0.002	0.271	0.134	0.044	0.424	0.109	0.000
2nd	0.110	0.158	0.484	0.250	0.141	0.077	0.327	0.134	0.015	0.245	0.134	0.067	0.347	0.109	0.001
3th	0.010	0.157	0.947	0.148	0.141	0.292	0.204	0.134	0.128	0.128	0.134	0.340	0.322	0.109	0.003
4th	-0.071	0.157	0.651	0.067	0.141	0.632	0.109	0.134	0.415	0.045	0.134	0.735	0.213	0.109	0.050
5th - highest	-0.134	0.158	0.396	-0.079	0.141	0.575	0.007	0.134	0.957	-0.071	0.134	0.594	0.070	0.108	0.517
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.010	0.187	0.958	-0.243	0.173	0.159	-0.229	0.164	0.162	-0.254	0.164	0.123	-0.330	0.140	0.019
2nd	0.043	0.188	0.818	-0.123	0.173	0.477	-0.165	0.164	0.312	-0.164	0.164	0.320	-0.245	0.141	0.082
3th	0.009	0.187	0.961	-0.152	0.172	0.377	-0.148	0.163	0.366	-0.170	0.164	0.301	-0.260	0.140	0.063
4th	0.019	0.187	0.919	-0.126	0.172	0.464	-0.133	0.163	0.413	-0.137	0.164	0.401	-0.220	0.140	0.115
5th - highest	0.162	0.188	0.389	-0.038	0.172	0.826	-0.038	0.163	0.817	-0.064	0.164	0.699	-0.192	0.141	0.173
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.147	0.288	0.611	0.118	0.259	0.648	-0.241	0.243	0.323	-0.085	0.257	0.742	-0.153	0.240	0.523
Town & Fringe – Sparse	-0.054	0.274	0.843	-0.013	0.210	0.952	-0.147	0.201	0.466	0.133	0.186	0.473	-0.010	0.176	0.955
Village, Hamlet & Isolated dwellings – Sparse	-0.280	0.203	0.167	-0.168	0.167	0.315	-0.108	0.164	0.511	0.009	0.161	0.956	0.055	0.162	0.734
Urban >10k - Less sparse	-0.031	0.061	0.619	0.001	0.060	0.990	0.030	0.057	0.596	0.011	0.054	0.840	0.003	0.052	0.947
Town & Fringe – Less sparse	0.035	0.065	0.591	-0.047	0.062	0.446	-0.044	0.060	0.460	-0.015	0.057	0.787	-0.043	0.054	0.431
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.010	0.034	0.771	-0.009	0.027	0.726	0.011	0.023	0.633	-0.016	0.024	0.510	-0.023	0.024	0.338
Prevalence	0.005	0.043	0.910	-0.001	0.034	0.978	-0.019	0.027	0.473	0.020	0.027	0.448	-0.024	0.025	0.351
Country															
England	-0.038	0.125	0.759	0.275	0.091	0.003	0.270	0.082	0.001	0.205	0.082	0.012	0.176	0.080	0.028
Northern Ireland	-0.187	0.244	0.444	0.225	0.201	0.263	0.326	0.184	0.076	0.156	0.188	0.407	0.071	0.173	0.680
Scotland	0.148	0.236	0.530	0.212	0.200	0.288	0.282	0.185	0.126	0.165	0.188	0.381	0.033	0.161	0.835
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.140	0.030	<.001	-0.021	0.024	0.373	-0.015	0.022	0.498	-0.011	0.022	0.608	-0.009	0.022	0.693
Nurse Contact - any involvement															
Low	-0.171	0.069	0.013	-0.103	0.056	0.066	-0.081	0.051	0.111	-0.058	0.053	0.279	0.013	0.052	0.808
Medium	-0.160	0.072	0.026	-0.031	0.058	0.589	-0.068	0.050	0.175	-0.051	0.053	0.329	0.037	0.050	0.461
High	0.000			0.000			0.000			0.000			0.000		
Hba1c ≤ 7% (previous year)	1.004	0.029	<.001	1.102	0.027	<.001	1.160	0.025	<.001	1.100	0.023	<.001	1.179	0.021	<.001
Random Variance															
Practice	0.493	0.023		0.387	0.019		0.353	0.017		0.389	0.018		0.383	0.017	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	63.809		<.001	104.228		<.001	157.475		<.001	129.680		<.001	135.772		<.001
Percent White (5df)	11.189		0.025	14.856		0.005	12.162		0.016	13.540		0.009	9.282		0.054
Urban-Rural Classification (5df)	4.855		0.434	2.704		0.746	3.829		0.574	1.098		0.954	1.987		0.851
Country (3df)	3.536		0.316	9.220		0.027	11.184		0.011	6.315		0.097	5.645		0.130
Nurse Contact - any involvement (2df)	7.700		0.021	3.491		0.175	3.026		0.220	1.468		0.480	0.550		0.759

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.23 Multilevel model (including whether previous years threshold was achieved), HbA1c ≤10%, nurse contact based on any involvement[1], 2008-2011

	2008			2009			2010			2011		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.117	0.104		1.131	0.101		1.177	0.097		1.045	0.098	
Age												
linear	0.373	0.011	<.001	0.372	0.010	<.001	0.396	0.010	<.001	0.437	0.010	<.001
quadratic	-0.078	0.007	<.001	-0.091	0.006	<.001	-0.084	0.006	<.001	-0.075	0.006	<.001
Gender (Female)	-0.156	0.017	<.001	-0.167	0.016	<.001	-0.155	0.016	<.001	-0.176	0.016	<.001
Charlson	0.010	0.008	0.221	-0.012	0.008	0.140	0.000	0.008	0.979	-0.030	0.008	<.001
Obesity	0.321	0.018	<.001	0.268	0.017	<.001	0.289	0.017	<.001	0.204	0.016	<.001
Townsend												
1st - lowest	0.201	0.105	0.055	0.294	0.094	0.002	0.306	0.090	0.001	0.262	0.083	0.002
2nd	0.178	0.104	0.088	0.265	0.094	0.005	0.268	0.089	0.003	0.243	0.082	0.003
3th	0.067	0.104	0.522	0.148	0.094	0.115	0.147	0.089	0.100	0.137	0.082	0.093
4th	-0.069	0.104	0.508	0.032	0.094	0.729	0.001	0.089	0.990	0.032	0.082	0.695
5th - highest	-0.120	0.104	0.250	-0.078	0.094	0.408	-0.053	0.089	0.554	-0.126	0.082	0.126
Unknown	0.000			0.000			0.000			0.000		
Percent White												
1st - lowest	-0.099	0.134	0.460	-0.264	0.124	0.033	-0.343	0.119	0.004	-0.083	0.112	0.457
2nd	-0.032	0.135	0.812	-0.170	0.124	0.171	-0.295	0.119	0.013	-0.088	0.112	0.435
3th	-0.036	0.134	0.789	-0.138	0.123	0.264	-0.277	0.118	0.019	-0.115	0.111	0.301
4th	-0.011	0.134	0.936	-0.142	0.123	0.249	-0.293	0.118	0.013	-0.073	0.111	0.514
5th - highest	0.009	0.135	0.944	-0.121	0.124	0.329	-0.207	0.119	0.081	-0.043	0.112	0.699
Unknown	0.000			0.000			0.000			0.000		
Urban-Rural Classification												
Urban >10k – Sparse	-0.230	0.232	0.323	-0.299	0.316	0.344	0.228	0.313	0.468	0.177	0.313	0.573
Town & Fringe – Sparse	0.287	0.176	0.103	-0.044	0.168	0.791	0.327	0.167	0.050	0.316	0.168	0.060
Village, Hamlet & Isolated dwellings – Sparse	0.080	0.160	0.619	-0.149	0.161	0.356	0.047	0.155	0.763	0.269	0.176	0.127
Urban >10k - Less sparse	0.020	0.049	0.687	0.078	0.048	0.103	0.187	0.047	<.001	0.046	0.047	0.332
Town & Fringe – Less sparse	-0.013	0.052	0.798	0.008	0.050	0.868	0.104	0.048	0.031	-0.043	0.049	0.380
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000		
Practice List Size	-0.021	0.022	0.359	-0.017	0.022	0.434	-0.029	0.020	0.156	-0.022	0.021	0.284
Prevalence	0.017	0.024	0.473	0.001	0.022	0.951	-0.008	0.020	0.677	-0.007	0.019	0.713
Country												
England	0.097	0.076	0.198	0.097	0.075	0.194	0.049	0.070	0.483	0.138	0.073	0.058
Northern Ireland	0.015	0.174	0.930	0.098	0.165	0.556	-0.028	0.155	0.854	0.194	0.151	0.199
Scotland	0.220	0.150	0.143	0.116	0.140	0.409	0.047	0.132	0.723	0.165	0.128	0.197
Wales	0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.003	0.017	0.839	-0.022	0.016	0.180	-0.016	0.018	0.370	-0.012	0.020	0.551
Nurse Contact - any involvement												
Low	0.063	0.049	0.194	0.016	0.048	0.740	-0.007	0.045	0.873	-0.040	0.046	0.381
Medium	0.077	0.049	0.115	0.065	0.049	0.178	0.023	0.045	0.617	0.001	0.047	0.991
High	0.000			0.000			0.000			0.000		
Hba1c ≤ 7% (previous year)	1.164	0.020	<.001	1.148	0.019	<.001	1.206	0.019	<.001	1.226	0.019	<.001
Random Variance												
Practice	0.374	0.016		0.375	0.016		0.344	0.015		0.345	0.015	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	166.839		<.001	209.508		<.001	224.439		<.001	231.473		<.001
Percent White (5df)	5.944		0.203	12.594		0.013	9.227		0.056	3.246		0.518
Urban-Rural Classification (5df)	5.182		0.394	5.945		0.312	18.994		0.002	8.671		0.123
Country (3df)	5.066		0.167	1.743		0.627	1.019		0.797	3.843		0.279
Nurse Contact - any involvement (2df)	2.936		0.230	1.888		0.389	0.427		0.808	0.929		0.629

