THE DEVELOPMENT OF AN ADAPTED DONABEDIAN STRUCTURE, PROCESS AND OUTCOMES MODEL TO EVALUATE THE INFLUENCES ON PRESCRIBING FOR DIABETES IN ENGLISH NATIONAL HEALTH SERVICE PRIMARY CARE ORGANISATIONS.

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Abstract

Prescribing of medicines is a major healthcare cost, subject to multiple influences. This study uses the lens of a Donabedian Structure-Process-Outcome model, to model those influences. The thesis examines the existing literature on the influences on Primary Care Organisation prescribing and assesses the utility of the Donabedian model when applied to prescribing.

Using profiles developed for all Primary Care Organisations in England, differences in prescribing were examined over 3 years to test the utility of this model as a framework to understand prescribing influences. The prescribing of long acting insulin analogues and Glucagon-like-peptide 1 receptor (GLP-1) agonists, were profiled within Primary Care Organisations using the Donabedian model for data for three years from 2011/12 to 2013/14.

This study is the first to apply the Donabedian model to influences on prescribing. This model provided a good fit for all known influences on prescribing, providing an overview of how prescribing habits of an organisation are balanced against other clinical targets in a disease area. Using the Donabedian model could enable organisations to evaluate the effect of changing an influence on prescribing behaviour.

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ABBREVIATION LIST

Abbreviation	
ABPI	Association of the British Pharmaceutical Industry
ACE	Angiotensin-converting enzyme
APC	Area Prescribing Committee
APMS	Alternative Provider Medical Services
ARB	Angiotensin II receptor blocker
ARI	Acute respiratory infection
BNF	British National Formulary
CCG	Clinical Commissioning Group
CHD	Coronary heart disease
CHI	Commission of Health Improvement
CQC	Care Quality Commission
COXIB	Cyclooxygenase (COX)-2–selective inhibitor
DoH	Department of Health
DI	Diffusion of Innovations
DOVE	Diabetes Outcomes versus Expenditure
DPP-4	Dipeptidyl peptidase 4
ECHI	European Health Indicators project
GLP-1	Glucagon-like-peptide 1 receptor
GP	General practitioner
HbA1C	Glycated haemoglobin
HCQI	Health Care Quality Indicator
HEDIS	Health Plan Employer Data and Information Set
HMIC	Health Management Information Consortium
HSCIC	Health and Social Care Information Centre
IOM	Institute of Medicine
JBDS-IP	Joint British Diabetes Society for inpatient care
JSNA	Joint Strategic Needs Assessment
LA	Long Acting
LHE	Local Health Economy
M/R	Modified release
MSK	Musculoskeletal

NAMCS	National Ambulatory Medical Care Survey
NAO	National Audit Office
NDA	National Diabetes Audit
NHAIS	National Health Application and Infrastructure Services
NIC	Net Ingredient Cost
NICE	National Institute of Clinical Excellence
NHS	National Health Service
NPH	Neutral protamine hagedorn
OECD	Organisation for Economic Co-operation and Development
PBC	Practice Based Commissioning
PCO	Primary Care Organisation
PCG	Primary Care Group
PCT	Primary Care Trust
PCTMS	Primary Care Trust Medical Services
PICOS	Population, Intervention, Comparator and Outcomes
PMS	Personal Medical Services
PPI	Proton Pump Inhibitor
PRISMA	Preferred Reporting Items for Systematic reviews and Meta Analyses
QIPP	Quality, Innovation, Productivity and Prevention
QOF	Quality Outcomes Framework
QUALICOPC	Quality and costs in primary care in Europe
SPO	Structure, Process and Outcome
SPOT	Spend and Outcome Tool
SU	Sulfonylurea
TA	Technology Appraisal
UK	United Kingdom
USA	United States of America
VHA	Veteran Health Administration
WHO	World Health Authority

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Summary

Prescribing medicines is an area of practice that has major implications for healthcare costs, patient outcomes, and patient safety. The area is contested by a number of competing interest groups, including professionals, patients, patient advocacy groups, the pharmaceutical industry, and government.

Despite attempts to contain prescribing costs, they have increased significantly showing an increase from 29.1% in total spend between 2010/11 to 53.9% in 2015/16 in primary care (NHS Digital, 2016). Influencing prescribing in primary care has been identified as important in order to contain costs, but also to encourage adoption of best practice guidelines, to meet disease management and audit targets and to improve patient outcomes. In the United Kingdom (UK), variations in prescribing exists across all groups of drugs, despite a number of national government-led initiatives (Ewbank et al., 2018).

None of the conceptual models used extensively in health service research have been deployed to try and analyse the relative importance of all these influences on prescribing behaviour. However, these models can provide a framework for evaluating the relative importance of all the competing influences and factors that might affect prescribing behaviour. An adapted Donabedian Structure, Process and Outcome (SPO) model was chosen as the most appropriate model to use for this research.

Changes in the availability of National Health Service (NHS) information and data since 2000 now allow for the construction of Primary Care Organisation (PCO) profiles

(structured using the Donabedian SPO model) containing the possible influencing factors on prescribing for diabetes. All PCOs in England were included in this analysis.

The time period from 2011/12 to 2013/14 was chosen to allow for a three year period in which to compare PCO profiles. This also coincided with a major organisational change in PCO structures and management and thus would allow for investigation of the importance of organisational influences on prescribing behaviour.

Diabetes prescribing has been identified as an area of high cost and significant variation for PCOs despite a significant national focus. It has therefore been chosen as an area to pilot this novel Donabedian SPO model.

The aims of the research were fourfold. Firstly, to examine the existing literature on the influences on PCO prescribing. Secondly, to assess the utility of the Donabedian SPO model when applied to prescribing. Thirdly, to create PCO profiles based on the Donabedian SPO model for all PCOs in England by searching for data to measure PCO prescribing influences. Finally, to analyse differences in PCO Profiles over a three year period in order to test the usefulness of the Donabedian SPO model as a framework to understand prescribing influences in PCOs.

1.2. Summary of research

The first part of this study was a systematic review carried out to identify influences that change prescribing behaviour. From the results of the review it was possible to create a list of all known influences that might affect general practitioner (GP) prescribing behaviour.

Following this, conceptual models used in health service research were assessed for their suitability as a model for analysing the influences on general practitioner (GP)

prescribing. An adapted Donabedian SPO model was developed to be used in this research.

Published information and data from national and local NHS organisations were evaluated to ascertain if they could be used to reflect the different influences identified from the systematic review. Quantitative data were compiled and qualitative information collected, coded and scored.

A quantitative analysis was then carried out comparing the prescribing of two newly introduced drug classes (long acting (LA) insulin analogues and Glucagon-like-peptide 1 receptor (GLP-1) agonists) for all English PCOs for each of the three years to assess the utility of the developed model. The profiles for each PCO were also examined to measure changes in influencing factors in individual organisations over the three years. A multiple regression analysis was performed to identify statistically significant influences on the prescribing of the two drug classes.

1.3. Background

This chapter provides an overview of the background of primary care organisations in the UK NHS (with a focus on NHS England), prescribing variation in the UK primary care organisations, and attempts to control prescribing, including at a national level. It will also introduce the conceptual model that will used in this research. Finally it sets out the central research aims.

1.3.1. Primary care in the NHS

The NHS has seen significant changes in the organisation of primary care in response to changing government policies. The following elaborates on their structure and purpose, with a focus on the past thirty years.

Development of a ‘primary care led NHS’ has been a central policy within the NHS since the early 1990s (NHS Executive, 1994). Successive governments have imposed various structures, targets and philosophies on the delivering of primary care but at their core they have all encouraged GPs to take a greater role in managing and controlling the costs of their activities. Initially this involved creation of GP fundholding practices and locality commissioning groups for non fundholding GPs in the 1990s (Lewis and Gillam, 2007). With a change of government in 1997, fundholding was abolished but in its place, primary care groups (PCGs) were created in England. PCGs covered all of England with the aim of controlling and improving clinical quality, cost effectiveness and the health of the population they were responsible for (Health Committee, December 2005). In 2000, Primary Care Trusts (PCTs) were established, followed by practice based commissioning groups and in 2013, 151 PCTs were abolished and replaced with 211 Clinical Commissioning Groups (CCGs) (Lansley, 2010). The management structure of each primary care organisation has varied considerably over time and in line with the type of primary care organisation scheme being used. Primary Care Trusts were criticized for being bureaucratic with needless layers of management (Smith et al., 2010, Miller et al., 2012) and CCGs were introduced with the express purpose of reducing bureaucracy, reducing the influence of professional managers and increasing clinical engagement (Lansley, 2010).

1.3.2. Importance of prescribing costs

In 2007 it was reported that the NHS had seen expenditure on prescription drugs in primary care increase by 60% over the last decade (National Audit Office, 2007b). With new drugs being developed; identification of additional uses and applications of

current drugs, and an ageing population rising drug expenditure was expected to continue.

This has indeed been the case, with prescribing costs rising from a total prescribing spend in 2010/11 of £13.0 billion to £17.4 billion in 2016/17 (NHS Digital, 2017). Drugs treating diabetes have seen the greatest increase in Net Ingredient Cost (NIC) from £562 million to £984 million in 2016 (NHS Digital, 2016).

The costs of prescribing for diabetes represents a significant proportion of the total prescribing costs within the NHS and accounted for approximately 9.5% of total prescribing in 2013/14, up from 8.4% in 2010/11 (Health and Social Care Information Centre, 2011, Health and Social Care Information Centre, 2014d). The costs of prescribing in diabetes have been identified as the most significant element in the total cost of diabetes care in a review from the Audit Commission and ACCA (Association of Chartered Certified Accountants) (2012). They showed that, for diabetes, inpatient admissions are not the dominant driver of costs but that prescription costs account for three quarters of the average cost per patient. A 5 per cent reduction in spending on inpatients would secure a saving of less than £6 million. A 5 per cent reduction in spending on primary care prescriptions would save the NHS £32 million. Not only is there a difference in scale of savings, but greater efficiency in prescription costs would produce real savings to the NHS.

1.3.3. Prescribing variation

The 2007 National Audit Office (NAO) Review, also showed a significant variation in prescribing between PCOs. They estimated £200 million could be saved if all the PCOs in England prescribed certain drugs in the same way as the 25 per cent most efficient organisations (National Audit Office, 2007b). This variation in prescribing still exists

today and prescribing data is collated nationally by NHS Digital to identify variations in prescribing at practice and PCO level, and to identify trends in behaviour over time. Variation is the subject of ongoing scrutiny from NHS England under the responsibility of NHSRightCare and the Medicines Optimisation Programme.

Because of the cost of prescribing for diabetes and the increasing number of patients with type 2 diabetes there have been a number of national audits and reports looking at the treatment of diabetes (Kerr, 2011). They have reported large variations in both the total expenditure on prescribing as well as the uptake of newer drugs. In 2010/11 PCO prescribing spend for diabetes ranged from £240 to £374 per patient on the Quality Outcome Framework (QOF) diabetes register. There was also variation on the way in which PCOs spent this money, with insulin prescribing accounting for between 38% and 58% of total costs and the proportion of the more expensive human analogue insulins (rapid and long acting) prescribed varying between PCOs, from 35% to 95% of all other insulin prescribed in 2009/1010 (Health and Social Care Information Centre, 2011). In 2013/14 human insulin analogues made up 88% of all insulins costs and the net ingredient cost for human insulins had increased by 91.1% between 2005/6 and 2013/14. Variation between PCOs in 2013/14 was still evident with a low of 37.6% to a high of 97% for percentage human insulin analogues as total spend on insulins (Health and Social Care Information Centre, 2014d).

These differences in prescribing behaviour between PCOs cannot be explained by differences in the patient population (Right Care Atlas Series, 2012). In a report by NHS England (NHS England, 2014a) looking at 2012 clinical data and information from a variety of sources it was concluded that there were large differences in the way in which diabetes care was managed and provided across PCOs in England.

There was no obvious link between spending on diabetes, clinical outcomes, diabetes prevalence, complications or prescribing behaviour.

Improving disease management does not automatically lead to uniform changes in prescribing. One study in 2011 correlated prescribing costs with quality indicators in the QOF and found no significant correlation between attainment of quality standards and prescribing costs (Fleetcroft et al., 2011). This is backed up by several other studies in different disease areas: hypertensive therapies (Aguado et al., 2000); clopidogrel prescribing (Petty and Silcock, 2008) and type 2 diabetes (Krass et al., 2011).

Other explanations for the variability in prescribing behaviour exist. A review of the literature on GP adoption of new drugs showed that there has been no comprehensive study exploring reasons for variations in GP behaviour across the UK (Mason, 2008). This review focused on the determinants of uptake, the causes of geographical variations, and the influence of price, cost and financial incentives on prescribing behaviour. It concluded that influences on prescribing behaviour are complex and that the UK studies typically surveyed, or undertook data analyses for relatively small numbers of GPs within a particular geographical region.

The UK is not unique in this variation in prescribing behaviour with this situation being reported in many other countries. In a large nine country study of primary care clinicians across Europe looking at the variation in prescribing behaviour for antibiotic prescribing for lower respiratory tract infections, Brookes-Howell (2012) found that prescribing decisions were influenced by factors imposed by the healthcare system as well as characteristics of the clinicians and patients but that for an intervention to be

successful flexibility was needed to take into account potential constraints and influences that exist locally.

1.4. Overview of factors influencing prescribing

1.4.1. Deprivation

Prescribing levels may be expected to change according to the deprivation of the patient population. A greater number of patients are seen in deprived populations and so it would be logical for a more deprived population to be linked to greater levels of prescribing for all diseases. However, there are indications that in some cases more affluent patients are able to articulate their needs and influence physicians to obtain the treatment they want. This was the case in a study looking at disease modifying treatments in multiple sclerosis in two centres (Nottingham and Glasgow) in the UK (Owens et al., 2013). In another study examining the socioeconomic status on quality of prescribing in the elderly (Odubanjo et al., 2004), they found that sub optimal prescribing was more likely in patients who were relatively deprived. The link with deprivation may depend on the particular disease, and a study in 2003 looking at the records of 181,647 patients in Ireland showed that prescribing for symptomatic medications increased with increasing deprivation while prescribing for disease specific drugs decreased with increasing deprivation (Williams et al., 2003).

1.4.2. GP characteristics

Another possible cause of variation in prescribing behaviour that has been studied are GP characteristics. In a study of 852 general practitioners in Canada (Cadieux et al., 2007) an analysis of antibiotic prescribing showed that international medical graduates, length of time qualified and high volume practice were all linked to increased inappropriate antibiotic prescribing. A questionnaire sent to 258 general

practitioners practising in rural locations in Queensland, Australia found that most respondents prescribe differently in rural practices compared with cities (Cutts and Tett, 2003). Another study found that there was no significant association between area of clinical interest and prescribing habits (Hansen et al., 2007). A study in East London in 139 practices found that South East Asian trained GPs prescribed less antidepressants and 57% of prescribing variation between practices was explained GP qualification; proportion of registered female patients; older patients >65 and list size per full time GPs (Hull et al., 2005).

1.4.3. Organisational level factors

Oragnisational factors may also influence prescribing behaviour. The majority of the research on the effects of the PCO on prescribing behaviour of GPs has focused on the nature of GP collaboration and the sharing of joint values and culture. Studies have demonstrated that those GPs that have chosen to work together in a local group and have a degree of autonomy over how they choose to prioritise work have been found to work more enthusiastically and more effectively towards jointly agreed target targets (Prosser and Walley, 2005). This has been demonstrated in a variety of primary care organisations in North London (Ashworth et al., 2000), Italy (Fattore et al., 2009), New Zealand (Malcolm et al., 2001) and Sweden (Strandberg et. al., 2013) and (van Eijk et al., 2004).

Organisational change has been found to produce a drop in performance and it is thought that it takes the new organisation between 1 and 3 years to become established (Lamont et al., 1994). Constant changes and disruptions to the PCOs make it difficult for staff within them to focus on improving local services. In a review of practice based commissioning by Smith et al. (2005) they concluded that

organisational stability particularly the structures of commissioning bodies is very important, since it takes time to embed PCOs into the system (approximately 8 years for fundholding to cover half of the practices in England; 1-2 years for practice based commissioning (PBC), and three years for CCGs to become established).

A survey by The Kings Fund and Nuffield Trust (Naylor C et al., 2013) over a three-year period assessing the implementation and impact of CCGs, showed 80% of GPs who responded believed that CCGs have a legitimate role in influencing members to change referrals and prescribing. The concept of peer reviews amongst GPs has become accepted and there was a degree of willingness by GPs take part in the process (Mannion et al., 2008) and (Coleman et al., 2009).

In a qualitative study by Prosser and Walley (2007), focus groups and in depth interviews in primary care found that a number of managerial approaches were used to try to influence prescribing behaviour. In an qualitative study by Spyridonidis and Calnan (2010), the implementation of National Institute of Clinical Excellence (NICE) guidelines was studied in four different NHS organisations. The process of changing behaviour was influenced by the interactions between managers and clinical staff and it was important that all levels of personnel across different disciplines had the ability to affect adoption of new guidance and prescribing practice.

There have been many papers looking at the relationship between the size of a primary care organisation and its performance. There is little evidence to support the hypothesis that there is an ideal size for these organisations. In an observational study of all 152 primary care trusts in England by Greaves et al. (2012) the size of the PCT was compared against 36 indicators of commissioning performance. The results were

not straightforward, but larger PCTs tended to provide higher quality care services (in 10 out of 14 indicators) but reported less efficient prescribing. Other research has confirmed that size is not a reliable predictor for performance and that performance is affected by a combination of their aims, tasks, functions, organisational features and environmental factors (Wilkin et al., 2003).

The number of GPs per head of population within a PCO was investigated in England in 1999 when a range of data comparing different health outcomes measures was analysed for 99 health authorities (Gulliford, 2002). They matched this against the number of GPs per 10,000 population and found that that higher numbers of GPs resulted in a decrease in hospital admissions for acute and chronic conditions. GP numbers were found to influence antidepressant prescribing rates In a study of 131 GP practices in a South Wales Health Authority in 2003, although population deprivation in practices proved the greatest influence on prescribing volumes and cost (Senior et al., 2003).

1.4.4. Influence of local neighbouring NHS organisations

Local organisations, often acute trusts, exert an influence on the prescribing behaviour of GPs within a PCO within the local health economy (LHE) (National Audit Office, 2007a). An open prospective study of 92 general practitioners in Ireland (Feely et al., 1999) they found that hospital specialists were responsible for up to 38% of prescriptions from some conditions. In a retrospective study in Italy (Florentinus et al., 2009) in 103 general practitioners in 59 practices the influence of medical specialists was dependent on the type of drug (respiratory inhalers were prescribed first by medical specialist in 60.2% of patients compared to non steroidal anti inflammatories in 23%). Researchers in France, also identified influence of secondary care and in

addition saw that small local hospitals where GPs and consultants worked most closely exerted the greatest influence (Gallini et al., 2013). This regional variation was also studied in the UK (Roberts et al., 1998) in a comparison of the use of anti epileptic drugs in general practice across 16 health authority areas in England for four years. Individual health authorities showed considerable differences in prescribing rates possibly due to different preferences in the catchment secondary care hospitals and the presence of different local treatment guidelines.

1.5. Measures to reduce prescribing cost and variability in England

There have been a number of government and local PCO initatives to reduce the variability in prescribing behaviour**.**

1.5.1. Government initiatives

The reduction of variability between service provision, spend and quality of care has long been a national aim, addressed through a range of government initiatives. A new pay for performance contract for GPs was launched in 2004 with a range of of clinical audit requirements for a range of chronic diseases, as well as medicines management and service standards under the QOF (Health and Social Care Information Centre, 2005). Prior to this, a series of National Service Frameworks from 1999 onwards has addressed major disease areas such as coronary heart disease, diabetes, stroke, long-term conditions. Included in these standards were requirements to change prescribing behaviour to ensure that medicines were used appropriately (Department of Health, 2001b).

The National Institute for Health and Clinical Excellence (NICE) was created in 1998 with a remit to reduce geographical variation in availability and quality of NHS treatment and care (the so-called ‘postcode lottery’). It also produces national guidance

on the best practice in treatment and care, based on principles of evidence based medicine (Rawlins et al., 2010).

The 2010 Quality, Innovation, Productivity and Prevention (QIPP) initiative (Health and Social Care Information Centre, 2013b) had one workstream focused on medicine use and procurement, including specific targets for medicines management. PCOs were tasked with saving money by changing prescribing habits, with prescribing spend on the specific drugs reported at quarterly intervals.

The Better Care Better Value Initiative (Better Care, 2007) was set up to identify potential areas where NHS organisations could make savings through changing practice changing referral patterns; reducing costs in prescribing; and improving efficiency. Opportunities were identified by estimating the savings an organisation could if they changed their behaviour to match the best performing organisations.

The Right Care Initiative (Right Care Atlas Series, November 2010) was developed in 2010 was aimed at maximising the local use of resources whilst delivering high quality care. It was driven by comparing data on spend and outcomes across a range of disease areas for PCOs with the focus on reducing variations.

Despite all of these government initiatives variation in all aspects of healthcare continues. The current drive to reduce prescribing variation is called Medicines Optimisation (NICE Guideline NG5, 2015) and a Medicines Optimisation Dashboard has been developed to display the continued variation in prescribing behaviour of PCOs. This continues to be used in 2018 with no sign that variation in prescribing behaviour has been eliminated.

1.5.2. Local PCO initiatives

1.5.2.1. Medicines management

One of the methods to control prescribing cost and variability in the new PCOs in 1997 was to utilise the skills of pharmacists (National Audit Office, 2007a). They were recruited to work as prescribing advisers within medicines management teams and were given responsibility for ensuring adherence to locally prescribing incentive schemes (Ashworth et al., 2002). In addition, PCOs were encouraged to utilise established area prescribing committees (or set them up if they did not already exist) to link up primary and secondary care medicines management teams and obtain a unified approach to the adoption and use of drugs in local organisations (National Prescribing Centre, 2009). This was found to result in significant changes in prescribing patterns in some PCOs. However, there was no consistent change in prescribing in all organisations and still some PCOs consistently fell short of national targets (Mossialos E, 2005). The use of practice support pharmacists to audit prescribing behaviour and deliver prescribing messages and targeted help to practices to change behaviour was another way to changes prescribing habits within PCOs. In one study (Cunningham et al., 2002) practice visits by pharmacists to reduce prescribing of proton pump inhibitors resulted in savings of £46,000. This effect seems to be valid across a number of therapeutic areas such as chronic pain (Li et al., 2011); hyperlipidaemia (Diwan et al., 1995) and diabetes (LaMarr et al., 2010).

Local prescribing incentive schemes have also been used by many PCOs in order to reduce prescribing spend and comply with specific national prescribing targets (Ashworth et al., 2003). However, results are not uniform across PCOs and don't represent a wider acceptance of prescribing targets and guidelines (Fernandez

Urrusuno et al., 2014).

1.5.2.2. Responsibility for prescribing costs

When general practitioners are given their own budget they have been shown in many studies to change their prescribing behaviour (Ohlsson and Merlo, 2007). However, it should be noted that although the change may be marked both in terms of cost and volume, it is not always the case for all prescribers and in a retrospective analysis looking at the introduction of a financial incentive scheme in Ireland, it was seen that incentives work for some prescribers but often seemed to have little effective on high spending practices (Walley et al., 2000).

In a review of economic factors influencing prescribing of antibiotics (Reed et al., 2002) physician knowledge of costs and financial incentives were found to be influential. However, a more recent review by the Cochrane Effective Practice and Organisation of Care Group (Scott et al., 2011) looking at the effect of financial incentives, found limited evidence to support their use and that at best only small effects in generally poorly designed studies.

1.5.2.3. Formularies

The development of drug formularies has also been a popular way to limit drug choices and improve prescribing in line with clinical guidelines (HillSmith, 1996). However, the adherence to formulary recommendations differs greatly across prescribers within an organisation (Buusman et al., 2006) and GPs do not always view restrictions positively (Hire and Rushforth, 2013).

1.5.2.4. Audit

Another approach to reducing the prescribing variability in primary care and ensure that drugs are prescribed according to national standards has been to encourage regular clinical audit of the care provided in practices. This is an accepted way to change behaviour supported by a number of reviews such as the Cochrane review of the usefulness of audit and feedback on prescribing behaviour in 2012 (Ivers et al., 2012). Their conclusion was that audit and feedback generally leads to small but potentially important improvements in professional practice.

Educational programmes to influence the choice of a drug have been shown to be more effective for a single short term treatments (urinary tract infection) than for a chronic diseases such as asthma in a study in Sweden (Lundborg et al., 1999). This was confirmed in Australia in 2010 (Gnjidic et al., 2010).

1.5.2.5. Clinical guidelines

Clinical guidelines are seen as a key tool in reducing variation in health care and cost (Borowitz and Sheldon, 1993) and improving quality of patient care and prescribing (Feder et al., 1999). In a cross sectional study involving analyses of prescribing data before and after the publication of NICE prescribing guidance in a PCT in Devon it was found that NICE guidance in isolation had little impact, but adoption was more likely when supported by other sources of information (Wathen and Dean, 2004). Another qualitative study reported by Rashidian et al. (2008) explored key themes for the implementation of clinical GP attitudes and beliefs about guidelines, and barriers to and facilitators of implementation. They identified a number of themes such as local ownership; credibility of source; organizational factors; disease characteristics; influential people and dissemination strategies that were important if guidelines were

to be adopted and used by general practitioners.

1.5.2.6. Pharmaceutical industry influence

Pharmaceutical companies were identified as a significant influence on prescribing behaviour in 66% of studies included in a systematic review in 2010 (Spurling et al., 2010) and were identified as the primary source of drug information in another study in Turkey (Vancelik et al., 2007).

1.6. Donabedian SPO model

Published research on influences on prescribing behaviour provides no single conceptual model to study prescribing variation in either single practices, PCOs or between individual GPs. However, looking at other forms of health services research has allowed an exploration of possible conceptual models that could be applied to this research. The most similar area of research has been that of identifying indicators for performance assessment and improvement of quality in health services and systems (Bowling A, 2009).

Conceptual models all share a number of common themes focusing on the measurement and improvement of quality in healthcare. One of the first theoretical evaluation models to measure quality in healthcare was postulated by Avedis Donabedian in the 1960s (Donabedian A, 1966). He created a Structure, Process and Outcome (SPO) Model that is still widely used today and forms the basis of a number of Countrywide Conceptual Models (Kelley E, 2006). Donabedian's approach focuses on (a) the measurement of structure (inputs and resources – including staffing, finance and other resources). (b) the measurement of process (service delivery, prescribing

practices, referral rates, access, and other productivity measures) and (c) the measurement of outcomes (death, morbidity, patient satisfaction) (Donabedian (1980).

Prescribing has been identified as one of the quality indicators in many of the quality frameworks that have been developed and used by many countries (Kelley E, 2006). For example, in the Donabedian SPO model, prescribing is regarded as one of the process indicators (together with referral rates, service delivery and other productivity measures) (Donabedian A, 1980). The Donabedian SPO model was originally developed to assess clinical practice. However, it has subsequently been adapted and used extensively as a basis for evaluating healthcare systems (Donabedian A, 2003). In a review of how to promote quality in the health care organisation by Glickman et al. (2007) argued that the following organisational attributes should be included in any Donabedian SPO model: Physical characteristics of the organisation; Management; Organisational Culture; Organisational Design; Information Management and Incentives.

Therefore a Donabedian SPO model that includes organisational measurements would provide a useful framework in which to investigate the relative importance of influencing factors on prescribing behaviour in PCOs.

Such a conceptual model would have the benefit of ensuring that all aspects of disease care and quality would be assessed not simply prescribing behaviour. This would endorse the initial observations made in this chapter that there are many influences that possibly interact to alter behaviour within local healthcare organisations and that the particular disease and how care is provided locally is potentially important in the analysis. The health service research on conceptual models and use in performance

measuring in health systems across many countries will be examined in more detail in Chapter 3. The use of such models as a means of grouping and understanding the influences on prescribing that were identified in the systematic review will also be evaluated.

1.7. Availability of PCO data and information

The availability of comparative NHS data at PCO and practice level have been increasing steadily since the first PCO organisations were created in 1997. This is firstly because of the response by the NHS to The Freedom of Information Act (NHS England, 2015) but also from a release of comparative data in response to the UK Government Transparency Agenda policy in 2012 (House of Commons Committee of Public Accounts, 2012). Following these changes, Local PCO prescribing data, attainment of audit targets and outcomes, formularies, population and organisation profiles are now accessible.

1.8. Conclusion

This chapter has described the changing environment of PCOs, the continuing need for systems to control prescribing, some of the possible reasons behind PCO prescribing variation and the methods adopted by organisations to control prescribing behaviour. Diabetes prescribing has been identified as an area of high cost and significant variation for PCOs despite a significant national focus. None of the conceptual models used extensively in health service research have been deployed to try and analyse the relative importance of all these influences on prescribing behaviour and this would be a valid subject for this research project.

1.9. Summary

PCOs are responsible for delivering prescribing change on accordance to national standards and targets. Research has shown that differences in organisations in terms of the degree of cohesiveness within the organisation as well as the organisational attributes can influence the ability of the PCO to change prescribing behaviour.

The structure and management of PCOs themselves has altered over the period 2011/12 to 2013/14 from 151 management led primary care trusts to 211 GP led clinical commissioning groups and so this was an ideal period of time to explore the importance of the organisation as a factor influencing prescribing.

Prescribing cost variation is apparent in all disease areas, but type 2 diabetes is an area of particular interest both nationally and locally because of the increasing costs owing to a rising patient population and an introduction of a number of new drugs for its treatment.

None of the published literature has systematically analysed all the possible factors influencing the prescribing behaviour of general practitioners in PCOs in the UK.

Prescribing has been identified as one of the important indicators in many of the performance and quality frameworks used in health service research. For example, in the Donabedian SPO model prescribing is one of the process indicators together with referral rates, service delivery and other productivity measures (Donabedian A, 1980).

In order to build up a set of data to populate the proposed conceptual model, a single disease area was chosen with a further focus on two recently introduced drug classes. Type 2 diabetes was chosen because prescribing costs are significant, accounting for approximately 10% of total NHS prescribing spend, and there is also significant

variation in prescribing habits for diabetes in PCOs. Moreover, it is an area where costs have risen more than any other disease category in the last ten years and where there have been a number of new drugs introduced in the last twenty years.

The increased production of publicly available data and information now makes this a viable way in which to examine differences between PCOs over a period of time. Also, because diabetes is an area of national focus there are many comparative datasets available measuring the attainment of a range of disease management targets and outcomes.

1.10. Aims and objectives of this research project

This thesis examines the influences on prescribing in the published literature, looking to develop and apply a widely used health services research conceptual model called the Donabedian SPO model.

There were four specific aims of the research project.

1. To perform a systematic review to critically appraise and synthesize the present published research on the possible influences on prescribing behaviour in PCOs.

In order to meet this aim the following objectives were met:

- Identification of the significant non-clinical prescribing influences that have been measured at an organisational level
- An understanding of the relative importance of these influences on prescribing decisions within organisations
- An insight into how the identified influences have been found to account for all the variation in prescribing behaviour

- Identification of any theoretical models that have been used to frame the analysis in the published quantitative research
- An understanding of whether the prescribing influences are disease specific.
- Collection of any influences that are specific for diabetes prescribing.

2. The second aim of this research was to ascertain if there were any conceptual quality models used in health service research that could be used to provide a useful insight into the influences on prescribing behaviour, and develop a model to apply to prescribing.

In order to meet this aim there were four main objectives:

- Investigation of the theory behind the use of quality models and identify what were the key elements in the most commonly used conceptual models.
- Identification of the most suitable conceptual model that is most appropriate to be used in this research.
- In order to test the utility of the Donabedian SPO model when understanding the interaction of influences on prescribing in English PCOs two new specific classes of drugs to treat diabetes (LA insulin analogues and GLP-1 agonists) were chosen as outcome indicators.
- Alignment of the influences identified in the prior systematic review (Chapter 2) to the Donabedian SPO conceptual model, according to their similarity, and based on their relationship to the two outcome indicators.

3. The third aim of this research project was to construct PCO profiles for all PCOs in England based on the Donabedian SPO Model. In order to do this the following objectives were met:

- Examination of the data and information from national and local sources to ascertain if they could be used to measure the individual influences that had made up the indicators in the structure and process domains in the Donabedian SPO model.
- Creation and development of standards to be applied when considering acceptable data coverage levels; standards for inclusion of data; scoring criteria for data and information and rationale behind the division of all data into quintiles.
- Collection of data and collection, coding and scoring of information and storage in Excel spreasheets to reflect individual indicators for all PCOs for each of three years from 2011/12 to 2013/14.
- To allow for comparison of each influence within the PCO Profile all collected data and information was also scored into one of 5 groupings (quintiles). The rationale for scoring following the general principle that the greater the value (be it prevalence, level of spend, numbers of referrals, cohesiveness and achievement of management goals of the organisation) then the higher score.

4. The final aim of this research was to compare PCO profiles for all 211 PCOs in England over a 3year period. Changes in the importance of individual influences within individual organisations over time as well as differences in profiles between organisations were measured.