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.24 Multilevel Model, Longitudinal Practice Cohort, HbA1c ≤ 7% (nurse contact based on any involvement), 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.852	0.236		-0.302	0.185		-0.597	0.179			0.166	0.001	-0.458	0.157	
Age															
linear	0.525	0.016	<.001	0.490	0.014	<.001	0.533	0.013	<.001	0.536	0.012	<.001	0.541	0.012	<.001
quadratic	-0.117	0.013	<.001	-0.105	0.012	<.001	-0.092	0.011	<.001	-0.074	0.010	<.001	-0.098	0.010	<.001
Gender (Female)	-0.127	0.024	<.001	-0.073	0.021	<.001	-0.068	0.020	0.001	-0.037	0.019	0.055	-0.039	0.018	0.033
Charlson	-0.179	0.014	<.001	-0.173	0.012	<.001	-0.157	0.012	<.001	-0.184	0.011	<.001	-0.152	0.010	<.001
Obesity	0.149	0.026	<.001	0.068	0.023	0.003	0.064	0.022	0.003	0.022	0.020	0.267	-0.001	0.019	0.977
Townsend															
1st - lowest	0.346	0.280	0.217	0.120	0.204	0.555	0.212	0.190	0.265	-0.088	0.174	0.614	-0.055	0.167	0.740
2nd	0.263	0.280	0.347	0.120	0.204	0.554	0.192	0.190	0.312	-0.164	0.174	0.347	-0.101	0.167	0.544
3th	0.264	0.280	0.347	0.113	0.204	0.578	0.154	0.190	0.418	-0.167	0.174	0.338	-0.149	0.167	0.371
4th	0.198	0.280	0.479	0.086	0.204	0.671	0.134	0.190	0.479	-0.234	0.174	0.178	-0.170	0.166	0.307
5th - highest	0.210	0.281	0.453	0.083	0.204	0.683	0.115	0.190	0.546	-0.181	0.174	0.300	-0.180	0.167	0.281
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.186	0.321	0.563	-0.227	0.244	0.352	-0.062	0.230	0.786	0.254	0.212	0.230	0.051	0.201	0.799
2nd	-0.112	0.322	0.728	-0.179	0.244	0.463	-0.050	0.230	0.827	0.278	0.213	0.190	0.116	0.201	0.564
3th	-0.223	0.322	0.489	-0.274	0.244	0.262	-0.109	0.230	0.636	0.239	0.212	0.261	0.084	0.201	0.675
4th	-0.159	0.322	0.622	-0.243	0.245	0.322	-0.057	0.231	0.805	0.243	0.213	0.254	0.072	0.202	0.720
5th - highest	-0.138	0.323	0.669	-0.180	0.245	0.463	-0.089	0.231	0.701	0.272	0.213	0.202	0.111	0.202	0.584
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.069	0.368	0.851	0.203	0.313	0.516	0.039	0.299	0.897	-0.010	0.285	0.973	-0.088	0.275	0.750
Town & Fringe – Sparse	0.057	0.319	0.859	0.033	0.269	0.903	-0.166	0.261	0.526	-0.498	0.250	0.046	0.087	0.232	0.707
Village, Hamlet & Isolated dwellings – Sparse	0.141	0.276	0.610	0.114	0.237	0.632	-0.108	0.234	0.645	-0.076	0.220	0.728	-0.142	0.216	0.511
Urban >10k - Less sparse	0.110	0.066	0.092	0.034	0.058	0.558	0.085	0.055	0.124	-0.015	0.052	0.773	0.015	0.050	0.759
Town & Fringe – Less sparse	-0.015	0.066	0.815	-0.066	0.059	0.267	0.034	0.056	0.542	-0.066	0.054	0.215	-0.052	0.051	0.310
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.037	0.050	0.456	0.017	0.038	0.659	-0.013	0.036	0.730	0.018	0.035	0.613	-0.015	0.033	0.642
Prevalence	0.214	0.074	0.004	0.180	0.052	0.001	0.147	0.047	0.002	0.120	0.043	0.005	0.139	0.041	0.001
Country															
England	0.082	0.170	0.629	0.009	0.128	0.945	0.054	0.125	0.666	0.132	0.117	0.261	0.283	0.115	0.014
Northern Ireland	-0.091	0.452	0.841	-0.257	0.338	0.447	-0.100	0.324	0.757	0.637	0.299	0.033	0.551	0.290	0.057
Scotland	-0.403	0.439	0.359	-0.269	0.326	0.410	-0.032	0.308	0.918	0.421	0.286	0.141	0.310	0.280	0.269
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.152	0.056	0.007	-0.080	0.044	0.069	-0.005	0.042	0.902	-0.024	0.039	0.540	0.034	0.041	0.416
Nurse Contact - any involvement															
Low	-0.020	0.114	0.862	-0.068	0.084	0.421	-0.119	0.085	0.164	-0.202	0.084	0.016	-0.098	0.078	0.212
Medium	-0.126	0.107	0.239	-0.168	0.081	0.038	-0.082	0.076	0.280	-0.168	0.070	0.017	-0.060	0.072	0.400
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.561	0.038		0.413	0.027		0.401	0.026		0.376	0.024		0.375	0.024	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	16.714		0.005	2.000		0.849	9.698		0.084	22.467		0.000	20.930		0.001
Percent White (5df)	7.213		0.125	7.532		0.110	2.795		0.593	1.684		0.794	4.183		0.382
Urban-Rural Classification (5df)	5.348		0.375	4.252		0.514	3.597		0.609	6.516		0.259	3.446		0.632
Country (3df)	1.686		0.640	0.994		0.803	0.449		0.930	4.682		0.197	7.243		0.065
Nurse Contact - any involvement (2df)	1.638		0.441	4.338		0.114	2.229		0.328	7.979		0.019	1.708		0.426

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.25 Multilevel Model, Longitudinal Practice Cohort, HbA1c ≤ 7% (nurse contact based on any involvement), 2007-20011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	-0.422	0.158		-0.537	0.147		-0.480	0.146		-0.479	0.139		-0.467	0.136		-0.416	0.137	
Age																		
linear	0.578	0.012	<.001	0.593	0.012	<.001	0.582	0.011	<.001	0.580	0.011	<.001	0.592	0.011	<.001	0.564	0.011	<.001
quadratic	-0.093	0.010	<.001	-0.102	0.010	<.001	-0.097	0.009	<.001	-0.109	0.009	<.001	-0.118	0.009	<.001	-0.127	0.009	<.001
Gender (Female)	-0.004	0.018	0.806	0.030	0.017	0.081	0.028	0.017	0.097	0.041	0.016	0.012	0.026	0.016	0.099	0.038	0.016	0.015
Charlson	-0.120	0.009	<.001	-0.127	0.008	<.001	-0.139	0.008	<.001	-0.137	0.008	<.001	-0.157	0.008	<.001	-0.156	0.008	<.001
Obesity	0.005	0.018	0.782	0.022	0.018	0.226	-0.003	0.017	0.880	-0.003	0.017	0.878	-0.045	0.016	0.006	-0.106	0.016	<.001
Townsend																		
1st - lowest	0.015	0.168	0.929	-0.015	0.162	0.927	0.007	0.149	0.961	0.255	0.147	0.083	0.142	0.142	0.319	0.163	0.139	0.242
2nd	-0.003	0.168	0.984	-0.053	0.162	0.742	-0.016	0.149	0.912	0.241	0.147	0.101	0.097	0.142	0.494	0.115	0.139	0.408
3th	-0.040	0.168	0.811	-0.056	0.162	0.730	-0.032	0.149	0.832	0.211	0.147	0.150	0.105	0.142	0.458	0.134	0.139	0.334
4th	-0.025	0.167	0.879	-0.090	0.162	0.576	-0.051	0.148	0.732	0.183	0.147	0.211	0.106	0.142	0.455	0.108	0.139	0.438
5th - highest	-0.090	0.168	0.590	-0.121	0.162	0.456	-0.106	0.149	0.477	0.156	0.147	0.288	0.027	0.142	0.848	0.074	0.139	0.595
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.126	0.197	0.523	0.063	0.189	0.739	-0.059	0.173	0.735	-0.257	0.169	0.128	-0.291	0.161	0.072	-0.357	0.158	0.024
2nd	-0.090	0.198	0.650	0.089	0.189	0.639	-0.005	0.173	0.977	-0.197	0.168	0.243	-0.210	0.161	0.193	-0.247	0.157	0.117
3th	-0.018	0.198	0.928	0.067	0.189	0.724	0.007	0.173	0.970	-0.201	0.168	0.232	-0.197	0.161	0.221	-0.272	0.157	0.084
4th	-0.068	0.198	0.730	0.078	0.189	0.679	-0.016	0.174	0.927	-0.203	0.169	0.230	-0.167	0.161	0.300	-0.228	0.158	0.148
5th - highest	-0.053	0.198	0.790	0.093	0.189	0.623	-0.014	0.174	0.936	-0.207	0.169	0.220	-0.146	0.162	0.365	-0.214	0.158	0.175
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	-0.414	0.283	0.144	0.135	0.270	0.618	-0.340	0.275	0.217	-0.150	0.265	0.571	-0.366	0.263	0.164	0.156	0.257	0.544
Town & Fringe – Sparse	-0.242	0.240	0.312	-0.007	0.232	0.977	-0.052	0.236	0.825	0.179	0.227	0.430	-0.163	0.221	0.460	0.180	0.217	0.406
Village, Hamlet & Isolated dwellings – Sparse	-0.509	0.217	0.019	-0.170	0.206	0.410	-0.119	0.209	0.569	-0.056	0.201	0.779	-0.186	0.196	0.344	-0.022	0.193	0.909
Urban >10k - Less sparse	0.052	0.049	0.285	0.037	0.047	0.431	-0.019	0.046	0.680	0.044	0.045	0.323	0.117	0.044	0.007	0.114	0.043	0.008
Town & Fringe – Less sparse	-0.027	0.050	0.594	-0.020	0.048	0.684	-0.075	0.047	0.110	-0.006	0.046	0.898	-0.011	0.044	0.811	0.030	0.044	0.494
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.013	0.035	0.709	-0.045	0.033	0.178	-0.020	0.034	0.549	-0.044	0.031	0.161	-0.024	0.030	0.431	-0.012	0.031	0.702
Prevalence	0.096	0.043	0.027	0.076	0.040	0.055	0.040	0.040	0.319	0.029	0.037	0.426	0.056	0.034	0.101	0.064	0.034	0.061
Country																		
England	0.254	0.126	0.043	0.157	0.120	0.189	0.275	0.125	0.028	0.147	0.117	0.211	0.144	0.115	0.210	0.110	0.117	0.347
Northern Ireland	0.501	0.300	0.094	0.380	0.287	0.185	0.318	0.284	0.262	0.178	0.273	0.514	0.272	0.265	0.304	0.100	0.265	0.707
Scotland	0.052	0.290	0.858	0.195	0.274	0.475	0.087	0.269	0.748	-0.213	0.259	0.412	-0.069	0.251	0.784	-0.035	0.252	0.889
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.104	0.045	0.022	0.116	0.042	0.006	0.100	0.050	0.045	0.039	0.031	0.216	0.123	0.039	0.002	0.075	0.036	0.036
Nurse Contact - any involvement																		
Low	-0.141	0.085	0.096	0.009	0.080	0.912	-0.041	0.085	0.632	-0.086	0.080	0.279	0.006	0.078	0.944	0.034	0.079	0.670
Medium	0.021	0.078	0.789	0.133	0.074	0.073	0.125	0.076	0.101	0.034	0.073	0.648	0.018	0.072	0.807	-0.011	0.073	0.876
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.409	0.026		0.392	0.024		0.412	0.025		0.396	0.025		0.384	0.024		0.394	0.024	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	11.030		0.051	12.222		0.032	13.298		0.021	15.264		0.009	15.139		0.010	10.881		0.054
Percent White (5df)	6.361		0.174	1.048		0.902	3.108		0.540	3.362		0.499	10.263		0.036	14.498		0.006
Urban-Rural Classification (5df)	9.657		0.086	3.622		0.605	4.524		0.477	3.618		0.606	15.870		0.007	9.364		0.095
Country (3df)	6.418		0.093	2.540		0.468	5.449		0.142	4.513		0.211	3.313		0.346	1.304		0.728
Nurse Contact - any involvement (2df)	3.676		0.159	3.657		0.161	4.190		0.123	2.168		0.338	0.061		0.970	0.311		0.856

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.26   Multilevel Model, Longitudinal Practice Cohort, HbA1c ≤ 10% (nurse contact based on any involvement), 2002-2006