There were two specific objectives:

- Examination of the structure, process and outcome indicators (scored into quintiles) across all PCOs for three years. Understanding of (a) Pattern of

scoring for the three years, for the individual indicators and individual PCOs (b) Difference between PCO profiles with the same outcomes and (c) examination of PCO profiles in a subset of PCOs with similar outcomes.

- Analysis using multiple regression to ascertain if there were any statistically significant relationship between the indicators in the structure and process domains and prescribing of LA insulin analogues and GLP-1 agonists

CHAPTER 2: SYSTEMATIC REVIEW - INFLUENCES ON GP PRESCRIBING WITHIN PCOs IN ENGLAND

2.1.Introduction

The aim of this research project was to test the usefulness of the Donabedian SPO model containing all the possible influences on GPs when they are making prescribing decisions in primary care. This approach has not previously been used in published research examining the influences on prescribing behaviour. Instead, the majority of published literature on this subject has either tended to focus on examining a single influence in order to try and change the behaviour of individual GPs. When organisations have been studied, variation in prescribing has been recorded but only a few of the possible influences have been measured.

In addition, the subject of influencing prescribing behaviour of GPs in primary care has most often focused on the prescribing of antibiotics because this is an important area where it is acknowledged that prescribing is often inappropriate (Pinder et al., 2015). The area of interest in this research project was type 2 diabetes, a chronic condition where patients are often managed in primary care but with a varying degree of help from specialist colleagues in secondary care. Far less has been published about the influences on prescribing in chronic diseases such as diabetes and no papers have specifically looked at the relative importance of different influences on prescribing decisions for diabetes in individual PCOs.

Therefore, this research project investigated a subject using a novel approach where there was no directly comparable published literature. The systematic review was required to identify influences on prescribing in PCOs. These influences would then be incorporated into the adapted Donabedian SPO model and the data measuring the

individual influences could be collected to allow for a profile of each organisation to be built.

2.2. Aims and objectives

The overall aim of this systematic review was to critically appraise and synthesize the present published research on the possible influences on prescribing behaviour in PCOs.

There were a few specific objectives that needed to be addressed in order for the systematic review to deliver this aim:

- Identification of the significant non-clinical prescribing influences that have been measured at an organisational level.
- An understanding of the relative importance of these influences on prescribing decisions within organisations.
- An insight into how the identified influences have been found to account for all the variation in prescribing behaviour.
- Identification of any theoretical models that have been used to frame the analysis in the published quantitative research.
- An understanding of whether the prescribing influences are disease specific.
- Collection of any influences that are specific for diabetes prescribing.

2.3. Method

The methodology described in the University of York's Centre for Reviews and Dissemination Systematic reviews was used as a guide in this systematic review (Centre for Reviews and Dissemination, 2009). The methodology employed in this

systematic review was also appraised using the Checklist developed by The Critical Appraisal Skills Programme (2018).

The methods involved in identifying suitable papers to be included in this systematic review included a number of steps:

1. Initial screening of title and abstracts against the inclusion criteria
2. Data extraction
3. Quality assessment of the papers included in the systematic review

2.3.1. Inclusion criteria

The overriding inclusion criteria for papers to be included in the systematic review was that the primary focus of the research should have been on the influences that affect the prescribing behaviour of primary care physicians. All primary and secondary study designs were considered. The papers were focused in a primary care setting (defined as community based generalist staffed care including ambulatory care). Included papers focused on the range of influences on general practitioner (or equivalent) prescribing behaviour and habits; looked at the hierarchy of importance of influences or studied the reasons behind variations seen in prescribing across geographical regions or PCOs. Papers from all countries were also included despite this research being limited to PCOs in England. Because of the lack of published literature, the review was also widened to include papers that have looked at the influences on prescribing at individual GPs level rather than at an organisational level. Research in this field and specifically focused on type 2 diabetes was too restricted so the search included all disease areas.

2.3.2. Exclusion criteria

Papers focusing on treatment outcomes for specific diseases following changes in prescribing or those that charted the variability in prescribing habits but did not investigate the reasons why this had occurred were excluded for inclusion. Additionally, papers that examined the importance of a single influence or the effect of an intervention to change a single influence were excluded. Conference proceedings, editorials, letters and reviews were also excluded.

2.3.3. Search strategy

The following medical databases were searched as part of this systematic review: Cochrane, Medline and Embase on OVID; Web of Science and The Health Management Information Consortium (HMIC) (1979 to 2014). Construction of the search terms was done using the Population, Intervention, Comparator and Outcomes (PICOS) elements and following the directions outlined in the University of York Guidance (Centre for Reviews and Dissemination, 2009).

The themes that were searched on were:

1. General practitioners (or family physicians, or primary care (depending on the database searched).
2. Prescribing
3. Influence on clinical practice or physician practice patterns

In addition, hand searching of specific journals (Social Science and Medicine; Health Policy and British Journal of General Practice) and following up on references was carried out.

2.3.4. Data extraction

Abstracts from all the papers retrieved in the searches from the four medical databases were obtained. All the papers were imported into a referencing software package called EndNote and also imported into an Excel spreadsheet. 116 duplicate papers were removed using the EndNote software.

The guidelines for data extraction published in the University of York Guidance (Centre for Reviews and Dissemination, 2009) were followed as a template.

The key aim of data extraction and evidence synthesis was to: assess the relative importance of each influence; record any interaction with other influences; identify any previously unrecorded other influences on prescribing; understand how much variation in prescribing could be explained by differences in the influences in various local health economies; understand if the situation is the same for different disease area / drug classes; understand if the situation is the same for different countries; identify any conceptual models that have been used to understand the interaction of influences; assess the way in which influences were identified (qualitative or quantitative research) and compare the methods for statistical analysis. With this in mind the following pieces of information were recorded about each study.

Information recorded:

- Country of origin
- Disease area / drug studied
- Prescriber role (general practitioner or specialist)
- Type of paper: (Qualitative study, quantitative study or review)
- Statistical Analysis

- Influences studied
- Conceptual models used
- Outcome / conclusion

Following the exercise to exclude unwanted papers, a grid was created in the Excel spreadsheet to identify the influences(s) that were being examined in each paper. A copy of the full papers was obtained and all the papers were then assigned to a separate folder in the EndNote system

2.3.5. Outcomes section

The primary outcome was the identification of all influences that have been found to affect prescribing decisions. Ideally, the population would have been primary care organisations, the disease would have been type 2 diabetes and quantitative research analysis using theoretical models would have been used. However, there were too few papers and so all papers investigating the possible influences on GPs were included in order to meet the primary objective.

2.3.6. Evaluation of quality

The 48 papers included in the systematic review were assessed for the following quality standards that have been described in the chapter titled “The Principles of Research” (Bowling A, 2009) and Guidance from The University of York (Centre for Reviews and Dissemination, 2009) was also followed.

2.3.6.1. Qualitative research papers

- Was there a quantitative analysis or recording of the number of times influences were mentioned following interviews, questionnaires or focus groups?

- Were no figures given in the results, only quotes and examples from selected responses?
- How were subjects chosen? How representative a sample were they?
- Were GP demographic details collected and used in the results / discussion?
- Were practice level details collected and used in the results / discussion?
- Did the discussion / conclusion reflect the study design and results obtained?

2.3.6.2. Quantitative papers

- Did the variables chosen for examination in the study reflect those reviewed in the introduction, discussion or conclusion?
- Was there a rationale for the influences that were included?
- How were subjects chosen? How representative a sample were they?
- Did the discussion / conclusion reflect the results and study design?

2.3.6.3. Mixed methods papers

- How were subjects chosen? How representative a sample were they?
- Was there a clear link between the qualitative and quantitative parts of the study?
- Were GP demographic details collected and used in the results / discussion for the qualitative part of the study?
- Were practice level details collected and used in the results / discussion for the qualitative part of the study?
- Did the variables chosen for quantitative analysis in the study reflect those reviewed in the introduction, discussion or conclusion?
- Was there a rationale for the influences that were included?

- Did the discussion / conclusion reflect the results and study design?

2.3.6.4. Assessment of quality for the methods adopted by this systematic review

At the outset of this systematic review it was agreed that the included papers would be checked by a second person. This was to ensure that results were consistent with the eligibility criteria, that the subsequent categorisation was an accurate reflection of the research reported in the included papers and that the quality assessments of the included papers were appropriate and correct. Due to the lack of a second researcher, a compromise system was used to for assessment of abstracts and full papers against the exclusion and inclusion criteria. Assessment of the included papers was carried out a second time, without recourse to the initial results, and decisions then made on discrepancies that were found as to the possible inclusion and categorisation of the paper.

2.4. Results

2.4.1. Systematic literature review

The systematic review search was undertaken 27 January 2015 and the following references were obtained:

Medline: 468 references

Embase: 662 references

HMIC: 76 references

Web of Science: 469 references

Total number of references from Medline, Embase, HMIC and Web of Science: 1,675

Reducing duplicates:116 references

This search was repeated on 31st August, 19th May 2016 and 8th November 2016 and 05 May 2018 and a further 29 references were produced.

In addition, when the full papers from the references above were read for inclusion in this review, a number potentially interesting references were identified. Copies of these papers were obtained and a further 21 papers were included in this systematic review.

The breakdown of search terms and results for each database is given below:

Medline 1947 – 27 January 2015

MESH terms:

1. Primary Health Care (expanded) 55046

2. Prescribing as a keyword 25731

3. Physician's Practice Patterns (expanded) 42310

4.Combine (1) (2) and (3)

Result: 468 papers

The updated searches produced an additional 6 references

Embase: Excerpta Medica (Ovid) 1974 to 27 January 2015

1. General practitioner (MESH term): - all subheadings included: 65749 results

2. Clinical Practice (MESH term): 177605 results

3. prescription [MESH] 117510 results

4. Combine (1) (2) and (3)

Result: 662 papers.

The updated searches produced an additional 29 references

Health Management Information Consortium (HMIC) 1979 to 2015

Prescribing as an expanded search term: results 3331 results

Primary care (expanded terms for all subheadings): 21146 results

General practitioner as an expanded search term for all subheadings: 9719 results

Combine (1) (2) and (3)

Result: 76 papers

The updated searches produced an additional 4 references

Web of Science

Topic search: prescribing* primary care* influence

1. Prescribing* 26,342 results.

2. Primary care* 144,637.

3. Influence* 2,020,209 results

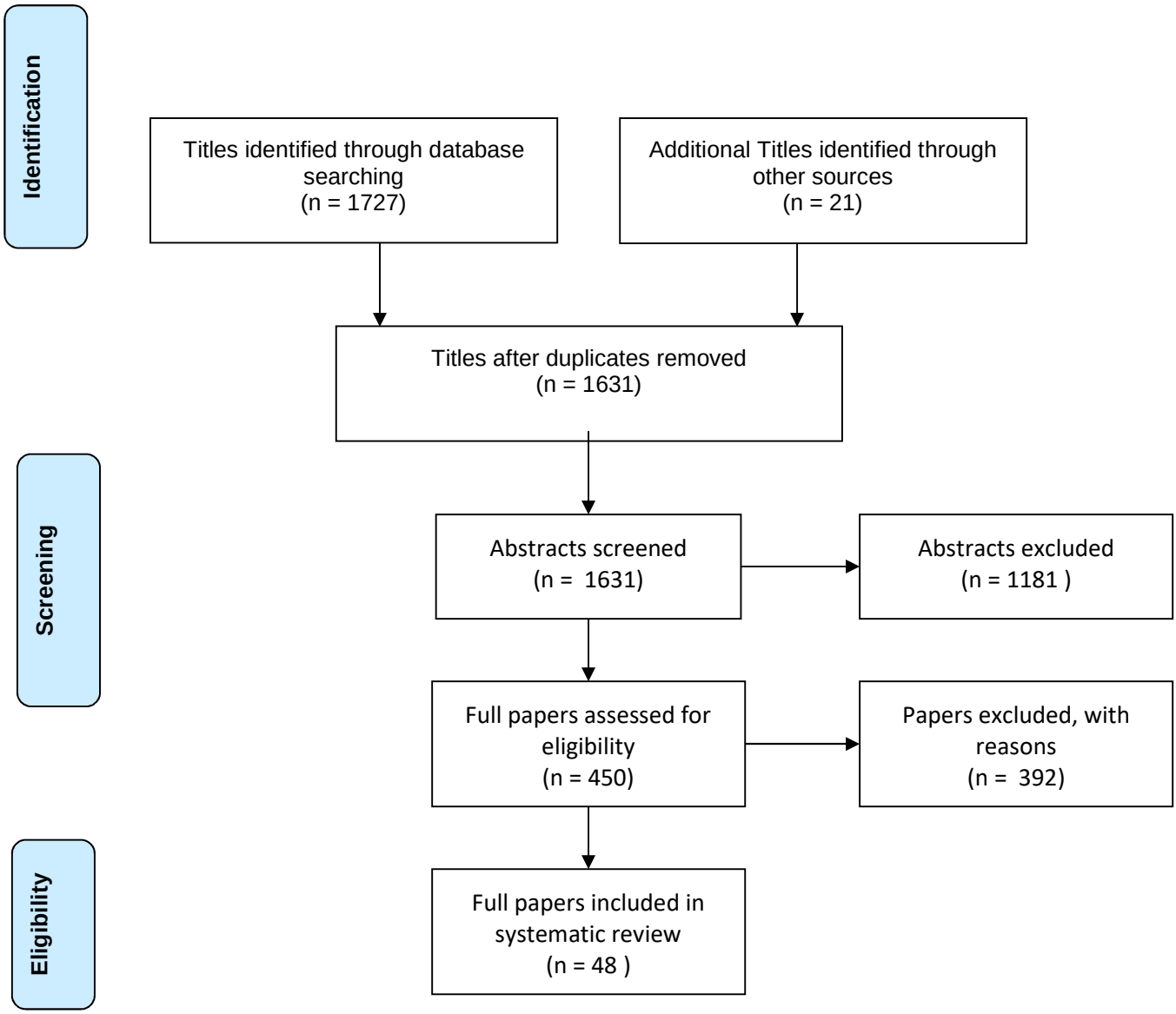
4. Combine three search terms with “and””

Results: 469 results

The updated searches produced an additional 13 references

Figure 1:

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Moher, 2009).



2.4.2. Reasons for exclusion

Focus on specific disease outcomes:

ANTIBIOTIC USE: Antibiotic prescribing linked to drug resistance, choice of antibiotics according to clinical and diagnostic indicators; very specific actions connected to antibiotic prescribing (delaying the issue of prescriptions etc. that are not applicable to diabetes); description of antibiotic prescribing habits (no focus on influences) - 159 records (4 records in the update)

DISEASE MANAGEMENT: Papers focusing on the improvement of disease management, comparisons between or reviews of possible treatments in a specific disease or patient groups (elderly or children for example) where prescribing is discussed but not the influences on prescribing decisions - 399 records (16 records in the update)

GENERAL PRACTITIONERS: GP variability (where prescribing was not the main focus of the paper); GP workload; general practice management and initiatives; information systems and training - 46 records (2 records in the update)

LETTERS OR OPINIONS: Letters or leader comments, opinion articles discussing general issues in general practice - 54 records (2 records in the update)

NO FULL PAPERS / ABSTRACTS: No translation available / no abstract or full paper or paper described a study that is not yet complete - 20 records

NURSING or ALLIED PROFESSIONALS: Papers focusing on nurse prescribing, allied health prescribing or nursing initiatives - 32 records (1 record in the update)

PAPER WITHDRAWN FROM SEARCH ENGINE – (paper retrieved as part of search strategy but had been subsequently withdrawn) - 1 record

PATIENTS: Patient attitudes to prescribed drugs, adherence or compliance to drug regimens; choices for non-prescription drug, relationships with medical practitioners - 15 records.

PHARMACY: Papers focusing on pharmacy issues (electronic prescribing, pharmacist prescribing; repeat prescribing; medication reviews, adverse events or prescribing errors, off label prescribing; drug utilisation reviews; prescription costs; drug interactions; drug formulations; prescribing information systems and development of prescribing indicators) - 161 records (2 records in the update)

PLACES OF CARE: Treatment focused in acute care or other sectors (specialist units, nursing homes for example) - 52 records.

VARIATION: General variability in prescribing across different countries or in specific patient groups. Prescribing for certain groups of patients; specific indications for a drug; inappropriate prescribing. Whilst variation in prescribing has been studied the influences that might explain the differences have not been explicitly studied - 213 records (2 records in the update)

Total number of papers excluded: 1181

2.4.3. Papers included in analysis

There were 48 papers that discussed multiple influences on the prescribing behaviour of GPs. All of the papers have been included in the systematic review. The papers are not of equal standard in terms of design, quality, analysis or their degree of relevance

to this research but all have been included in this analysis because the main aim of this review was to identify all possible influences on prescribing.

Of the 48 papers included in analysis; there were 25 that described qualitative research; 18 quantitative research; 5 Mixed methods (Qualitative and Quantitative).

A summary of the findings from these papers is displayed in Table 3 below with a brief description of the Type of Study; Setting and sample size; theoretical models used; influences on prescribing studied; Conclusion made from the research and finally, an assessment of the quality of the study based on the criteria described in section 2.3.

2.4.3.1. Qualitative research papers

All the papers describing qualitative studies have been included in this review because it was felt important to identify all possible influences. However, there are several issues with the studies. Out of the 25 studies only eight papers included any analysis of the number of times an influence was mentioned as important, and of these eight papers incomplete presentation of data was common (some influences were deemed more important than others) and so analysis was only presented for them. For example, the paper by Hunt et al. (2012) presents statistics available on the percentage of clinicians who mentioned certain influences but it was not given for all influences and there was extensive discussion about two of the influences mentioned with the others largely being ignored despite their apparent importance in the results. Although GP demographics (age, sex, training, education) and organisation details (size, geography, type - fundholding or non fundholding for example) are acknowledged as being influences in altered prescribing behaviour only a few of the

studies included this information in the analyses. If it was collected then it was usually presented simply as a description of the participants with no subsequent link to any of the results, making it impossible to ascertain if any of the influences that had been identified were linked to these characteristics. Where it is mentioned the analysis is incomplete, for example in the study by Baker and Klein (1991) results from fundholding and non-fundholding practices are reported separately but only for specific questions about financial constraints and incentives.

2.4.3.2. Quantitative research papers

All the Quantitative papers that were identified have also been included in the analysis, but are not without several common issues. The main problem with the quantitative research, was that they acknowledged that there were a number of influences thought to influence prescribing behaviour but they only chose variables in their research that were easy to obtain and there was no attempt to reflect the influences identified from the qualitative research. Some of the variables appeared to be included simply because they were available for the organisations. This is demonstrated in Table 4 where the influences indentified in qualitative papers are compared with those studied in quantitative papers.

2.4.3.3. Mixed methods research papers

There were five mixed methods papers and they have all been included in the analysis. These were all very useful papers because of the combination of collecting qualitative information and analysing quantitative data.

2.4.3.4. Description and analysis of the qualitative research papers included in the systematic review

The qualitative research papers included in the systematic review (Table 1) found that not only are there a number of possible influences that GPs must take into account, but that these varied according to the situation of the GP (what type of organisation they are part of, how they feel about incentives and guidelines, how confident they are about treating a particular disease).There was no clear hierarchy of the influences although one of the papers found that that organisation; education; contact with professionals accounted for 47.9% of the total reasons for change in prescribing (Allery et al., 1997). Clinical Guidelines were identified as important (67% clinicians) in a study in America in patient with diabetes and hypertension (Hunt et al., 2012). This was corroborated in another survey of clinicians treating patients with osteoarthritis where NICE guidelines were important for 65% of respondents and professional experience for 64% (Kingsbury and Conaghan, 2012).

The complexity of the interaction of influences is highlighted in all the qualitative research papers, but not all the papers agreed on the most critical issues. The theme that emerges from the papers are that the decision-making process of GPs is itself very complex, with GPs taking account of their own personal knowledge of the patient as well as other influences. The disease and drug in question are very important in this because decisions to treat with a one off short course of therapy (as in the case with antibiotics) are very different from starting the patient with a chronic disease on a lifelong treatment with likely side effects. Two of the papers compared the difference between the attitudes of hospital specialists and GPs in chronic diseases (Greenfield et al., 2005, Kedward, 2003) and both identified that knowledge of the patient's

situation and implications (both for the patient and on cost) of starting long term treatment was deemed much more important for GPs than for specialists.

The interaction between primary and secondary care is very important and one of the key influences of changing prescribing behaviour of GPs. In Crowe et al. (2009) the subject of prescribing of shared care specialist drugs was examined in the North West of England. This is an important area of research because increasingly more and more drugs previously thought of as specialist only are being moved into primary care. The study conducted semi structured interviews with GPs, PCO and strategic health authority staff and found that the most successful joint working was achieved if shared care protocols were developed with involvement of all staff and took into account of the local environment. The authors cite one possible weakness of this research that it was undertaken within a single strategic health authority on England and although the research had great breadth in the views that were obtained, it was narrow in terms of the number of organisations and locations. However, this highlights a potentially important fact, suggested elsewhere – namely that there is a local dynamic to the way in which patients are treated, and large scale studies that ignore this, may not fully elucidate reasons why decisions are made.

This was also demonstrated in a comparison of prescribing in non-fundholding practices in the UK (Eccles, 1996). The aim of this research was to understand GPs' attitudes to three things (a financial incentive scheme, use of guidelines and influence of secondary care). The results indicated that practices that achieved the savings under the incentive scheme were happier with timescales and targets and the philosophy behind the schemes. The willingness of health professionals within practices to work together with other local organisations and personnel is important to

the success of interventions. However, they also found that no one single influence was significant when changing prescribing behaviour and it would seem that it is a combination of influences that achieves a change.

Table 1: Qualitative papers included in the systematic review

Reference	Type of Study	Methodology	Influences studied	Conclusions	Assessment of study
(Agarwal et al., 2008)	Qualitative Study. Interviews. Type 2 Diabetes in older people. 21 GPs around Ontario, Canada.	Semi structured interviews focused on information related when prescribing insulin. Interview guide modified as interviews proceeded to reflect emerging themes. GROUNDED THEORY APPROACH. NO conceptual model utilised.	Seven main influences identified GPs beliefs about older people. GPs beliefs about diabetes and management. Gauging intensiveness of therapy required. Need for preparation of insulin therapy. Support available for individual. GP experience with insulin. Frustration with management complexity.	Patient and GP influences have an impact on insulin prescribing. GPs' prescribing varied depending on their assessment of the patients' situation. Under-prescribing of insulin could be improved by more GP education, better specialist-GP communication, and the use of other professionals to provide support networks for patients and GPs.	Not random selection of GPs (personal contacts) and 16 out of 21 GPs interviewed are male. Not many GPs had actually initiated insulin in their older patients. No analysis of data only quotes and discussion. GP demographic data collected and presented but not used to enhance results. No organisation details. Diabetes area of study.
(Allery et al., 1997)	Qualitative Study - (interviews) – general. Random sample of 50 GPs and 50 consultants in South Glamorgan.	Interviews using the critical incident technique resulted in classification framework of 12 categories and 50 subcategories. NO conceptual model utilised.	Six most frequent mentioned categories: Organisation (government, health authority, hospital, general practice, workload, uptake of new post); Education (literature, meetings, research, audit, guideline Contact with professionals (consultant, training staff, GPs, non-medical) Patient centred (patient led, patient need) Technology / tests	The main reasons for change in prescribing behaviour found (in order of the number of times they were mentioned) to be economic, education, contact with professionals, organisation, pharmacology, patient centred, pharmaceutical companies and clinical experience.	The study was not solely focused on prescribing change and also focused on management, referrals and investigations. However, all areas were discussed separately. Random sampling in 1 Family Health Authority. GP demographics collected but not included in discussion of results. All consultants (50) were men and GPs (50) - 66% men No organisation details

			(improvement, access, use) Economic (wish to save money, pressure to save money, lack of funding, prescription charges, PACT data, indicative drug budget, income generation).		collected. Analysis of all the important influences was presented.
(Armstrong et al., 1996)	Qualitative Study – semi structured interviews. General. 18 GPs in South East London, UK. The sample was selected to include GPs who differed in age, sex, and ethnic group and who worked in different circumstances, including different sized partnerships and deprived areas.	GPs were asked to identify any changes in their prescribing practice over last 6 months. NO conceptual model utilised.	For most changes several determining influences could be identified: these tended not to reveal a single trigger to behaviour change but rather an accumulation of cues that change was possible, desirable, and worthwhile. Mainly reading, influence by consultants, other GPs and the GPs own personal experience but also intervention from others (pharmacists), patient feedback, pharmacology of new drugs.	Three models of change were identified: an accumulation model, in which the volume and authority of evidence were important; a challenge model, in which behaviour change followed a dramatic or conflictual clinical event; and a continuity model, in which change took place against a background of willingness to change, modulated by other things such as cost pressures and the comprehensible therapeutic action of a drug. Behaviour change was reinforced and sustained by experiences with individual patients.	GP demographics collected from GPs in South East London. GPs chosen to reflect variation in age, gender and type of practice. No analysis of data. Only quotes and discussion.
(Buusman et al., 2007)	Qualitative Study – interviews. General. 15 GPs from the counties of both Funen and West Zealand in Denmark were selected with	Transcriptions were analysed in accordance with the sociological phenomenological approach of Schutz and systematic ethnographic domain analyses were	Influences identified include: drug price; external influences outside the GP's control such as governmental regulation on prescribing and the	GPs balance both internal and external influences when choosing between analogues. Drug costs were very important. External influences: Formularies acknowledged	GPs chosen to reflect variation in age, gender and type of practice. No analysis of data only quotes and discussion.

	reference to variation in organizational structure, age, and gender	performed. YES a conceptual model was used. The complexity theory was used as a framework for interpretation.	pharmaceutical industry. Internal influences related to the actual consultation included characteristics of the GP and the patient, drug characteristics, and repeat prescriptions.	as useful as were recommendations from secondary care and sales reps. Internal included patient demands, GP's previous experience. Prescribing decision requires GP to balance competing influences as well as individual patient needs.	
(Brookes-Howell et al., 2012)	Qualitative Study – semi structured interviews. Antibiotics. Eighty primary care clinicians randomly selected from primary care research networks based in nine European cities	Data subjected to a five-stage analytic framework approach (familiarisation, developing a thematic framework from interview questions and emerging themes. NO conceptual model utilised.	Non-clinical influences imposed by healthcare system: patient access to antibiotics; systems to reduce patient expectations; guidelines; and clinician characteristics.	Healthcare system influences (e.g., limiting patients' self-management with antibiotics before consulting in primary care, increased public awareness and provision of more consistent guidelines). Promoting clinicians' receptivity to change, confidence in decision-making and readiness to invest in explaining prescribing decisions may also be beneficial. Influences were emphasised differently between networks so local flexibility in interventions is likely to maximise effectiveness.	80 clinicians previously involved in research. No GP demographics or organisation details collected. NO analysis of data only quotes and discussion.
(Carthy et al., 2000)	Qualitative Study – semi structured interviews. Several disease areas. 17 GPs in Avon, South West UK.	Qualitative research principles were used to identify, log and list emerging themes, considered to influence prescriber decisions	Managerial or prescribing policy; doctor– patient relationship; professional knowledge; and educational support.	Prescribing decisions require complex personal and professional judgements about physical, psychosocial and cost dimensions.	GPs randomly selected but 15 out of 16 were male. Also assessed by prescribing behaviour (high, medium or low spend). Organisation details collected. No

		NO conceptual model utilised.	Peer influences, influences on prescribing policies and prescribing costs also seen as important influences. GPs had their own personal formulary shaped by medical training, colleagues, patients policy and own experience.		analysis of data only quotes and discussion. No linking of GP or organisation type with the results.
(Crowe et al., 2009)	Qualitative Study – semi structured interviews Specialist Drugs. Practice, primary care trust and strategic health authority level staff in North West of England.	Analysis was carried out using the five-stage 'framework' approach. This involved developing a workable list of main and subthemes and applying it systematically to the whole data set . NO conceptual model utilised.	Six Influences were identified: The specialist medicine; quality and quantity of information; shared care arrangement; financial arrangement, the patient, the practice decision and GPs specific area of interest.	Main themes were the GP's lack of knowledge and expertise using specialist drugs; relationship between GPs and local specialists and hospital staff. Shared care protocols are of variable quality and do not always involve GPs.	No analysis of data only quotes and discussion. Not just GP opinions – also practice managers, nurses, prescribing advisors and administrators. Not randomly chosen – practices chosen in GP was willing to be interviewed. No GP or organisation details collected.
(Eccles, 1996)	Qualitative Study – postal questionnaire. General. 348 GP practices in former Northern Region, UK.	The questionnaire covered a number of areas: the influences on a practice's decision on whether or not to try and achieve its target saving under the incentive prescribing scheme NO conceptual model utilised	GPs attitudes to financial prescribing incentive scheme; presence of guidelines and influence of prescribing initiated in secondary care (this included the influence of medical and pharmaceutical advisers.	Practices had no one overriding influence that affected them and it was a combination and their interplay that was important. 45% practices reported that informal discussions with colleagues influenced prescribing decisions compared with formal meetings 35%; local consultant opinion 17%, financial incentive not	No GP demographics collected and all fundholding practices. Analysis (chi squared test) on the results.

				enough 16%, national professional opinion 12% and informal discussions with colleagues outside practice 11%.	
(Greenfield et al., 2005)	Qualitative Study – postal questionnaire. Coronary Heart Disease (CHD). 296 respondents from West Midlands, UK. 43 cardiologists; 192 GPs and 61 practice nurses.	A questionnaire with general questions about CHD; six scenarios representing patients with CHD and 2 CHD risk questions. Open and closed questions. NO conceptual model utilised.	5 main themes: the risks and benefits of treatment; the patient's role, patient characteristics, costs to patients and costs to health services.	Prescribing lifelong preventative medication for CHD is difficult and decisions about treatment thresholds are most difficult. The same broad issues of cost to patient and health service, the characteristics of the patient themselves and their role in treatment decisions and the nature of risk assessment tools were raised not only by GPs and practice nurses but also by cardiologists. Cardiologists emphasized role of patient – but GPs did not talk about shared decision making. Their focus was on treatment thresholds and practice nurses were concerned about costs to health service.	No GP or organisation details collected. Analysis was presented on the results as well as quotes and discussion/
(Hedenrud et al., 2013)	Qualitative Study – four focus group discussions. Psychiatry. 21 participants (GPs, GP interns and heads of primary care units) from Gothenburg, Sweden	The focus group discussions were transcribed verbatim and analysed using manifest content analysis. NO conceptual modeul utilised.	Three different themes emerged. 1. Seeking care for symptoms, reflects the participants' understanding of why patients approach primary care. 2. Lacking a framework, resources, and treatment alternatives,	A variety of influences may affect the prescribing of psychotropic medications in primary care. Many influences were related to characteristics of the patient, the physician or their interaction, rather than the patients' medical needs per se. The results	No GP or organisation details collected. 21 GPs chosen through personal contacts. No analysis of data only quotes and discussion.

			which comprised categories such as economy and resources, technology, and organizational aspects. 3. Restricting or maintaining prescriptions, with the subthemes Individual influences reflect the physicians' internal decision making and comprised categories such as emotions, knowledge, and pharmaceutical industry.	may be useful for interventions to improve psychotropic prescribing in primary care.	
(Hunt et al., 2012)	Qualitative Study – Interviews. Type 2 diabetes and hypertension. 44 primary care clinics in Michigan - 58 clinicians and 70 of their patients, and observations of 107 clinical consultations. Clinicians included physicians, nurse practitioners and physician assistants.	The investigators developed, piloted, and revised 2 sets of standardized open-ended unstructured questions followed by focused probes, with advice from a cross-disciplinary expert panel. Clinician interviews explored concepts and strategies for managing type 2 diabetes and hyper-tension. Patient interviews focused on understanding causes, course, and consequences of these diseases, and patients' treatment experiences. NO conceptual models utilised	Clinical guidelines; clinical audit and reward systems; polypharmacy; patient views	Guidelines were identified as important (7% clinicians) – no reservations about appropriateness of targets or strategic use of medication to reach targets. Pay for performance (17% said this motivated them). Patient wellbeing does not seem to be high on agenda. Influence of Pharmaceutical company pushing more medication seen as deleterious.	Clinicians not randomly chosen. Deliberately chosen from clinics with a high number of low income and ethnic minority patients. Some statistics available on the % of clinicians who mentioned certain influences but not all of them. Big focus on cost of drugs and influence of pharmaceutical companies in discussion but not necessarily in the results. Diabetes the subject area.