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	0.735	0.329		1.565	0.224		1.395	0.206		1.511	0.200		1.589	0.196	
Age															
linear	0.427	0.015	<.001	0.440	0.016	<.001	0.478	0.016	<.001	0.493	0.016	<.001	0.476	0.015	<.001
quadratic	-0.144	0.011	<.001	-0.091	0.010	<.001	-0.057	0.010	<.001	-0.052	0.010	<.001	-0.066	0.010	<.001
Gender (Female)	-0.160	0.026	<.001	-0.122	0.025	<.001	-0.176	0.026	<.001	-0.145	0.026	<.001	-0.159	0.025	<.001
Charlson	-0.068	0.015	<.001	-0.071	0.015	<.001	-0.037	0.015	0.015	-0.056	0.015	<.001	-0.055	0.013	<.001
Obesity	0.490	0.030	<.001	0.445	0.029	<.001	0.371	0.029	<.001	0.351	0.027	<.001	0.365	0.026	<.001
Townsend															
1st - lowest	0.473	0.246	0.054	0.173	0.204	0.396	-0.066	0.249	0.791	0.230	0.233	0.325	0.225	0.224	0.315
2nd	0.426	0.246	0.083	0.154	0.204	0.451	-0.101	0.249	0.684	0.154	0.233	0.507	0.200	0.223	0.370
3th	0.334	0.245	0.173	0.049	0.203	0.810	-0.237	0.248	0.341	0.005	0.232	0.984	0.059	0.223	0.793
4th	0.268	0.245	0.274	-0.027	0.203	0.893	-0.293	0.248	0.237	-0.080	0.232	0.731	-0.019	0.223	0.934
5th - highest	0.201	0.246	0.413	-0.062	0.204	0.761	-0.439	0.248	0.077	-0.112	0.232	0.629	-0.127	0.223	0.569
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.197	0.291	0.499	-0.191	0.255	0.454	0.289	0.291	0.321	-0.242	0.277	0.382	-0.251	0.267	0.346
2nd	-0.132	0.292	0.651	-0.135	0.256	0.598	0.363	0.292	0.215	-0.155	0.278	0.578	-0.124	0.268	0.642
3th	-0.168	0.292	0.565	-0.137	0.256	0.592	0.347	0.292	0.235	-0.134	0.278	0.630	-0.178	0.267	0.506
4th	-0.158	0.293	0.590	-0.144	0.257	0.574	0.366	0.292	0.211	-0.062	0.278	0.823	-0.195	0.268	0.467
5th - highest	-0.173	0.294	0.555	-0.002	0.258	0.995	0.521	0.293	0.075	0.011	0.279	0.970	0.009	0.268	0.974
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.732	0.464	0.115	0.197	0.397	0.619	0.241	0.383	0.530	0.346	0.388	0.372	0.224	0.395	0.571
Town & Fringe – Sparse	0.641	0.390	0.100	0.005	0.332	0.989	0.005	0.350	0.989	-0.389	0.325	0.230	0.239	0.354	0.499
Village, Hamlet & Isolated dwellings – Sparse	0.244	0.359	0.497	-0.114	0.311	0.714	-0.300	0.291	0.302	0.367	0.333	0.272	-0.080	0.301	0.791
Urban >10k - Less sparse	0.089	0.072	0.219	0.030	0.072	0.672	0.118	0.073	0.106	0.134	0.071	0.059	0.049	0.069	0.477
Town & Fringe – Less sparse	0.077	0.074	0.299	0.046	0.076	0.544	0.022	0.078	0.774	-0.025	0.075	0.742	-0.023	0.072	0.746
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.069	0.080	0.389	0.048	0.048	0.312	-0.021	0.043	0.615	0.015	0.042	0.725	0.008	0.041	0.843
Prevalence	0.047	0.117	0.688	0.022	0.065	0.731	0.018	0.055	0.745	-0.020	0.051	0.693	0.044	0.051	0.378
Country															
England	0.190	0.270	0.482	-0.021	0.162	0.897	0.126	0.145	0.385	0.215	0.140	0.124	0.216	0.142	0.127
Northern Ireland	-0.287	0.582	0.623	-0.457	0.389	0.240	0.393	0.390	0.313	0.261	0.373	0.484	0.008	0.368	0.983
Scotland	-0.756	0.565	0.181	-0.546	0.374	0.144	0.628	0.376	0.095	0.006	0.357	0.988	-0.087	0.357	0.808
Wales	0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	-0.268	0.088	0.003	-0.083	0.055	0.133	-0.036	0.049	0.462	0.016	0.047	0.732	0.032	0.051	0.534
Nurse Contact - any involvement															
Low	-0.079	0.182	0.664	-0.137	0.107	0.199	-0.163	0.099	0.100	-0.121	0.100	0.228	-0.083	0.097	0.388
Medium	-0.224	0.172	0.192	-0.212	0.103	0.039	-0.169	0.089	0.056	-0.063	0.085	0.460	-0.047	0.089	0.596
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.925	0.056		0.528	0.034		0.459	0.031		0.443	0.030		0.458	0.030	
Global Tests (degrees of Freedom)	χ²		p	χ²		p	χ²		p	χ²		p	χ²		p
Townsend (5df)	44.214		<.001	39.875		<.001	74.059		<.001	79.307		<.001	80.189		<.001
Percent White (5df)	1.732		0.785	7.839		0.098	10.952		0.027	11.715		0.020	20.589		<.001
Urban-Rural Classification (5df)	5.255		0.386	1.124		0.952	6.478		0.262	12.679		0.027	2.551		0.769
Country (3df)	3.923		0.270	2.687		0.442	2.910		0.406	2.994		0.393	2.990		0.393
Nurse Contact - any involvement (2df)	1.776		0.412	4.446		0.108	4.466		0.107	1.499		0.473	0.789		0.674

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

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A3.27 Multilevel Model, Longitudinal Practice Cohort, HbA1c ≤ 10% (nurse contact based on any involvement), 2007-20011/12

	2007			2008			2009			2010			2011			2011/12		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intercept	1.544	0.191		1.315	0.178		1.458	0.173		1.453	0.164		1.392	0.166		1.538	0.165	
Age																		
linear	0.479	0.015	<.001	0.475	0.015	<.001	0.470	0.014	<.001	0.512	0.014	<.001	0.535	0.013	<.001	0.485	0.013	<.001
quadratic	-0.073	0.009	<.001	-0.069	0.009	<.001	-0.093	0.009	<.001	-0.081	0.009	<.001	-0.097	0.008	<.001	-0.130	0.008	<.001
Gender (Female)	-0.164	0.024	<.001	-0.152	0.023	<.001	-0.182	0.022	<.001	-0.154	0.021	<.001	-0.152	0.021	<.001	-0.148	0.020	<.001
Charlson	-0.014	0.012	0.241	-0.023	0.011	0.046	-0.040	0.011	<.001	-0.029	0.011	0.006	-0.057	0.010	<.001	-0.060	0.010	<.001
Obesity	0.314	0.025	<.001	0.350	0.024	<.001	0.296	0.023	<.001	0.319	0.022	<.001	0.201	0.021	<.001	0.040	0.021	0.057
Townsend																		
1st - lowest	0.402	0.217	0.064	0.075	0.209	0.719	0.139	0.190	0.462	0.210	0.177	0.236	0.271	0.168	0.106	0.494	0.157	0.002
2nd	0.353	0.217	0.104	0.067	0.209	0.749	0.120	0.189	0.526	0.143	0.177	0.420	0.254	0.167	0.129	0.434	0.157	0.006
3th	0.265	0.217	0.221	-0.041	0.209	0.844	-0.010	0.189	0.958	0.032	0.177	0.856	0.187	0.167	0.263	0.339	0.156	0.030
4th	0.146	0.216	0.500	-0.216	0.209	0.301	-0.149	0.189	0.430	-0.149	0.177	0.397	0.180	0.167	0.850	0.180	0.156	0.249
5th - highest	0.050	0.216	0.819	-0.210	0.209	0.315	-0.196	0.189	0.301	-0.209	0.177	0.238	-0.102	0.167	0.542	0.135	0.156	0.388
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.370	0.254	0.146	0.077	0.242	0.751	-0.136	0.221	0.537	-0.145	0.205	0.479	-0.271	0.193	0.160	-0.542	0.181	0.003
2nd	-0.314	0.255	0.218	0.154	0.242	0.526	-0.026	0.221	0.905	-0.075	0.205	0.716	-0.202	0.193	0.294	-0.483	0.181	0.008
3th	-0.269	0.254	0.291	0.187	0.242	0.439	0.012	0.220	0.956	-0.020	0.204	0.921	-0.155	0.192	0.421	-0.451	0.180	0.012
4th	-0.224	0.255	0.380	0.249	0.243	0.304	0.018	0.221	0.937	-0.079	0.205	0.699	-0.158	0.193	0.413	-0.402	0.181	0.026
5th - highest	-0.226	0.256	0.376	0.264	0.243	0.276	0.025	0.221	0.909	-0.035	0.205	0.866	-0.146	0.193	0.451	-0.421	0.181	0.020
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	0.022	0.366	0.952	0.233	0.364	0.522	-0.196	0.357	0.583	0.292	0.359	0.415	0.521	0.357	0.144	0.596	0.342	0.081
Town & Fringe – Sparse	-0.089	0.333	0.789	0.004	0.338	0.991	-0.154	0.322	0.632	0.241	0.319	0.450	0.358	0.314	0.254	-0.074	0.281	0.793
Village, Hamlet & Isolated dwellings – Sparse	-0.293	0.277	0.291	-0.146	0.275	0.596	-0.135	0.283	0.634	0.338	0.285	0.235	0.578	0.302	0.056	0.221	0.256	0.386
Urban >10k - Less sparse	0.091	0.066	0.169	0.018	0.064	0.778	0.087	0.063	0.165	0.168	0.059	0.005	0.121	0.058	0.036	0.200	0.055	0.000
Town & Fringe – Less sparse	0.042	0.069	0.549	-0.091	0.066	0.172	-0.017	0.065	0.793	0.065	0.062	0.294	-0.027	0.060	0.653	0.138	0.058	0.017
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.020	0.042	0.628	-0.026	0.040	0.520	-0.029	0.039	0.465	-0.050	0.037	0.179	-0.017	0.037	0.651	0.007	0.038	0.859
Prevalence	-0.023	0.052	0.655	-0.012	0.048	0.807	-0.044	0.046	0.345	-0.051	0.043	0.240	-0.047	0.042	0.255	-0.023	0.042	0.581
Country																		
England	0.105	0.148	0.481	0.179	0.144	0.212	0.149	0.145	0.305	0.084	0.137	0.543	0.197	0.140	0.158	0.147	0.141	0.297
Northern Ireland	0.295	0.370	0.425	0.355	0.352	0.313	0.190	0.340	0.575	0.314	0.325	0.334	0.413	0.321	0.198	0.085	0.315	0.788
Scotland	-0.128	0.356	0.719	0.158	0.337	0.639	-0.009	0.322	0.978	-0.029	0.306	0.925	-0.094	0.301	0.755	-0.132	0.298	0.657
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Consultations per healthcare professional	0.031	0.054	0.568	0.048	0.051	0.352	0.033	0.058	0.577	-0.008	0.037	0.826	0.072	0.047	0.128	0.002	0.043	0.969
Nurse Contact - any involvement																		
Low	-0.017	0.101	0.866	0.077	0.096	0.421	0.076	0.099	0.441	-0.018	0.094	0.849	0.045	0.095	0.639	0.017	0.096	0.856
Medium	0.033	0.092	0.722	0.155	0.089	0.083	0.187	0.089	0.036	0.116	0.087	0.182	0.158	0.088	0.073	-0.027	0.089	0.758
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.477	0.031		0.464	0.030		0.471	0.030		0.459	0.029		0.464	0.029		0.474	0.030	
Global Tests (degrees of Freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend (5df)	84.024		<.001	94.245		<.001	108.936		<.001	163.638		<.001	128.974		<.001	138.024		<.001
Percent White (5df)	5.261		0.262	8.591		0.072	9.035		0.060	6.296		0.178	5.567		0.234	5.957		0.202
Urban-Rural Classification (5df)	3.942		0.558	5.250		0.386	4.814		0.439	9.548		0.089	12.839		0.025	16.346		0.006
Country (3df)	2.015		0.569	1.990		0.575	1.423		0.700	1.635		0.652	4.513		0.211	2.116		0.549
Nurse Contact - any involvement (2df)	0.232		0.890	3.022		0.221	4.418		0.110	2.457		0.293	3.311		0.191	0.207		0.902