(Jarusevicie ne et al., 2013)	Qualitative Study – Focus Groups. Antibiotics. Five focus groups with 22 GPs from Lithuania and 29 GPs from Kaliningrad Region of the Russian Federation.	Themes were grouped into categories; reviewed and summarised in terms of what they revealed about external enabling influences. NO conceptual models utilised	Six thematic categories were identified the necessity for political leadership to encourage clinically grounded antibiotic use; over-the-counter sale of antibiotics; designation of antibiotics as reimbursable medications; supervision by external oversight institutions; lack of guidelines for the treatment of upper respiratory tract infections; and pharmaceutical company activities.	The enabling environment around the physician should be addressed as well as the GP /patient influences.	GPs already taking part in a multicentre audit of antibiotic prescribing (HAPPY AUDIT). More females than males. Organisation details collected but not linked to the discussion of results. No analysis of data only quotes and discussion.
(Kedward, 2003)	Qualitative Study – semi structured interviews. Coronary heart disease and statins. 26 GPs from General practices in mid and south Bedfordshire, UK.	Interviews until saturation point was reached with no new themes emerging. NO conceptual model utilised	Concerns about cost and cost effectiveness; workload; adherence to treatment; medicalisation; effects on health behaviour - lifestyle issues	There are complex barriers to statin prescribing and coronary prevention in general practice, which may explain some of the variation that exists. Statin prescribing guidelines – interpreted differently by GPs for number of reasons.	Purposively samples to select GPs with diversity of sex, year qualification, practice size and location. Quarter GPs already known to researchers. No analysis of data only quotes and discussion.
(Kingsbury and Conaghan, 2012)	Qualitative Study – online survey. Osteoarthritis. 232 GPs across UK.	Questionnaire used. NO conceptual model utilised.	Patient assessment; sources of information; disease management; barriers to better care; strategies to improve care.	NICE guidelines (65%) and professional experience (64%) were biggest influences on OA management. 52% did not use educational materials and only a third rated their current educational material as good. Prescription review carried	GP demographics and organisation details collected. GPs across UK contacted and those who selected a special interest in musculoskeletal disorders were included. Analysis of

				out by 74%. Most common needs identified to improve care: more time with patients, collaboration with specialist colleagues and improved communication tools	results using descriptive statistics.
(Khan et al., 2015)	Qualitative Study – semi structured interviews.19 patients with migraine; 6 physicians who have prescribed triptans for migraine; 8 pharmacists who have dispensed them. Canada.	Coding and analysis of transcripts using a Framework Approach by two independent analysts to identify common themes. NO conceptual model utilised	Four themes that emerged at the patient, provider, and health-care systems levels: (1) awareness; (2) apathy; (3) advocacy; and (4) affordability.	Patients were sometimes apathetic about seeking treatment and physicians lack of concern about migraine. Pharmacists seen as advocates to help patients receive triptans.	GP demographics collected but not used in discussion. Not just GPs in the focus groups. No analysis of data only quotes and discussion. Extensive focus on specific problems associated with triptan use and insurance / payment issue.
(Klein et al., 2006)	Qualitative Study – individual semi structured interviews. Cyclooxygenase-2–selective inhibitors (COXIB) prescribing. A random sample of 19 primary care physicians were interviewed from Alberta, Canada.	Interviews about real-life clinical management decisions. The dataset was coded into key thematic areas following the analytic inductive method suggested by Ritchie and Spenser. NO conceptual model utilised.	Influences judged important included safety, patient characteristics, affordability to patients, availability of samples, drug company marketing practices, habit formation, time constraints, previous clinical experience of doctors and/or patient with certain drugs and doctors' perception of absolute versus relative risk.	In terms of influences important in deciding whether to use COXIBs to combat Musculoskeletal (MSK) pain and mobility issues, safety, affordability, availability, visibility (marketing) and physician-specific and patient-specific influences. Although drug marketing plays a key role in a doctor's choice of drugs for MSK disorders, this study shows that doctors rely on much more complex and personalized decision making.	GP demographics collected to produce heterogeneous sample population. No organisation details collected. No analysis of data only quotes and discussion. GPs chosen their own index cases so may have chosen exemplary examples of treatment according to guidelines and recommendations
(Kotwani et al., 2010)	Qualitative Study. Focus groups with 36	Theoretical sampling procedure was adopted.	Three broad themes emerged: Doctor	Lack of rules around the supply of antibiotics (and	No GP demographics collected. Specific

	primary care physicians in public and private sectors in Delhi. Antibiotics Misuse.	Discussions were focused on the motivations and behaviours leading to antibiotic misuse. Information coded according to Grounded Theory. NO conceptual model utilised.	related influences (diagnosis and uncertainty; perceived demand and expectation from patients; type of practice (public or private). Influence from medical representatives. Patient related Influences (not completing the course, self-medication, lack of education/understanding). Lack of guidelines	several ways for a patient to get the drugs apart from a GP prescription) seriously compromise a reduction in antibiotic misuse. Other influences such as lack of time, financial considerations and patient expectation, patient education, lack of guidelines and the type of organisation (public or private) are also important	types of organisations (public or private) deliberately chosen across a geographical area. No analysis of data only quotes and discussion. Ability to buy antibiotics over the counter in important for private GP practices.
(Magzoub et al., 2011)	Qualitative Study – Questionnaire. General. 87 Primary Health Care physicians. working in the private and public PHC centres in Rhiyadh City, Saudi Arabia who were previously selected for a study of prescribing	Principal component analysis was used the pattern of correlations. The questions were combined to identify a smaller number of influences that accounted for most of the variance observed in the physicians' questionnaire responses and to generate hypotheses regarding causal mechanisms underlying physicians' prescribing behaviour. Influence scores were saved as variables to undertake a logistic regression model to predict prescription quality. NO conceptual model utilised.	Socio demographic influences; practice setting; continuing education; access to educational materials; pharmaceutical company representatives; and patient influences	Of the 7 influences found to explain 46% of variance, 4 components positively related to perceived good prescribing behaviour: 1. clinical experience of physicians; 2. use of educational materials for continuous updating of medical knowledge; 3. enhanced levels of continuing medical education and 4. willingness to involve patients in decision-making; and working as a team using pharmacists for consultation and emphasizing the role of medical education. The other 3 influences are less easy to interpret – 5. Value of educational meetings (but not those organised	GP demographics and organisation details collected and 47 public GPs and 40 private GPs. GPs previously involved in other research. Sample stratified to ensure full range of primary care practices covered in both sectors. influence analysis carried out on the influences identified

				by pharma) 6. Effect of size and organisation of the health centre and 7. Physician nationality and continuing education of physicians.	
(Pollock and Grime, 2003)	Qualitative Study – semi structured interviews. Proton Pump Inhibitors (PPI)s. 9 general practices in the North Staffordshire Health Authority (UK) were approached and seven agreed to take part in the study (26 GPs)	Semi structured home interviews conducted. NO conceptual model utilised.	Prescribing pattern for PPIs; effect of cost cutting on GP / patient relationship; response to guidelines; clinical need; situational pressures; stereotypes of patients; cost effectiveness; organisation type (fundholding or non fundholding practices); incentive schemes	There was an adverse impact on medical practice because of the competing pressures of meeting patient needs while complying with prescribing incentives and guidelines. GPs felt that policies relating to cost containment and patient-centred medicine are incompatible and may help to explain the systematic inertia which appears to have hindered the development of genuinely patient-centred medicine over the last few decades.	GP demographics and organisation details collected. Of the 18 GPs interviewed, 17 were male. Analysis of some of the influences (those focused on cost containment and linked to fundholding or not). But for other influences just quotes and discussion.
(Prosser et al., 2003)	Qualitative Study – semi structured interviews. New drugs. 107 GPs selected purposively from high, medium and low new drug prescribing practices in two health authorities in the north west of England	Interviews used the critical incident technique to encourage GPs to give factual accounts of prescribing events and explain why they had prescribed a new drug. NO conceptual model utilised.	Influences influencing new drug uptake were: failure of current therapy and adverse event profile; pharmaceutical representative; hospital consultants opinion and prescribing; patients; local guidelines.	Prescribing of new drugs is not simply related to biomedical evaluation and critical appraisal but, more importantly, to the mode of exposure to pharmacological information and social influences on decision making	GPs purposively sampled to reflect high, medium and low prescribing of new drugs in North West England. Some analysis of influences provided (% mentioned) as well as quotes and discussion.
(Scott et al., 2011)	Qualitative Study – semi structured interviews with 11 GPs in UK	Interviews revolved around 3 set questions. NO conceptual model utilised.	3 questions – 1. main influences on prescribing; 2. specific influences of local	GPs cited the following influences cost and PCO (cited by all GPs) then NICE guidelines,	GP gender collected. No organisational details. No analysis of

			influences – local organisational; national; pharma industry and financial incentives. 3. Future influences.	consultants, British National Formulary (BNF), Pharma industry, patients, information sources, previous experience / training, colleagues, educational meetings, familiarity and drug safety.	data only quotes and discussion.
(Strandberg et al., 2013)	Qualitative Study – focus groups and semi structured interviews. Antibiotics. Two focus groups representing rural and urban areas in primary health care (13 GPs) in 2 counties in Southern Sweden	An editing analysis style according to Miller and Crabtree. Once units were identified they were sorted and organized into categories in an iterative process throughout the analysis. NO conceptual model utilised.	Influences connected to the GP, the relationship, and the setting; organization as well as professional culture.	Synergies between the influences exist, and one can sometimes compensate for lack of another. Continuity and mutual trust can make a brief consultation successful, but lack of continuity can eliminate the effects of knowledge and professional skills. Importance of an appropriate organization of primary care, which promotes continuity and encourages professional autonomy.	GP demographics collected and participants chosen for heterogenicity in sex, age and professional experience. GPs previously involved in multicenter audit of antibiotic prescribing (HAPPY AUDIT). 2 focus groups – 1 urban and 1 rural. No analysis of data only quotes and discussion
(Tan et al., 2009)	Qualitative Study – focus groups. Asthma. 29 Singapore Family Physicians working as private GPs, polyclinic doctors and locums - recruited into five focus groups	A qualitative method using focus group discussions (FGD) was used to gather qualitative data based on a semi-structured topic. NO conceptual model utilised.	Prescribing Decisions related to medical training; acquisition of asthma related information and updates. Uncertainty of disease diagnosis, patients' beliefs and their perceptions of the disease; concerns about drug side effects, costs related to differential subsidies.	Family Physicians' asthma drug prescribing behaviour is influenced by their medical training, disease definition, patient influences and drug costs in the context of the local primary healthcare system and policy.	Age of GPs collected but not chosen for anything else. 5 focus groups with GPs specifically from organisation types (private, polyclinic and locums). No analysis of data only quotes and discussion

(Tsiantou et al., 2013)	Qualitative Study – focus groups. Genera GPs from private and public sector in primary care in three geographically defined areas in Greece.	Study part of a European project entitled 'Assessing the Over-the-counter Medications in primary care and translating the Theory of Planned Behaviour TPB) into interventions' (OTCSOCIOMED) . YES Conceptual model used – Theory of Planned Behaviour	Influences include: patients expectations; pharmaceutical sales representatives; other GPs and specialists; public health authorities; patient income and limited time availability	Influences that are not common in the usual European setting were revealed, such as the influence of the patients' family and special situations during prescribing.	GP demographics collected but not used in results. GPs previously part of OTCSOCIOMED study. 3 geographically defined areas in public and private sectors. No analysis of data only quotes and discussion
(Vazquez-Lago et al., 2012)	Qualitative study – 5 focus groups with 33 physicians in Spain. Antibiotics.	Focus group method using themes and categories found on a previous systematic review to provide an agenda for discussion. NO conceptual model utilised.	The influences / attitudes that were identified by the groups as influencing GP prescribing of antibiotics were: fear, complacency, insufficient knowledge, pharmaceutical industry, patients and antibiotics. Antibiotic resistance was not thought to be a problem n the community.	GPs proposed more manageable clinical guidelines, and rapid diagnosis. Important that GPs did not think resistance was a problem. They also blamed other professionals (dentists, vets, pharmacists). The industry was only mentioned as important by 2 of the groups.	GP gender only collected. GPs within one area but 75 contacted (no rationale given). Focus group from 5 health centres. No statistics but some explanation of differences in results between groups and total number times an influence was mentioned. Older patient population so fear of complications a big driver to prescribe antibiotics.

2.4.3.5. Mixed methods research papers included in the systematic review

In the 5 mixed methods papers (table 2) that have combined qualitative and quantitative research, the quantitative analyses only investigated a small number of critical influences (Weiss et al., 1996) or simply used the results from the quantitative work as a means of stratifying the GPs prior to taking part in the qualitative study (Jones et al., 2001; Jacoby et al., 2003). Only one study (Houten et al., 2014) used a wider range and type of possible influenes. It analysed the supply influences that affected prescribing across six therapeutic areas in primary care trusts in the UK. A number of variables were measured (QOF scores – including clinical, patient experience and organisational influences); CG Annual Health Check score, GP list size (number of patient per GP); Services offered (screening, mental health services, medication reviews); Strategic health Authority linked to the PCT (indicating regional variation in policy at SHA level); drug spend; disease prevalence and population demographics. The results of the detailed regression analysis showed that drug use varied significantly in the PCTs in England and that a wide number of general influencers impacted in most of the therapeutic areas as well as individual influences for specific therapeutic areas. They found that PCT organisational standards (part of the QOF score and the Care Quality Commission (CQC) annual health check score) also seemed to influence levels of prescribing. Unfortunately, the paper did not present the differences in prescribing levels between PCTs for the therapeutic areas nor did it look for any patterns of scores in the different variables for the PCTs. The authors have acknowledged that they have only looked at some of the known influences on prescribing so the analysis was incomplete.

Table 2: Mixed methods papers included in the systematic review

Reference	Type of Study	Methodology	Influences studied	Conclusions	Assessment of study
(de Bakker et al., 2007)	Mixed – Qualitative data from a survey and prescribing and demographic data from national database. 138 GPs in 93 practices in The Netherlands. Range of drugs measured. Data from Second Dutch National Survey in 2001.	Pearson correlation coefficients computed between explanatory variables and overall range. Multiple regression analysis for joint relationship between dependent variable and explanatory variables. NO conceptual model utilised	Patient demographics; practice information (type of practice, dispensing status, number of prescriptions per head, urbanisation; GP age, gender and list size. Information sources (audit, guidelines, formularies, pharmaceutical industry)	No clear relationship between prescribing behaviour and any one influence.	Examining a range of drugs can be useful to understand prescribing behaviour but the study did not link prescribing against diagnosis for specific diseases
(Carlzon et al., 2010)	Mixed - Qualitative Study linked with quantitative data – Questionnaire in 25 primary care units in Sweden. General.	Result from the questionnaire were analysed against Sales information for adherence to six regional prescribing objectives (Proton Pump Inhibitors (PPI)s; Angiotensin converting enzyme (ACE) inhibitors, statins and antidepressants). Spearman correlation coefficients were calculated to evaluate bivariate correlations. NO conceptual model utilised.	Characteristics of practice settings – size unit; profession of manager; temporary physicians; information from pharmaceutical industry; independent drug information; education for physicians.	A physician as head of organisation; independent drug information were positively correlated with adherence to prescribing objectives. Presence of Pharma company information; education for physicians were negatively associated.	No GP demographics collected. Analysis focused on primary health care units. Lots of influences identified as being important but not collected or measured. Despite aims of study being broad investigation into characteristics of units and prescribing behaviour there was focus on importance of pharmaceutical industry influence.

(Jones et al., 2001)	Mixed Study – semi structured interviews. new drugs. Quantitative prescribing data. 38 consultants and 56 GPs who regularly referred to the teaching hospital in Birmingham, UK.	Issues from the interviews were categorized into main themes. Prescribing data from hospital and general practice analysed. NO conceptual model utilised	Issues from the interviews could be organised into three main themes: use of new drugs, attitudes to innovation and sources of information.	Decisions to prescribe new drugs based on a combination of influences and these varied between consultants and GPs. GPs relied more on drug representatives, and hospital specialists.	No GP (or consultant) demographic data or organisation details. Prescribing data for each GP, but no analysis of influences and themes only quotes and discussions.
(Kasje et al., 2005)	Mixed Study. Questionnaire and prescribing data. Angiotensin-converting enzyme (ACE) inhibitor prescribing of 735 patients from 95 GPs in The Netherlands.	Study part of a baseline study from a larger research project. Evaluating audit programmes for diabetes, hypertension and Coronary heart disease (CHD). Data extracted from questionnaire. Multilevel analysis used to assess the influence of characteristics simultaneously on each of the outcome variables. NO conceptual model utilised.	Influences recorded: GP gender, work experience, dispensing status, size and type of practice and location. Patient visits of outpatient clinics, referrals to cardiologist and hospitalisations in previous year. Patient demographics were age and gender as well as comorbidities. Patients with a diagnosis of heart failure were included for study.	Underuse and under-dosing of ACE inhibitors were mainly associated with patient characteristics, such as gender, age, concomitant hypertension and the use of a diuretic. Organisational influences as specialist care and outpatient heart failure clinics were also associated with higher prescribing of ACE inhibitors. General GP characteristics, such as work experience or gender, did not determine whether heart failure patients received ACE inhibitor treatment.	GP demographics, specific patient population with Heart failure with GPs who had at least 10 patents being chosen. Organisation details collected and information about referrals to hospital and cardiologists. Multilevel analysis of the most important characteristics.
(Weiss et al., 1996)	Mixed Study Questionnaire. Quantitative analysis of prescribing data. Qualitative questionnaire (228 GPs) and interviews 23 GPs.Antibiotics.	In depth qualitative interviews were conducted with 23 GPs to discuss non-clinical influences influencing prescribing. Content analysis revealed 4 themes. A fixed choice questionnaire was then created. Twenty	4 broad areas of prescribing 1. sense of burden providing healthcare; 2. views on financial constraints and incentives; 3. clinical workload and 4. patient pressure. Secondary aim to relate concerns to PCT prescribing data.	Sense of burden not reflected in prescribing data. Fundholders and non fundholders saw the financial constraints very differently and tending to behave differently in their prescribing habits.	GP demographics collected. 386 GPs in Southern England sent questionnaire. Organisation details collected and used in analysis of some of the questions. PACT data used to create prescribing dependent variables. Influence analysis of

		statements with a five-point Likert raring scale were developed to address the themes. NO conceptual model utilised.			variables. Data not linked to specific patients.

2.4.3.6. Quantitative research papers included in the systematic review

In contrast to the qualitative research, the papers describing quantitative research (Table 3) had pre-defined influences that had been studied often because of their availability. There was no consensus on the critical influences that might be responsible for variation in prescribing behaviour. In the study by Baker and Klein (1991) four influences accounted for 69% of variation (Lower rates of prescribing per 10000, fewer GPs per 10000 patients on lists, a smaller proportion of GPs over 65, and a larger number of ancillary workers per general practitioner). Pharoah and Melzer (1995) found that the proportion of temporary residents and proportion of women over 65 explained 25% of variation in prescribing and in Morton-Jones and Pringle (1993) four explanatory variables showed a correlation with Net ingredient cost – list inflation, standardised mortality ratio, % pensioners and % prepayment certificates. 81% of variation explained by these influences. There was no consistent pattern in the influences found to be significant in accounting for prescribing variation.

The relationship between spend on prescribing and good management of the disease was not proved in any of the papers looking at chronic disease. An observational study looking at the variability in potentially preventable hospitalisations and outcomes in clinical practice patterns of GPs in Spain (Orueta et al., 2015) analysed data for the entire healthcare system for a population in one location in Spain. They were able to examine variables at several levels (patient, doctor, primary and secondary healthcare institutions and found that GPs with a greater than expected number of visits with patients, higher prescribing costs or lower referral rates were associated with higher rates of preventable admissions.

Table 3: Quantitative papers included in the systematic review

Reference	Type of Study	Methodology	Influences studied	Conclusions	Assessment of study
(Baker and Klein, 1991)	Quantitative Study – General 90 family health services authorities in England..	The family health services authorities were treated as discrete primary health care systems. MAIN OUTCOME MEASURES: Rates of cervical smear testing, immunisation, prescribing, and night visiting. No conceptual model	Nineteen performance indicators reflecting the size, distribution, and characteristics of the population served; the organisation of general practice (inputs); and the activities generated by GPs and their staff (output) were analysed.	Lower rates of prescribing per 100,000 population were associated with lower standardised mortality ratios, fewer GPs per 100,000 patients on lists, a smaller proportion of GPs over 65, and a larger number of ancillary workers per general practitioner. These four influences accounted for 69% of variation). Healthier areas might be expected to have lower prescribing rates, and these are also strongly associated with better staffed practices. But this does not mean that lower prescribing can always be interpreted as a positive indicator as such rates are also associated with fewer practitioners per patient.	No rationale as to why variables have been chosen so not obvious why some data has been included. Outcome measures not just prescribing but also focusing on smear testing, immunisation and night visits. SIMILAR to this RESEARCH. Data not linked to specific patients.
(Bjerrum , 1999)	Quantitative study - comparing polypharmacy (more than 5 drugs) in 173 GPs in Denmark.	Prescribing data from National database. Other data from Regional Health Insurance database. Data analysed using backward step weighted linear multiple regression. No conceptual model	Practice characteristics (type of practice (solo or group, number of GPs and number of patients per GP); workload in practice; referral patterns; clinical work in practice and prescribing profile	Predictors related to practice, structure, workload, clinical work profile, and prescribing profile could explain 56% of the variation in major polypharmacy between practices.	All GPs in one district in Denmark. SIMILAR to this RESEARCH. Data not linked to specific patients.

(Bjerrum and Bergman, 2000)	Quantitative study – investigating the number of different drugs prescribed in 173 practices in Denmark	Prescribing data from National database. Other data from Regional Health Insurance database. Data analysed using backward step weighted linear multiple regression. No conceptual model	Practice characteristics (type of practice, workload in practice, number of GPs, number of patients per GP, age and gender of patients, workload in practice and referral pattern / procedures performed in practice.	Four practice characteristics were significant predictors of the number of different drugs prescribed. explaining 74% of the variation.	Prescribing data across several drug groups as the dependent variables. Explanatory variables include GP demographics, patient characteristics and practice attributes. Also some reflection of workload, referrals and procedures performed in practice. SIMILAR to this RESEARCH. Data not linked to specific patients.
(Davis et al., 2000)	Quantitative study to examine –The Supply hypothesis to explain medical practice variation on sample of GPs in New Zealand.	Data from a regional survey of GPs. Multi-level statistical analysis. Predictions were made about inter practitioner variations. 3 areas of clinical decision making used as outcomes – prescribing, follow up visits and test ordering are examined. Supply Hypothesis as a conceptual model.	Paper studied at effect on the 3 clinical decision making areas of,1. income incentives (doctor density) 2. Physician agency (who initiated visit) and 3. Clinical ambiguity (diagnostic uncertainty). Patient demographics, diagnosis, practice characteristics and GP demographics. Were also collected.	The Supply hypothesis – that practice and practitioner differences explain medical variation did not fit with the results of the analysis. Other influences are also important.	Not so relevant to this research – several areas of research and focusing on the Supply Hypothesis. Data not linked to specific patients.
(Davis et al., 1994)	Quantitative study looking at inter practitioner variation in prescribing in general practice. Range of drugs in GP practices in Waikato region of New Zealand.	A multivariate analysis is carried out on seven measures of prescribing activity in the areas of prescribing volume, script detail (generic or combination), and therapeutic choice (antibiotic, analgesic or psychotropic). No conceptual model	Study uses The Sources of Variation (morbidity, population, health system, professional and unexplained) as a framework. Patient demographics, GP characteristics and demographics and practice attributes were recorded.	Inter practice variation remains (although reduced) once GP, patient and practice variation are taken into account.	Focus on variables associated with GP demographics, patient characteristics and some practice attributes. Patient morbidity (diagnosis and severity) also recorded. SIMILAR to this RESEARCH Useful because focus is on relative impact of groups of influences on prescribing.

					Also data linked to individual patients.
(Hull et al., 2001)	Quantitative study looking at prescribing of antidepressants and anxiolytics in 164 practices in E London, UK	A practice based cross sectional survey using prescribing rates of antidepressants and anxiolytics as dependent variables. Multivariate repression model to examine influence of explanatory variables. No conceptual model.	Explanatory variables: partnership size; practice locality; training status; practice manager; no GPs; patient age, deprivation, % practice with patient Asian names; asthma prophylaxis (corticosteroid vs bronchodilator) and cervical screening %.	10 explanatory variables accounted for 47.7% variance in antidepressants and 34% of anxiolytics.	Focus on variables associated with GP demographics, patient characteristics and practice attributes but also with measure of use of asthma prophylaxis and cervical screening (no explanation). SIMILAR to this RESEARCH. Data not linked to specific patients.
(Jones et al., 2015)	Quantitative study assessing influences influencing antibiotic use for acute respiratory infections US over 8 year period.	Multivariate linear logistic regression model. No conceptual model	Overall antibiotic prescription, patient, provider and setting characteristics extracted.	Patients commonly received antibiotics regardless of patient, provider or setting characteristics. Use increased over time and substantial variation identified at provider level.	Focus on variables associated with GP demographics, patient characteristics including specific disease features and organisation type. No inclusion or discussion of other relevant influences. SIMILAR to this RESEARCH. Data not linked to specific patients.
(Mazzaglia et al., 2003)	Quantitative study - prescribing of antibiotics for acute respiratory infections in patients from 469 GPs in Italy.	Patient demographic data, drug history and physician information available. A frequency analysis for antibiotic prescribing by acute respiratory infection (ARI) Group and patient and GP characteristics. No conceptual model	Antibiotic appropriateness (according to guidelines) was assessed; patient demographics and diagnosis and physician features (gender, geographical region, type of practice, experience, number of patients and use of diagnostic tests.	Results did not show link between antibiotic use and patients characteristics. Antibiotic use was associated with physicians' characteristics, such as area of practice, and the number of patients under care. Practices in southern Italy and living in an urban area were also important in determining the choice of parenteral antibiotic use. Finally, the use of diagnostic tests showed a significantly	Focus on variables associated with GP demographics, patient characteristic and organisation attributes. Frequency analysis for each outcomes and multiple regression analysis. Data not linked to specific patients.

				associated lower risk of antibiotic use	
(Morrison et al., 2009)	Quantitative cross sectional Study – antidepressants 983 general practices in Scotland	Age-sex standardised prescribing rates were calculated for each practice. Univariate and multivariate regression analyses were undertaken to examine how the variation in prescribing was related to population, GP, and practice characteristics at individual practice level. No conceptual model	Population, GP, and practice characteristics at practice level.	Significantly higher prescribing than expected was associated with more limiting long-term illness (highly correlated with deprivation and the single most influential influence), urban location, and a greater proportion of female GPs in the practices. Significantly lower prescribing than expected was associated with single-handed practices, a higher than average list size, a greater proportion of GP partners born outside the UK, remote rural areas, a higher proportion of patients from minority ethnic groups, a higher mean GP age, and availability of psychology services. None of the quality-of-care indicators investigated was associated with prescribing levels. The model explained 49.4% of prescribing variation.	Focus on more variables than usual: GP demographics, patient characteristics and organisation attributes also QOF points, involvement with clinical audit and some service provision relevant to the area of research. SIMILAR to this RESEARCH. Data not linked to specific patients.
(Morton Jones et al., 1993)	Quantitative study – total prescribing costs in 90 health authorities in England	24 influences covering patient demographics, GP and practice details as explanatory variables against total net ingredient cost (NIC). Multiple regression analysis. No conceptual model	Patient demographics deprivation, mortality ratios, % pensioners and prepayment certificates. GP and practice variables including number GPs per population, age, movement, other staff, dispensing and single handed practices	Four explanatory variables showed a correlation with NIC – list inflation, standardised mortality ratio, % pensioners and % prepayment certificates. 81% of variation explained by these influences.	Focus on variables associated with GP demographics, patient characteristic and organisation attributes as well as number of pharmacies, ancillary practice staff, health authority staff per population and movement of GPs (no

					rationale as to why these things are included). SIMILAR to this RESEARCH. Data not linked to specific patients.
(Olveira et al., 1999)	Quantitative study – Diabetes.	Crossover study analysing prescriptions by 144 GPs in Spain. No conceptual model	Insulin and oral diabetic medication compared against GP characteristic, work place or patient population demographics	The GP characteristics had little effect on prescribing but the type of practice / workplace (teaching facility) and the patient population (age) had a much greater influence.	Focus on variables associated with GP demographics, patient characteristic and organisation attributes. SIMILAR to this RESEARCH. Data not linked to specific patients. Study about Diabetes.
(Orueta et al., 2015)	Quantitative study patients with ACSC (Ambulatory care sensitive conditions) admitted over 12 month period in 1 primary care network in Spain over 12 month period.	Cross sectional study analysing outcomes of the primary care network for a 1 year period. Multilevel mixed effect logistic regression. Analysed at patient, GP and organisation level. No conceptual model	Demographics and morbidity of patients; GP characteristics; health centre attributes were explanatory variables comparing visits, referrals and prescribing costs.	Patient admission more likely when seen by GPs with greater number of patients visits (less likely to refer?) and higher prescribing costs.	Focus on variables associated with GP demographics, patient characteristic and organisation attributes. Also included data for referrals and level of patient satisfaction. Complementary to this research and data linked to specific patients so can link prescribing and disease outcomes in same patients. Useful to enhance understanding.
(Pharoah and Melzer, 1995)	Quantitative study – hypnotics and anxiolytics in 61 practices in Cambridgeshire, UK.	Multiple regression analysis of prescribing rates for hypnotics, anxiolytics and antidepressants against a number of variables. No conceptual mode,	Explanatory variables: patient age, deprivation, nursing home and learning disability; standardised mortality ratios; practice size, number temporary residents, no GPs per population, ancillary staff, presence of counsellor, rural/urban location, GP	Proportion of temporary residents and proportion of women over 65 explained 25% of variation in prescribing.	Focus on variables associated with GP demographics, patient characteristic and organisation attributes but also some disease specific variables. SIMILAR to this RESEARCH. Data not linked to specific patients.

			age and GP with interest in mental health		
(Payk et al., 2015)	Quantitative study in diabetic patients in US (retrospective analysis of prescribing data)	Multivariate logistic regression model to assess prescribing of sulphonylureas (SUs) with number of variables. No conceptual model.	SU use after Dipeptidyl peptidase 4 (DPP4) inhibitors or GLP-1 agonists were introduced was measured against age, sex, ethnicity, primary care physician type	Data showed differences in prescribing rates for different patient age and sex and ethnicity subgroups and type of physicians seen.	Focus on variables associated with patient characteristics and type of physician and limited organisation attributes type and region but also some disease specific variables. SIMILAR to this RESEARCH. Data not linked to specific patients. Diabetes Prescribing.
(Pugh et al., 2003)	Quantitative Study – Diabetes Diabetic patients from two geographically diverse regions (Florida/Puerto Rico and New England) who were regular users of the Veteran Health Administration (VHA)	Diffusion of Innovations (DI) conceptual theory provides a relevant theoretical model for understanding specialist - generalist differences	Time, provider type, and geographic location are supported by DI theory and are important, the ability to analyse these patterns simultaneously provides insight into the process by which generalist-specialist differences may occur.	The data suggest that DI theory is useful in examining both adoption of new clinical recommendations and differences in care provided by specialists and generalists. Our data suggest that DI theory is useful in examining both adoption of new clinical recommendations and differences in care provided by specialists and generalists.	In depth study of 2 distinct areas in Diabetes patients with prescribing linked to other measurements – complementary to this research area. Highlights importance of the local heath economy and relative importance of organisations within it.
(Senior et al., 2003)	Quantitative Study – Asthma, diabetes and depression. 131 doctors' practices in a South Wales health authority	Novel use is made of a negative binomial model for prescribed items. These models are then evaluated, particularly by offering explanations for residual variations, which often identify more specific and localised influences on prescribing.	The determinants of practice prescribing behaviour can be broadly categorised into need and supply influences. Need is represented by patients with various medical conditions, with those illnesses in turn influenced by demographic, socio-economic, cultural and environmental conditions.	The health authority's population is characterised by substantial inequalities in wealth and health. Statistical analyses reveal the consistent influence of deprivation on prescribing costs and volumes, with the exception of items of insulin. Supply influences exert more selective influences. Thus, the number of doctors per	Focus on variables associated with patient characteristics and type of physician and limited organisation attributes. SIMILAR to this RESEARCH. Data not linked to specific patients. Diabetes Prescribing one area of interest in this study.

		NO conceptual model		practice and per patient has a positive influence on antidepressant prescribing; fundholding status is associated with lower costs for bronchodilator prescribing; and older doctors tend to prescribe more bronchodilators and oral antidiabetics. Residuals from the statistical analyses suggest further systematic influences, notably advice from hospital consultants, as well as more localised and less consistent effects.	
(Sleath and Shih, 2003)	Quantitative Study - The 1998 National Ambulatory Medical Care Survey (NAMCS) was used to examine the treatment patterns of depressed patients in ambulatory settings	The survey collects information regarding patient socio-demographics, physician specialty, diagnoses, procedures, and prescription drugs associated with the visits, and includes weights to produce nationally representative estimates. Statistical analysis used Heckman's 2 step estimation procedure Conceptual model utilised: Eisenbergs typology of sociological influences	Theoretical model was Eisenberg's typology of sociological influences on physician decision making. Physician demographics were not available but specialty was included.	The four influences that were investigated were all found to affect decision making physician prescribing of antidepressants was influenced by four main influences: patient characteristics, physician characteristics, the physician's interaction with the health care system, and the physician's relationship with the patient.	Focus on variables associated with patient characteristics and type of physician and organisation attributes as well as diagnosis of patient and patient insurance status. Data not linked to specific patients.

(Tsimtsiou, 2009)	Quantitative study - anxiolytic and hypnotic prescribing – all GPs in England.	QOF data, prescribing data and practice characteristics, Multivariate analysis using multiple linear regression. No conceptual model	Multiple deprivation population; QOF domain scores; practice characteristics; patient demographics; GP characteristics and training history.	Ten variables explained 20.5% of the variation in anxiolytic and hypnotic prescribing volume. After adjustment, the predictive power of four variables increased: the IMD score, the proportion of black or black British, and Asian or Asian British, and the Clinical Care domain score; these variables accounted for 17.7% of the variation.	Focus on variables associated with patient characteristics and type of physician and organisation attributes as well as general QOF domain scoring. SIMILAR to this RESEARCH. Data not linked to specific patients.

2.4.3.7. Influences identified by the papers included in the systematic review.

Table 4: Influences identified by the qualitative research papers

References	Audit and education	Clinical Guidelines	Financial	GP characteristics	GP peers	GP beliefs and experience	GP training and education	Incentives	Formulary	Organisation influence	Organisation profile	Patient demographics	Patient feedback / opinion	Pharmaceutical companies	Hospital consultant and specialists	Local health economy (LHE) and network of care provision
(Agarwal et al., 2008)				Y		Y	Y					Y			Y	Y
(Allery et al., 1997)			Y			Y	Y			Y		Y		Y	Y	
(Armstrong et al., 1996)					Y	Y	Y						Y		Y	
(Brookes-Howell et al., 2012)		Y		Y	Y	Y	Y									Y
(Buusman et al., 2007)			Y	Y		Y			Y	Y		Y	Y	Y	Y	
(Carthy et al., 2000)					Y	Y	Y		Y	Y			Y		Y	
(Crowe et al., 2009)	Y	Y				Y							Y		Y	Y
(Eccles, 1996)	Y		Y		Y			Y	Y						Y	Y

(Greenfield et al., 2005)		Y	Y			Y	Y			Y		Y	Y			
(Hedenrud et al., 2013)	Y		Y		Y	Y	Y		Y			Y	Y	Y	Y	Y
(Hunt et al., 2012)		Y	Y					Y					Y	Y		
(Jarusevicience et al., 2013)		Y								Y				Y		Y
(Kedward, 2003)		Y	Y			Y					Y	Y				
(Kingsbury and Conaghan, 2012)	Y	Y				Y	Y								Y	
(Khan et al., 2015)			Y				Y								Y	Y
(Klein et al., 2006)	Y	Y	Y			Y	Y					Y	Y	Y		
(Kotwani et al., 2010)		Y								Y			Y	Y		
(Magzoub et al., 2011)	Y					Y				Y	Y	Y		Y		
(Pollock and Grime, 2003)		Y	Y					Y	Y	Y		Y	Y			
(Prosser et al., 2003)		Y			Y							Y	Y	Y	Y	
(Scott et al., 2011)	Y	Y	Y		Y	Y	Y			Y			Y		Y	
(Strandberg et al., 2013		Y				Y	Y			Y	Y		Y			Y

(Tan et al., 2009)			Y				Y			Y	Y		Y			
(Tsiantou et al., 2013)					Y					Y	Y		Y	Y	Y	
(Vazquez-Lago et al., 2012)		Y				Y	Y			Y		Y	Y		Y	Y

Table 5: Influences identified by the mixed methods research papers

References	Audit and education	Clinical Guidelines	Financial	GP characteristics	GP peers	GP beliefs and experience	GP training and education	Incentives	Formulary	Organisation influence	Organisation profile	Patient demographics	Patient feedback / opinion	Pharmaceutical companies	Hospital consultant and specialists	Local health economy (LHE) and network of care provision
(de Bakker et al., 2007)		Y		Y							Y	Y		Y		
(Carlzon et al., 2010)	Y	Y					Y		Y	Y	Y			Y		
(Jones et al., 2001)	Y	Y												Y	Y	
(Kasje et al., 2005)				Y		Y	Y				Y	Y			Y	Y
(Weiss et al., 1996)			Y					Y	Y	Y			Y		Y	

Table 6: Influences identified by the quantitative research papers

References	Audit and education	Clinical Guidelines	Financial	GP characteristics	GP peers	GP beliefs and experience	GP training and education	Incentives	Formulary	Organisation influence	Organisation profile	Patient demographics	Patient feedback / opinion	Pharmaceutical companies	Hospital consultant and specialists	Local health economy (LHE) and network of care provision
(Baker and Klein, 1991)				Y							Y	Y				
(Bjerrum, 1999)				Y							Y	Y				Y
(Bjerrum and Bergman, 2000)				Y							Y	Y				Y
(Davis et al., 2000)				Y							Y	Y				
(Davis et al., 1994)				Y							Y	Y				
(Hull SA et al., 2001)																
(Jones et al., 2015)				Y						Y	Y	Y				Y
(Mazzaglia et al., 2003)				Y							Y	Y				Y
(Morrison et al., 2009)	Y			Y							Y	Y				Y

(Morton Jones et al., 1993)																
(Olveira et al., 1999)				Y							Y	Y				
(Orueta et al., 2015)				Y						Y	Y	Y				
(Pharoah PD at al., 1995)				Y			Y			Y	Y	Y				
(Payk et al., 2015)							Y	Y				Y				
(Pugh et al., 2003)	Y						Y			Y		Y				Y
(Senior et al., 2003)				Y						Y	Y	Y				
(Sleath and Shih, 2003)				Y			Y			Y		Y				Y
(Tsimtsiou, 2009)	Y			Y								Y				

2.5. Summary of influences on prescribing

The main groups of influences on prescribing together with a description of the specific aspects of that influence that have been identified in the papers included in this systematic review is summarised in the Table 7 below:

Table 7: Summary of influences on prescribing in primary care

Influences (obtained from the systematic review)	Detailed description of the influences identified in the systematic review
Audit and Education influences	Audit and feedback; education initiatives; computer decision programmes
Clinical Guidelines influences	Adherence to clinical guidelines
Financial influences	Financial situation at organisation; financial incentives
GP influences	GP demographics; GP training specialist qualified; GP patient relationship; prescribing behaviour (adoption of new drugs)
Medicines Management influences	Medicines Management involvement; specific formulary decisions; incentive schemes
Organisational influences	Organisation culture, cohesiveness; Organisation attributes (size and profile)
Organisational priority	Organisational level priority and interest in specific project
Patient influences	Patient characteristics; patient education; patient opinion
Patient population	Patient disease prevalence; socio-economic classification of the population
Pharmaceutical company influences	Sales and marketing approaches to GPs; involvement in research

2.6. Discussion

The aim of the systematic review was to critically appraise and synthesise the published research in the possible influences on prescribing behaviour in PCOs. Doing this revealed a number of important facts.

The qualitative studies included in this review brought up a number of common themes and consistently identified the same influences on prescribing despite using a range of

qualitative study methods such as semi structured interviews using: thematic research, critical incident technique, manifest content analysis, purposive sampling frame; focus groups, questionnaires and surveys. This has been demonstrated by table 4. There was general agreement from the qualitative studies that influencing prescribing is multi influential and that specific individual influences were more important for some GPs than others. The research consistently showed that sometimes an interaction will affect the prescribing but not for all GPs and not necessarily for a long time.

There was a noticeable difference between the influences identified in the qualitative papers compared to the papers describing quantitative research. This is likely to be due to difficulty in collecting some of this information in the quantitative research. However, it does mean that influences identified in qualitative research papers as being potentially important were ignored in the quantitative research and so the usefulness of this research in elucidating key influences was greatly diminished. The influences identified as most important in these quantitative papers were not reproducible from one study to the next and appeared to differ according to the local health economy studied; the country of origin; the type of drug and disease area being investigated (antibiotics or chronic disease); the organisation under investigation and finally the focus of the study (for example cost or clinical outcomes). The focus of all the quantitative research was to discover the most important influences on prescribing in the study population so that this result could be extrapolated to other organisations. However, one of the main conclusions from most of the papers included in this systematic review was that the organisation, the local environment and the influence of the local hospital - defined as the local health economy (LHE) need to be included in these quantitative analyses to more fully explain the reasons behind variations

(Senior et al., 2003). Therefore, it is unlikely that results from one small population sample are going to be applicable to other organisations. It is perhaps more important to investigate all the possible influences found from qualitative research as well and build up a picture of what is happening in each LHE so as to understand the relative importance of each influence in that particular locality (Pugh et al., 2003, Houten et al., 2014).

A good summary of the interaction of the influences on prescribing decisions was presented in a systematic review in 2008 on the uptake of new drugs (Mason, 2008). This review investigated the possible influences that might influence the uptake of new drugs in the UK. The determinants were classified using Bonair and Persson's framework for diffusion of innovation which categorises influences influencing adoption as (1) people influencing prescribing (2) structural / environmental characteristics (3) product characteristics (Szczepura and Kankaanpaa, 1996). The review found that in terms of people influencing prescribing there was evidence that: hospitals specialists were important in initiating new drugs that then filter down to influence GPs; other healthcare personnel and the way in which services are integrated are also important; prescribing advisers and drug company representatives. Structural / environmental characteristics included: education, guidelines, and incentive schemes. Product characteristics included: cost awareness and attitudes. It was also useful because it confirmed that there has been no single study exploring the reasons for variations in GP prescribing behaviour across the UK and that research typically focuses on a small number of GPs within a small geographical area. However, despite this usefulness, this review did not cover all the issues that are pertinent to this research, namely: it fails to differentiate between classes or therapeutic areas of new drugs; included no

discussion of patient influences; there was no analysis of the type of primary care organisation; and the only product characteristic discussed was the cost. Another review of new drug uptakes by Lubloy (2014) concluded that each influencing variable has only a small impact, and predicting doctors' prescribing behaviour is a complex and multi influenceable exercise. They conclude that models with high numbers of variables and high explanatory power would be needed to help design policy approaches.

This systematic review was designed to examine the influences affecting prescribing decisions in primary care across all disease areas so as to get the widest level of understanding. However, from the papers identified it was clear that whilst the influences on the prescribing decision can be generalized, the relative importance of them varies according to the disease studied. The majority of research of influences influencing prescribing in primary care has studied the prescribing of antibiotics because they represent an important area of inappropriate prescribing, However the relative importance of the influences when prescribing antibiotics are quite different when compared with, a complex chronic condition such as type 2 diabetes. The patients' ability to cope with treatment changes and side effects as well as the availability of specialist advice and training to help support the GP are significant for this disease (Agarwal et al., 2008). The influence of secondary care and the local interactions between organisations are also much more significant in chronic diseases. In a study of patients with osteoarthritis, GPs cited the relationship with specialists as crucial, as was their own expertise and experience in treating the condition and national guidelines (Kingsbury and Conaghan, 2012). In managing a chronic disease there is also a tension between attaining clinical targets and balancing side effects of

increased medication. In a study in the United States by Hunt et al. (2012) looking at diabetes and hypertension, guidelines were cited as being very important in 67% of clinicians but attaining clinical markers of better management of a disease often led to increased side effects and poorer quality of life for patients.

The significance of the organisation and networks of people working across interacting organisations was investigated in a study in The Netherlands (van Eijk et al., 2004) where they used the natural networks of practice study groups consisting of GPs and pharmacists and measured the relative success of a group approach educational intervention against an individual intervention to reduce anticholinergic prescribing in the elderly. The groups had been in existence for varying times, differed in their set up and aims, use of formularies and in use of feedback data. They found that all three of these characteristics modified the effect of the group educational intervention. This would fit in with accepted general theory on the diffusion of innovations that concludes that diffusion is a social process and networks are important (Rogers, 1995). An in depth study of the use of antibiotics in the USA found the way in which the organisation of primary care is managed was important in helping to develop a professional culture with a locally owned common prescribing policy. They found that if this was achieved it helped to improve prescribing habits (Strandberg et al., 2013).

One weakness of this systematic review was that it included research from countries outside the UK, and in some instances, some of the conclusions drawn from international research may not be relevant in the UK. In the qualitative study in Greece (Tsiantou et al., 2013) they found that some of the influences that were important were not necessarily applicable to other European countries such as the influence of the patients' family on decisions. In the study of antibiotic prescribing in Lithuania and

Russia (Jaruseviciene et al., 2013) legal and political constraints and interference impacted of prescribing decisions and created an environment where it might be advantageous to prescribe antibiotics more frequently than necessary to avoid potential medico legal problems. The way in which healthcare is funded (insurance systems, or population tax) also affects prescribing decisions - a fact demonstrated by a study of asthma prescribing in Singapore (Tan et al., 2009) and antibiotics in India (Kotwani et al., 2010).

Out of the 48 papers included in the systematic review, only five utilised any conceptual models. In the qualitative studies Buusman et al. (2007) used the Complexity Model and Tsiantou et al. (2013) used the Theory of Planned Behaviour. In the quantitative studies, Davis et al. (2000) studied the Supply Hypothesis and Pugh et al. (2003) used Diffusions of Innovations and a third used Eisenbergs typology of sociological influences (Sleath and Shih, 2003). A review by Mason (2008) investigated the adoption of new drugs also used the Diffusion of Innovations Model by Bonair and Persson as a method of analysis. Another review of the models and theories of prescribing decisions in 2017 confirmed this lack of research into the use of conceptual models when analysing prescribing decisions. In their research they put forward a new conceptual model but only looked to explain links between marketing efforts, patients and pharmacists on physician prescribing decisions (other influences have not been considered). Their model was also derived from social and behavioural theories (Murshid and Mohaidin, 2017).

2.7. Conclusion

This systematic review identified a number of influences that have been found to affect prescribing behaviour. The review also found that there has been no published

research using the adapted Donabedian SPO model to look at prescribing influences. None of the quantitative research papers were able to identify influences to explain all the variation in prescribing and they restricted their study to the measurement of influences that are easy to obtain and readily available. This is despite the results from the qualitative research identifying important influencing influences.

Meaningful quantitative research should therefore take the influences and themes that have evolved from qualitative research should be used to frame the areas of analysis in the quantitative analysis. Moreover, since the local dynamics both within the organisation and between the acute sector and local networks within the local health economy are crucial, it is unlikely that studying one organisation will provide meaningful results to be extrapolated to the wider community.

CHAPTER 3: THE DEVELOPMENT OF A CONCEPTUAL MODEL FOR THE MEASUREMENT OF INFLUENCES ON PRESCRIBING

3.1. Introduction

This chapter investigates conceptual models used in the area of health services research, and then seeks to develop a conceptual model for exploring influences on prescribing behaviour.

Prescribing research has not previously engaged with conceptual models used in health services research. None of the studies in the systematic review (chapter 2) or in a recent review of models and theories to explain the prescribing decisions by Murshid and Mohaidin (2017) considered any of the conceptual models used in this branch of research. However, In health services research it is acknowledged that there is a need to create and develop conceptual models in which to place indicators and understand the relevance, meaning and importance of these indicators in improving healthcare (Zelman et al., 2003). This chapter considered whether application of such conceptual models could be useful in understanding the importance of influences on prescribing behaviour.

Health service research is a discipline involved in examining the relationship between the provision, effectiveness and efficient use of health services and the health needs and demands of the population (Bowling A, 2009). A distinction between heath service research and quality and audit assessment is that audit and quality tend to monitor whether predefined and agreed standards have been met, whereas health service research concentrates on evaluating the different aspects by recording what changes have happened (Bowling A, 2009). Health service research would therefore

encapsulate all the aspects of influences on prescribing that are the subject of this research project.

A number of conceptual models have been developed to evaluate health services. One of the first conceptual evaluation models to measure quality in healthcare was first postulated by Avedis Donabedian in the 1960s (Donabedian A, 1966). He created a Structure, Process and Outcome (SPO) Model. Donabedian's approach focused on (a) the measurement of structure (inputs and resources – including staffing, finance and other resources). (b) the measurement of process (service delivery, prescribing practices, referral rates, access, and other productivity measures) and (c) the measurement of outcomes (death, morbidity, patient satisfaction) (Donabedian A, 1980).

This conceptual model has been used extensively to evaluate a range of clinical processes, service developments, disease management tools and clinical staff interventions (Ameh et al., 2017, Bainbridge et al., 2010, Gardner et al., 2013, Gardner and Mazza, 2012, Neville et al., 1996). In each case it is adapted to fit the specific subject being studied and has been found to provide some useful insights into the interactions between the various important influences on the quality of the service / condition being studied. Prescribing has been identified as one of the indicators in the Donabedian SPO models (together with referral rates, service delivery and other productivity measures) (Donabedian A, 1980) However, this model has not previously been used to study the influences on prescribing. This model could therefore provide a useful conceptual basis for understanding the influences on, and the indicators and measurements in these models are similar to the influences on prescribing behaviour that were identified by the systematic review described in chapter 2. Using this area of

health service research opened up the possibility of measuring prescribing behaviour within the context of the other measurements made in quality models.

3.2. Aims and objectives

The aim of this chapter was to ascertain if there were any conceptual quality models used in health service research that could be used to provide a useful insight into the influences on prescribing behavior, and develop a model to apply to prescribing. In order to meet this aim there were four main objectives:

- Investigation of the theory behind the use of quality models and identify what were the key elements in the most commonly used conceptual models.
- Identification of the most suitable conceptual model that is most appropriate to be used in this research.
- In order to test the utility of the Donabedian SPO model when understanding the interaction of influences on prescribing in English PCOs two new specific classes of drugs to treat diabetes (LA insulin analogues and GLP-1 agonists) were chosen as outcome indicators.
- Alignment of the influences identified in the prior systematic review (Chapter 2) to the Donabedian SPO conceptual model, according to their similarity, and based on their relationship to the two outcome indicators.

3.3. Literature review

The literature search for this part of the research project, was divided into two separate parts:

1. General search on a number of terms to understand the background to the subject of performance and quality frameworks and conceptual models.

Terms searched (in Medline, Embase, Web of Science and HSMC)

> *Quality framework; Performance framework; Quality indicator; Quality improvement; Quality indicator and Performance indicator*

Useful papers were identified from this search and references in these papers were followed up by hand searching.

There is considerable difficulty in defining search terms with quality frameworks and conceptual models. Similar concepts can be described by different terminology. For instance, performance frameworks and conceptual models are used interchangeably in many papers. Similarly, quality domains, categories and dimensions were all terms used to describe a grouping of similar indicators that make up part of a framework or model. These findings are corroborated by other researchers that have examined this subject (Klassen et al., 2010, Gardner and Mazza, 2012).

A second more focused search was carried out, once the primary literature search has been performed and reviewed. At this stage the Donabedian conceptual model had been identified as chosen model to develop a framework to evaluate the influences on prescribing.

The literature searching that was performed for this was based on searching for the use of Donabedian structure process outcome model in a clinical setting.

Search terms were:

> *Donabedian (keyword search); structure process outcome; model; clinical and health quality*

Using the keyword search of Donabedian found many irrelevant papers and no consistent MESH term identified the use of the model in papers. Therefore, a keyword search was undertaken together with the terms above across all databases available at The University of Birmingham, including Medline, EMBase and HMIC. Abstracts were read to discard unsuitable papers. Handsearching of relevant papers were performed in order to retrieve other original research where the model had been used as a relevant evaluation framework.

The search strategy was set up to identify research where the Donabedian SPO model had been used as a conceptual framework in a similar manner to that intended in this research. Papers where it had been used to evaluate a clinical service, management of a condition, evaluate a primary care service / organisation or a specific part of the management of a disease were all of interest. Original research was selected rather than review papers for this literature review because it was important to understand how the model had been adapted for research into different subjects. In addition, original research that only focused on one aspect of the model was not included in this review.

Full copies of the papers were obtained and read to discern how the model was adapted, what indicators were used to populate the system, how they were analysed and how useful the model was.

3.4. Theory behind the use of conceptual models

The improvement of quality within the health service has been consistently identified as a key issue in the industrialised and developed countries (Gardner and Mazza, 2012, Klassen et al., 2010). One of the ways in which healthcare systems have tried

to improve and measure the quality, care and cost effectiveness is to deploy a range of performance measurements and improvement initiatives reflecting dimensions of quality (Mainz, 2003). In the UK measurement of performance of local NHS organisations was first introduced in 1999 (The Performance Assessment Framework) where a range of indicators were measured. This developed into performance league tables, the setting up of the Care Quality Commission, the Quality and Outcomes Framework (QOF) in 2004 and the development of 200 Indicators for Quality Improvement (IQIs) in 2009 (Raleigh and Foot, 2010). More recently, the NHS Outcomes Framework (Department of Health, 2011) has been developed with a specific aim to help to improve quality and outcome measurement throughout the NHS.

There are various dimensions of health care performance that have been developed to define of quality. They have variously been used in performance frameworks in a number of countries and share many similarities.

1. The Institute of Medicine (IOM) six dimensions of quality – effectiveness, safety, efficiency, timeliness, patient-centredness and access (Institute of Medicine, 2001).
2. The Maxwell six dimensions of quality: appropriateness; social acceptability; effectiveness; relevance to need; equity and accessibility (Maxwell, 1984).
3. Donabedian seven attributes of quality - efficacy, effectiveness, efficiency, optimality, acceptability, legitimacy and equity (Donabedian A, 1990).

These attributes of quality are reflected in the individual indicators that are used in the Frameworks (Mainz, 2003, Raleigh and Foot, 2010). A systematic review of performance and quality models was carried out by Klassen et al. (2010) to identify the

common quality domains across them all. This work found that regardless of how they were constructed or where they originated from there were 16 quality concepts applicable across health, education and social care that could be grouped into five common themes.

1. **collaboration** – partnerships, networks and links among service delivery systems
2. **learning and innovation** – commitment to learning environment that supports research, development and dissemination of information and knowledge, evidence based guidelines etc.
3. **management perspective** – leadership, organisation, infrastructure capability, business and financial management.
4. **service provision** – equity (provision of services distributed according to population, geography, ethnicity, need); availability, comprehensiveness, appropriateness and client centredness.
5. **outcomes** – measure of effectiveness at patient, population or organisational level.

They also concluded that the different conceptual models had been developed by building on existing frameworks and models. The most popular one in the health sector was the Balanced Scorecard (consisting of quadrants measuring financial performance, customer satisfaction, internal processes and learning and growth). However, it should be noted that the majority of frameworks (54 out of 97) were being used to analyse health systems for national performance frameworks and so the importance of and need to record customer satisfaction and financial performance may be different from the use of a framework to measure and gauge quality and

performance in an organisation. Organisation level frameworks such as the Donabedian SPO model were used in ten frameworks.

This review is of interest to this research because it identified that the quality concepts were applicable across many settings and levels of application despite being labelled variously as domains, dimensions, or quadrants. These common elements were important in measuring quality and performance regardless of the model used. However, national performance frameworks comparing measures across a health system were most commonly studied in this paper and their focus was different from those focusing at an organisation level. The review also reinforced the view that conceptual models whilst important, are flexible and should be adapted to fit the context and setting being studied.

Indeed, the fact that common quality themes are identified in different models makes it important that an appropriate one is chosen to underpin the development of a conceptual model to evaluate a specific clinical situation or condition. In 2012, a review of the published literature on definitions of quality and the use of quality frameworks in primary care in the UK, New Zealand, Australia and Germany was published (Gardner and Mazza, 2012). This paper included 47 papers in its review and concluded that in all four of the countries the fundamental principles behind the Donabedian SPO model of structure-process-outcome have been adopted but with a need in each case to translate the theoretical concepts into individual situations. For example, in New Zealand, the frameworks are used as part of pay for performance programme for their primary care organisations whereby the standards to be attained were categorized as part of the structure domain; the national programme to meet the standards as the process domain and local implementation and measurement as the outcome domain.

This published review does not give any details about the relative success of the different quality frameworks but concludes that the essential quality dimensions are similar and that the Donabedian SPO model is the basis for the primary care country wide frameworks studied.

Another comparative analysis of the characteristics of national frameworks and performance indicators was published in 2017 (Braithwaite et al., 2017). In this analysis, countries that were at the forefront of adopting performance indicators for quality improvement and where details of the indicators, domains and frameworks to apply them were available were studied. The most common domains measured were: Effectiveness (8 frameworks); access and safety (7), efficiency (5), quality (4), appropriateness (4), patient experience (4). Creating a conceptual framework for the development of indicators to measure and assess these domains was found to be an important issue for the countries because it sets out the rationale and principles behind the collection and measurement of indicators and could be modified to suit the local health system (Braithwaite et al., 2017) . A paper by Arah et al. (2006) has described the development of a framework for the Organisation for Economic Co-operation and Development (OECD) Health Care Quality Indicators Project (HCQI). The proposed framework was based on models developed in many countries, including the USA Institute of Medicine's National Health Care Quality Indicator Framework; Canadian Health Indicator Framework; adaptions in Australia and ECHI (European Health Indicators) project and on the World Health Organisation (WHO) and OECD proposals for identifying key economic and social goals for health policy. This HCQI framework has four interconnected tiers to represent (a) health – broader measures of heath that may be influenced by health care and non-health care factors; (b) non health care

determinants of health (c) health care system performance – processes, inputs and outcomes of health care system and its efficiency and equity and (d) health system design and context – country and health system policy and delivery characteristics which affect cost , expenditure and utilisation patterns (Arah et al., 2006).

The HCQI Project used the structure, process and outcome model to categorise the indicators. However, in their project it was decided that the indicators that form the structure domain were likely to be less important because their presence would not ensure that necessary processes were carried out or that satisfactory outcomes were achieved (Kelley E, 2006). This is in contrast to the findings of the Klassen et al. (2010) or Arah et al. (2006) reviews where indicators that made up the structural domains were found to be critical. The importance of the structural domain has been highlighted by other research (Glickman SW, 2007) that has focused on the role of the management organisation as an important factor into the success of quality initiatives. in this review looking at the use of the Donabedian SPO model but drawing upon organisational behaviour they concluded that the organisational characteristics, culture and management capabilities as well identification of relationships between individuals, leadership, group dynamics and incentive schemes and information technology, all influenced changes in processes and ultimately health outcomes. They suggested that these features should be included in the structure domain of the Donabedian SPO model. The review looked at the key elements of organisational attributes that have been shown in the medical and business literature to be important in delivering improvements in process and outcomes. The importance of organisational level attributes have been identified in other healthcare research fields. For instance, in the field of primary care research; organisation cohesion, management, structure

and financial stability have all been identified as crucial when making improvements in the quality of care in PCOs (section 1.4.3.). In addition, the papers identified in the systematic review of this thesis (Chapter 2) identified the importance of the organisation when trying to change prescribing behaviour.

Whilst the Donabedian SPO model is a useful conceptual model to consider as a basis for understanding the quality and performance indicators important in clinical care there are some recognised limitations (Donabedian A, 2003) . Firstly, the three domains are linked in a linear relationship with the structural domain influencing the process domain and the process domain influencing outcomes. To counteract this issue many studies that use the Donabedian SPO model as a basis for evaluating a healthcare process look at the effects of the structure domain directly upon outcomes as well as the traditional S-P-O relationship (Ameh et al., 2017, Kunkel et al., 2007). Secondly, the model was created to look at clinical quality and so when it is used in other ways it needs to be adapted to reflect the situation being studied. Thirdly, there is no way of measuring how the three domains may interact with one another and there is a degree of blurring between the three domains (Donabedian A, 2003).

3.5. Why use the Donabedian SPO model in this research?

In order to assess whether the Donabedian SPO conceptual model would be appropriate to be used as a framework to evaluate the influences on prescribing in primary care, a literature search was carried out to identify where the model had previously been used in similar clinical situations.

A summary of the ways the model has been implemented and adapted in nine different healthcare settings is given in the table below (Table 8). In all of these examples the

indicators chosen to measure three themes of structure, process and outcomes have varied according to the subject being studied.

Table 8: Summary of adaptations to Donabedian SPO model by other researchers

Subject	Structure indicators	Process indicators	Outcome indicators	Comments
Telemonitoring service for diabetes (Nocella et al., 2016)	Professional and organisational resources to provide the telemonitoring service, Patient demographic Profile	Frequency of contact with nurses and doctors	Management of blood glucose levels glycated haemoglobin (HbA1C) and blood pressure	The model provided a useful method to understand the effectiveness of the service.
Asthma care (Neville et al., 1996)	Type of practice, size, patient population, FHSA accreditation, specialist nurse with diploma	Audit of asthma care, consultations by patients, review of asthma	Asthma acute attacks and treatments, secondary care use	Association found between practice structure and clinical outcome
Palliative care (Bainbridge et al., 2010)	Environment factors (population, profession / specialist) Network characteristics, (history, culture, evolution, policies) economic factors (capacity for 24/7 care, financial incentives, resources)	Organisation factors, collaboration amongst providers, information transfer, provider characteristics	Patient satisfaction with care and access, perceptions of client centredness, perceptions of continuity of care	Focus of this research was the palliative care network and indicators built around aspects important to network functioning rather than more clinical measures.
Primary care services (Reeve et al., 2015)	Primary care services available, geographical accessibility, integrated care with other providers, resources, appropriate for population characteristics	Rates of admission/ visits to health services, preventative care, unplanned admissions, chronic disease care plans	Mortality rates, prevalence of disease, patient satisfaction and reported illness, comparison of performance indicators against other areas	Framework allowed use of currently collected data to evaluate the service. Highlighted the degree primary and secondary care services were related to one another
Costs in Diabetes care (Nuckols et al., 2013)	Measures of community, demography and patient population. General structure, disease specific structure and	Appropriateness of care and associated costs	Cost of disease progression, complications and cost of care for complications	This work focused on development of a Quality Cost Framework for glycaemic control for type

	quality improvement. Costs associated with the above			2 diabetes. It allowed a study of the mechanisms of how quality affects costs.
SPO model to analyse regional diabetes networks (Mahdavi et al., 2018)	Human resources, physical accessibility and equipment. Contextual factors : disease and socio demographic characteristics	Hours of care, costs of services, responsiveness empathy and communication between patients and providers	HbA1C; quality of life and satisfaction of services	Differences in quality of life, services and patient satisfaction associated with differences in SPO in 6 regions in Europe.
SPO analysis of hospital departments (Kunkel et al., 2007)	Resources and administration	Culture and professional cooperation	Competence and goal achievement	The model provided useful aid to evaluate single systems or compare different quality systems
Evaluation of primary care systems (Schäfer et al., 2013)	Three levels of primary care analysed – primary care systems – organisation, financing and workforce.	Primary care service provision at GP practice level	Patient level outcomes	Large analyses across 35 countries. Complex results broadly supporting need for strong primary care systems to create good quality healthcare
Evaluation elderly care nurse practitioner (NP) service.(Dwyer et al., 2017)	Structural dimensions of the nurse practitioner service as a hospital avoidance service.	Referral process; response process and flow process	Consequences of the interventions for the patients	Qualitative research. Methological approach provided useful way to anise a complex situation.

In all of these examples the model provided a useful method to consider all the possible factors that might affect the type of outcomes obtained, be it an entire local primary health service (Reeve et al., 2015), a specific diseases specific service (Nocella et al., 2016) a disease quality outcome (Neville et al., 1996); or the evaluation of costs for a disease intervention (Nuckols et al., 2013). However, the studies are not all of equal

quality, nor are they all of equal relevance to this research project. A number of them only consider a limited range of possible indicators in each of the SPO domains. For example, the Swedish study of hospital quality systems (Kunkel et al., 2007) found a strong relationship between the SPO domains. The indicators included in the three domains were elucidated by the results of questionnaires but were limited and did not take into account many of the possible indicators. This was also the case in the paper describing the telemonitoring for diabetes service (Nocella et al., 2016); and the evaluation of palliative care (Bainbridge et al., 2010) and evaluation of the nurse practitioner role in Australia (Dwyer et al., 2017). The QUALICOPC project (Quality and costs of primary care in Europe), examined the effect of the strength of the primary care system on the quality of health care provision. Indicators were created as a result of information and data collected from questionnaires from approximately 7500 GPs and 7500 patients as well as existing sources of data from 34 countries. The level of analysis was very complex but broadly supported the value of a strong primary care system to help achieve healthcare that scored highly in quality costs and equity. Whilst this supports the inclusion of indicators measuring primary care organisation attributes, the scope of this study was too large to be of specific use in adapting a Donabedian SPO model in this research project.

One paper that is useful to this research described the adaption of the Donabedian SPO model to understand and evaluate the relationship between quality and cost for type 2 diabetes (Nuckols et al., 2013). It describes a similar situation to the one identified by this research project (see chapter 2), namely that in the field of research looking at quality and health costs there is no one accepted framework that connects up the specific dimensions of quality to variations in healthcare costs. They have

searched the literature and concluded that the lack of a conceptual model has led to published research where measurements differ from study to study (some focusing on structural quality indicators and others looking at process and outcome indicators). The framework that they have developed has taken the Donabedian SPO model and adapted this by taking into account work by the Institute of medicine (IOM), RAND Corporation researchers and economic methodology used in cost effectiveness analyses and cost benefit analyses. This is very similar to the methodology adapted here, whereby the Donabedian SPO model is the starting point for the development of PCO profiles with additional research from literature examining the influences on prescribing as well as research into the importance and influence of PCOs on prescribing behaviour.