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

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A3.28 Multilevel model, HbA1c ≤7% - effect of diabetic review 2002 – 2006[1]

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intecept	-0.847	0.190		-0.500	0.122		-0.622	0.109		-0.673	0.099		-0.453	0.095	
Age															
linear	0.510	0.014	<.001	0.495	0.010	<.001	0.524	0.010	<.001	0.528	0.009	<.001	0.530	0.008	<.001
quadratic	-0.109	0.012	<.001	-0.094	0.008	<.001	-0.096	0.008	<.001	-0.084	0.007	<.001	-0.104	0.007	<.001
Gender (Female)	-0.118	0.021	<.001	-0.089	0.016	<.001	-0.066	0.015	<.001	-0.017	0.014	0.202	-0.012	0.013	0.365
Charlson	-0.177	0.012	<.001	-0.167	0.009	<.001	-0.162	0.009	<.001	-0.179	0.008	<.001	-0.147	0.007	<.001
Obesity	0.123	0.023	<.001	0.069	0.017	<.001	0.044	0.016	0.005	0.011	0.014	0.436	0.001	0.013	0.951
Townsend															
1st - lowest	0.241	0.242	0.318	0.131	0.117	0.264	0.133	0.108	0.219	0.114	0.101	0.257	0.065	0.096	0.498
2nd	0.165	0.241	0.495	0.093	0.117	0.425	0.105	0.108	0.332	0.051	0.101	0.613	0.028	0.096	0.768
3th	0.154	0.241	0.523	0.064	0.117	0.581	0.055	0.108	0.610	0.052	0.100	0.604	0.002	0.096	0.987
4th	0.083	0.241	0.731	0.043	0.117	0.713	0.047	0.108	0.663	-0.003	0.100	0.975	-0.051	0.096	0.596
5th - highest	0.101	0.242	0.678	0.034	0.117	0.772	0.014	0.108	0.898	0.001	0.101	0.991	-0.048	0.096	0.617
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.268	0.266	0.314	-0.148	0.141	0.295	0.000	0.132	0.997	0.071	0.123	0.564	0.008	0.118	0.948
2nd	-0.191	0.265	0.471	-0.128	0.141	0.364	0.021	0.132	0.872	0.101	0.123	0.410	0.036	0.118	0.758
3th	-0.300	0.265	0.258	-0.184	0.141	0.191	-0.013	0.132	0.924	0.063	0.123	0.608	0.009	0.118	0.938
4th	-0.244	0.266	0.358	-0.184	0.141	0.192	0.020	0.132	0.881	0.049	0.123	0.692	0.007	0.118	0.953
5th - highest	-0.202	0.266	0.447	-0.141	0.141	0.319	-0.007	0.132	0.958	0.073	0.123	0.556	0.021	0.118	0.862
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.024	0.258	0.926	-0.069	0.216	0.748	-0.046	0.203	0.822	-0.202	0.193	0.295	0.165	0.184	0.371
Town & Fringe – Sparse	0.111	0.266	0.677	0.075	0.195	0.700	-0.118	0.157	0.452	-0.354	0.150	0.018	0.205	0.122	0.094
Village, Hamlet & Isolated dwellings – Sparse	0.080	0.200	0.691	-0.152	0.153	0.322	-0.043	0.133	0.750	-0.269	0.127	0.034	-0.002	0.117	0.987
Urban >10k - Less sparse	0.097	0.058	0.092	0.037	0.045	0.406	0.033	0.043	0.434	-0.004	0.039	0.912	0.047	0.037	0.205
Town & Fringe – Less sparse	-0.025	0.059	0.675	-0.027	0.045	0.552	-0.014	0.042	0.739	-0.039	0.040	0.330	0.003	0.038	0.938
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.023	0.039	0.563	-0.049	0.027	0.068	-0.029	0.025	0.257	-0.032	0.022	0.144	-0.038	0.021	0.074
Prevalence	0.161	0.061	0.008	0.129	0.034	0.000	0.111	0.031	<.001	0.080	0.025	0.001	0.080	0.023	0.001
Country															
England	0.113	0.150	0.453	-0.003	0.096	0.972	0.062	0.084	0.463	0.127	0.076	0.096	0.163	0.072	0.024
Northern Ireland	-0.130	0.378	0.731	-0.232	0.186	0.213	-0.048	0.172	0.781	0.319	0.156	0.041	0.334	0.151	0.026
Scotland	-0.358	0.384	0.351	-0.030	0.180	0.868	0.108	0.166	0.514	0.128	0.153	0.405	0.104	0.147	0.478
Wales	0.000			0.000			0.000			0.000			0.000		
Reviews with a healthcare professional	0.131	0.034	<.001	0.082	0.023	<.001	0.038	0.021	0.064	0.040	0.018	0.029	0.006	0.019	0.760
% Practice nurse reviews															
Low	0.139	0.087	0.113	-0.026	0.055	0.640	-0.046	0.054	0.393	-0.077	0.050	0.118	-0.133	0.049	0.006
Medium	0.029	0.086	0.732	0.062	0.055	0.262	0.031	0.052	0.551	0.001	0.046	0.989	-0.090	0.045	0.044
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.501	0.029		0.389	0.018		0.379	0.017		0.356	0.015		0.360	0.015	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend(5df)	23.567		<.001	14.994		0.010	23.611		0.000	31.610		<.001	36.725		<.001
Percent White(5df)	10.010		0.040	4.372		0.358	2.171		0.704	3.421		0.490	1.952		0.745
Urban-Rural Classification(5df)	6.238		0.284	4.364		0.498	2.337		0.801	7.504		0.186	6.582		0.254
Country(3df)	2.322		0.508	2.892		0.409	2.034		0.565	6.095		0.107	9.411		0.024
% Practice nurse reviews(2df)	2.729		0.256	2.481		0.289	1.982		0.371	3.028		0.220	8.593		0.014

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

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A3.29 Multilevel model, HbA1c ≤7% - effect of diabetic review 2007 – 20011/12[1]

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intecept	-0.489	0.094		-0.369	0.087		-0.387	0.086		-0.358	0.082		-0.333	0.084		-0.352	0.083	
Age																		
linear	0.583	0.008	<.001	0.591	0.008	<.001	0.593	0.008	<.001	0.595	0.008	<.001	0.596	0.007	<.001	0.570	0.008	<.001
quadratic	-0.094	0.007	<.001	-0.109	0.006	<.001	-0.107	0.006	<.001	-0.123	0.006	<.001	-0.111	0.006	<.001	-0.122	0.006	<.001
Gender (Female)	0.001	0.012	0.953	0.026	0.012	0.024	0.042	0.011	<.001	0.052	0.011	<.001	0.030	0.011	0.008	0.053	0.011	<.001
Charlson	-0.120	0.006	<.001	-0.125	0.006	<.001	-0.131	0.005	<.001	-0.141	0.005	<.001	-0.153	0.005	<.001	-0.149	0.005	<.001
Obesity	-0.001	0.013	0.952	0.002	0.012	0.854	-0.004	0.012	0.738	-0.010	0.011	0.368	-0.049	0.011	<.001	-0.119	0.011	<.001
Townsend																		
1st - lowest	0.051	0.080	0.529	-0.021	0.073	0.771	-0.014	0.067	0.829	0.104	0.064	0.105	0.108	0.061	0.076	0.119	0.061	0.051
2nd	0.020	0.080	0.801	-0.079	0.072	0.275	-0.060	0.066	0.364	0.084	0.064	0.190	0.079	0.060	0.191	0.094	0.060	0.120
3th	-0.009	0.080	0.913	-0.081	0.072	0.261	-0.089	0.066	0.178	0.043	0.064	0.500	0.070	0.060	0.249	0.090	0.060	0.136
4th	-0.020	0.080	0.807	-0.109	0.072	0.133	-0.106	0.066	0.111	0.012	0.064	0.851	0.054	0.060	0.370	0.069	0.060	0.250
5th - highest	-0.064	0.080	0.427	-0.128	0.072	0.078	-0.141	0.067	0.034	0.003	0.064	0.962	-0.004	0.061	0.954	0.034	0.061	0.570
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.060	0.103	0.558	0.037	0.095	0.699	-0.026	0.089	0.773	-0.202	0.086	0.019	-0.250	0.082	0.002	-0.243	0.082	0.003
2nd	-0.026	0.103	0.798	0.033	0.095	0.727	-0.010	0.089	0.910	-0.157	0.086	0.069	-0.194	0.083	0.019	-0.166	0.082	0.043
3th	-0.007	0.103	0.944	0.041	0.095	0.662	0.016	0.089	0.854	-0.153	0.086	0.074	-0.207	0.082	0.012	-0.186	0.081	0.022
4th	-0.021	0.103	0.838	0.040	0.095	0.672	-0.018	0.089	0.838	-0.152	0.086	0.078	-0.173	0.082	0.035	-0.168	0.082	0.040
5th - highest	-0.018	0.103	0.860	0.047	0.095	0.623	0.010	0.089	0.912	-0.154	0.086	0.075	-0.179	0.082	0.030	-0.167	0.082	0.041
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	0.201	0.182	0.271	0.216	0.177	0.222	-0.261	0.239	0.275	-0.186	0.230	0.419	-0.317	0.235	0.177	0.052	0.226	0.818
Town & Fringe – Sparse	0.078	0.121	0.518	0.086	0.119	0.467	0.138	0.122	0.256	-0.014	0.118	0.904	0.000	0.119	0.999	0.065	0.118	0.582
Village, Hamlet & Isolated dwellings – Sparse	0.130	0.113	0.249	0.149	0.110	0.175	0.075	0.114	0.512	-0.009	0.111	0.936	-0.060	0.124	0.632	-0.028	0.123	0.819
Urban >10k - Less sparse	0.065	0.036	0.071	0.070	0.035	0.043	0.035	0.034	0.310	0.102	0.034	0.003	0.121	0.034	0.000	0.118	0.034	0.001
Town & Fringe – Less sparse	0.055	0.037	0.135	0.048	0.035	0.175	0.030	0.034	0.376	0.067	0.034	0.049	0.037	0.034	0.281	0.030	0.035	0.387
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.046	0.023	0.043	-0.045	0.021	0.030	-0.035	0.021	0.098	-0.047	0.019	0.014	-0.037	0.019	0.051	-0.031	0.019	0.110
Prevalence	0.056	0.024	0.016	0.071	0.021	0.001	0.047	0.021	0.024	0.043	0.019	0.023	0.047	0.018	0.008	0.045	0.018	0.009
Country																		
England	0.164	0.075	0.029	0.082	0.069	0.235	0.190	0.071	0.008	0.134	0.065	0.040	0.096	0.068	0.157	0.081	0.067	0.225
Northern Ireland	0.309	0.146	0.035	0.083	0.145	0.566	0.236	0.140	0.093	0.064	0.131	0.627	-0.013	0.130	0.920	-0.103	0.128	0.422
Scotland	0.181	0.133	0.173	0.130	0.118	0.271	0.136	0.115	0.234	-0.051	0.108	0.634	-0.070	0.106	0.509	-0.100	0.105	0.341
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Reviews with a healthcare professional	-0.021	0.020	0.285	-0.002	0.019	0.904	0.001	0.019	0.966	-0.009	0.019	0.617	-0.004	0.019	0.823	-0.004	0.020	0.842
% Practice nurse reviews																		
Low	-0.083	0.050	0.097	-0.042	0.047	0.362	-0.054	0.047	0.242	-0.005	0.044	0.901	-0.033	0.047	0.477	-0.041	0.046	0.375
Medium	-0.001	0.047	0.979	-0.032	0.044	0.462	-0.030	0.045	0.513	-0.056	0.042	0.180	-0.063	0.041	0.121	-0.072	0.040	0.073
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.383	0.015		0.365	0.014		0.378	0.015		0.347	0.014		0.342	0.014		0.336	0.014	

Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend(5df)	26.439		<.001	30.497		<.001	42.380		<.001	36.615		<.001	29.281		<.001	18.452		0.002
Percent White(5df)	2.841		0.585	0.183		0.996	3.329		0.504	3.952		0.413	7.596		0.108	10.792		0.029
Urban-Rural Classification(5df)	4.468		0.484	5.506		0.357	4.407		0.493	10.395		0.065	17.579		0.004	15.059		0.010
Country(3df)	6.515		0.089	1.824		0.610	7.999		0.046	8.515		0.037	5.471		0.140	6.006		0.111
% Practice nurse reviews(2df)	3.174		0.205	1.014		0.602	1.413		0.493	1.917		0.383	2.459		0.292	3.307		0.191

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.30 Multilevel model, HbA1c ≤10% - effect of diabetic review 2002 – 2006[1]

	2002			2003			2004			2005			2006		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intecept	0.775	0.275		1.175	0.151		1.381	0.124		1.366	0.111		1.550	0.113	
Age															
linear	0.411	0.013	<.001	0.404	0.011	<.001	0.437	0.012	<.001	0.471	0.011	<.001	0.466	0.011	<.001
quadratic	-0.134	0.010	<.001	-0.095	0.008	<.001	-0.067	0.007	<.001	-0.070	0.007	<.001	-0.081	0.007	<.001
Gender (Female)	-0.154	0.022	<.001	-0.110	0.019	<.001	-0.163	0.019	<.001	-0.148	0.018	<.001	-0.168	0.017	<.001
Charlson	-0.070	0.013	<.001	-0.070	0.011	<.001	-0.035	0.011	0.002	-0.074	0.010	<.001	-0.064	0.009	<.001
Obesity	0.468	0.026	<.001	0.425	0.021	<.001	0.360	0.021	<.001	0.349	0.019	<.001	0.354	0.018	<.001
Townsend															
1st - lowest	0.482	0.227	0.034	0.202	0.130	0.121	0.270	0.134	0.044	0.390	0.125	0.002	0.218	0.125	0.081
2nd	0.413	0.226	0.068	0.171	0.130	0.188	0.226	0.134	0.090	0.325	0.125	0.009	0.188	0.124	0.130
3th	0.339	0.226	0.134	0.064	0.130	0.621	0.123	0.133	0.355	0.190	0.125	0.127	0.093	0.124	0.453
4th	0.274	0.226	0.225	-0.015	0.129	0.906	0.042	0.133	0.752	0.102	0.124	0.410	-0.012	0.124	0.920
5th - highest	0.221	0.227	0.330	-0.065	0.130	0.613	-0.096	0.133	0.469	-0.005	0.125	0.969	-0.112	0.124	0.368
Unknown	0.000			0.000			0.000			0.000			0.000		
Percent White															
1st - lowest	-0.462	0.257	0.072	-0.127	0.159	0.424	-0.216	0.162	0.184	-0.286	0.153	0.061	-0.180	0.152	0.238
2nd	-0.386	0.256	0.131	-0.065	0.159	0.685	-0.114	0.162	0.483	-0.198	0.153	0.194	-0.105	0.152	0.491
3th	-0.421	0.256	0.100	-0.093	0.159	0.558	-0.141	0.162	0.384	-0.182	0.152	0.233	-0.127	0.152	0.404
4th	-0.425	0.257	0.098	-0.079	0.159	0.622	-0.114	0.162	0.481	-0.170	0.152	0.264	-0.122	0.152	0.422
5th - highest	-0.413	0.257	0.108	0.043	0.160	0.790	-0.013	0.163	0.937	-0.095	0.153	0.535	-0.022	0.153	0.887
Unknown	0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification															
Urban >10k – Sparse	0.539	0.306	0.078	0.150	0.267	0.574	0.154	0.248	0.534	-0.136	0.236	0.564	-0.124	0.246	0.615
Town & Fringe – Sparse	0.682	0.325	0.036	0.120	0.253	0.634	-0.035	0.202	0.862	-0.197	0.190	0.300	0.047	0.174	0.787
Village, Hamlet & Isolated dwellings – Sp	0.058	0.214	0.785	-0.161	0.189	0.396	-0.121	0.161	0.453	-0.022	0.159	0.891	-0.122	0.152	0.421
Urban >10k - Less sparse	0.074	0.063	0.237	-0.001	0.054	0.989	0.030	0.055	0.584	0.056	0.052	0.282	0.012	0.050	0.811
Town & Fringe – Less sparse	0.048	0.066	0.469	0.058	0.057	0.307	-0.039	0.057	0.489	-0.044	0.055	0.420	-0.019	0.053	0.718
Village, Hamlet & Isolated dwelling – Les	0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000		
Practice List Size	0.029	0.061	0.640	-0.053	0.034	0.119	-0.031	0.029	0.279	-0.020	0.024	0.421	-0.037	0.024	0.135
Prevalence	0.046	0.094	0.624	0.019	0.042	0.654	0.016	0.034	0.651	-0.010	0.027	0.726	0.037	0.027	0.170
Country															
England	0.301	0.233	0.196	0.125	0.122	0.306	0.257	0.094	0.006	0.265	0.082	0.001	0.199	0.082	0.015
Northern Ireland	-0.290	0.490	0.554	0.004	0.224	0.986	0.206	0.199	0.301	0.199	0.179	0.266	0.226	0.182	0.214
Scotland	-0.725	0.507	0.153	0.312	0.216	0.148	0.281	0.196	0.150	0.189	0.178	0.289	0.153	0.179	0.394
Wales	0.000			0.000			0.000			0.000			0.000		
Reviews with a healthcare professional	0.268	0.053	<.001	0.183	0.029	<.001	0.081	0.024	0.001	0.071	0.020	<.001	0.073	0.022	0.001
% Practice nurse reviews															
Low	0.110	0.136	0.419	0.029	0.070	0.677	0.006	0.061	0.922	0.058	0.054	0.288	0.008	0.056	0.890
Medium	-0.040	0.134	0.765	0.075	0.071	0.285	-0.021	0.058	0.724	0.006	0.050	0.911	0.008	0.051	0.877
High	0.000			0.000			0.000			0.000			0.000		
Random Variance															
Practice	0.809	0.043		0.497	0.022		0.416	0.019		0.372	0.017		0.398	0.017	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend(5df)	51.506		<.001	84.721		<.001	128.436		<.001	182.116		<.001	144.373		<.001
Percent White(5df)	2.764		0.598	12.021		0.017	15.540		0.004	14.031		0.007	12.667		0.013
Urban-Rural Classification(5df)	8.105		0.151	4.216		0.519	3.578		0.612	6.756		0.239	1.701		0.889
Country(3df)	7.177		0.067	4.412		0.220	7.830		0.050	10.537		0.015	6.187		0.103
% Practice nurse reviews(2df)	1.255		0.534	1.149		0.563	0.213		0.899	1.285		0.526	0.031		0.984

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

A3.31 Multilevel model, HbA1c ≤10% - effect of diabetic review 2007 – 2011/12[1]

	2007			2008			2009			2010			2011			2011/2012		
	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t	β	SE(β)	prob<t
Intecept	1.444	0.106		1.459	0.099		1.477	0.097		1.483	0.093		1.415	0.095		1.431	0.095	
Age																		
linear	0.484	0.010	<.001	0.480	0.010	<.001	0.484	0.010	<.001	0.510	0.009	<.001	0.547	0.009	<.001	0.500	0.009	<.001
quadratic	-0.076	0.006	<.001	-0.075	0.006	<.001	-0.089	0.006	<.001	-0.085	0.006	<.001	-0.082	0.006	<.001	-0.116	0.006	<.001
Gender (Female)	-0.155	0.016	<.001	-0.148	0.016	<.001	-0.155	0.015	<.001	-0.142	0.015	<.001	-0.153	0.014	<.001	-0.131	0.014	<.001
Charlson	-0.018	0.008	0.034	-0.026	0.008	0.001	-0.048	0.007	<.001	-0.039	0.007	<.001	-0.069	0.007	<.001	-0.071	0.007	<.001
Obesity	0.308	0.017	<.001	0.339	0.016	<.001	0.286	0.016	<.001	0.292	0.015	<.001	0.207	0.015	<.001	0.040	0.015	0.007
Townsend																		
1st - lowest	0.376	0.102	<.001	0.237	0.095	0.013	0.238	0.087	0.006	0.315	0.082	<.001	0.265	0.075	<.001	0.273	0.073	<.001
2nd	0.300	0.101	0.003	0.206	0.095	0.030	0.189	0.087	0.030	0.267	0.081	0.001	0.235	0.075	0.002	0.225	0.073	0.002
3th	0.242	0.101	0.017	0.110	0.094	0.243	0.077	0.086	0.373	0.136	0.081	0.093	0.132	0.074	0.077	0.108	0.072	0.134
4th	0.137	0.101	0.173	-0.025	0.094	0.789	-0.033	0.086	0.704	0.015	0.081	0.856	0.013	0.074	0.864	0.008	0.072	0.913
5th - highest	0.010	0.101	0.923	-0.077	0.094	0.416	-0.133	0.086	0.124	-0.050	0.081	0.540	-0.132	0.074	0.077	-0.063	0.072	0.387
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Percent White																		
1st - lowest	-0.334	0.130	0.010	-0.158	0.122	0.195	-0.203	0.114	0.075	-0.345	0.108	0.001	-0.153	0.102	0.133	-0.216	0.099	0.028
2nd	-0.261	0.130	0.044	-0.096	0.122	0.430	-0.111	0.114	0.329	-0.279	0.108	0.010	-0.117	0.102	0.250	-0.190	0.099	0.055
3th	-0.265	0.129	0.040	-0.094	0.121	0.438	-0.066	0.113	0.561	-0.243	0.108	0.024	-0.136	0.101	0.179	-0.178	0.098	0.069
4th	-0.219	0.129	0.089	-0.082	0.121	0.497	-0.076	0.113	0.504	-0.270	0.108	0.012	-0.103	0.101	0.309	-0.128	0.098	0.191
5th - highest	-0.207	0.130	0.111	-0.067	0.122	0.581	-0.064	0.114	0.575	-0.192	0.108	0.075	-0.088	0.102	0.389	-0.134	0.099	0.176
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Urban-Rural Classification																		
Urban >10k – Sparse	-0.021	0.234	0.928	-0.147	0.229	0.521	-0.227	0.306	0.458	0.141	0.307	0.647	0.283	0.304	0.352	0.477	0.298	0.110
Town & Fringe – Sparse	0.037	0.166	0.824	0.317	0.170	0.062	-0.019	0.164	0.905	0.191	0.157	0.226	0.263	0.162	0.104	-0.030	0.151	0.840
Village, Hamlet & Isolated dwellings – Sparse	0.062	0.155	0.690	0.124	0.154	0.420	-0.136	0.155	0.380	0.028	0.148	0.847	0.194	0.169	0.251	0.058	0.157	0.710
Urban >10k - Less sparse	0.059	0.048	0.223	0.045	0.046	0.322	0.084	0.045	0.066	0.197	0.044	<.001	0.110	0.044	0.012	0.157	0.043	<.001
Town & Fringe – Less sparse	0.037	0.051	0.460	0.012	0.048	0.810	0.024	0.047	0.606	0.118	0.046	0.009	0.005	0.046	0.907	0.095	0.046	0.038
Village, Hamlet & Isolated dwelling – Less sparse	0.000			0.000			0.000			0.000			0.000			0.000		
Unknown	0.000			0.000			0.000			0.000			0.000			0.000		
Practice List Size	-0.041	0.025	0.097	-0.045	0.023	0.047	-0.042	0.023	0.065	-0.046	0.021	0.030	-0.037	0.021	0.081	-0.020	0.022	0.357
Prevalence	-0.009	0.026	0.731	0.027	0.024	0.262	0.015	0.023	0.505	-0.001	0.021	0.946	0.005	0.020	0.799	0.001	0.020	0.958
Country																		
England	0.211	0.081	0.009	0.162	0.075	0.032	0.130	0.076	0.088	0.119	0.072	0.097	0.168	0.075	0.025	0.174	0.076	0.022
Northern Ireland	0.127	0.168	0.450	0.064	0.168	0.705	0.126	0.161	0.434	0.051	0.151	0.738	0.243	0.149	0.103	0.193	0.148	0.191
Scotland	0.064	0.155	0.681	0.206	0.141	0.144	0.185	0.134	0.168	0.113	0.126	0.371	0.193	0.123	0.115	0.205	0.121	0.092
Wales	0.000			0.000			0.000			0.000			0.000			0.000		
Reviews with a healthcare professional	0.064	0.022	0.004	0.074	0.021	<.001	0.092	0.021	<.001	0.056	0.021	0.007	0.082	0.021	<.001	0.091	0.023	<.001
% Practice nurse reviews																		
Low	0.072	0.054	0.182	0.058	0.051	0.254	0.087	0.050	0.081	0.058	0.049	0.230	-0.043	0.052	0.402	-0.007	0.053	0.898
Medium	0.048	0.051	0.346	0.072	0.048	0.136	0.056	0.049	0.250	0.022	0.046	0.638	-0.047	0.045	0.300	-0.026	0.046	0.574
High	0.000			0.000			0.000			0.000			0.000			0.000		
Random Variance																		
Practice	0.401	0.017		0.386	0.016		0.391	0.016		0.368	0.016		0.369	0.015		0.375	0.016	
Global Tests (degress of freedom)	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p	χ^2		p
Townsend(5df)	171.204		<.001	180.127		<.001	233.026		<.001	254.604		<.001	281.664		<.001	219.227		<.001
Percent White(5df)	8.631		0.071	4.929		0.295	14.517		0.006	13.064		0.011	3.176		0.529	4.907		0.297
Urban-Rural Classification(5df)	1.631		0.897	5.725		0.334	5.864		0.320	21.028		0.001	11.526		0.042	16.089		0.007
Country(3df)	7.846		0.049	6.116		0.106	3.405		0.333	3.128		0.372	5.424		0.143	5.422		0.143
% Practice nurse reviews(2df)	2.003		0.367	2.611		0.271	3.305		0.192	1.449		0.485	1.353		0.508	0.321		0.852