The approach adopted by Nuckols et al. (2013) has been to take the outcome measure of costs that are influenced by health driven quality of care and identify the potential structural, process and outcome indicators. They firstly identified that there were three external factors that influence quality and cost but are not dimensions of quality, namely: the specific clinical indications or disease that define the healthcare process and population; the demographic characteristics of the target population and the characteristics of the local healthcare provision. They have given no detailed explanations as to how they arrived at these three categories, although the categories have been identified in some of the research into quality of healthcare described in this chapter (Klassen et al., 2010, Kelley E, 2006, Arah et al., 2006). They mirror the systematic review into prescribing influences described in chapter 2. This review found that the patient characteristics were deemed to be important; the local healthcare provision of services and interactions between professionals from other organisations

were crucial and varied according to the disease area; the characteristics of the organisation being studied were important. Their second change to the model was to add sub domains to three SPO domains and their third was follow the reasoning to join up specific quality issues to the related economic costs. They were able to draw up a model with indicators chosen to fit into the following principles:

- Structural subdomains: disease or circumstance specific characteristics; quality improvement systems and general structural characteristics
- Process subdomains: Appropriateness and Medical errors
- Outcome subdomains: Disease or condition specific and Health Status

Another paper of particular interest was that of Mahdavi et al. (2018) where they adapted the Donabedian SPO model a disease specific model where the outcomes were glycated haemaglobin (HBA1C), measurements, quality of life and patient satisfaction. They had added in context measures of disease and patient characteristics of the population studied as a separate domain although these subdomains are defined in the structural domain by other researchers. The main relevance to this research was the creation of a SPO model where the individual indicators formed the variables in the statistical analysis to determine the relationship between outcomes and the context, structure and process variables. There were issues around the completeness of the data in the different regions, there was no explanation as to why some of the indicators were included in the analysis (for example smoking, physical activity, age) and some of the data was collected at network level with other data at patient level. In addition, structural indicators previously found to be significant (organisation management, collaboration) were ignored. However, the

research did demonstrate how it is possible to adapt the Donabedian SPO model and use this structure to perform a statistical analysis of the relationship between outcome variables and the structural and process variables. Similarly to this research project, a number of organisations were compared. The statistical analysis in this study was complex with several analyses run to investigate the S-O, P-O relationships for each of the 3 outcome variables. However, the researchers unable to reach any generalised conclusions as to the link between SPO domains in the different regions.

A third paper that was of importance in helping to shape my own adaptation of the Donabedian SPO model was the evaluation of primary health services (Reeve et al., 2015). Their adaption of the Donabedian SPO model was illuminating because they took the SPO model and applied the common quality dimensions (accessibility, appropriateness, effectiveness, responsiveness, continuous care and efficiency) to each of the domains. They also used nationally produced health indicators that were most relevant to their context and where they answered the questions that they needed to ask. However, there are some differences and there are additional tables (called key foundations) included in the framework to measure the socio-economic determinants of health; essential requirements for the structural domain and quality of care indicators needed to ensure service performance and monitoring. The key foundation tables and indicators are similar to those included in other Donabedian SPO models in their relevant domains, the content follows the same pattern and methodology as other adaptations of the Donabedian SPO model. The ultimate model may be much more complete, but this paper only describes the process of creating the model and deciding upon the individual indicators. There is no description of it being used with actual data

and so no elucidation of how the different tables within the framework would be joined together to analyse the primary health services.

The final paper that was useful in pulling together ideas on how to adapt the model for this research project was an evaluation of asthma care in general practice in the UK (Neville et al., 1996). This paper focused on 200 practices recruiting 30 patients each and collecting data and information from these patients in the manner of a clinical trial. The structural domain was only concerned with the age and gender of patients, whether they were FHSA accredited, recently audited asthma care or whether there was a specialist asthma nurse. Despite this it was instructive in the development of a framework using UK data and opening up the possibility of using this sort of analysis to examine primary care behaviour of another type, namely prescribing behaviour.

3.6. Adaptation of the Donabedian SPO model

In considering whether to use the Donabedian SPO model as a basis for understanding influences on prescribing it was important to look at the list of influences identified from the systematic review (Chapter 2) and see if they were consistent with the possible descriptions of individual indicators that make up the three domains (structure – process – outcomes) of the model. When allocating the influences the definitions of the three domains by Donabedian A (2003) will be followed, namely:

- Structure Domain. The conditions under which care is provided. This includes facilities and equipment, human resources and organisation characteristics. The way that the healthcare system is set up and managed and influenced.

- Process Domain. The activity constituting the healthcare and the way in which it is provided.

- Outcomes Domain. The changes seen as a result of the processes.

The adapted Donabedian SPO model in this research used the examples of the adaptations described in table as well as the results from Klassen et al. (2010) outlining the common features of adapted quality and performance frameworks and Glickman SW (2007) on the organisation aspects of the structural domain. That is, in addition to the descriptions of each domain developed by Donabedian himself, who during his time researching this area adapted his own SPO model to fit the subject area being studied (Donabedian A, 1980). Finally, in a paper by Mainz (2003) the definition and classification of clinical indicators used to describe health care performance and outcomes making up the structure, process and outcomes domain are reviewed and a list of type of information in each domain has been described. The principles outlined in this paper were also used to assign the influences on prescribing to the appropriate domain. When considering how the influences might fit into the model it is important to understand the ultimate aim of this research – namely to understand the influences on prescribing.

3.6.1. Structure domain

The following subdomains and indicators in Table 9 have been identified as being part of the Structure Domain (Donabedian A, 1980, Mainz, 2003, Nuckols et al., 2013, Klassen et al., 2010, Glickman SW, 2007).

Table 9: Structure domain in the Donabedian SPO model

Subdomains or groupings	Descriptions of the type of information
structural	Organisation culture; organisation management; type of organisation
Collaborative	Organisations working together within local environment; professionals working together
Organisation	Organisational priorities and plans
Workforce	Numbers of available personnel; type of personnel
Quality systems	Local responses to national quality / guidelines

Financial	Resources available
Health and socioeconomic demographics	Patient population; population classifications (socio-economic and demographic)
External organisational influences	Government departments, parent management structures; external organisations

All of the papers that have described adaptions to the Donabedian SPO model have stressed that the subject being studied defines the outcome indicators that are chosen and these in turn influence the way in which the structural and process indicators are chosen (Table 8). Some indicators may be generic whilst others are specific to the disease or condition being studied (Mainz, 2003).

3.6.2. Process domain

The following subdomains and indicators (Table 10) have been identified as being part of the Process Domain (Donabedian A, 1980):

Table 10: Process domain in the Donabedian SPO model

Subdomains or groupings	Descriptions of the type of information
Services or processes available	clinical audit of the quality of services available
	Responsiveness, accessibility of services
	Equity and appropriateness of care

3.6.3. Outcomes domain

The following subdomains and indicators have been identified as being part of the Outcomes Domain (Donabedian A, 1980) (Table 11):

Table 11: Outcome domain in the Donabedian SPO model

Subdomains or groupings	Descriptions of the type of information
Disease specific morbidity	
General health status	
Measures of effectiveness	Specific indicators relevant to the disease or clinical situation being studied

3.7. Matching the Influences on prescribing to the domains and indicators in the Donabedian SPO model

The influences on prescribing that were identified in the systematic review in Chapter 2 are listed in the table below, together with more detailed description of the type of influence that was described in the individual papers included in the review.

Table 12: Influences on prescribing in primary care

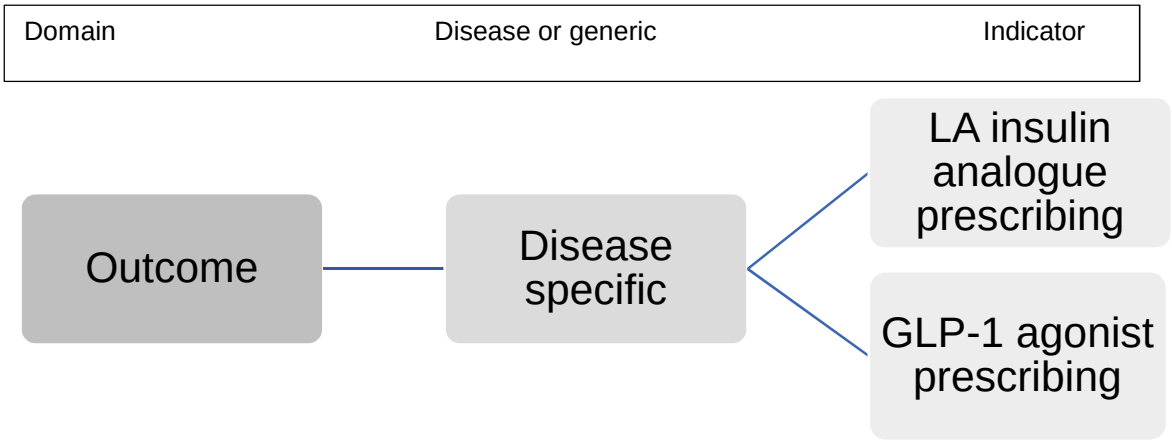
Influences (obtained from the systematic review)	Detailed description of the influences identified in the systematic review
Audit and Education influences	Audit and feedback; education initiatives; computer decision programmes
Clinical Guidelines influences	Adherence to clinical guidelines
Financial influences	Financial considerations for the organisation
GP influences	GP demographics; GP training specialist qualified; GP patient relationship; prescribing behaviour (adoption of new drugs)
Medicines Management influences	Medicines Management involvement; specific formulary decisions; incentive schemes
Organisational influences	Organisation culture, cohesiveness; Organisation attributes (size and profile)
Organisational priority	Organisational level priority and interest in specific project
Patient influences	Patient education; patient GP relationship
Patient population	Patient disease prevalence; socio-economic classification of the population
Pharmaceutical company influences	Sales and marketing approaches to GPs
Secondary Care and other NHS organisations in LHE influences	LHE analysis - Relationship between acute and primary care; organisations involved in area prescribing committees; involvement between primary and secondary care in joint formularies

3.7.1. Defining the outcomes indicators

The process of matching these influences with the descriptions of the three domains of the Donabedian SPO models in Tables 9, 10 and 11 was carried out in stages. The first stage involved clarifying what the outcomes of the model would be. This research

is focused on the influences on prescribing for type 2 diabetes by GPs in primary care. Therefore, the logical outcome measures will be the prescribing for drugs to treat diabetes by GPs in primary care over the period of study. The specific outcome indicators chosen were the prescribing of two relatively new classes of drugs used to treat type 2 diabetes during the period of this study, namely the LA) insulin analogues and the GLP-1 agonists. Both of these two groups of drugs had recently been introduced prior to the period of this study but during this study period had been two areas where the reduction of prescribing has been an aim of national initiatives and guidelines because of cost issues (National Prescribing Centre, 2012), but their use was part of the treatment options available to help control and lower blood glucose levels in people with type 2 diabetes.

Figure 2 Indicators used in the outcome domain



3.7.2. Matching influences on prescribing to the subdomains and indicators in the structure domain

The next stage of the exercise was to take the structure domain categories and see how they matched up to the influences in Table 12 above. Crucially, it was important to go back to the aims of this research where the level of analysis was chosen as the PCO. This meant that the structural dimensions would need to correspond to this organisational level. The description of the structural subdomain corresponds closely to the organisational influences identified in the table above.

When considering the collaborative subdomain it became clear that there are two dimensions to the level of collaboration that might be evident when considering prescribing influences. There are the collaborative efforts associated with GPs working with professional colleagues (such as consultants specialising in diabetes) at the local acute trusts). This is a disease specific collaboration. However, there are also more generic collaborations between GPs in PCOs such as the links between GPs and medicines management personnel (in PCOs and acute trusts) as well as acute trust

staff who work together on area prescribing committees. This is also the situation for local formulary committees that seek to influence prescribing behaviour of acute trust staff as well as the PCOs that refer patients to these trusts. The prescribing influences in Table 12 that correspond to these dimensions are the Secondary Care and other NHS organisations in LHE influences.

The importance of the organisation and how involved and committed to improving the outcome is the next subdomain to be considered. This is mirrored in the prescribing influences (Table 12) by the identification of diabetes as an organisational priority and the planned developments to improve diabetes care. The next subdomain was workforce and in the context of the PCO this would correspond to the GPs working in practices that are attached to each PCO. The GP influences on prescribing that correspond to this subdomain are the characteristics of the GPs, and the specialist training in diabetes that they might have.

The quality systems subdomain refers to the national quality initiatives and guidelines. When we are considering this project, it is the PCO response to these quality systems that is of importance. However, the quality systems most relevant to the prescribing for type 2 diabetes are those that make up the clinical audit targets of the diabetes QOF. Details of the diabetes QOF targets and use of the data is available in chapter 4 and Appendix 1). These specifically address the control of blood glucose levels in patients with diabetes. However, when the outcome indicator is the prescribing rate of drugs used to control blood glucose levels, data pertaining to the achievement of blood glucose levels in patients reflects the process that the GP is following. It is the same situation when we consider the adherence to national clinical guidelines that are also measured in the diabetes QOF targets (see chapter 4 for a description of the individual

data that make up these targets). Another possible indicator could be the local guidance for the use of drugs to treat type 2 diabetes restrict the choice of drugs according to the clinical needs of the individual patient. The local PCO response to encourage GPs to prescribe in accordance to the national guidelines is to produce local formularies with specific advice and restrictions. This is a disease specific indicator (and is actually more specific being focused on particular drugs in a class of drugs). However, since this model is specifically concerned with prescribing choices this indicator has been deemed to be more appropriately placed in the process domain.

The financial subdomain refers to the amount of resources that are available to the organisation. This could be a generic indicator although prescribing spend is only a small percentage of total spend of each PCO and so it would be more useful to look at the total spend on diabetes for each PCO. This indicator matches the financial influences on prescribing described in Table 12.

The health and socio-economic subdomain is a mixture of a disease specific indicator In terms of the patient population with diabetes and a more general description of the population reflecting their need in relation to diabetes. This matches to the patient characteristics identified in Table 9.

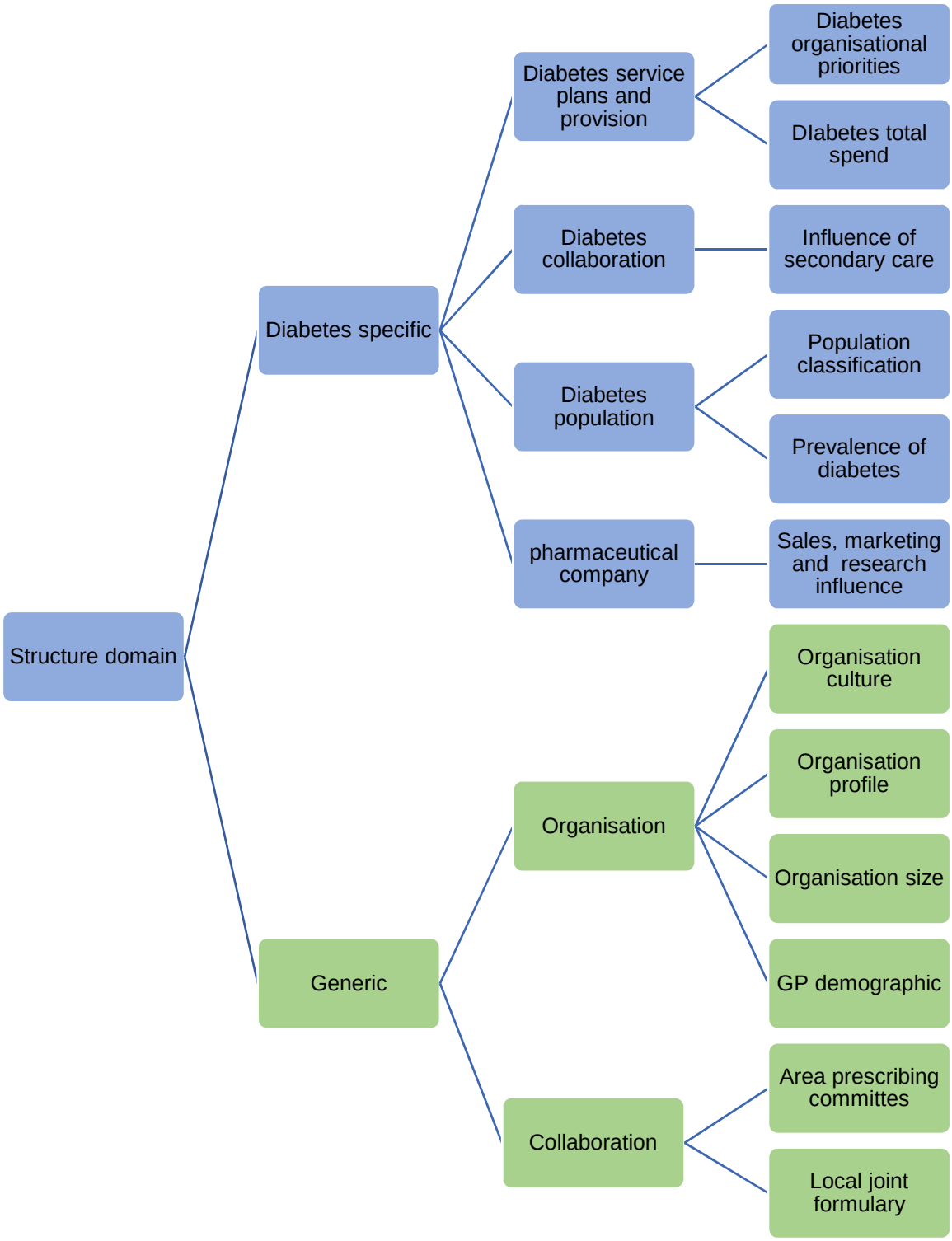
External organisations in the final subdomain can be matched in the prescribing influences table to the influence of pharmaceutical companies who have contact with PCOs and the GPs in the organisations in order to promote the prescribing of their drugs to treat diabetes. Other influences that might be matched to this subdomain could be government and Department of Health (DoH) initiatives to change prescribing behaviour, however, as was discussed above for the quality systems subdomain-

these are more relevant to the process domain in this particular adaptation to the model because they directly affect changes in prescribing behaviour.

Having gone through this exercise, the structure domain in this adapted Donabedian SPO model now had the following influences on prescribing matched to it:

FIGURE 3 : Prescribing Influences assigned as indicators to the structure domain

Domain	Disease or generic	subdomains	Indicator



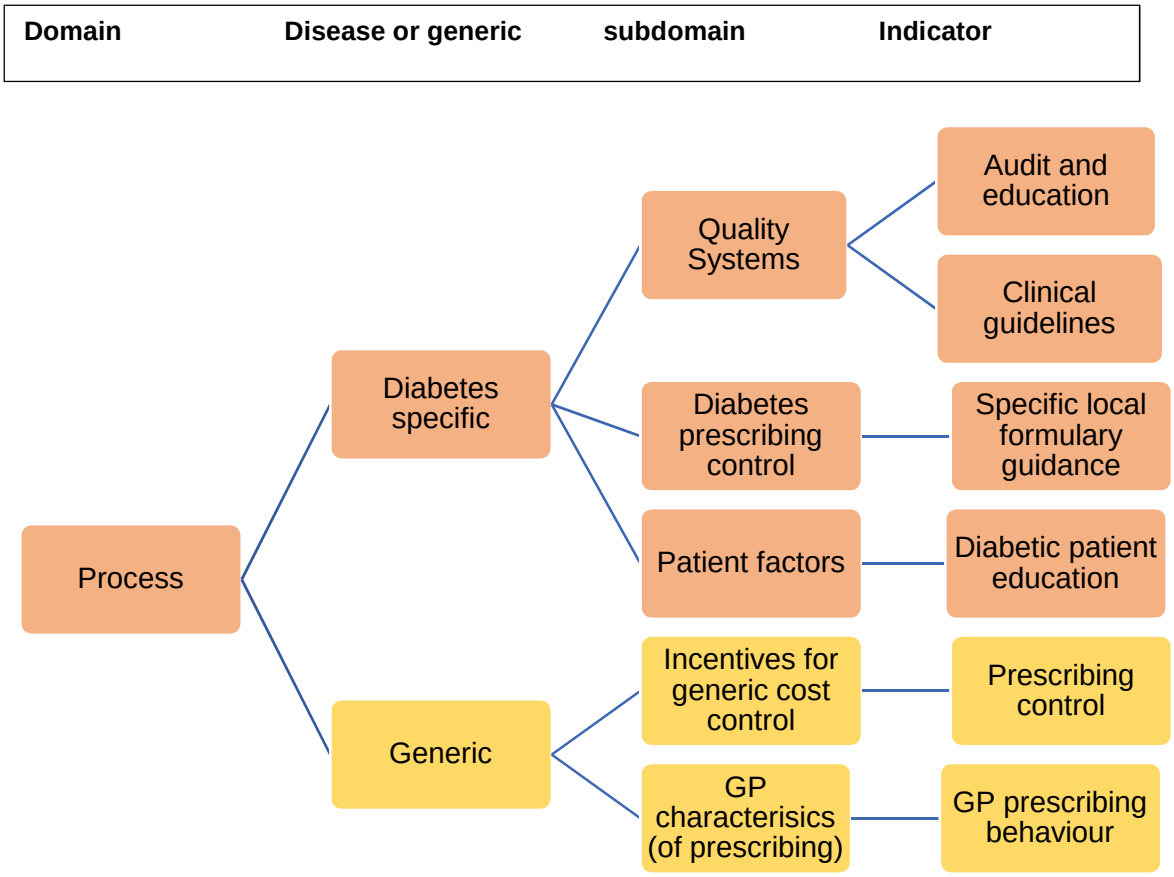
3.7.3. Matching influences on prescribing to the subdomains and indicators in the process domain

The process domain, related to prescribing influences, concerns the way in which the GPs in a PCO carry out the process of prescribing. There are two aspects to this – how they prescribe in general and how they prescribe for diabetes. Furthermore, the Donabedian SPO model describes a measurement of the quality of the process. This would translate in this adapted model to measures of how well the prescribing of GPs in each PCO corresponds to national standards, initiatives and guidelines both in terms of general prescribing and for diabetes specific prescribing behaviour. The influences on prescribing that match to these descriptions are for disease specific indicators; the attainment of audit and education targets and adherence to the clinical guidelines. The other measure is how GPs in a PCO are prescribing appropriately would be to look at the local formulary guidance for drugs to treat diabetes. This indicator matches up to the specific guidance in local formularies and local prescribing incentive schemes described under the heading of medicines management influences in Table 12. It reflects the local response to national guidelines outlining the recommended use of the two classes of drug. The degree to which patients are able to understand the importance of taking their medication and managing their disease appropriately also influences the take up of both groups of drugs, particularly since both classes are usually self -injected and patients need to be competent to do this. Other patient factors such as patient - GP relationship may also be included in this group of indicators.

General prescribing behaviour and variations within an organisation, in accordance with national recommendations were identified as part of the medicines management influences (this is generally the part of the PCO charged with getting GPs to achieve nationally created and locally agreed prescribing targets). Finally, innate GP

characteristics in terms of adoption of new drugs (part of the GP influences in Table 12) was identified in the systematic review of chapter 2 as a possible influence on GP prescribing behaviour. Therefore, this is another measure of generic GP prescribing behaviour in PCOs that can be captured in the process domain indicators. Using this information, the following process has the following influences on prescribing matched to it:

FIGURE 4: Prescribing influences assigned as indicators to the process domain



3.8. Discusssion

In this chapter I have shown that the Donabedian conceptual model is a useful framework for evaluating the factors that influence a clinical process and subsequent outcomes (Braithwaite et al., 2017, Gardner and Mazza, 2012). The model has been used and validated in a range of projects in a variety of clinical situations from disease management (Mahdavi et al., 2018, Neville et al., 1996) to whole healthcare systems (Reeve et al., 2015, Ameh et al., 2017), individual interventions such as telemonitoring in type 2 diabetes (Nocella et al., 2016) and quality cost effectiveness of type 2

diabetes interventions (Nuckols et al., 2013).This has suggested that the model might be suitable to use when evaluating the influences on prescribing in type 2 diabetes. The use of the model is not without issues because it implies that the structure – process – outcome relationship is a linear one and therefore that indicators in the structural domain have no direct effect on final outcomes. However, there is evidence in some of the research using this model that the relationship may not be so strictly defined and that structure can have a direct relationship with outcome measures (Ameh et al., 2017). This has also been concluded by Donabedian himself (Donabedian A, 2003). It has also been found to be essential to adapt the indicators in the three domains to the subject being studied. The outcomes are specific to the research aims and the structure and process indicators must relate to them. Indicators must be carefully chosen and measured to provide an accurate picture of the relationship the three domains (Mainz, 2003).

A possible limitation of choosing to define the outcome indicators purely in terms of prescribing is that other wider outcome measures reflecting the effects of the prescribing on the health status of patients may be missed. Outcomes could have included overall patient satisfaction, clinical morbidity and mortality. Prescribing is just one aspect in the management of a chronic condition such as diabetes. Low levels of prescribing for the two classes of drug studied in this research could be associated with the poor clinical outcomes that result from inadequate control of HbA1C. However, it could also be found in patients with good clinical outcomes being treated with older alternative drugs but more intensive clinical support systems within their local organisations. It might therefore be argued that the Donabedian SPO model would more appropriately be utilised to understand the influences on overall management of

diabetes and that the outcome indicators could also reflect overall disease outcomes as well as specific prescribing outcomes.

There has been no published research on the use of this model when analysing the influences on GP prescribing behaviour (or on any prescribing behaviour). However, it seems that adopting this conceptual model would be appropriate and could provide a useful framework to evaluate the importance of the possible influences on prescribing that were identified in the systematic review in Chapter 2. Therefore, a process of mapping the influences on prescribing against the three Donabedian domains was carried out. Modifications and adaptations to the definitions of the type of indicators that should be considered in each domain were summarised in Tables 10,11 and 12, taking into account work from the field of organisational behaviour (Glickman SW, 2007) and work identifying common themes that have been identified as important when measuring factors important in quality improvement and performance management (Klassen et al., 2010).

The exercise to map the influences on prescribing onto the three domains started by defining the outcome indicators. These were chosen according to the aim of this research project, namely the prescribing behaviour of GPs in PCOs when prescribing for patients with type 2 diabetes. Once this was agreed, it was found that the influences on prescribing corresponded closely to the descriptions of indicators in the three domains. This model was then applied in the next part of this project, where specific indicators to reflect the influences on prescribing were sought to allow the population of the model.

3.9. Summary

The Donabedian SPO model is a suitable conceptual model to use to group the influences on prescribing in primary care. Having decided upon the outcome indicators, it was possible to assign the influences on prescribing to the structure and process domains that make up the remainder of the Donabedian SPO model, creating a new framework for the analysis of prescribing. Population of the PCO profiles with data is discussed in the next chapter.The resulting framework and PCO profiles will then be used connect the influences on prescribing and prescribing rates for 2 classes of drug used to treat type 2 diabetes.

CHAPTER 4: APPLICATION OF MODEL TO SAMPLE DATA

4.1. Introduction

In the previous chapter, an adapted Donabedian SPO model for prescribing was developed, and then tailored for prescribing in diabetes. This model formed the structure used to create the PCO Profiles. This chapter collates publically available data and information and sets out the criteria for assessing the data for validity and usefulness in measuring the influences on prescribing in PCOs. The suitable data and information is then used to create PCO profiles for all 211 PCOs in England for three successive years from 2011/12 to 2013/14.

The information sources used in this research are all publically available and can be categorized as follows:

- Diabetes datasets – nationally available;
- Diabetes specific information – available from local PCOs and other local NHS organisations;
- PCO organisational and non-disease specific information – nationally available
- Local NHS Organisational and non-disease specific information - available from local PCOs and other local NHS organisations.

The information used to create the indicators is both quantitative and qualitative in nature. For the purposes of this analysis it was important that the qualitative information (textual) was coded and scored to allow for a quantitative comparison across organisations.

4.1.1. Selection of outcome indicators

Before it was possible to identify suitable information and data to create the indicators it was important to identify specific outcome indicators. Once this was done it was possible to find structure and process indicators that were relevant to the outcome indicators.

Two outcome indicators, both measuring the prescribing of two classes of new drugs that had been introduced for management of type 2-diabetes (LA insulin analogues and GLP-1 analogues). Both of these two groups of drugs had recently been introduced prior to the period of this study but during this study period had been two areas where the reduction of prescribing has been an aim of national initiatives and guidelines because of cost issues. Prescribing of both groups of drugs was consistently targeted in an effort to save money on prescribing costs from 2011/12 to 2013/14 (National Prescribing Centre, 2012).

The increasing uptake of the expensive LA insulin analogues over cheaper isophane insulin products was targeted by the QIPP programme (Health and Social Care Information Centre, 2013b) as a way of reducing prescribing spend in PCOs. It was therefore an example of a drug class that may have been actively discouraged by many PCOs. This was reflected in the recommendations in many of the formularies during this period whereby prescribing was only recommended as a second line option if isophane insulin was found to be unsuitable. It was often also one of the indicators chosen by PCOs as part of their prescribing incentive schemes to reduce or contain costs in prescribing budgets. In a similar way, GLP-1 agonists were chosen because they were a relatively new therapeutic class of drug used as third line therapy in type 2 diabetes often as an alternative to initiating insulin. GLP-1 agonists' place in the

treatment of type 2 diabetes, according to NICE Guidance (NICE Guidance CC87, 2009) was after the cheaper and more established agents (metformin and sulphonylureas). To encourage the use of metformin and sulphonylureas, the rate of their use was also measured, and they both were also the subject of QIPP (with the aim of increasing use in the majority of patients). Despite these initiatives, however, during 2011/12 to 2013/14 analysis of diabetes drug prescribing data in England from 2005-6 to 2013-14 found that the number of items of newer antidiabetic drugs increased by 164.3% from 2005-6 to 2013/14 with an attendant rise in net ingredient cost of 129.6% for the same period (£102.9 million) (Health and Social Care Information Centre, 2014d). Uptake of GLP-1 agonists was greater than predicted (according to costing models created by NICE) when the 2013/14 prescribing patterns were analysed, with prescribing rates being 8% higher than expected (Health and Social Care Information Centre, 2014c). A study in the UK (y Thong et al., 2014) reported two nationwide audits on the use of GLP-1 agonists and found that they were being used outside the indications recommendations by national guidelines available at the time.

Analysis of the prescribing behaviour of individual PCOs showed that that the rate of adoption of these newer drugs was very different depending on the particular organisation studied. It was found that prescribing of the newer insulin analogues (as a % of all long and intermediate acting insulins) ranged between 38% and 98.6% across organisations (average being 85.3%) (Health and Social Care Information Centre, 2011). An updated report in August 2014 showed that this variation between PCOs still existed following the organisational changes. The difference between the prescribing rates of LA insulin analogues in 2013/14 in PCOs ranged from 37.6% to

97% in 2013/14 (average figure of 82.2%). These differences cannot solely be explained by a variance in the prevalence of diabetes (Health and Social Care Information Centre, 2014d).

This intended restriction on the prescribing of these two groups of drugs for type 2-diabetes to save money did not necessarily fit in with the clinically orientated targets to gain a tighter control of blood glucose levels. NICE in its national guidance has recommended that tower blood glucose levels are critical to reducing complications, improving patient outcomes and reducing (or at least, limiting) total money spent on type 2 diabetes (NICE Guidance CG66, 2008). In the treatment of type 2 diabetes, it is recommended that the prescribing of different medications and alterations of dosing of insulins and oral diabetic medication is done in response to a number of clinical markers such as levels of blood glucose (measured as HbA1c). It has been found in a number of studies that intensive treatment with antidiabetic drugs can reduce micro (amputations, chronic renal disease and retinopathy) and macro (myocardial infarction, heart failure and stroke) vascular complications that are causes not only of major disability but also shortened life expectancy (Control and Complications Trial Research Group, 1994). The LA insulin analogues and GLP-1 agonists are both groups of drugs that can be added in to the drug regimens of type 2 diabetics when the control of HbA1C is suboptimal (NICE Guidance CC87, 2009).

It was clear from looking at the published data described above that there was an opportunity within this research project to obtain a range of comparative data and information for all PCOs in England that could reflect influences on the prescribing behaviour of GPs as well as recording the differences in prescribing data down to individual drug level for the organisations from 2011/12. If this year was used as the

first year for this research then the enormous changes to PCOs as organisations taking them from largely management controlled Primary care Trusts in 2011/12 towards GP led organisations (Clinical Commissioning Groups) in April 2013 could also be studied. Finally, if diabetes was the chosen disease area, then the uptake and use of two new drug classes (LA insulin analogues and GLP-1 agonists) could be compared in different PCOs. A three-year study period from 2011/12 to 2013/14 would provide an opportunity to use the newly available data and measure influencing factors for PCOs that have undergone significant organisational change. Limiting the research to type 2 diabetes and specifically to two classes of drugs would further allow for analysis of the factors influencing an important and costly chronic disease over this time

4.2. Aims and objectives

The third aim of this research project was to construct PCO profiles for all PCOs in England based on the Donabedian SPO Model. In order to do this the following objectives were met:

- Examination of the data and information from national and local sources to ascertain if they could be used to measure the individual influences that had made up the indicators in the structure and process domains in the Donabedian SPO model.
- Creation and development of standards to be applied when considering acceptable data coverage levels; standards for inclusion of data; scoring criteria for data and information and rationale behind the division of all data into quintiles.