[1] Nurse contact – Any involvement low <26%, medium 26-35%, high 35% and over

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Appendix 4 Read codes (activity labels)

A4.1a Doctors - Readcode entries (%) on the Vision System – Diagnosis or label

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Diagnosis or label	Diabetes mellitus	20.45	15.14	12.26	11.04	8.01	5.45	4.92	4.41	3.76	2.90	2.63
	Diabetes mellitus with ketoacidosis	0.13	0.06	0.04	0.04	0.03	0.05	0.05	0.04	0.05	0.04	0.04
	Diabetic on diet only	0.17	0.29	0.26	0.26	0.28	0.23	0.22	0.22	0.19	0.15	0.12
	Diabetic on insulin	0.12	0.13	0.17	0.12	0.08	0.10	0.07	0.10	0.12	0.06	0.05
	Diabetic on oral treatment	0.34	0.65	0.61	0.42	0.38	0.49	0.56	0.66	0.45	0.29	0.23
	H/O: diabetes mellitus	0.65	0.50	0.49	0.60	0.80	0.79	0.89	0.48	0.35	0.29	0.28
	H/O: insulin therapy	0.06	0.10	0.08	0.07	0.12	0.11	0.12	0.13	0.11	0.08	0.07
	IDDM-Insulin dependent diabetes mellitus	0.29	0.25	0.23	0.22	0.14	0.14	0.11	0.08	0.08	0.05	0.04
	Insulin dependent diabetes mellitus	1.46	1.02	0.63	0.40	0.32	0.22	0.16	0.14	0.14	0.13	0.13
	Insulin treated Type 2 diabetes mellitus	0.19	0.24	0.16	0.20	0.23	0.16	0.16	0.17	0.15	0.11	0.09
	Maturity onset diabetes	0.27	0.24	0.17	0.13	0.11	0.07	0.03	0.06	0.03	0.03	0.03
	NIDDM - Non-insulin dependent diabetes mellitus	0.13	0.09	0.26	0.24	0.20	0.13	0.12	0.10	0.10	0.06	0.07
	Non-insulin dependent diabetes mellitus	9.01	6.79	3.84	2.61	1.84	1.33	0.91	0.60	0.71	0.59	0.56
	Type 1 diabetes mellitus	0.58	0.84	0.97	0.97	1.40	1.38	1.34	1.18	1.01	0.88	0.70
	Type 2 diabetes mellitus	7.84	11.83	13.32	14.54	19.69	21.02	21.04	20.10	19.28	15.40	13.74
	Type II diabetes mellitus	0.14	0.09	0.04	0.05	0.07	0.08	0.08	0.06	0.07	0.07	0.07
	All	41.90	38.40	33.67	32.11	33.85	31.90	30.93	28.70	26.75	21.25	18.95

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

A4.1b Doctors – Readcode entries (%) on the Vision System – Annual review

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Annual review	Annual diabetic blood test	0.04	0.02	0.02	0.05	0.07	0.11	0.09	0.07	0.07	0.13	0.12
	Attending diabetes clinic	0.39	0.27	0.28	0.19	0.28	0.27	0.30	0.24	0.18	0.17	0.15
	Attends diabetes monitoring	0.82	0.49	0.35	0.28	0.34	0.35	0.42	0.61	0.41	0.20	0.21
	Background diabetic retinopathy	0.06	0.11	0.07	0.08	0.07	0.12	0.12	0.13	0.13	0.08	0.06
	DNA - Did not attend diabetic clinic	0.01	0.04	0.09	0.17	0.15	0.20	0.29	0.21	0.22	0.19	0.24
	Declined diabetic retinop scrn							0.00	0.04	0.18	0.20	0.14
	Diabetes care plan agreed			0.00	0.01	0.02	0.03	0.14	0.10	0.49	0.93	1.04
	Diabetes clinic administration	0.23	0.11	0.05	0.13	0.01	0.01	0.00	0.00	0.00	0.00	0.00
	Diabetes clinical management plan							0.04	0.05	0.09	0.24	0.16
	Diabetes management plan given	0.50	0.67	0.79	0.97	1.31	1.74	2.79	3.24	3.22	2.92	2.83
	Diabetes mellitus with neuropathy	0.39	0.32	0.23	0.22	0.22	0.22	0.18	0.16	0.18	0.15	0.15
	Diabetes mellitus with no mention of complication	0.20	0.07	0.06	0.05	0.09	0.07	0.02	0.03	0.00	0.01	0.01
	Diabetes monitor.verbal invite	0.00	0.00	0.03	0.01	0.02	0.02	0.05	0.14	0.14	0.10	0.10
	Diabetes monitored	0.11	0.41	0.37	0.46	0.18	0.11	0.48	0.53	0.53	0.44	0.41
	Diabetes monitoring 1st letter		0.00	0.44	0.67	0.73	0.21	0.13	0.15	0.40	0.24	0.48
	Diabetes monitoring 2nd letter		0.00	0.09	0.07	0.10	0.05	0.07	0.05	0.15	0.05	0.08
	Diabetes monitoring admin.	29.07	28.03	23.55	20.24	18.22	17.66	18.02	18.93	16.69	12.42	10.99
	Diabetes monitoring admin.NOS	0.02	0.01	0.01	0.06	0.14	0.10	0.01	0.00	0.05	0.13	0.13
	Diabetes type 2 review				0.00		0.23	0.65	0.94	1.09	1.19	1.19
	Diabetes: practice programme	0.83	1.12	1.31	1.44	1.39	0.85	1.07	1.47	1.67	1.38	1.35
	Diabetic - good control	0.85	0.70	0.55	0.47	0.44	0.42	0.75	0.76	0.78	0.61	0.55
	Diabetic - poor control	3.79	3.26	2.71	2.76	2.42	2.43	2.36	2.35	2.39	2.02	1.85
	Diabetic 6 month review	0.00		0.00	0.01	0.10	0.80	0.79	1.11	1.27	1.18	1.12
	Diabetic annual review	2.67	2.93	3.57	2.98	4.31	4.35	4.57	4.11	3.60	2.35	2.24
	Diabetic foot examination		0.02	0.18	0.10	0.13	0.05	0.03	0.07	0.11	0.13	0.13
	Diabetic foot screen								0.01	1.73	3.19	2.06	1.14
	Diabetic leaflet given	0.01	0.01	0.00	0.21	0.12	0.01	0.01	0.01	0.04	0.01	0.00
	Diabetic monitoring	8.15	10.19	11.58	12.21	13.20	15.03	13.92	13.15	13.87	11.54	10.41
	Diabetic monitoring NOS	2.58	2.25	1.96	2.22	2.26	2.41	2.73	2.60	2.40	1.64	1.47
	Diabetic neuropathy	0.16	0.15	0.13	0.15	0.17	0.27	0.17	0.14	0.15	0.14	0.12
	Diabetic peripheral neuropathy screening		0.12	1.45	1.81	1.25	1.02	0.65	0.33	0.29	0.41	0.65
	Diabetic retinopathy	0.48	0.42	0.29	0.27	0.23	0.23	0.23	0.27	0.19	0.16	0.14
	Diabetic retinopathy screening	0.16	0.80	1.08	0.90	0.30	0.43	0.38	0.36	0.38	0.30	0.25
	Diabetic retinopathy screening refused			0.00	0.08	0.06	0.17	0.19	0.12	0.06	0.02	0.01
	Follow-up diabetic assessment	0.82	1.66	2.24	2.10	2.61	1.70	1.69	1.70	1.86	1.49	1.28
	Fundoscopy - diabetic check	0.01	0.10	0.11	0.06	0.01	0.01	0.00	0.00	0.00	0.00	
	Hb. A1C - diabetic control	0.20	0.30	0.25	0.48	0.60	0.66	0.52	0.55	0.53	0.34	0.25
	HbA1 - diabetic control	0.04	0.04	0.04	0.06	0.06	0.10	0.11	0.08	0.05	0.04	0.04
	Health education - diabetes		0.01	0.02	0.04	0.04	0.05	0.14	0.11	0.18	0.12	0.16
	Injection sites - diabetic	0.02	0.04	0.11	0.09	0.07	0.08	0.09	0.09	0.07	0.07	0.05
	Non-insulin dependent diabetes mellitus - poor control	0.02	0.03	0.12	0.14	0.18	0.20	0.02	0.03	0.02	0.02	0.01
	O/E - Left diabetic foot at high risk		0.01	0.06	0.04	0.06	0.07	0.09	0.08	0.08	0.43	0.59
	O/E - Left diabetic foot at low risk	0.04	0.14	0.57	0.60	0.57	0.80	0.92	0.99	1.07	9.19	11.96
	O/E - Left diabetic foot at moderate risk		0.03	0.13	0.12	0.23	0.41	0.37	0.36	0.32	2.04	2.78
	O/E - Right diabetic foot at high risk		0.01	0.07	0.05	0.06	0.06	0.07	0.07	0.08	0.45	0.61
	O/E - Right diabetic foot at low risk	0.04	0.15	0.61	0.66	0.58	0.81	0.93	1.00	1.10	9.46	12.29
	O/E - Right diabetic foot at moderate risk		0.03	0.15	0.13	0.24	0.41	0.39	0.36	0.33	2.13	2.84
	Pt advised re diabetic diet	0.04	0.07	0.06	0.08	0.09	0.19	0.14	0.14	0.13	0.10	0.08
	Seen in diabetic clinic	3.60	3.64	2.51	3.23	2.64	3.40	3.42	3.30	3.26	2.33	2.10
	Type 2 diabetes mellitus with persistent microalbuminuria	0.00	0.06	0.21	0.28	0.33	0.30	0.26	0.18	0.22	0.15	0.13
	Type 2 diabetes mellitus with persistent proteinuria		0.02	0.07	0.05	0.07	0.14	0.14	0.09	0.08	0.07	0.07
	All	57.50	60.30	59.91	58.69	58.11	60.78	62.45	64.64	65.36	73.42	76.42