- Collection of data and collection, coding and scoring of information and storage in Excel spreasheets to reflect individual indicators for all PCOs for each of three years from 2011/12 to 2013/14.

To allow for comparison of each influence within the PCO Profile all collected data and information was also scored into one of 5 groupings (quintiles). The rationale for scoring following the general principle that the greater the value (be it prevalence, level of spend, numbers of referrals, cohesiveness and achievement of management goals of the organisation) then the higher score.

4.3. Method

National guidance documents that focused on prescribing, diabetes, PCOs, quality indicators, and performance measurements were read to gain an understanding of the general situation in the NHS at the time of this research. Specifically, the pressures, targets, standards and guidelines that influenced and impacted upon PCOs (particularly those that affected prescribing, diabetes care and PCO organisations) during the three years were recorded. Following this, national datasets and local information sources that might be relevant to this research were identified and assessed to ascertain if they represented a measurement of the individual indicators previously identified as important as influences on GP prescribing behaviour. Finally, data and information was collected and saved onto Excel spreadsheets for all PCOs for each of three years. All the data and scored qualitative information was divided into quintiles to allow for comparison (see chapter 5).

4.3.1. Criteria for using data and information

The inclusion criteria for using data from these information sources to populate the PCO Profile followed previous published work by Mainz on the definition and

classification of clinical indicators in the Donabedian SPO model (Mainz, 2003). Also, more broadly by the guidelines for choosing indicators to measure quality improvements developed in 2010 (Raleigh and Foot, 2010) . Accordingly, an inclusion criteria for the data was developed and is described below. In summary, data was included only if it provided a measure of the importance of each individual influence on prescribing within the PCO previously identified in the systematic review described in chapter 2. Simply having access to a dataset that covers all the PCOs in England over the time period of this study was not a reason for inclusion. When a possible data source was identified, it was examined to see why and how it was being collected. It was assessed to look for coverage across all PCOs for the three years, and the source of the data was identified; nationally collected (for example, QOF yearly data) or locally published by PCOs and acute trusts (local formulary guidance). The inclusion criteria described in the next section was developed.

4.3.1.1. Inclusion criteria for data and information

- it identified how well an influence has been adopted (in the case of audit and education; clinical guidelines; prescribing control; new drugs adopted; financial balance) or
- it described the relative situation in the organisation – relatively stable (population description; GP characteristics; involvement of local organisations within area prescribing committees) or
- it outlined patterns of behaviour (referral patterns, spend analysis)

In addition, the following rules applied:

- Wherever possible diabetes specific information was used, unless it was not relevant to the influence (for example organisational culture)
- Data had to be available for over 90% PCOs
- Nationally available and locally available sources were examined to see if useful data was available for each influence.
- Data was chosen to measure the effectiveness of the intervention wherever possible (for example the effectiveness of audit and education and prescribing incentive schemes)
- Wherever possible, raw data was used that had not been adjusted for differences in the population (this was been taken into account by other indicators).
- Once the dataset had been identified, the data was examined to ascertain whether it had stayed the same over the research period and whether it had been collected in the same way over the three years.
- To create the most robust analysis possible, wherever possible more than one set of data was used to score each influence. Where this was possible, each influence was scored separately and these scored combined to provide a final single score.

The period of study was from 2011/12 to 2013/14, and followed the NHS financial year from April to March. This period encompassed the change in PCOs in England from Primary Care Trusts (PCTs) to Clinical Commissioning Groups (CCGs). To allow for the analysis to provide a meaningful comparison for organisations over time, wherever possible data was built up from practice level information. Organisational data and textual information at PCT level that could not be created in this way, was scored at

the separate organisation level and matched from parent PCTs to the related CCGs across the three years.

4.3.2. Potential data sources

There were two sources of information and data for this research, nationally collected from all PCOs or locally published by individual PCOs and acute trusts.

4.3.2.1.Nationally published information

There were a number of datasets collected nationally from or about all PCOs in England for the period of this study. National guidance and review documents discussing prescribing, diabetes management, PCO management and development, targets and priorities, and measurement of quality indicators and outcomes produced by the DoH, NHS Commissioning Board, NHS England, NICE, Public Health England, Audit Commission, National Audit Office, Right Care, Atlas of Variation and The Kings Fund were read to identify possible datasets that may be relevant to this research. The main source of relevant data was the Health and Social Care Information Centre (HSCIC). Other sources are listed in Table 13 below together with those datasets that were scrutinised to ascertain their relevance for this research. A more detailed description of the datasets is given in Appendix 1.

Table 13: Summary of nationally collected datasets appraised for inclusion in this research

Dataset	Source
Diabetes Clinical Data sets	HSCIC
Hospital Episode Statistics	HSCIC
Innovation Scorecard	HSCIC
Mortality data	HSCIC
National Diabetes Audit	HSCIC
Prescribing Data	HSCIC
Prescribing comparators	HSCIC
Quality Outcomes Framework (QOF)	HSCIC
Workforce Analysis	HSCIC
Years Lost	HSCIC

Better Care Better Value	NHS Improving Quality
Programme Budgeting Spend Analysis	NHS England
PCO Organisational Changes	NHS England
PCO Annual Risk Assessment Reports	NHS England
PCO Authorisation Waves	NHS England
CCG Diabetes Classification	Public Health England
Diabetes Outcomes versus Expenditure (DOVE) Tool	Public Health England
Healthier Lives	Public Health England
Atlas for Variation	Right Care
CCG Commissioning for Value	Right Care
Spend and Outcome Tool	Right Care

The nationally collected data had many advantages. The major one was that there was excellent coverage of data across all the PCOs in England over the period of this research for all of the major data sources such as QOF, Prescribing data, HES, Better Care Better Value, NICE Innovation Scores and Programme Budgeting. Another advantage was that the data sources were already being used extensively to compare PCOs and help them to gain an insight into how they might wish to improve or change their services and are publically available for inspection and scrutiny so there is a pressure on the reporting PCOs and managers of the national dataset for accuracy.

However, there are also some potential disadvantages. Firstly, there is a potential political motivation to present the most positive picture for any individual indicator. Secondly, often only the final situation is presented – for example the information about the CCG waves of authorisation is accurate but does not give the full picture of organisational change before that situation was arrived at. Specific limitations with each dataset have been described in Appendix 1 but there are some general issues in terms of measurement and validity. There was a possibility that differences recorded from year to year may be due to changes in recording rather than clinically significant differences and data quality is impossible to control and there is always the possibility that this has caused anomalies in the results. However, the importance of these datasets has increased over the last ten years and since PCOs, acute trusts and NHS

management have focused on this area, it might be argued that accuracy of the data has become more important to the PCOs.

4.3.2.2. Local NHS organisations as a source of information

One of the main sources of information about PCOs was the organisations themselves. They are publically accountable organisations and under a legal obligation to make available certain pieces of information to the public. Under the Freedom of Information Act, they must provide organisational information, governance arrangements, financial information (income and expenditure breakdown), strategy and performance information, plans and reviews, how the organisation makes decisions, policies and procedures (NHS England, 2015). All PCOs produce an Annual Report and Annual Accounts, as well as yearly commissioning intentions and plans.

4.3.2.3. Pre April 2013

Following the 2010 White Paper (Lansley, 2010), PCTs joined together to form clusters and SHA grouped together to form SHA clusters. They facilitated the creation of pathfinder and emerging CCGs. During 2011/12 and 2012/13 PCTs remained statutorily accountable as organisations although PCT Clusters were formed (to allow some capacity to help create emerging consortia and as part of a bigger drive to reduce running costs in the NHS). PCTs or PCT clusters were responsible for delivery of 2011/12 and 2012/13 operational plans, although some pathfinder or emerging CCGs produced their own commissioning plans during this period and even if they did not produce their own plans, they were encouraged to take part in planning and development of the operating plans. SHAs (or SHA Cluster) were responsible for operational delivery and management of the PCT's delivery of requirements set out in the NHS Operating Frameworks (Department of Health, 2010).

4.3.2.4. Post April 2013

From April 2013, PCT Clusters and SHAs were dissolved and CCGs and Area teams became the new organisations with responsibility for The Planning Cycle for PCOs is approximately 18 months. CCGs share first draft of plans with the Area Team Directors. Final Plans were agreed by 5 April 2013 and approved by the NHS Commissioning Board by 10 May 2013 (NHS Commissioning Board, 2012d).

4.3.2.5. Documents produced by PCTs, PCT Cluster, Practice Based Commissioning Groups and CCGs

Table 14 below sets out the different types of documents produced by PCOs over the period 2011 - 2014. It is not exhaustive because some have produced additional strategy and commissioning or planning documents, and others have produced less. Similarly, the documents (other than the Annual Reports) are not all named in the same way.

Table 14: Documents produced by local PCOs

Document	Year	Organisation
Integrated Strategic and Operational Plan (ISOP)	2011/12	PCT or PCT Cluster (with or without input from CCGs)
Operating Plan	2011/12	PCT or PCT Cluster (with or without input from CCGs)
Annual Report	2011/12	PCT or PCT Cluster
Integrated Strategic and Operational Plan (ISOP)	2012/13	PCT or PCT Cluster (with or without input from CCGs)
Clear and Credible Plan	2012/13	CCG
CCG Plan on a Page	2012/13	CCG
Commissioning and Strategy Plan (CSP)	2012/13	PCT or PCT Cluster (with or without input from CCG)
Annual Report	2012/13	PCT or PCT Cluster
Local Delivery Plan (LDP)	2013/14	CCG
CCG Commissioning Plan (Intentions)	2013/14	CCG
Annual Report	2013/14	CCG
Clear and Credible Plan	2013/14	CCG
PCO Board Papers	2011/12-2013/14	PCT and CCG

4.3.2.6. Validity of the locally published information

It was important in this research project to understand how relevant the publically available documents were and how authoritative and reliable a source of information they could be. The planning and commissioning documents produced by PCOs were signed off and approved by the SHAs (2011/12 and 2012/13) and Area teams (2013/14) as well as being finally authorised by NHS England and latterly The NHS Commissioning Board. Delivery of the targets and priorities was monitored by the area teams and the NHS Commissioning Board, although the PCOs were not forced to reach the targets within the set timeframe (NHS Commissioning Board, 2012d). The advantages of using locally published information were that the development of organisations and views of the importance and success of local projects as seen by local groups of GPs and managers would be captured. In some PCOs there was extensive organisational change during the period from 2010 to April 2013 with several consortia being set up, merging and disbanding before the final configuration was decided upon. This information is lost in the National datasets. In the case of the use of local formularies and prescribing guidelines, these are by necessity produced by local organisations and no national dataset exists. Limitations of the local documentation include the possibility that PCOs may have been inclined to present the most positive picture to the local community and the public, so may have described a significantly improved service where the quantitative data may have contradicted the degree of improvement attained. Finally, the documents have not been produced in answer to a specific research question sent to them as part of this research. For example, there was a possibility that the organisation had identified major changes in diabetes care but had not mentioned this in any of the official planning documents.

4.4. Results of the examination of possible data sources

The results of the exercise to find and collect data and information to populate the model to be used in this research are described in this section. A number of findings are generic and have been presented in this first part of the results. The second part has focused on the creation of individual explanatory indicators that reflect the influences on prescribing and that make up the PCO profile.

The availability of comparative NHS data at PCO and practice level have been increasing steadily since the first PCO organisations were created in 1997. The Freedom of Information Act in 2000 allowed members of the public to request information from public authorities such as PCOs, health authorities, acute trusts and DoH. In addition, comparative data have been increasingly collected and made publically available in response to the UK Government Transparency Agenda policy in 2012 (House of Commons Committee of Public Accounts, 2012) and as a result of initiatives to reimburse NHS organisations to collect data such as QOF introduced in 2004/5 (Health and Social Care Information Centre, 2005).

4.4.1. Types of data and information collected – generic findings

A number of differences between the information and data were identified and a set of rules have been adopted to allow for uniform and logical manipulation of data. To allow for a meaningful comparison across the three years', data has been collated at PCO level wherever possible. This can be done when data was held at practice level and built up to cover the organisation. However, not all information or data could be manipulated in this way because it only existed at organisational level. This means that for 2011/12 year it was sometimes reported at PCT level (152 organisations) but in 2012/13 and 2013/14 it was available at CCG level (211 organisations). In the majority

of cases a CCG has been formed within the boundaries of a PCT and so the PCT information could be used for the relevant CCG. However, there were some instances where the resulting CCG was formed as a result of a merger of PCTs (7 CCGs) or as a result of the movement of practices within one PCT to join with practices from another PCT (3 CCGs). In these cases, it was not always possible to accurately allocate data to the new CCGs and it was apportioned from the PCTs to the new CCGs according to the ratio of the practices moving from each PCT to the CCG (this applies to the Programme Budgeting and the Better Care Better Value data). Some information has been retrospectively re-presented at CCG level for 2011/12 (for example prescribing data) and did not require any manipulation. The individual organisational changes from PCT to CCG are listed in detail in Appendix 2. NHS England provided a spreadsheet in 2014 mapping the best fit between PCTs and CCGs and this has been used to ensure that the calculations are as accurate as possible (Health and Social Care Information Service, 2014) .

For most of the data scoring these changes do not cause a problem because the data is linked to specific practices and not their parent PCO. However, some data is linked to the PCO and is not available at practice level. Therefore, the PCT scores must be apportioned to the new CCGs accordingly.

The quantitative and qualitative information that has been scored to create the measurements for the factors can be grouped according to the type and level of the data.

4.4.2. Quantitative data only available at PCT level

- 2011/12 Better Care Better Value Data

- 2011/12 Programme Budgeting Data

4.4.3. Qualitative information that is recorded at PCO level

- 2011/12 Area Prescribing Committee membership
- 2011/12 Local Formulary involvements within the LHE
- 2010 WCC Local Priorities
- 2011/12 Annual Report diabetes developments
- 2011/12 planned changes in diabetes services

4.4.4. Data at practice level

Wherever possible quantitative data has been collected at practice level and the practices linked to the PCO to calculate the PCO value. This gives us the most accurate picture of the results at PCO level. However, during the 3 year period there were changes to practices. These changes are reflected in the Organisation Profile (recording number of practices, % dispensing practices, % single handed practices) and in the GP demographics (age, gender and training of GPs**.** NHS England has provided a file linking practices with CCGs back to 2011/12 which was used for all calculations (Health and Social Care Information Service, 2014).

4.4.5. Data collected at practice level and calculated to provide PCO level data

GP Workforce analysis (age, gender, training)

- Practice analysis (% dispensing practices, % single handed practices, type of GP contract (GMS or PMS for example) and number of practices linked to a PCO)

- Prescribing Data (PACT) for drugs to treat diabetes, specific diabetes drug groups (LA insulin analogues and GLP-1 Agonists) and specific drugs (Exenatide, Liraglutde and Lixisenatide – GLP-1 Agonists).
- QOF Data for diabetes prevalence, attainment of audit and education and clinical guidelines adherence.

4.4.6. Changes in data during the period of this research

There were some differences in the targets or specific data that was measured over the three years. The new targets (in the QOF for instance) were applicable for all the organisations and reflected the changing landscape within the NHS in England so if required, the scoring rationale in each year was altered to reflect changes in national targets. This applied in the following comparators:

- NICE data changes over the period (GP prescribing behaviour factor)
- Changes in QOF targets (audit and education and clinical guideline factors)
- Organisation culture – changes in developments of the organisations over 3 years.
- Organisation Profile individual comparators over the three year period.
- Diabetes Priorities over the three year period (reflecting different NHS England priorities imposed on the PCOs)

4.4.7. Diabetes prescribing data

Prescribing data used in the analysis could not be split into treatment for type 1 or type 2 diabetes because the treatments were the same for both groups. In this case the total number of diabetics is used. This is commonly not expected to corrupt results because of the much smaller number of type 1 diabetics and the even distribution

throughout the population in each PCO (Health and Social Care Information Centre, 2014d).

4.4.8. Practice alterations

Practices have opened or closed during the period of study and although the practices within a CCG may change over the year it is possible that the number may remain the same. Similarly, new GPs will have joined practices and others will have retired. These changes were reflected in the GP demographics indicator and the Organisation Profile indicator.

4.4.9. Choice of weighted data

Some of the information sources described in Appendix 1 have used a weighted population when analysing the data. However, only non-weighted information has been used in this analysis because the purpose of this study is to identify key influences on prescribing so it would be inappropriate to have both an indicator for patient characteristics and use weighted data that has been adjusted for the population differences.

4.4.10. Collection and storage of quantitative data

In order to store the quantitative data in a systematic manner, separate Excel spreadsheets were created for each explanatory indicator. In all the spreadsheets columns containing SHAs, Area teams, practices and PCOs (PCTS and CCG) together with the relevant NHSID codes were recorded. To take account of the organisational changes in PCOs, both PCTs and the CCGs that were replaced in 2013 were identified and linked to Strategic Health Authorities and Area teams. Columns with the quantitative data for the explanatory indicator were then created for the three years of

this study. The precise manipulation of data required for each indicator is described in section 4.5. All spreadsheets are available for examination.

4.4.11. Collection, storage and coding of qualitative information

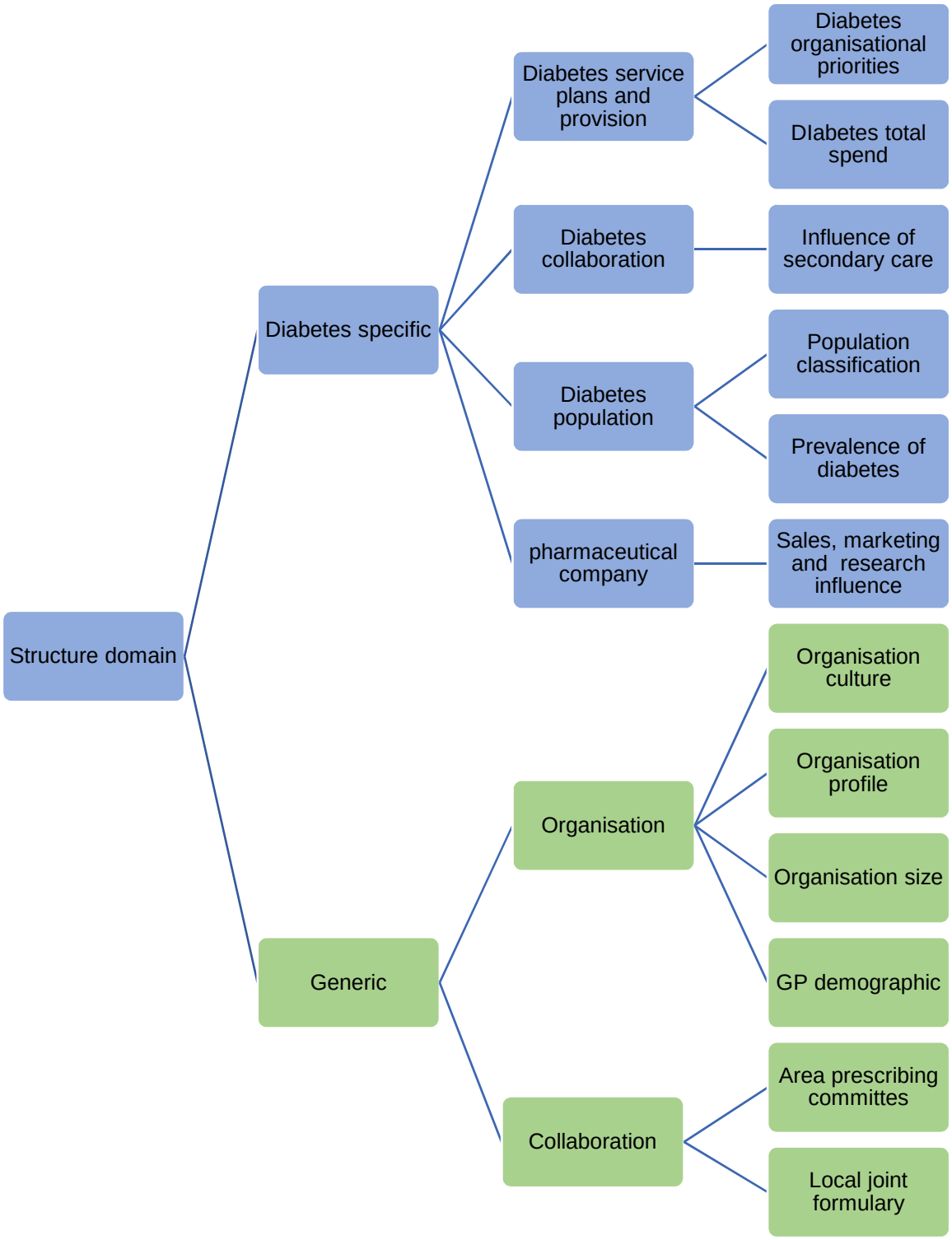
The text (qualitative data) was extracted verbatim from the public documents (and referenced accordingly), linked to the relevant PCO and inserted into an Excel Spreadsheet (separate for each explanatory indicator). In order to score the information, it was then described in standardised terms and natural groupings of similar terms were noted to allow for manual categorisation as per the concepts behind coding and categorisation of qualitative data outlined in Chapter 16 (Bowling A, 2009).

4.5. Application of data sources to the modified Donabedian SPO model for prescribing

The next section describes the creation of individual explanatory indicators reflecting the influences on prescribing in the Modified Donabedian SPO model using the publically available data and information described in the previous section. The list of individual indicators follows the order (and colour coding) set out in Structure-Process-Outcome model previously described in Chapter 3.

Figure 3: Prescribing Influences assigned as indicators to the structure domain

Domain	Disease or generic	subdomains	Indicators



4.5.1. Structure domain – Diabetes specific subgroup

There are six indicators in the diabetes specific subgroup: Diabetes organisation priorities and plans; diabetes total spend; influence of secondary care; population classification; diabetes prevalence and one that reflects the influence of pharmaceutical companies.

4.5.1.1. Diabetes organisational priorities

Diabetes was already a priority area for all PCOs under the Yearly National Planning and Priorities Guidance (NHS Commissioning Board, 2012b); The National Outcomes Framework and The Quality Premium Priority Scheme (NHS Commissioning Board, 2013c). However, some PCOs have specifically identified diabetes as a local priority and measuring this should reflect the extra emphasis given to diabetes services that comes from the organisation choosing diabetes as a local priority.

There were a number of sources of information that could have been accessed to build up a picture of how significant diabetes was for each PCO during the period of research. Increasingly, a number of tools have been created and provided to PCOs to help them to use their resources more effectively and prioritise areas of clinical need where they were performing less well or areas where they were prescribing ineffectively, inappropriately or in

PCOs have to go through a process of yearly prioritisation of need and allocation of funds for the coming year. These tools include the SPOT tool (Spend and Outcomes analysis); The Atlas of Variation and The Right Care Initiative, Programme Budgeting Tool and Better Care Better Value Productivity tool (see Appendix 1). Research has shown that PCOs have used these tools to help them (Schang et al., 2014). However, there are several issues with using the data from these tools as an identification of

whether diabetes should be a priority for a PCO. Firstly, the data used in each of the tools is based on previous years, for example, NHS Atlas of Variation in Healthcare for people with diabetes was made available in June 2012 Atlas of Variation (Right Care Atlas Series, 2012). The data sources were NIC 2010/11 and National Diabetes Audit data for 2009/10. Secondly, although some of the tools have used the relevant years' data in terms of this research, the tools were not available to the PCOs during the period of planning and prioritisation (roughly 6 months prior to the start of each financial year in April). For example, the Right Care Analysis was released in October 2013 but, although it is based on information and data 2011/12, was not available for the PCOs when they were identifying clinical priorities areas for 2013/14. Finally, the underlying data used in these tools has been used in the creation of other factors as a measure of the way in which diabetes services are provided. Therefore, it would be a duplication to include the data again in the construction of this factor.

This is identified their commissioning or business for the next year. They then report on the previous year's achievements in their Annual Reports. Therefore, in order to capture all the plans and achievements made by the PCO in terms of improvements in diabetes care locally, both the PCO Commissioning Plans and the Annual Reports must be viewed for the years 2011/12 – 2013/14. Identification of major pieces of work on developing diabetes care pathways, service improvements, reduction of referrals to secondary care has therefore been collected in the local plans and annual reports of the PCOs. The information has been extracted and scored depending on the source of the information for Annual Reports, Commissioning and Business Plans and for 2013/14 for information about the Quality Premium Priorities. The scoring for service developments was allocated to the year in which it had largely taken place – so if a

new diabetes service was set up in 2012/13 but was mentioned in a Commissioning Plan 2013/14 then the scoring was applied to 2012/13. Scoring for 2011/12 and sometimes in 2012/13 has been at PCT level and then copied to the relevant CCG levels so that a comparison over the 3 years is possible.

Creation of individual indicator: Diabetes organisational priorities

Type of data: Public local documents and information. Qualitative information coded and scored.

Table 15: Diabetes organisational priorities scoring

Score for Diabetes organisational priorities	Description
	PCO Annual Reports – 3 years
Score 4	major improvements or changes in local diabetes services achieved during the year
Score 3	smaller specific targets achieved during the year (diabetic retinopathy screening, patient education)
Score 2	planned changes – service reviews etc. within the year
Score 1	no mention of diabetes in annual reports – or only mentioned as part of diabetes being detected in The NHS health Check programme or no Annual report for the PCO
	Note: If the Annual Report has reported achievements to the local premium quality priorities then this is not scored again because this has been capture elsewhere. Scoring for 2011/12 and sometimes in 2012/13 has been at PCT level and then copied to the relevant CCG levels so that a comparison over the 3 years is possible.
	Score for Commissioning / Business Plans 3 years
Score 4	major specific improvements to the local diabetes services or redesign of care pathway planned during the year. Or Diabetes acknowledged as a priority area.
Score 3	smaller specific targets planned during the year (diabetic retinopathy screening, patient education)
Score 2	achievements mentioned. Plan to review diabetes care pathway
Score 1	no mention of diabetes in Commissioning / Business Plans – or only mentioned as part of diabetes being detected in The NHS health Check programme. Or no Commissioning / Business Plans for the PCO
	Note: The scoring for service developments is allocated to the year in which it has largely taken place – so if a new diabetes service is set up in 2012/13 but is mentioned in a Commissioning Plan 2013/14 then the scoring will be applied to 2012/13.
	Priorities Scoring
	Quality Premium local priority 2013/14

Score 2	Diabetes a priority
Score 1	Long Term Conditions a priority
Score 0	Diabetes or long term conditions not a priority
	Commissioning Plans
Score 2	Diabetes a priority
Score 1	Long Term Conditions a priority
Score 0	Diabetes or long term conditions not a priority
	Annual Report
Score 2	Diabetes a priority
Score 1	Long Term Conditions a priority
Score 0	Diabetes or long term conditions not a priority
	Scoring criteria different for all three years depending on the measures made over the period.
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal. Diabetes Priorities 2011/12: Q1 (38 PCOs); Q2 (44 PCOs); Q3 (24 PCOs); Q4 (61 PCOs); Q5 (44 PCOs) 2012/13: Q1 (38 PCOs); Q2 (52 PCOs); Q3 (80 PCOs); Q4 (34 PCOs); Q5 (7 PCOs) 2013/14: Q1 (30 PCOs); Q2 (66 PCOs); Q3 (40 PCOs); Q4 (55 PCOs); Q5 (21 PCOs)

4.5.1.2. Diabetes total spend

Each PCO was required to meet a number of financial targets during the financial years 2011/12 to 2013/14 (April to March). The financial targets for PCOs were included in the relevant Operating Frameworks for each year issued by The DoH and then NHS England. However, it was difficult to link the relevance of the total PCO financial situation for a year with the total PCO budget and spend on diabetes prescribing, because although diabetes prescribing costs account for around 11% of the total prescribing budget of a PCO (Health and Social Care Information Centre, 2014d), prescribing is generally only reported as accounting for around 10-20% of total PCO budget in PCO Annual Reports. Therefore, a comparison of the spend on diabetes is more relevant to this research.

The HSCIC (and before 2012, the NHS Information Centre) have compiled data to compare prescribing spend for diabetes in primary care since 2005/6. Prescriptions issued in primary care are analysed for all medicines to treat diabetes providing the NIC by the Prescription Cost Analysis system. This spend figure was broken down to individual drug groups within the total spend and these were linked to the number of patients with diabetes by using QOF diabetes prevalence. However, spend on human long acting insulins and GP-1 agonists form a large percentage of the total spend and since this is the subject of our research and this data has been used to create two explanatory indicators it cannot be used as another indicator in the model.

Another way to compare spend on diabetes would be to use a figure for total spend on diabetes including, for example, prescribing costs, primary care management, and secondary care referrals. Each year PCOs were required to provide a full analysis of the way in which they spend their budget on twenty three different healthcare conditions (including diabetes); a process called Programme Budgeting (Martin et al., 2008). PCTs originally collected and analysed the information, and now CCGs are responsible for doing this. The Programme Budgeting data was only available at PCT level for 2011/12 and 2012/13, so the granularity of the information is compromised. However, it was possible to provide data for all PCOs for the three years.

Creation of individual indicator: Diabetes total spend

Quantitative data at PCO level. Yearly data available for all organisations in England. Programme Budgeting spend on diabetes. Department of Health. Total programme Budgeting spend on diabetes per 100,00 population.

Table 16: Diabetes total spend scoring

Score for Diabetes total spend	Description
Data ranked 1-211	Total spend on diabetes per 100,000 population from Programme Budgeting data
	Note: Weighted populations for 2012-13 were not available. Therefore the 2012-13 weighted populations within this workbook have been calculated by taking the 2011/12 weighted populations as a proportion of the 2011/12 total population, and applying this to the 2012/13 raw population figure.
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation.	Creating quintiles. Highest quintile corresponds to highest spend per 100,000. Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.1.3. Influence of Secondary Care

The importance of the acute hospital in affecting the prescribing behaviour of GPs is significant (Florentinus et al., 2009). There were several different aspects the influence exerted: the role of consultant and specialist team – how they prescribe new drugs has been shown to directly encourage similar prescribing behaviour in GPs (Larsen et al., 2014, Mason, 2008). In the case of type 2 diabetes the two drug groups in this research project were usually initiated in secondary care at the beginning of the study period (2011/12) although that changed over the three years as GPs were trained and become more confident in initiating insulin therapy and GLP-1 agonists for their type 2 diabetic patients. Schemes whereby GPs are supported to manage more complex patients in the community have been seen to reduce referrals to hospital and better glycaemic control (Choudhury et al., 2013, Kar et al., 2013). Historically, diabetes services have developed in many different ways across England and this has often led to services being predominantly provided in secondary care in some local health economies and far more in primary care in other places (Joint British Diabetes Societies for Inpatient Care (JBDS-IP), 2013). Nationally, it has long been the aim of the government to reduce reliance on the acute sector and provide more services in

primary care. This has been an ongoing yearly priority for patients with long term conditions over the period of this study (Department of Health, 2001a).

The role of the acute hospital in influencing prescribing behaviour is not measured by any direct set of data but it is possible to build up a picture of the relationship between a PCO and the acute trusts within the LHE. There has been a national move to try and shift care from expensive secondary care towards primary care particularly for chronic conditions such as diabetes and as part of this initiative, the Better Care Better Value Initiative (Better Care, 2007) records inappropriate referrals to secondary care for diabetes. Therefore, it is possible to quantify how much PCOs make use of secondary care when it is not deemed necessary, and conversely to identify PCOs that manage most of their patients (and hence the initiation and prescribing of drugs to control HbA1C) themselves.

Creation of individual indicator: Influence of secondary care

Better Care Better Value data for inappropriate outpatient diabetes referrals to secondary care – ranking from 1 - 211 (where a ranking of 1 denotes the lowest inappropriate number of referrals)

Quantitative data. Quarterly data available for all PCOs in England from Better Care Better Value website. Individual comparator: Inappropriate diabetes outpatient referrals to secondary care. Data at PCO level (see section 4.4.2 for explanation of splitting data from PCT to CCG)

Table 17: Influence of secondary care scoring

Score: influence of secondary care	Description
Data ranked 1-211	Ranking of data for inappropriate referrals to secondary care (ranking of 1 for highest inappropriate referrals)
Scoring criteria	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Creation of quintiles. Score 5 denotes the quintile for lowest inappropriate referrals. This data is ranked 1-211 and so can be divided into 5 quintiles as with the numerical continuous data

There were two explanatory indicators that reflected the diabetes patient population within each PCO.

4.5.1.4. Population classification

It is established within healthcare research and the NHS that patient demographic profiles are very important when analysing patterns of healthcare provision in general and prescribing in particular (Brouwer et al., 2012, Wawruch et al., 2009). Risk factors and prevalence of diabetes vary according to patient characteristics and need.