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

A4.1c Doctors - Readcode entries (%) on the Vision System – medication review, referral to another party, care for by secondary clinic and exemption codes

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Medication review	Conversion to insulin	0.15	0.11	0.10	0.08	0.09	0.08	0.09	0.08	0.07	0.04	0.03
	Diabetes medication review	0.02	0.54	1.38	0.81	1.09	1.04	0.73	0.98	1.02	0.69	0.60
	Diabetic treatment changed	0.09	0.07	0.07	0.05	0.09	0.15	0.16	0.12	0.13	0.10	0.09
	Patient on maximal tolerated therapy for diabetes		0.02	0.81	1.38	1.31	1.34	1.23	1.51	2.36	1.50	1.20
	All	0.27	0.74	2.36	2.32	2.59	2.62	2.24	2.74	3.61	2.37	1.98
Referral to another party	Refer to diabetic foot screener	.	0.00	0.01	0.27	0.16	0.12	0.18	0.19	0.14	0.08	0.06
	Refer, diabetic liaison nurse	0.10	0.10	0.08	0.09	0.08	0.07	0.09	0.07	0.13	0.10	0.10
	Referral to DESMOND diabetes structured education						0.00	0.06	0.12	0.08	0.07	0.04
	Referral to community diabetes specialist nurse						0.05	0.05	0.07	0.10	0.10	0.12
	All	0.16	0.15	0.14	0.43	0.36	0.39	0.54	0.62	0.64	0.54	0.47
Care for by secondary clinic	Diabetes: shared care programme	0.12	0.22	0.24	0.11	0.07	0.10	0.12	0.18	0.20	0.15	0.15
	Seen in community diabetes specialist clinic					0.00	0.01	0.00	0.02	0.02	0.17	0.15
	Under care of diabetic foot screener	0.00	0.07	1.67	3.54	2.17	1.53	1.48	1.38	1.24	0.65	0.58
	All	0.14	0.33	2.03	3.71	2.30	1.69	1.73	1.68	1.52	1.02	0.92
Exemption codes	Diabetic foot examination not indicated			0.21	0.25	0.27	0.25	0.14	0.10	0.09	0.04	0.03
	Diabetic patient unsuitable for digital retinal photography				0.01	0.07	0.14	0.11	0.11	0.11	0.10	0.09
	Diabetic retinopathy screening not indicated			0.00	0.14	0.22	0.13	0.06	0.06	0.06	0.05	0.03	0.02
	Excepted from diabetes qual indicators: Patient unsuitable			0.02	1.06	1.65	1.66	1.44	1.08	0.83	1.17	0.74	0.68
	Excepted from diabetes quality indicators: Informed dissent			0.03	0.45	0.58	0.64	0.64	0.55	0.49	0.63	0.43	0.41
	All	0.00	0.07	1.88	2.74	2.79	2.54	1.98	1.60	2.08	1.36	1.24
Other	Did not attend diabetic retinopathy clinic					0.00	0.06	0.14	0.02	0.03	0.02	0.01
	All	0.03	0.02	0.00	0.01	0.01	0.07	0.15	0.03	0.04	0.05	0.03

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

A4.2a Practice nurses - Readcode entries (%) on the Vision System – Diagnosis or label

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Diagnosis or label	Diabetes mellitus	4.51	4.19	3.08	1.96	1.51	1.03	0.75	0.66	0.60	0.56	0.49
	Diabetic on diet only	0.29	0.47	0.70	0.51	0.36	0.44	0.58	0.65	0.47	0.30	0.27
	Diabetic on insulin	0.06	0.11	0.36	0.28	0.27	0.43	0.43	0.43	0.30	0.19	0.19
	Diabetic on insulin and oral treatment	0.01	0.04	0.05	0.08	0.12	0.18	0.29	0.32	0.19	0.10	0.09
	Diabetic on oral treatment	0.48	0.88	1.06	1.01	0.87	1.10	1.40	1.60	1.15	0.75	0.68
	H/O: diabetes mellitus	0.13	0.12	0.09	0.12	0.08	0.05	0.04	0.04	0.02	0.01	0.01
	H/O: insulin therapy	0.06	0.08	0.27	0.22	0.22	0.29	0.22	0.17	0.12	0.05	0.06
	Insulin dependent diabetes mellitus	0.19	0.24	0.12	0.09	0.05	0.03	0.02	0.01	0.01	0.01	0.01
	Insulin treated Type 2 diabetes mellitus	0.08	0.16	0.15	0.13	0.13	0.16	0.16	0.06	0.05	0.04	0.03
	Maturity onset diabetes	0.16	0.12	0.06	0.05	0.03	0.00	0.00	0.00		0.00	0.00
	Non-insulin dependent diabetes mellitus	1.16	1.61	0.73	0.61	0.41	0.19	0.05	0.02	0.01	0.02	0.02
	Type 1 diabetes mellitus	0.17	0.30	0.28	0.21	0.26	0.27	0.18	0.17	0.14	0.11	0.10
	Type 2 diabetes mellitus	3.29	4.95	4.93	4.07	5.54	5.08	4.60	4.52	3.79	2.61	2.39
	Type II diabetes mellitus	0.14	0.13	0.03	0.02	0.02	0.01	0.01	0.04	0.01	0.02	0.02
	All	10.85	13.46	11.99	9.40	9.91	9.28	8.74	8.71	6.90	4.91	4.49

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

A4.2b Practice nurses - Readcode entries (%) on the Vision System – Annual review

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Annual review	Annual diabetic blood test	0.10	0.04	0.05	0.04	0.03	0.05	0.24	0.25	0.23	0.12	0.07
	Attending diabetes clinic	0.02	0.03	0.13	0.10	0.02	0.02	0.02	0.01	0.01	0.32	0.32
	Attends diabetes monitoring	2.97	2.60	2.48	2.57	2.37	2.38	1.99	1.21	0.94	0.75	0.64
	DNA - Did not attend diabetic clinic	0.10	0.41	0.93	0.92	1.07	1.33	1.04	0.79	0.96	0.56	0.45
	Declined diabetic retinop scrn							0.00	0.03	0.14	0.11	0.12
	Diabetes care plan agreed				0.00	0.01	0.10	0.27	0.41	0.93	0.86	1.00
	Diabetes clinic administration	0.40	0.28	0.34	0.34	0.43	0.32	0.01	0.02	0.02	0.01	0.01
	Diabetes clinical management plan							0.00	0.00	0.01	0.22	0.29
	Diabetes management plan given	0.22	0.35	0.60	0.99	1.17	0.95	1.47	1.49	1.51	1.19	1.23
	Diabetes monitor. check done	0.59	1.02	0.61	0.83	0.93	1.42	0.94	0.24	0.53	0.43	0.37
	Diabetes monitor.phone invite	0.01	0.01	0.05	0.06	0.07	0.04	0.09	0.18	0.27	0.08	0.05
	Diabetes monitor.verbal invite	0.01	0.02	0.03	0.02	0.02	0.01	0.03	0.29	0.25	0.12	0.10
	Diabetes monitored	0.29	0.41	0.09	0.10	0.16	0.18	0.12	0.15	0.08	0.04	0.03
	Diabetes monitoring 1st letter	0.72	0.41	0.27	0.19	0.46	0.49	0.60	1.10	0.98	0.50	0.34
	Diabetes monitoring 2nd letter	0.00	0.04	0.03	0.08	0.13	0.14	0.13	0.19	0.19	0.10	0.05
	Diabetes monitoring admin.	59.14	53.79	40.77	36.83	34.01	32.81	30.62	29.68	26.58	17.28	15.12
	Diabetes monitoring admin.NOS	0.00		0.01	0.16	0.08	0.01	0.01	0.01	0.00	0.02	0.02
	Diabetes type 2 review					0.00	0.15	0.43	0.42	0.66	0.75	0.68
	Diabetes: practice programme	1.09	1.86	3.34	3.55	3.28	2.56	2.95	2.83	2.80	2.25	1.97
	Diabetic - follow-up default	0.02	0.04	0.00	0.00	0.33	0.13	0.08	0.04	0.00	0.00	0.01
	Diabetic - good control	0.10	0.17	0.20	0.11	0.09	0.19	0.42	0.42	0.23	0.15	0.11
	Diabetic - poor control	0.48	0.74	0.47	0.27	0.29	0.24	0.21	0.22	0.31	0.25	0.24
	Diabetic 6 month review				0.02	0.37	0.82	1.34	1.16	1.28	0.93	0.91
	Diabetic annual review	1.83	1.80	4.25	4.46	5.12	5.31	4.74	5.03	3.90	2.46	2.35
	Diabetic diet - good compliance		0.06	0.45	0.27	0.17	0.25	0.42	0.34	0.15	0.04	0.05
	Diabetic foot examination		0.11	0.43	0.32	0.20	0.08	0.13	0.10	0.08	0.14	0.19
	Diabetic foot examination declined			0.01	0.11	0.16	0.15	0.16	0.14	0.17	0.13	0.13
	Diabetic foot risk assessment		0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.20	0.08
	Diabetic foot screen							0.03	4.99	9.94	6.21	4.00
	Diabetic leaflet given	0.05	0.04	0.02	0.05	0.07	0.02	0.04	0.06	0.11	0.02	0.02
	Diabetic monitoring	7.93	6.82	9.14	9.90	12.47	13.15	14.92	14.90	17.94	12.58	10.44
	Diabetic monitoring NOS	1.92	1.59	1.55	1.88	2.32	2.48	2.25	2.12	1.51	0.83	0.77
	Diabetic neuropathy	0.15	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Diabetic peripheral neuropathy screening	0.00	0.14	1.70	1.97	1.27	1.33	1.17	1.29	1.31	1.28	1.47
	Diabetic retinopathy	0.07	0.09	0.05	0.03	0.04	0.08	0.06	0.11	0.09	0.07	0.07
	Diabetic retinopathy screening	0.79	1.07	1.17	0.99	0.38	0.34	0.13	0.09	0.12	0.08	0.07
	Diabetic retinopathy screening refused			0.02	0.10	0.16	0.09	0.15	0.14	0.06	0.01	0.01
	Follow-up diabetic assessment	2.23	3.62	4.76	4.73	5.37	5.64	5.36	4.42	3.73	2.44	2.02
	Fundoscopy - diabetic check	0.05	0.14	0.03	0.00	0.00	0.00	0.00				
	Hb. A1C - diabetic control	0.17	0.31	0.73	0.77	0.94	0.75	0.72	0.63	0.53	0.32	0.26
	Health education - diabetes			0.22	0.06	0.08	0.10	0.28	0.19	0.13	0.07	0.11
	Initial diabetic assessment	0.32	0.43	0.34	0.35	0.29	0.32	0.30	0.29	0.25	0.14	0.12
	Injection sites - diabetic	0.09	0.26	0.36	0.36	0.35	0.32	0.31	0.26	0.19	0.15	0.15
	O/E - Left diabetic foot at high risk		0.00	0.06	0.09	0.04	0.03	0.13	0.07	0.07	0.52	0.68
	O/E - Left diabetic foot at low risk	0.01	0.03	0.44	0.84	0.59	0.65	1.03	0.90	1.20	13.63	17.47
	O/E - Left diabetic foot at moderate risk	0.00	0.01	0.10	0.19	0.14	0.11	0.29	0.20	0.27	2.59	3.45
	O/E - Right diabetic foot at high risk		0.00	0.06	0.10	0.04	0.03	0.13	0.06	0.07	0.53	0.70
	O/E - Right diabetic foot at low risk	0.01	0.03	0.46	0.95	0.64	0.71	1.07	0.90	1.27	13.85	17.68
	O/E - Right diabetic foot at moderate risk	0.00	0.01	0.11	0.24	0.15	0.13	0.31	0.21	0.28	2.64	3.46
	Patient held diabetic record issued			0.03	0.03	0.13	0.30	0.15	0.07	0.29	0.25	0.23
	Pt advised re diabetic diet	0.13	0.16	0.47	0.56	0.41	0.37	0.88	1.21	1.08	0.81	0.54
	Referral for diabetic retinopathy screening					0.00	0.08	0.08	0.10	0.11	0.07	0.07
	Seen in diabetic clinic	6.27	5.99	3.70	3.21	3.06	2.64	2.84	1.94	1.56	0.95	0.57
	Type 2 diabetes mellitus with persistent proteinuria				0.01	0.07	0.11	0.07	0.07	0.05	0.04	0.03
	All	88.82	85.64	81.76	80.37	80.66	80.63	81.97	82.79	86.15	90.65	91.81

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

A4.2c Practice nurses - Readcode entries (%) on the Vision System – medication review, referral to another party, care for by secondary clinic and exemption codes

Readcode classification	Readcode label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/12
Medication review	Conversion to insulin	0.15	0.13	0.27	0.22	0.17	0.13	0.11	0.08	0.05	0.05	0.04
	Diabetes medication review	0.00	0.03	0.49	0.44	0.42	0.54	0.63	0.29	0.15	0.13	0.12
	Patient on maximal tolerated therapy for diabetes			0.21	0.29	0.25	0.45	0.37	0.39	0.58	0.34	0.26
	All	0.16	0.18	0.98	0.97	0.86	1.15	1.18	0.89	0.86	0.58	0.46
Referral to another party	Refer to diabetic foot screener		0.01	0.03	0.84	0.83	0.63	0.69	0.64	0.47	0.34	0.32
	Referral to DESMOND diabetes structured education						0.00	0.09	0.28	0.22	0.15	0.14
	Referral to diabetes structured education programme				0.02	0.06	0.10	0.22	0.19	0.26	0.13	0.08
	All	0.07	0.10	0.10	0.93	0.95	0.84	1.13	1.26	1.12	0.78	0.70
Care for by secondary clinic	Diabetes care by hospital only	0.03	0.11	0.06	0.09	0.03	0.03	0.02	0.06	0.03	0.02	0.02
	Diabetes: shared care programme	0.06	0.28	0.36	0.32	0.26	0.18	0.18	0.15	0.15	0.11	0.10
	Seen by diabetic liaison nurse		0.01		0.00	0.00	0.00	0.04	0.27	0.16	0.00	0.00
	Subcutaneous injection of insulin	0.00	0.02	0.10	0.43	0.22	0.19	0.04	0.03	0.02	0.02	0.02
	Under care of diabetic foot screener		0.18	3.58	6.08	5.85	6.29	5.35	4.66	3.68	2.29	1.85
	All	0.09	0.59	4.10	6.93	6.37	6.69	5.64	5.23	4.13	2.52	2.07
Exemption codes	Diabetic foot examination not indicated		0.00	0.29	0.32	0.18	0.30	0.43	0.37	0.11	0.07	0.06
	Diabetic retinopathy screening not indicated			0.15	0.17	0.07	0.05	0.05	0.02	0.03	0.00	0.00
	Excepted from diabetes qual indicators: Patient unsuitable		0.01	0.40	0.50	0.53	0.49	0.30	0.22	0.21	0.14	0.13
	Excepted from diabetes quality indicators: Informed dissent		0.01	0.21	0.40	0.41	0.47	0.41	0.36	0.36	0.24	0.19
	All	0.01	0.03	1.06	1.40	1.25	1.38	1.28	1.08	0.81	0.54	0.44
Other	All	0.00	0.01	0.01	0.01	0.01	0.02	0.05	0.03	0.03	0.03	0.04

Note: only Readcode labels that represent ≥0.01% of all Readcode entries for one or more years during the study period are listed in this appendix

Appendix 5. Algorithm for removing weight outliers

All records with inconceivable body mass index (BMI) measurements (age $\geq$ 16 and BMI <13 or BMI >150), missing weights, weights of zero or less and missing event (measurement) dates were removed. This reduced the number of observations from 4,706,621 to 4,603,058. An inspection of a sample of weight histories suggested that a pragmatic approach should be used to further reduce the number of outliers.

Initially each weight measurement (subscript 0) was compared with the two measurements that preceded it (subscripts -1, -2) and the two that followed (subscripts 1, 2). Note this approach was adapted for short series of weight measurements and for the beginning and end of a series of measurements. Eight change values were computed:

$(t_0 - t_{-2})/t_{-2}$, $(t_0 - t_{-1})/t_{-1}$, $(t_1 - t_0)/t_0$ and $(t_2 - t_0)/t_0$

and their corresponding counterparts

$(t_{-2} - t_0)/t_0$, $(t_{-1} - t_0)/t_0$, $(t_0 - t_{-1})/t_{-1}$ and $(t_0 - t_{-2})/t_{-2}$

Where there was a difference of at least a year between measurements the change value was adjusted downwards so for two measurements two years apart the change value was divided by 2. If the selected measurement differed by 50% or more from the measurements immediately before (t_{-1}, t_0) and after (t_0, t_1) and by at least 25% from both the two outer values $\{(t_{-2} , t_0) (t_0 , t_2)\}$ then it was defined as an outlier. This process removed many of the solitary outliers that were grossly different from the rest of a person's weights.

At the second stage the criteria for defining an outlier were tightened. If the selected measurement differed by 20% or more from the measurement immediately before (t_{-1}, t_0) or after (t_0, t_1), and (t_{-1} ,t_{-2}), (t_1 ,t_2) and (t_{-1} ,t_1) all differed by less than 10% the measurement was deemed to be an outlier and removed. This was repeated two more times. In the final stage, measurements that still differed by 20% or more from measurements immediately before and after were selected for visual inspection. The whole process reduced the number of useable weights down to 4,534,221. The cleaned weight histories were then used to create a time varying obesity index based on the threshold for obesity (BMI $\geq$ 30). It was therefore possible for some people to fluctuate above and below the obesity threshold as their weight changed over time.

Appendix 6. Practice survey questionnaire

THIN Practice Questionnaire

Contact details

(This information will be used by THIN for administrative and research/audit purposes only)

Vision User No: **«User_Number»**

Name .... Position in practice..

Phone number: .... Fax number:...

E-mail..

Address:..

....

....

PCT/HB..SHA...

Practice Opening Hours:...

Please circle the answers below as appropriate

1. Number of GP WTEs (Whole Time Equivalents)   …………………………………………

2. Number of GP principals (If different from above)   …………………………………………

3. Are you a Training practice: Yes / No

4. Are you a VES site?   Yes / No / Coming (date: /   /   )

    If "Yes" who is your provider?   ……………………………………………..

5. How long have you had Vision?   Less than a year / 1-2 years / 2+ years

6. Which system, if any, did you use before Vision?   …………………………………………

7. Do the GPs use paper medical records?　　　Regularly / Occasionally / Rarely or never

8. Do the practice nurses use paper records?　　Regularly/ Occasionally/ Rarely or never

9. Do you receive electronic Pathology Results? Yes / No

If "Yes" are they:　　　　Histology　　Microbiology　Chemistry　　Haematology　Others

10. Do you scan in hospital correspondence?　　　　Yes / No

11. In which type of area is the practice　　　　Rural / Urban / Inner city

12. Are you a dispensing practice?　　　　Yes / No

P.T.O.

13. Please give the full name of all GPs and tick whether they are full-time, part-time or trainee:

Name	Sex	Full-time	Part-time	Trainee

14. Do you contribute data to any other research data scheme(s)?　　　Yes / No

If yes, which scheme(s)? …………………………………………………………………

15. As a THIN member you have the opportunity to earn extra money for "follow-up" studies through THIN's Additional Information Services Department (AIS). Payments start from £30 per patient

request. If you do not already undertake AIS studies, and are willing to be contacted in the future with no obligation to participate, please complete the following:-

Are you interested in finding out more?   Yes / No

If "Yes" please provide contact details:

Name:……………………………………….   Position: ……………………………………………

Telephone:………………………………………   Email………………………………………………

16. Please list the number of staff employed by the practice, according their job title (as Whole Time Equivalents).

	WTE
Practice nurse	
Consultant Nurse	
Nurse Practitioner	
Advanced Nurse Practitioner	
Other registered nurse (please describe)	
Practice manager (clinical background e.g. RN)	
Practice manager (non-clinical background)	
Nursing assistant	
Clinical support worker	
Receptionist	
Other (please describe)	

17. How many nursing staff (as Whole Time Equivalents) are employed on the following pay bands or their equivalent (excluding London weighting)?

	WTE
Band 2 (£13,903 - £17,003)	
Band 3 (£15,860 - £18,827)	
Band 4 (£18,402 - £21,798)	
Band 5 (£21,176 - £27,625)	
Band 6 (£25,528 - £34,189)	
Band 7 (£30,460 - £40,157)	
Band 8 (£38,851 - £80,810)	

18. Do any of the nurses providing care to patients with diabetes hold a post graduate qualification relating to diabetic care from a Higher Education Institute?

Yes / No

19. How is the care of people with diabetes generally managed? *(Please tick all that apply)*

a) By GPs (but none specialise in this)	
b) By a designated GP (or GPS) who specialises in diabetes	
c) By practice nurses (but none specialise in this)	
d) By a designated nurse (or nurses) who specialises in diabetes	
e) Shared between the practice and hospital / community based consultants	
f) By hospital / community based specialists	
g) Other (please describe)	

20. Which of the above is the main approach to managing care of people with diabetes?

(please write one number) _____

21. How do patients with diabetes typically receive the majority of their diabetes related care and assessment? *(Please tick all that apply)*

Appointments as and when needed	
Routinely scheduled appointments	
Through regularly held clinics specifically for diabetic patients	
Other (please specify)	

22. Who initiates patient's treatment with insulin?

GP	
Practice Nurse	
Community Diabetic Nurse Specialist	
Outpatient diabetes mellitus clinic	
Other (please specify)	

THIN Ref: «THIN_Ref»

Thank you for your time.