A dataset called The CCG Classification group comparing the patient population of each PCO was available and relevant to this research project. It was originally created by Yorkshire and Humber Health Intelligence (and latterly is the responsibility of Public Health England) and classified PCOs into a set of five groups with similar characteristics for all the organisations in England. This has been used to benchmark PCO level indicators and provide a comparison with PCOs that were likely to be facing similar challenges. The data used to build up the CCG Classification groupings consists of:

1. Age structure of population
2. % of population from Asian ethnic groups
3. % population from Black ethnic groups

4. Indices of deprivation (average score)
5. Population density

The five groupings were given different colours with the following descriptions:

- An older population living in rural areas and low deprivation levels. – **Purple**
- A very young population with a high proportion of the population from black and Asian ethnic groups and high levels of deprivation. - **Blue**
- A younger population with a high proportion of the population from black and Asian ethnic groups and moderate levels of deprivation. - **Green**
- A younger population with a higher than average proportion of the population from black and Asian ethnic groups and moderate levels of deprivation. - **Yellow**
- A population with an average age structure, average deprivation levels and a low population density. – **Orange**

Creation of individual indicator: Population classification

Measure of the predominant demographic profile of patients in the PCO with the aim of categorizing the level of need in terms of diabetes.

Qualitative data coded and scored. Only one set of data for the period of this study.

Source: Public Health England.

Table 18: Population classification scoring

Score for population classification	Description
Score 5	Purple group
Score 4	Blue group
Score 3	Green group
Score 2	Yellow group
Score 1	Orange group
	Same scoring criteria for all three years. Data the same for all three years.

Quintile allocation	Creation of quintiles. Data already divided into quintiles. Highest quintile denoting population group with highest propensity to develop diabetes.

4.5.1.5. Diabetes prevalence

Diabetes prevalence was measured in the yearly QOF scheme with the number of patients diagnosed with type 2 diabetes who are over 17 years of age. As has been mentioned before in the Audit and Education section, QOF has a very high uptake from practices in England with 7,921 practices providing information in 2013/14.

The National Diabetes Audit (NDA) also collected information on the prevalence of diabetes in practices across England during the period of this study. However, the number of practices participating in this audit was less than in the QOF data. In addition, the National Diabetes Audit (NDA) runs for a 15 month period and so it is not aligned to the yearly analysis that is part of the research.

QOF: Type 2 Diabetes prevalence for patients over 17 (%). The data was available from the HSCIC website.

Creation of individual indicator: Prevalence of diabetes

Quantitative data at PCO level and some at practice level. Yearly data produced by QOF. % of patients with type 2 diabetes in each PCO (Indicator DM019 in 2011/12; DM032 in 2012/13 and DM001 in 2013/14). Source: HSCIC. The data presented at practice level was calculated up to PCO level according to the description in section 4.4.4.

Table 19: Diabetes prevalence scoring

Score for Total diabetes prevalence	Description
Data ranked 1-211	% patients with diabetes (over 17)
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Creation of quintiles. Highest quintile corresponds to highest spend per 100,000. Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.1.6. Pharmaceutical company

In the UK there is an agreed Code of Practice for the Pharmaceutical Industry that has been agreed with the Association of the British Pharmaceutical Industry (ABPI) July 2012. There were no nationally publically available data comparing the interaction between sales and marketing personnel in a pharmaceutical companies and GPs. All PCO and GPs are targets to be visited by sales representatives working for pharmaceutical companies and recipients of marketing information produced by them. Therefore, it was difficult to discern any differences between PCOs based on sales and marketing activity. PCOs had before 2011 developed and approved policies and guidelines to outline appropriate joint working between them and pharmaceutical companies, but there was no national or locally publically available information detailing the amount of actual sales and marketing contact between PCOs and pharmaceutical companies. For this reason it has not been possible to include this indicator in the analysis.

4.5.2. Structure domain - Generic subgroup

Subheading: Group 1 collaboration indicators

There were two separate indicators that were used to give a picture of the level of influence of other organisations on the diabetes prescribing of individual PCOs.

4.5.2.1. Area Prescribing Committees

Organisations within the LHE have influenced each other by the shared prescribing decisions that are made via joint prescribing committees called area prescribing committees (APCs). APCs and Prescribing forums have been set up across local health economies in many parts of England for a varying number of years. They are used to help prioritise and make decisions about the choice of a particular drug within a therapeutic class, to develop prescribing guidelines and policies, to manage new drug entry into the LHE and agree prescribing decision across primary and secondary care organisations within the LHE (National Prescribing Centre, 2012).

Qualitative Information about the organisations and their involvement in APCs over the years from 2010/11 to 2013/14 has been collected from local publically available information and scored following the rationale previously described – namely, that PCOs with a greater level of influence within the APC receive a higher score.

Creation of individual indicator: Area Prescribing Committees

Measure of the involvement of Acute trusts and PCOs in their local APCs. Information scored from 1-5 with a score of 5 denoting where acute trusts and PCOs have the closest relationship and acute trusts have the greatest degree of influence of local in prescribing decisions.

Table 20: APC scoring

Score: involvement of PCO within APC	Description
Score 5	A 1:1 relationship between the acute trust and primary care organisation with one joint APC covering both organisations
Score 4	Joint APC across several primary care organisations and 1 acute trust – or 1 primary care organisation and several acute trusts

Score 3	There is a joint APC across several primary care organisations and acute trusts in the local health economy
Score 2	There is one APC covering more than one local health economy. Or a relatively tight APC (1 acute trust but more than 1 primary care organisation)
Score 1	The primary care organisation is influenced by decisions made by more than one APC from different LHEs or there is 1 APC (involving several organisations) for the LHE and another APC covering the LAT with several more organisations Or influenced and/or part of LHE across LAT borders.
Note:	Reduced score by 1 if the LHE has 1 CCG or acute trust that is part of another APC (e.g. Swindon)
Score from 1-5	Same scoring criteria for all three years. Different data for each of the three years
Quintile allocation	Creation of quintiles. This information is already scored from 1-5 so this scoring will be retained for the quintile analysis. This has not resulted in a normal distribution of scores.

4.5.2.2. Local organisations sharing formularies

Prior to April 2013, formularies were used in some secondary care organisations, PCOs and across LHEs. They were sometimes joint ventures with local NHS organisations but also purely for use in a single organisation. There was no legal requirement for an organisation to produce or adhere to a formulary. In a number of cases, acute trusts chose to use the British National Formulary (BNF) rather than their own customized formulary. In 2012 as part of the Innovation, Health and Wealth Publication, there was a directive that NHS hospitals trusts should publish their formularies on line from April 2013 (Nicholson D, 2012). Since then, acute trusts have made available their formularies to the public. They are not produced to any particular blueprint and vary in content with some formularies being a list of available drugs whilst others contain clinical guidelines and traffic lights listing for all drugs. It should be noted that formularies, as with clinical guidelines are not always updated continuously and

do not always match up with the structural changes in organisations, however they have usually been adopted by the new organisations.

Creation of individual indicator: local organisations sharing formularies

Measure of the level of influence of PCOs on the local shared formulary. Information scored from 1 - 4 with a score of 4 for the greatest degree of influence of PCOs on the decisions in the local formulary.

Qualitative Information about the organisations and the local formularies they have produced over the years from 2010/11 to 2013/14 was collected from local publically available information and scored following the rationale previously described – namely, that PCOs with a greater level of influence on the decisions in the local formulary receive a higher score.

Table 21: local joint formulary scoring

Score: involvement of PCO in local formulary	Description
Score 4	1:1 Joint primary care organisations Acute Trust Formulary (single LHE)
Score 3	joint formularies across primary care organisations and acute trust in LHE
Score 2	Joint formulary across primary care organisations in LHE with individual acute trust formularies (when the CCGs were previously only one or two PCTs). Or Joint formulary across primary care organisations in LHE with no individual acute trust formularies.
Score 1	Several formularies or no formularies affecting primary care organisation or Primary care organisation has no formulary but main acute trust has its own formulary or 1 formulary across several LHEs (more than 2 former PCTs) – many primary care organisation and acute trusts
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Creation of Quintiles. Data not continuous and for this dataset no PCOs allocated to the 5th (top) Quintile. The Scoring into quartiles dedcribed above was retained.

4.5.2.3. Organisation culture

The different incarnations of the PCO in accordance with successive government initiatives to encourage primary care led commissioning have resulted in varying degrees of clinical engagement amongst GPs (Audit Commission, 1999, Smith et al., 2005, Audit Commission, 2007). The one common theme from all of them is that the clinical engagement improves when GPs feel that they have more autonomy and control in responding to the needs and key issues affecting their patients (Miller et al., 2012, Coleman et al., 2009). Smaller schemes that were limited in scope (for example GP fundholding) found it easier to engage all member GPs but more comprehensive schemes have found it difficult to engage with all GPs and where there was only a minority of GPs involved in decision making (as with PCGs and PCTs) there was a degree of disengagement and disenchantment with the system (Checkland et al., 2008). A joint King's Fund and Nuffield Trust survey found that more than half of GPs have said that being a member of a CCG had altered their referral or prescribing patterns. The survey found that almost 60 per cent of the 207 respondents in six chosen CCGs had altered prescribing patterns, and that almost 75 per cent had changed their referral pathways and just over 50 per cent had changed their referral volumes (Robertson, 2014).

The cohesiveness of the organisation can be defined in several ways but in order to score PCOs according to their degree of cohesiveness I had to be able to understand and compare how keen the GPs were to work together in each PCO, how well organised and able to work together as a single unit; how stable the organisation was; the historical experience in working together; degree of variability in practice performance; and degree of clinical engagement. In all of these individual comparators

PCOs may be more or less cohesive – in other words, some organisations had a history of GPs that have been involved in GP commissioning; the current PCO was similar in configuration to previous PCO (so there was minimal organisational disruption following the changes to create CCGs). Other organisations were very different – having lots of different configurations with multiple mergers, were last to become authorised and the GPs were not keen to become involved in primary care commissioning.

The information about the cohesiveness or organisations and historical relationships that have existed locally has come from a mixture of national and local sources. Nationally the development of PCOs from PCTs to CCGs was a political move undertaken following a change in government. Due to the crucial role that PCOs play in commissioning care for their local population, the viability and success of the emerging CCGs has been of critical importance to the government and they have been monitoring these things by setting up an authorisation framework with a range of standards to be met before the CCGs can be authorised as independent commissioning bodies. The timescale for this has been from 2011 to 2013. The government have also sought to identify CCGs and groups of GPs that were keen to take on their new roles in managing and directing CCGs and so set up a pathfinder programme to allow early responsibility to be passed to those keen and ready to become involved. Local data and other national data sets allowed for other comparators to be created so that the historical relationships between local practices that have been involved in commissioning could be measured, as well as their ability to start behaving as independent organisations.

The detailed description of the background behind the organisational changes during the period from 2011/12 and 2013/14 and the subsequent creation of the individual indicators is discussed in greater detail in Appendix 3.

Creation of individual indicator: Organisation culture

Qualitative and quantitative information coded and scored at PCO level. Information collected throughout the three year period. DoH / NHS England comparative data. PCO Public local documents and board papers.

Table 22: Organisation culture 2011/12 scoring

Score for organisation culture in 2011/12	Description
	CCG mergers and organisational changes during 2011/12
Score 4	no organisational change from April 2011 to March 2012
Score 3	merger during 2011 prior to the DoH Risk Assessment
Score 2	merger by end of 2011 but organisation not included in DoH Risk Assessment
Score 1	CCG changed after March 2012 before April 2013
	CCG Size Impact – DoH Risk Analysis
Score 4	CCG boundary and population rated GREEN in DoH Dec 2011 Risk Analysis
Score 3	CCG boundary and population rated AMBER in DoH Dec 2011 Risk Analysis
Score 2	CCG boundary and population rated RED in DoH Dec 2011 Risk Analysis
Score 1	CCG Impact of size not rated because CCG was formed following merger of consortia deemed to be unviable by the DoH 2011 Risk Analysis.
	CCG Geography Boundary and Population – DoH CCG Risk Analysis
Score 4	CCG boundary and population rated GREEN in DoH Dec 2011 Risk Analysis
Score 3	CCG boundary and population rated AMBER in DoH Dec 2011 Risk Analysis
Score 2	CCG boundary and population rated RED in DoH Dec 2011 Risk Analysis
Score 1	CCG Impact of size not rated because CCG was formed following merger of consortia deemed to be unviable by the DoH 2011 Risk Analysis
	CCG Geography LA Boundaries
Score 4	CCG boundary and population rated GREEN in DoH Dec 2011 Risk Analysis
Score 3	CCG boundary and population rated AMBER in DoH Dec 2011 Risk Analysis
Score 2	CCG boundary and population rated RED in DoH Dec 2011 Risk Analysis
Score 1	CCG Impact of size not rated because CCG was formed following merger of consortia deemed to be unviable by the DoH 2011 Risk Analysis
	CCG Member Practice engagement
Score 4	CCG boundary and population rated GREEN in DoH Dec 2011 Risk Analysis

Score 3	CCG boundary and population rated AMBER in DoH Dec 2011 Risk Analysis
Score 2	CCG boundary and population rated RED in DoH Dec 2011 Risk Analysis
Score 1	CCG Impact of size not rated because CCG was formed following merger of consortia deemed to be unviable by the DoH 2011 Risk Analysis.
	CCG Commissioning Experience – PCT / PCG Correlation
Score 5	CCG boundary matches 'current' PCT boundary
Score 4	CCG boundary matches historical PCT or PCG boundary
Score 3	CCG boundary is within, but does not match, 'current' PCT boundary
Score 2	CCG boundary crosses 'current' PCT boundary and is coterminous with the combined boundaries of those PCTs
Score 1	CCG boundary crosses 'current' PCT boundary but is not coterminous with the combined boundaries of those PCTs
	CCG Commissioning experience – GP Consortia / PBC Group Correlation
Score 4	CCG built on a previous GP Commissioning Consortium that was originally a PBC Group
Score 3	CCG built on a previous GP Commissioning Consortium that was not originally a PBC Group
Score 2	CCG established following merger of two or more previous emerging CCGs/GP Commissioning Consortia
Score 1	CCG has a structure largely not based on previous GPCC/PBC Groups
	National Pathfinder Consortia Status
Score 4	CCG emerged from an existing GP Consortium that was awarded national Pathfinder Consortia Status
Score 3	CCG emerged from two or more existing GP Consortia; at least one of which was awarded national Pathfinder Consortia Status
Score 2	CCG emerged from an existing GP Consortium which was awarded national Pathfinder Consortia Status and then split into smaller groups
Score 1	CCG emerged from GP Consortium/a that was/were not awarded national Pathfinder Status
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal but as far as possible equal groups were created. Q1 (44 PCOs); Q2 (48 PCOs); Q3 (45 PCOs); Q4 (35 PCOs); Q5 (39 PCOs)

Table 23: Organisation culture 2012/13 scoring

Score for Organisation Culture in 2012/13	Description
	CCG mergers and organisational changes during 2012/13
Score 2	no organisational change during year
Score 1	merger during 2012/13

	CCG Structure / Commissioning Experience – GP consortia /PBC group
Score 4	Organisation was previously a Practice Based Commissioning Group that developed into a GP Consortia and finally emerged as a CCG
Score 3	Organisation previously emerged as a GP Consortia and then proceeded as a CCG (not originally a Practice Based Commissioning Group)
Score 2	Organisation established following merger of two or more previous emerging Clinical Commissioning Groups
Score 1	Organisation has a structure largely not based on previous GP Consortia or emerging CCGs. May be a split of a larger GPCC/CCG.
	CCG Website
Score 4	Independent, public website with comprehensive information (Board minutes, CCG priorities, FOI requests etc)
Score 3	Independent, public website with some information; or pages of PCO website with full information (Board minutes, CCG priorities, FOI requests etc)
Score 2	Independent, public website, or pages of PCO website with little information (Board minutes, CCG priorities, FOI requests etc)
Score 1	No public website, or very little information on website or pages of PCO website
	CCG Commissioning Plan 2012/13
Score 4	CCG has published a 2012/13 Commissioning Plan as well as other documents (Business Plan, Commissioning Intentions, Organisational Development Plan etc)
Score 3	CCG has published a 2012/13 Commissioning Plan
Score 2	CCG has published a 2012/13 Plan on a Page or similar summary plan (10 pages or less); or CCG has a shared plan with other CCGs in the Cluster; or CCG has published other documents but not a Commissioning Plan
Score 1	CCG has not published a 2012/13 Commissioning Plan or other planning documents
	CCG Authorisation Status
Score 9	CCG authorised in Wave 1 with full authorisation
Score 8	CCG authorised in Wave 1 with conditions
Score 7	CCG authorised in Wave 2 with full authorisation
Score 6	CCG authorised in Wave 2 with few conditions (1-6)
Score 5	CCG authorised in Wave 2 with more than 10 conditions and / or directions
Score 4	CCG authorised in Wave 3 with full authorisation
Score 3	CCG authorised in Wave 3 with few conditions (1-6)
Score 2	CCG authorised in Wave 3 with more than 10 conditions and/or directions
Score 1	CCG not authorised before end 2012/13
	Note: Wave 1 applications for CCG authorisation. May 2012 – the NHS Commissioning Board Authority confirmed that there were 35 aspiring CCGs chosen to be assessed in the first wave of applications. Applications for authorisation take place in 4 waves from July 2012 to January 2013.
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal. but as far as possible equal groups were created Q1 (41 PCOs); Q2 (36 PCOs); Q3 (56 PCOs); Q4 (38 PCOs); Q5 (40 PCOs)

Table 24: Organisation culture 2013/14 scoring

Score for Organisation Culture in 2013/14	Description
	CCG mergers and organisational changes during 2013/14
Score 2	no organisational change during year
Score 1	merger during 2013/14
	CCG Authorisation Status (scored April 2013)
Score 9	CCG authorised in Wave 1 with full authorisation
Score 8	CCG authorised in Wave 1 with conditions
Score 7	CCG authorised in Wave 2 with full authorisation
Score 6	CCG authorised in Wave 2 with conditions and/or directions
Score 5	CCG authorised in Wave 3 with full authorisation
Score 4	CCG authorised in Wave 3 with conditions and directions
Score 3	CCG authorised in Wave 4: full authorisation
Score 2	CCG authorised in Wave 4 with 1-9 conditions
Score 1	CCG to be authorised in Wave 4 with more than 10 conditions and/or directions
	CCG Progress towards authorisation in 2013/14 (*)
Score 4	Full authorisation at beginning of 2013/14 (April 2013)
Score 3	Full authorisation granted at July or October inspection 2013
Score 2	Full authorisation granted in February 2014
Score 1	Full authorisation not granted by March 2013
	CCG Structure / Commissioning Experience – GP consortia /PBC group
Score 4	Organisation was previously a Practice Based Commissioning Group that developed into a GP Consortia and finally emerged as a CCG
Score 3	Organisation previously emerged as a GP Consortia and then proceeded as a Clinical Commissioning Group (not originally a Practice Based Commissioning Group)
Score 2	Score 2: Organisation established following merger of two or more previous emerging CCGs
Score 1	Organisation has a structure largely not based on previous GP Commissioning Consortia or emerging Clinical Commissioning Groups. May be a split of a larger GPCC/CCG.
	CCG Assurance Annual Assessment 2013/14
Score 2	Assured
Score 1	Assured with support
	The CCGs were assessed three further times during the year (July 2013, October 2013 and February 2014) and some reduced the number of conditions and/or directions towards gaining full authorisation during this time. To recognise this progress a scoring to reflect progress during 2013/14 has been created.
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal. but as far as possible equal groups were created. Q1 (39 PCOs); Q2 (40 PCOs); Q3 (38 PCOs); Q4 (44 PCOs); Q5 (50 PCOs)

4.5.2.4. Organisation profile

The make-up of each PCO varies in terms of number of practices, GP demographics, and type of practices.

Number of GPs per population

The number of GPs working at each PCO was collected on the National Health Application and Infrastructure Services (NHAIS)/Exeter General Practice Payments System, a computerised payment system of GPs in England. It included “details of each practitioner’s name, date of birth, gender, working hours/sessions, practice details and whether certain allowances were payable. (Health and Social Care Information Centre, 2014g). In February 2015 practice level data about GP numbers, contract type, practice type were published for 2013/14. NHS Payments to General Practice in England, analysed by individual provider of general practice services and main payment category, was published for the first time by the HSCIC Website accessed 3 September 2015. The Number of Practitioners (headcount) is expected to be lower than the Number of Practitioners (contracts) because some GPs had more than one contract. For example, in September 2014 there were 1,436 with two or more contracts; in 2013 there were 1,227; in 2012 there were 1,353; in 2011 there were 1,482 such GPs.

Single handed practices

A Single-Handed Practice is defined in the NHS Workforce Census as a practice where “there is only 1 working GP (Provider or Salaried/Other), although a GP registrar or GP retainer may work in the practice” (Health and Social Care Information Centre, 2014g).

Dispensing practices

There were over 1000 dispensing practices in the UK in 2013/14 (NHS payments to GPs 2013/14). It was estimated in a report by Duerden et al. (2011) that more than 3.5 million patients in the UK were covered by dispensing practices. In 2013, dispensing doctors may generally only be allowed to provide pharmaceutical services to patients who live in a designated controlled locality, more than 1.6km (as the crow flies) from a pharmacy. The only exception to this was where it was a distance selling pharmacy or the patient lived in a reserved location (Reviewing Patient dispensing lists June 2013 DoH).

Information about dispensing practices was collected by the NHS Business Services Authority prior to April 2013 and then more recently by the HSCIC and available in The Patient List size and GP count for April 2012 (providing a picture of the situation at the end of 2011/12); and The Practice list size and GP count in April 2013 (providing a picture of the situation at the end of 2012/13). This can be cross checked by looking at the Dispensing practices list a monthly and NHS Payments for GPs 2013/14.

Type of practice

Most GPs were employed by the NHS under a GMS (General Medical Services) Contract. This was a national financial agreement between providers (practices) and the NHS that set out the services the practices provided. Another type of practice was covered by Personal Medical Services (PMS) contract. This option was first introduced in 1998 to allow the practice to negotiate a local agreement for the services they will provide and payments they will receive, taking into account specific local healthcare needs. PMS practices may participate in QOF or enter into local QOF arrangements

These two types of contract cover the vast majority of practices in England. Two other types of contract existed - Alternative Provider Medical Services (APMS) and Primary Care Trust Medical Services (PCTMS). APMS contracts could be offered to private, voluntary and public sector organisations and there was greater flexibility in how services will be provided. PCTMS services were provided directly, as well as managed, by NHS England, enabling it to employ health care professionals directly, perhaps as salaried staff. However PCTMS contracts ceased to exist in April 2013 following the restructuring of the NHS in England (Health and Social Care Information Centre, 2014h).

In February 2015 practice level data about GP numbers, contract type, practice type were published for 2013/14. NHS Payments to General Practice in England, analysed by individual provider of general practice services and main payment category, were published for the first time by the HSCIC.

No similar set of data existed for comparison in 2011/12 or 2012/13, although there were data containing numbers of GPs, dispensing practices and patients on April 1st 2012 which was the equivalent of the end of year QOF data for 2011/12 and April 1st 2013 which corresponds to the 2012/13 QOF data. Whilst practices pre 2013 can be linked to CCGs, there is however, no source of data that provided type of practice contract at practice level prior to 2013/14, so this data is unable to be used in this analysis.

Creation of individual indicator: Organisation profile

Measure of the ease of control and influence within the PCO. Number of GPs per head of Population (assumption - GPs have more time with patients to devote to better care.

% Single handed practices within the PCO (Single handed practices less able to provide adequate care and % of dispensing practices (dispensing practices often follow their own prescribing behaviour according to the benefits to themselves).

Quantitative data at PCO level and some at practice level. Yearly data. HSCIC. The data was presented at practice level and the calculation at PCO level has performed according to the description in section 4.4.4.

Table 25: Organisation profile scoring

Score for Organisation Profile in 2013/14	Description
Data set ranked 1-211	Number of GPs per population
Data set ranked 1-211	% of single handed practices (inverse scoring for this indicator)
Data set ranked 1-211	% dispensing practices
	Ranking from 1-211 for all three datasets – ranking of 1 denoting the highest % of each for Number of GPs per population and % dispensing practices but inverse scoring for single handed practices. Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.2.5. Organisation size

There have been a number of papers looking at the relationship between the size of a primary care organisation and its performance but there has, however, been little evidence to support the hypothesis that there is an ideal size for these organisations. In an observational study of all 152 primary care trusts in England (Greaves et al.), the size of the PCT was compared against 36 indicators of commissioning performance. The results were not straightforward, but larger PCTs tended to provide higher quality care services (in 10 out of 14 indicators). The larger PCTs were also serving more affluent, rural and ethnically diverse populations and once deprivation is taken into consideration size was no longer a significant contributor for any indicator.

Interestingly, larger PCTs were worse for a few indicators (lower smoking quit rates, poorer satisfaction with opening hours and less efficient prescribing. Other research in this area in 2003 confirmed that size is not a reliable predictor for performance and that performance is affected by a combination of their aims, tasks, functions, organisational features and environmental factors (Wilkin et al., 2003). It would appear that there is no ideal size of a primary care commissioning organisation (Smith et al., 2004).

There were a number of data sources available nationally that provided figures for the patient list size or patient population cared for by each PCO in England over the 3year period. However, the figures they presented were not exactly the same. A comparison of the two main sources of this information (QOF and NHS payments data) has been described in Appendix 3. For the purposes of this analysis we will use the QOF data source for patient list size and numbers of practices because this fits in with the other factors where QOF data has been used (audit and education; clinical guidelines; patient education; financial factors – for diabetes prevalence; and diabetes prevalence).

Creation of individual indicators

Quantitative data at practice level. Yearly data available for all organisations in England. QOF data produced by HSCIC. The data was presented at practice level and the calculation at PCO level has performed according to the description in section 4.4.4.

Table 26: Organisation size scoring

Score for Organisation Profile in 2013/14	Description
Ranking from 1-211	Population size (ranking 1 for smallest population)
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.2.6. GP Demographics

There were two explanatory indicators used to reflect the GP demographics within each PCO that in the systematic review have been found to influence prescribing decisions. The GP characteristics factors were descriptive and the data was available as part of a general comparison of PCOs and the GPs that they have within their organisation. The HSCIC produced a yearly analysis of the GP workforce for each practice in England. This report recorded the number of GP's in each practice, the gender and age breakdown, the training history, type of GP and those practices that were single handed.

Creation of individual indicator: GP Demographics

Quantitative data at practice level and the calculation at PCO level has performed according to the description in section 4.4.4. Yearly data available for all organisations in England. Source: HSCIC Workforce analysis.

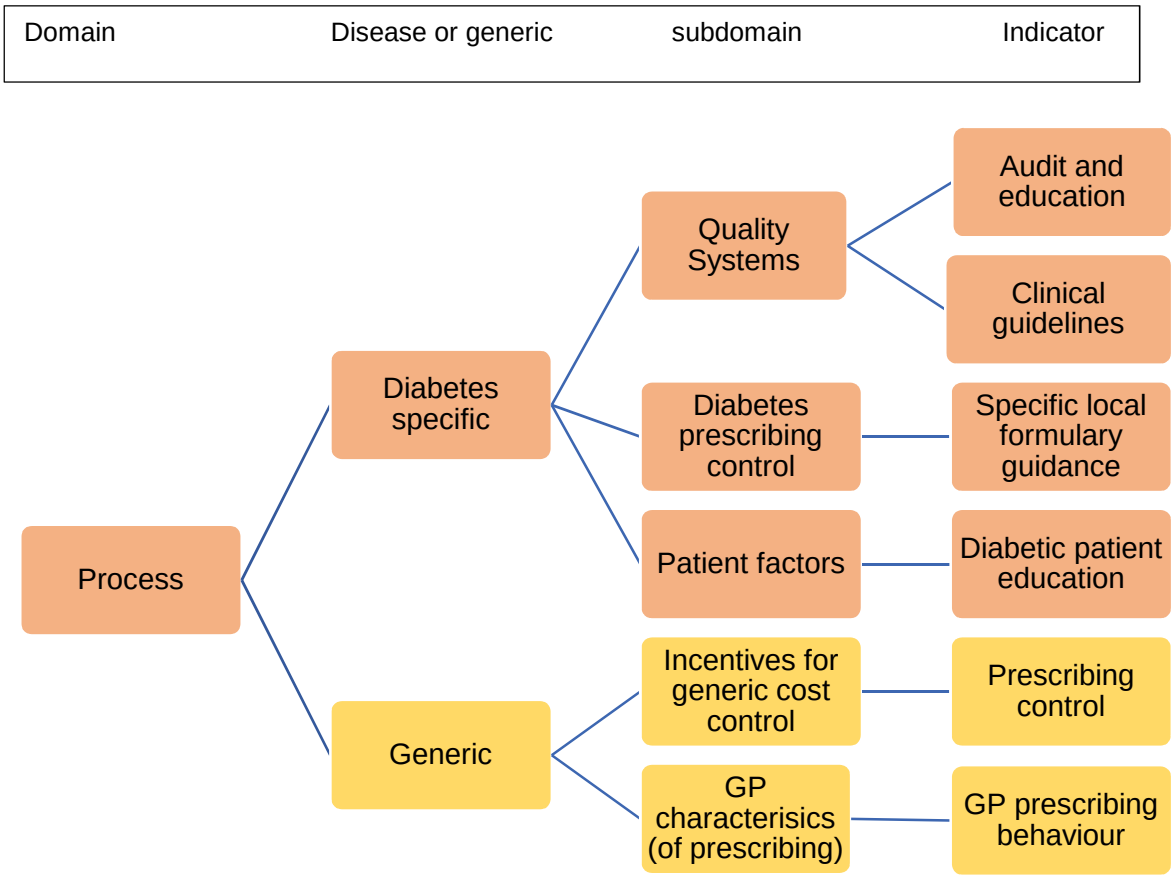
Table 27: GP age scoring

Score for GP age	Description
Data ranked 1-211	% GPs aged over 55 (ranking 1 for lowest %)
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

Table 28: GP gender scoring

Score for GP gender	Description
Data ranked 1-211	% male GPs (ranking 1 for lowest %)
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

Figure 4: Prescribing influences assigned as indicators to the process domain



4.5.3. Process domain - Diabetes specific subgroup

There were three separate indicators in the diabetes specific sub group that could be used to give a picture of the level of adoption of audit and targets for keeping blood glucose levels within nationally agreed limits as well as prescribing and management for diabetic patients in general in line with national guidelines. In addition specific patient factors that influence the adherence to the treatment regimen required to control type 2 diabetes are important.

4.5.3.1. Audit and education

One of the major aims of the Diabetes QOF from 2011/12 to 2013/14 datasets was to measure and improve glycaemic control; and this was assessed by measuring levels of HbA1C (glycated haemoglobin). A measurement of HbA1C indicates what average blood sugar levels have been over a period of time. Importantly, there is a link between glycaemic control and the death rate of type 2 diabetic patients so the lower the HBA1C, the better the diabetes control and long term outcomes. There were three separate targets levels for HbA1C (59, 64 and 75 mmol/mol) for all three years of this study (NICE Guidance CC87, 2009, Checkland et al., 2013, Health and Social Care Information Centre, 2013c, Health and Social Care Information Centre, 2014f).

Creation of individual indicator: Attainment of audit and education targets

Quantitative data at practice level. Yearly data available for all organisations in England. Source: HSCIC. The data was presented at practice level and the calculation at PCO level has performed according to the description in section 4.4.4.

Table 29: Audit and education scoring

Score for audit and education	Description
	2011/12
Data ranked 1-211	Diabetes Mellitus Clinical Indicator (DM26): The percentage of patients with diabetes in whom the last IFCC-HbA1c is 59 mmol/mol (equivalent to HbA1c of 7.5% in DCCT values) or less (or equivalent test/reference range depending on local laboratory) in the preceding 15 months.
	Diabetes Mellitus Clinical Indicator (DM28): The percentage of patients with diabetes in whom the last IFCC-HbA1c is 75 mmol/mol (equivalent to HbA1c of 9% in DCCT values) or less (or equivalent test/reference range depending on local laboratory) in the preceding 15 months
	Added the numerator data and the denominator data from DM026 and DM0928 together and then created % achievement from these figures. Note: the % underlying achievement for each clinical indicator would be used
	2012/13 and 2013/14
Data ranked 1-211	DM007: The percentage of patients with diabetes, on the register, in whom the last IFCC-HbA1c is 59 mmol/mol or less in the preceding 12 months, NICE 2010 menu ID: NM14
	DM009: The percentage of patients with diabetes, on the register, in whom the last IFCC-HbA1c is 75 mmol/mol or less in the preceding 12 months
	Added the numerator data and the denominator data from DM07 and DM09 together and then created % achievement from these figures. Note: the % underlying achievement for each clinical indicator would be used
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.3.2. Clinical guidelines

Great efforts have been made to create and update comprehensive national guidelines for the management of diabetes. Improving the care of patients with diabetes has long been a priority area for the government and the first Diabetes National Service Framework was written in 2001(Department of Health, 2001b) outlining national standards in terms of prevention, clinical care standards, management of complications, service developments and empowerment of patients. There are also a number of guidelines produced by NICE outlining specific targets and developments

that should be undertaken in primary and secondary care to improve the standards of care. It has been found in a number of studies that intensive treatment with antidiabetic drugs can reduce micro (amputations, chronic renal disease and retinopathy) and macro (myocardial infarction, heart failure and stroke) vascular complications that are causes not only of major disability but also shortened life expectancy (Control and Complications Trial Research Group, 1994). Diabetes is a complex chronic condition and studies have also identified that cholesterol and blood pressure must also be controlled appropriately to reduce long term problems of stroke and heart disease (UK Prospective Diabetes Study Group, 1991). Therefore, attainment of the clinical targets by altering and adding specific medication can be seen as prescribing for patients in the most appropriate way according to the most up to date clinical guidelines and protocols.

The Diabetes QOF collected data that reflected adherence to national guidelines with specific comparators. Achievement of a total number of points for the clinical targets would therefore give an indication of how well diabetic patients are managed in practice in England. It should be noted, however, that out of a possible 101 points for ongoing management 35 points are available for control of HbA1C targets (Checkland et al., 2013). These comparators have been used as a measure of the success of education and audit initiatives, and so to include them in this analysis would allow for potential bias towards PCOs that only concentrate on blood glucose levels without managing the wider aspects of good diabetes care. Therefore, it would sensible to exclude the HbA1C comparators. The ongoing management targets within the diabetes QOF have provided a set of measurements that have measured adherence to clinical guidelines across PCOs in England (Health and Social Care Information Centre, 2013c,

Checkland et al., 2013, Health and Social Care Information Centre, 2014f). It should be noted that there were some changes in the individual clinical targets set for ongoing management of diabetes during the 3 year period. These were included in the analysis except for the targets not directly connected to the clinical management of diabetes (structured education, record of smoking status, influenza immunisation or BMI).

Creation of individual indicator: Adherence to clinical guidelines

QOF data for all the clinical targets (except for HbA1C management)

Quantitative data at practice level. Yearly data available for all organisations in England. Source: HSCIC. The data was presented at practice level and the calculation of spend at PCO level has used according to the description in section 4.4.4.

Table 30: Clinical guidelines adherence scoring

Score for clinical guidelines	Description
	2011/12
	The percentage of patients with diabetes in whom the last blood pressure is 150/90 or less (Diabetes Clinical Indicator DM30)
	The percentage of patients with diabetes in whom the last blood pressure is 140/80 or less (Diabetes Clinical Indicator DM31)
	The percentage of patients with diabetes whose last measured total cholesterol within the preceding 15 months is 5mmol/l or less (Diabetes Clinical Indicator DM17)
	The percentage of patients with diabetes who have a record of micro-albuminuria testing in the preceding 15 months (exception reporting for patients with proteinuria) (Diabetes Clinical Indicator DM13)
	The percentage of patients with diabetes with a diagnosis of proteinuria or micro-albuminuria who are treated with ACE inhibitors (or Angiotensin II receptor blockers (ARB)s) (Diabetes Clinical Indicator DM15)
	The percentage of patients with diabetes with a record of a foot examination and risk classification: 1) low risk (normal sensation, palpable pulses), 2) increased risk (neuropathy or absent pulses), 3) high risk (neuropathy or absent pulses plus deformity or skin changes in previous ulcer) or 4) ulcerated foot within the preceding 15 months. (Diabetes Clinical Indicator DM29)
Data ranked 1-211	Calculation: Added the numerator data and the denominator data from DM 13, 15, 17, 29, 30, 31 together and then create a % achievement from these figures
	2012/13 and 2013/14

	The percentage of patients with diabetes, on the register, in whom the last blood pressure reading (measured in the preceding 12 months) is 150/90 mmHg or less, NICE 2010 menu ID: NM01 (Clinical Indicator number DM002)
	The percentage of patients with diabetes, on the register, in whom the last blood pressure reading (measured in the preceding 12 months) is 140/80 mmHg or less, NICE 2010 menu ID: NM02 (Clinical Indicator number DM003)
	The percentage of patients with diabetes, on the register, whose last measured total cholesterol (measured within the preceding 12 months) is 5 mmol/l or less (Clinical Indicator number DM004)
	The percentage of patients with diabetes, on the register, who have a record of an albumin:creatinine ratio test in the preceding 12 months, NICE 2012 menu ID: NM59 (Clinical Indicator number DM005)
	The percentage of patients with diabetes, on the register, with a diagnosis of nephropathy (clinical proteinuria) or micro-albuminuria who are currently treated with an ACE-I (or ARBs) (Clinical Indicator number DM006)
	The percentage of patients with diabetes, on the register, with a record of a foot examination and risk classification: 1) low risk (normal sensation, palpable pulses), 2) increased risk (neuropathy or absent pulses), 3) high risk (neuropathy or absent pulses plus deformity or skin changes in previous ulcer) or 4) ulcerated foot within the preceding 12 months, NICE 2010 menu ID: NM13 (Clinical Indicator number DM012)
	The percentage of patients with diabetes, on the register, who have a record of a dietary review by a suitably competent professional in the preceding 12 months, NICE 2011 menu ID: NM28 (Clinical Indicator number DM013)
Data ranked 1-211	Added the numerator data and the denominator data from DM 02, 03, 04, 05, 06, 12 and 13 together and then create a % achievement from these figures
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.2.3. Specific formulary guidance for use of LA Insulin analogues and GLP-1 agonists

Formularies are local documents and were available from the relevant local NHS organisations (PCOs and acute trusts). They contained formulary directions for the use of LA insulin analogues and GLP-1 agonists over the period of this research study.

Specific recommendations made by the primary and secondary care organisations in their formularies and prescribing guidelines with regard to diabetes drugs for the

treatment of type 2 diabetes (specifically for LA insulins and GLP1 agonists – the areas of interest in this research) have been collected over the period from 2011-2014. Formularies and prescribing guidelines are not necessarily updated every year and not all sections of a formulary are updated at the same time. Therefore, all possible updates over the period that refer to the diabetes drugs in question were collected. Once the documents were collected the directions for use of the two groups of drugs was summarised and placed into the most appropriate category. This exercise was carried out for formularies present at the end of each of the three years (2011/12; 2012/13 and 2013/14). These formulary directions have incorporated national recommendations for use of these drugs.

Creation of individual indicator: Adherence to local LA insulin analogue formulary guidance

During the time of this study national guidelines encouraged the restriction of use of LA insulin analogues because they were more expensive than older alternatives (Waugh et al., 2010, NICE Evidence Summary ESNM25, 2013). Local formularies changed their guidance over the period of this research as is described in the table below:

Trend in LA insulin analogue local formulary guidance over three years (information from local formularies collected as part of this research). Note: PCOs may be affected by more than 1 formulary.

Table 31: LA insulin analogue formulary changes

Advice in formularies or prescribing guidelines	2011/12 Number of documents	2012/13 Number of documents	2013/14 Number of documents
Insulins not listed in formulary or all LA insulins listed	64	18	13
LA insulin analogues (determir and glargine) listed with no restrictions for use. Insulin Degludec NOT listed or classified as NON formulary.	67	162	111
LA Insulin analogues (determir and glargine) listed with no restrictions for use. Insulin Degludec listed but restricted	0	3	2
LA Insulin analogues (determir and glargine) listed but restricted Insulin Degludec Not listed	44	138	108
LA Insulin analogues (determir and glargine) listed but restricted. Insulin degludec listed but more restricted.	0	9	9
Insulin Glargine chosen as 1st choice.	41	91	66
Insulin Determir listed as 1st choice	4	3	2

Summary of data to be used and information source: Qualitative information from PCOs, Acute Trusts, Formulary Committees and APCs coded and scored. Information collected throughout the 3 year period.

Table 32: LA analogue scoring

Score for guidance for using LA insulin analogues	Description
Score 7	Insulin Determir listed as 1st choice
Score 6	Insulin Glargine chosen as 1st choice.
Score 5	LA insulin analogues listed but restricted. Insulin degludec listed but more restricted.

Score 4	LA insulin analogues listed but restricted, Insulin degludec NOT listed.
Score 3	LA insulin analogues listed and insulin degludec listed but restricted.
Score 2	LA insulin analogues listed with no restrictions for use. Insulin Degludec not listed or classified as NON formulary.
Score 1	LA insulin analogues available (all insulins classified green or no insulins listed in formularies).
	Note: insulins are not always listed in formularies because they are available for use as required. In addition prescribing traffic Light lists are often focused on drugs that should not be prescribed and so again, insulins are not often listed. When there is more than 1 formulary or set of guidelines affecting an organisation but one of the formulary does not list insulins then the final scoring will use the scoring for the formulary that has listed the insulins. When there is more than 1 formulary affecting the organisation with differing advice the score will be 0.
	Same scoring criteria for all three years. Different data for each of the three years
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal but reflects the degree of restriction to the use of LA insulin analogues.
Score 5	Only one LA insulin analogue (determir or glargine on the formulary) (score of 6 or 7 above)
Score 4	Both determir and glargine on formulary but restricted (score 4 or 5 above)
Score 3	No restriction on determir or glargine and degludec restricted (score 3 above)
Score 2	No restriction on determir or glargine, but degludec not permitted (score 2)
Score 1	No restriction on prescribing (score of 1 above)

GLP-1 Agonists local formulary guidance

Restricting the use of GLP-1 agonists has been an important consideration for NICE since the cost of treatment with them is much higher than the other drug treatments in the groups. A number of national guidelines were issued during the time of this study (NICE Guidance CG66, 2008, NICE Guidance Costing Statement, 2012, NICE Evidence Summary ESNM26, 2013, NICE Technology Appraisal TA248, 2013, NICE Guidance CC87, 2009, NICE Technology Appraisal TA203, 2010) and changes in local guidance changed throughout the period of this study to reflect these guidelines are shown in the table below.

Table: Trend in GLP-1 agonist formulary directives over three years (information from local formularies collected as part of this research).

Note: PCOs are affected by more than 1 formulary

Table 33: GLP-1 agonist formulary changes

Advice in formularies or prescribing guidelines	2011/12 Number of documents	2012/13 Number of documents	2013/14 Number of documents
Advice to use one of 2 GLP-1 agonists no preference	49	47	17
Advice to use one of 3 GLP-1 agonists no preference	5	68	35
Advice to use one of 4 GLP-1 agonists no preference	0	2	38
Exenatide preferred choice	55	64	57
Liraglutide once daily preferred choice	1	17	24
Lixisenatide once daily preferred choice	0	1	28

Formularies are produced locally but should be in line with the national guidance described above.

Creation of Individual indicator: Adherence to local GLP-1 agonist formulary guidance

Scored based on the formulary decisions keeping pace with national guidelines and new drug introductions. Qualitative information from PCOs, Acute Trusts, Formulary Committees and APCs coded and scored. Information collected throughout the 3-year period.

Table 34: GLP-1 agonist scoring

Score for guidance to use GLP-1 agonists	Description
Score 15	4 GLP-1 agonists listed and exenatide or lixisenatide 1st choice
Score 14	4 GLP-1 agonists listed and liraglutide or lixisenatide 1st choice
Score 13	4 GLP-1 agonists listed and Lixisenatide 1st choice
Score 12	4 GLP-1 agonists listed and exenatide or liraglutide 1st choice
Score 11	4 GLP-1 agonists listed and exenatide bd restricted 1st choice
Score 10	4 GLP-1 agonists listed and exenatide 1st choice
Score 9	4 GLP-1 agonists listed and no preference in choice
Score 8	3 GLP-1 agonists listed and Lixisenatide 1st choice
Score 7	3 GLP-1 agonists listed and exenatide once weekly or liraglutide 1st choice
Score 6	3 GLP-1 agonists listed and liraglutide 1st choice
Score 5	3 GLP-1 agonists listed and exenatide 1st choice
Score 4	3 GLP-1 agonists listed and either no preference or liraglutide and exenatide bd 1st preference
Score 3	2 GLP-1 agonists listed and exenatide bd and liraglutide
Score 2	2 GLP-1 agonists listed and liraglutide 1st choice
Score 1	2 GLP-1 agonists listed and exenatide bd 1st choice
Score 0	GLP-1 agonists not listed, or several different decisions influencing PCO
	Same scoring criteria for all three years. Different data for each of the three years
Quintile allocation	Creation of Quintiles. Data not continuous so PCOs in each quintile not equal but reflects the degree of restriction to the use of GLP-1 agonists and adoption of new drugs during the time of the study
Score 5	4 GLP-1 agonists with 1 chosen as first choice (score 10-15 above)
Score 4	4 GLP-1 agonists listed no preference (score 9 above)
Score 3	3 GLP-1 agonists listed (score 4-8 above)
Score 2	2 GLP-1 agonists listed (score 1-3 above)
Score 1	No formulary guidance for this class of drugs (score 0)

4.5.2.4. Patient education

NICE Guidelines recommend that patients should be offered specific education programmes cover all major aspects of diabetes self-management (NICE Guidance CG66, 2008). There was evidence from a Cochrane review that computer based diabetes self-management interventions could have a beneficial effect on blood glucose. In this way, the more knowledgeable the patient, the better their understanding of their disease and the likely benefits in the audited outcomes measures (Pal et al., 2013).

Such was the acknowledgement of the importance of patient education that it was one of the indicators that had been introduced into the 2013/14 Diabetes Indicators in the QOF Framework. The question in QOF is; “The percentage of patients newly diagnosed with diabetes, on the register, in the preceding 1 April to 31 March who have a record of being referred to a structured education programme within 9 months after entry on to the diabetes register”, NICE 2011 menu ID: NM27 (Health and Social Care Information Centre, 2014f).

It was also a question posed as part of the National Diabetes Audit and has been for 2011/12 and 2012/13. They had collected the number of patients with diabetes who have (a) been offered and (b) who have attended Structured Diabetes Education. The NDA has been collecting data on structured education in England since 2005. The NDA has reported whether there was a record that a person with diabetes has been offered or has attended structured education. Unfortunately, the percentage coverage of the 211 PCOs under the NDA is low and together with the fact that the data is quite different between the two sources has meant that this factor was not be included in this analysis.

4.5.3. Process domain - Generic subgroup

There were two indicators for measuring the process of influencing prescribing behaviour within each PCO that were relevant to this research project. They covered the ability of the PCO to control the prescribing behaviour of GPS within the organisation according to national and organisation guidelines and priorities and the willingness of GPs within the PCO to adopt and prescribe new drugs.

4.5.3.1. Prescribing control

NHS England (and predecessors) set a prescribing budget for each PCOs. There are a number of ways in which prescribing patterns in primary care have been measured and the following comparators were collected and analysed nationally to provide a regular picture of how GPs have prescribed for selected disease and therapeutic areas. As an incentive to change prescribing habits a number of drugs or classes of drugs were identified as being targets for a reduction in prescribing (and sometimes an increase in prescribing if they are cheap alternatives) under the Medicines Management part of QIPP targets. QIPP was a national programme to improve quality and make efficiency savings first set up in 2011. The QIPP programme ended in March 2013 although updates to the comparators and measurements of prescribing trends have continued and this prescribing comparator development work was integrated into the NHS England medicines optimisation work stream (Health and Social Care Information Centre, 2014e).

Quarterly prescribing data for 17 individual comparators for all PCOs was analysed across the three years. Some comparators have changed during this time. A detailed description of the individual comparators is available in Appendix 3. There was one missing quarter (April – June 2012) during this period. In addition, two of the individual comparators were concerned with the subject area of this research, namely GLP-1 agonists and LA insulin analogues. This data has been removed from this prescribing comparator because it will be used to create the outcomes indicator.

Creation of individual indicator: Degree of prescribing control

Level of prescribing control at PCO using QIPP Prescribing comparators.

Quantitative data at practice level (calculated to provide PCO level information). Quarterly data available for all organisations in England. PACT data (QIPP comparators). The data was presented at practice level and the calculation at PCO level has performed according to the description in section 4.4.4.

Table 35: Prescribing control scoring

Score for prescribing control	Description
Data ranked 1-211 for each individual comparator	Add up the ranking of organisations for all appropriate drugs for all 3 years . The lower the final score, the higher the group.
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.3.2. Prescribing behaviour of GPs

A report discussing the need to accelerate the adoption and spread of innovation across the NHS was published in December 2011 (Department of Health, 2012). This is part of the Government's Plan for Growth and the Life Sciences Strategy. One of the actions that was identified in this report was the need to improve compliance with NICE Technology Appraisals (TAs) and reduce the variation that was seen across NHS organisations in England and Wales. There is no way of accurately measuring this because there is no universal easy way to access patient records, however the concept of an Innovation Scorecard (IS) was developed to provide an indication of compliance and variation at PCO level. The first IS was produced in January 2013 and this used data from 2011. Since then there has been a report for data in 2012 (published June 2013) and quarterly reports from Q1 2013/14 onwards that have been published since October 2013. The data and publication of the data was classified as experimental whilst feedback and development were being requested to the confirm the usefulness

and suitability of the data and the way it was presented. There were two types of analysis that are relevant to this research. Firstly, there is an in depth analysis of a handful of new drugs that have NICE guidelines to advise GPs in how to use them and that were mainly prescribed in primary care. For these drugs, an estimate of the likely numbers of patients who would be eligible to receive the drug (eligible population) had been calculated for each PCO, the expected prescribing levels based on prescribing of the drug in accordance with the guidelines was calculated and then the actual prescribing rate for each drug was measured and a ratio of observed against expected obtained. A number of estimates and assumptions were made in this analysis. The eligible patient population was estimated using The NICE Costing Tool. An example of such a Costing Tool is the one for GLP-1 agonists (NICE Guidance Costing Statement, 2012). The second type of analysis was one where a range of new drugs had been monitored over the period to measure uptake across the PCOs. The predominant use of these medications is in primary care (97% or more). For this analysis prescription data has again be obtained from HSCIC and the data is presented in DDDs per 100,000 resident population (Health and Social Care Information Centre, 2014b).

Prescribing of new drugs – NICE Innovation Scorecard – across all drugs

Note: drugs used in the analysis changed each year. In 2011/12 one of the drug classes analysed was GLP-1 agonists for type 2 diabetes. This has not been included in the creation of this indicator because it has been used as the dependent indicator.

Creation of individual indicator: Measure of GP prescribing behaviour

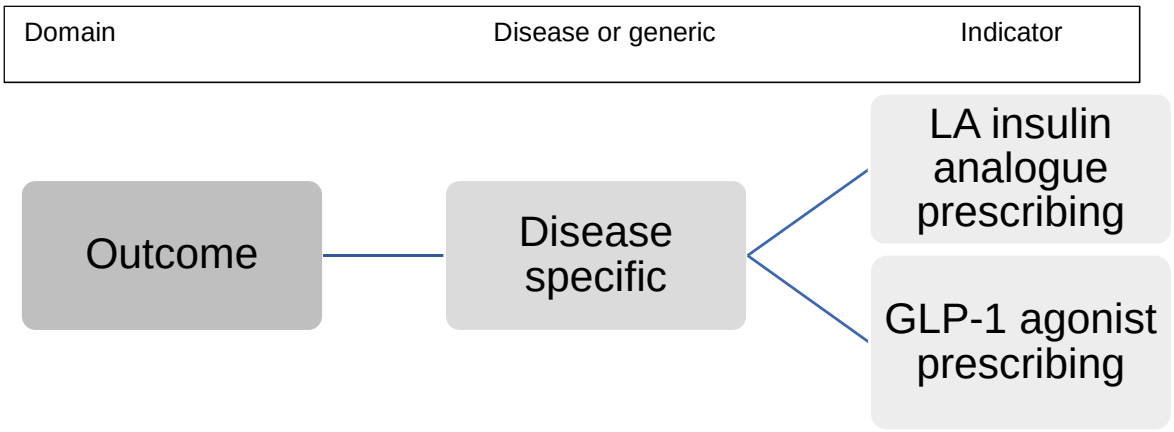
Quantitative data at PCO level. Yearly data available for all organisations in England. NICE Report Innovation Scorecard.

Table 36: GP Prescribing behaviour scoring

Score for GP prescribing behaviour	Description
	2011/12
Data ranked 1-211	Drugs included for analysis in 2011 (ratio of expected: observed) : Varenicline Osteoporosis and Statins (Health and Social Care Information Centre, 2013a)
	Each PCO ranked from 1 (lowest prescriber of new drug) to 211 (highest prescriber of new drug)
	2012/13
Data ranked 1-211	Drugs included for analysis in 2012 (ratio of expected: observed): Exenatide and liraglutide in type 2 diabetes. Insulin determir and insulin glargine in type 2 diabetes (Health and Social Care Information Centre, 2013a) Drugs included for analysis of a range of primary care drugs in 2012 (calendar year): bupropion hydrochloride; celecoxib; esomeprazole; etodolac; meloxicam; Orlistat; oxcarbazepine; rabeprazole sodium; raloxifene hydrochloride; tiagabine; zalepion and zopiclone (Health and Social Care Information Centre, 2014b)
	Each PCO ranked from 1 (lowest prescriber of new drug) to 211 (highest prescriber of new drug) for 13 different drugs selected by NICE. All scores added together.
	2013/14
Data ranked 1-211	Drugs included for analysis of a range of primary care drugs in 2013/14: dipyridamole Modified release (M/R) with aspirin; ezetimibe; febuxostat; fluvastatin sodium; insulin determir; insulin glargine; liraglutide; naftodrofuryl oxalate; pravastatin sodium; raloxifene hydrochloride; rosuvastatin calcium; simvastatin; strontium ranelate; varenicline tartrate; zaleplon; and zolpidem (Health and Social Care Information Centre, 2015b)
	Each PCO ranked from 1 (lowest prescriber of new drug) to 211 (highest prescriber of new drug)
	Note: Drugs included for analysis in 2011 and 2012: the information in this analysis was originally linked to PCTs but was converted to match CCG populations in April 2013.
	Same scoring criteria for all three years. Different data for each of the three years.
Quintile allocation	Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)

4.5.4. Outcome domain

Figure 2: Indicators used in the Outcome Domain



There were two separate outcome indicators in this research. The first was the net ingredient cost (NIC) per 100,00 for spend on LA insulin analogues and the second was the net ingredient cost (NIC) per 100,000 for spend on GLP-1 agonists. A separate value for each PCO in England for each of the three years from 2011/12 to 2013/14 was calculated based on practice level prescribing spend for each of the years.

This study was focused on type 2 diabetes although it should be noted that LA insulin analogues are also prescribed for patients with type 1 diabetes. The increasing uptake of the expensive LA insulin analogues over cheaper isophane insulin products has been targeted by national productivity programmes as a way of reducing prescribing spend in PCOs. It is therefore an example of a drug class that may be actively discouraged by many organisations. This has been reflected in the recommendations in many of the formularies whereby prescribing should only be as a second line option if isophane insulin has been found to be unsuitable. It is also one of the indicators that

was chosen by PCOs during the period of the study as one of the targets in their prescribing incentive schemes to reduce prescribing costs. In a similar way, GLP-1 agonists were chosen for study because they are a relatively new therapeutic class of drug used as third line therapy in type 2 diabetes often as an alternative to initiating insulin. Their place in the treatment of type 2 diabetes according to NICE Guidance (NICE Guidance CC87, 2009) is after the cheaper and more established metformin and sulphonylureas. To encourage the use of metformin and sulphonylureas this was also a prescribing QIPP comparator (National Prescribing Centre, 2011, National Prescribing Centre, 2012). However, increasingly the newer more expensive antidiabetic drugs are being used. Analysis from the HSCIC Report Prescribing for Diabetes: England 2005-6 to 2013-14 (Health and Social Care Information Centre, 2014d) has found that the number of items of newer antidiabetic drugs increased by 164.3% from 2005-6 to 2013/14 with an attendant rise in net ingredient cost of 129.6% for the same period (£102.9 million).

Creation of individual indicator: Prescribing of LA insulin analogues and GLP-1 agonists

The prescribing data for both drug classes for the period of study was available from the HSCIC database. The data was presented at practice level and the calculation at PCO level has performed according to the description in section 4.4.4.

Table 37: LA insulin analogue prescribing score

Score for LA insulin analogues	Description
Data ranked 1-211	Prescribing data for LA insulin analogues per 100,000 (ranking 1 for lowest rate)
	Same scoring criteria for all three years. Different data for each of the three years.

Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)	Creation of Quintiles

Table 38: GLP-1 agonist prescribing scoring

Score for GLP-1 agonists	Description
Data ranked 1-211	Prescribing data for GLP-1 agonists per 100,000 (ranking 1 for lowest rate)
	Same scoring criteria for all three years. Different data for each of the three years.
Ranked data divided into 5 equal groups (Quintile 5 with 1 extra PCO)	Creation of quintiles

4.6. Discussion

The previous chapter concluded that it was feasible to create an outline PCO Profile for influences on GP prescribing using a modified Donabedian SPO model as the conceptual framework to structure and understand the known prescribing influences on GPs. This chapter examined publically available data and information to ascertain if it could be used to measure and reflect the varying degree of importance of each prescribing influence in the 211 PCOs during the three years. National datasets proved useful in creating a number of the indicators. However, this data was originally collected and intended for other purposes and although national agencies may intend it as a means of identifying areas for improvement it can often be regarded as a measure of success linked to financial payment by local organisations (Raleigh and Foot, 2010). This might be a problem particularly when we look at the measures of organisational culture and the Department of Health scores for the success and attainment of targets where there could be an element of political pressure for an

initiative to be seen to be successfully adopted. The possible solutions to this problem are twofold. Firstly, it is sensible to try and obtain several measures of the influence using different datasets from both national and local sources. Secondly, it would be ideal for local organisations (PCOs and acute trusts and practices for this research) to be contacted and the importance of each influence on prescribing to be specifically collected from them both from a quantitative viewpoint but also from a qualitative standpoint. Only then could a fully rounded view of the influences on prescribing in each PCO be appreciated.

There were two gaps in the availability of data that meant that the influence could not successfully be measured over the three years. Therefore no indicator for the influence of the pharmaceutical companies, or measure of patient education were able to be added into the model. However, none of the previous research published in the literature has definitively shown that any of these three missing influences are consistently found to have a reproducible effect on prescribing nor have they been identified as particularly important in the papers included in Chapter 2. Therefore, it would be ideal to have the data in this analysis it is unlikely that the results would have been any different. Nevertheless, future studies need to include this data if it is possible to collect it for the great majority of PCOs.

One final element that has not been included in this building of the PCO Profile is a measure of the variability between practices within a PCO. This would be another way of viewing the cohesiveness of an organisation and also measuring the level of influence that GPs within a PCO have on each other (peer pressure). This is often cited as significant and an important way of changing behaviour (Walker, 2004, Naylor, 2013). Whilst a lot of the national datasets do include practice level information (QOF

and prescribing spend), the range of available data is more limited. An indicator could therefore theoretically be constructed to reflect the degree of practice prescribing variability. However, practices are not all the same and just as this research has focused on variability in influences on prescribing in PCOs, there may be value in creating practice level profiles comparing influences on prescribing at practice level.

4.7. Summary

It has been possible to identify data to reflect the influences on prescribing for two drug classes used to treat type 2 diabetes. This data was used to populate PCO profiles for all 211 PCOs in England for the 3years of this research project. The next chapter describes the exercise that was undertaken to compare the PCO profiles that have been created.

CHAPTER 5: COMPARISON OF PCO PROFILES

5.1. Introduction

The aim of this chapter was to compare the PCO Profiles that were created by populating the Donabedian SPO model described in Chapter 4. To test the utility of Donadbedian model, this chapter examined the relationship between the two outcome indictors (prescribing of LA insulin analogues and GLP-1 agonists) and the structure and process indicators used to create the PCO profiles. PCO Profiles for all 211 PCOs in England were created for three successive years so that changes in the PCO profiles and the prescribing rates for both classes of drug could be examined over time as well as compared between PCOs. By repeating the exercise of creating PCO Profiles for three years ,changes in the influences within the structural and process domains could be measured. These changes over time could then be examined against the prescribing of the two outcome indicators to ascertain if there any patterns between altered influences and prescribing behaviour.

Previous published quantitative research looking at influences on prescribing have focused on one off analyses of a limited number of influence (Bjerrum and Bergman, 2000, Kasje et al., 2005, Weiss et al., 1996). This research by contrast, aimed to provide a more comprehensive insight into influences on prescribing over three years. Most other research has also chosen a sample of organisations to study but due to the increased availability of data and information it was also possible to build PCO profiles for all organisations for 3 years. This has the advantage of allowing for an examination of the pattern of change in PCO profiles and prescribing over time. This has not been done before and would allow for identification of PCOs that had similar prescribing

behaviour and a subsequent insight into the PCO profiles that were associated with this prescribing behaviour.

One of the ways in which health data is presented to compare performance across different categories for an organisation is to divide the data into equal groups, for example when exploring the variation in diabetes care in the Atlas of Variation (Right Care Atlas Series, 2012) ; national audit reports on diabetes services in the NHS (National Audit Office Review, 2012); and comparisons of PCO organisations produced by Public Health England such as the Spend and Outcome Tool (SPOT) comparing spend and outcome for CCGs (Public Health England, 2017) and the comparisons of CCG care and spend on the Public Health Dashboard (Public Health England, 2018). The data used in this research is the same in many cases as the data in these national tools and publications (see Chapter 4) so it would be appropriate to investigate this method as a way of gaining insight into changes in data for each organisation over time.

Finally, the quantitative research on influences on prescribing included in the systematic review in Chapter 2 overwhelmingly used multiple regression as a means of identifying how much of prescribing variation could be accounted for by the influencing factors (16 out of 23 papers). In addition, the National Diabetes Audit uses this method to explore the link between PCO indicators such as gender, diabetes type, age, deprivation etc. and achievement of care processes for diabetes (National Diabetes Audit, 2011/12b). This research examined the interaction of a number of possible factors that influenced prescribing behaviour of GPs and so the use of multiple regression analysis would be an appropriate method of analysing the data (Petrie A, 2010).

These research papers used prescribing rates as the dependent variables and the influences on prescribing as the explanatory variables. Creating the PCO Profiles and measuring prescribing rates of the two drug classes allowed for a number of multiple regression analyses on the data. The prescribing rates became the dependent variables and the indicators in the structure and process domains, the explanatory variables.

The multiple regression was performed separately for the two different classes of drugs for each year. This allowed for the results of each year to be compared. Other quantitative studies have identified statistically significant influences on prescribing that account for prescribing variability but there have been no universal findings. For example, one study (Morton-Jones and Pringle, 1993) investigated total prescribing costs and could explain 81% of variation in spend with just four explanatory variables; whereas another study found that 47.7% of variance in prescribing was accounted for by 10 explanatory variables (Hull et al., 2001). The ability to perform the multiple regression on the same organisations for 3years would therefore contribute to current understanding on the key statistically significant influences on prescribing. Looking at two separate dependent variables in the same disease area would also increase understanding of how influences might be different even within treatment for the same disease.

5.2. Aims and objectives

The final aim of this research was to compare PCO profiles for all 211 PCOs in England over a 3year period. Changes in the importance of individual influences within individual organisations over time as well as differences in profiles between organisations were measured.

There were two specific objectives:

1. Examination of the structure, process and outcome indicators (scored into quintiles) across all PCOs for three years. Understanding of (a) Pattern of scoring for the three years, for the individual indicators and individual PCOs (b) Difference between PCO profiles with the same outcomes and (c) examination of PCO profiles in a subset of PCOs with similar outcomes.
2. Analysis using multiple regression to ascertain if there were any statistically significant relationship between the indicators in the structure and process domains and prescribing of LA insulin analogues and GLP-1 agonists

5.3. Method

In order to compare the relative importance of the individual indicators for the PCOs (in the PCO profile) each one was scored into quintiles for all three years so that the relative importance of each indicator over time could be compared for each organisation. In addition, changes in indicator scoring over the three years was examined and a selection of individual PCOs with similar scores for the outcome domain of the Donabedian SPO model were examined to investigate differences and similarities in scores for the corresponding structure and process domains.

Data and information for each indicator was collected, scored according to the method described in Chapter 4 and saved into Excel spreadsheets (separate ones for each indicator by year). All manipulation of the data was performed in Excel and Access. To enable comparison across the years and across indicators all the indicators were divided into quintiles. The allocation of the data for each indicator into quintiles is described in detail in chapter 4, but the general rule was the greater the value (be it

prevalence, level of spend, cohesiveness and achievement of management goals of the organisation; degree of prescribing control; adoption of new drugs) then the higher the allocated quintile.

5.3.1. Changes in PCO indicators in the SPO domains over time

In order to measure the movement between each quintile for each PCO indicator over the three years the pattern was assessed to be in one of four groupings:

1. changing over the three years (not in any one direction);
2. decreasing (moving to a lower quintile over the 3 years);
3. increasing (moving to a higher quintile over the 3 years) and staying in the same quintile for the 3 years. An example of this is shown in Table 39:

Table 39: Example of PCO indicator quintile scoring

PCO	Audit and education 2011/12 quintile	Audit and education 2012/13 quintile	Audit and education 2013/14 quintile	Pattern of change across the 3 years
Camden CCG	4	3	3	decreased
Merton CCG	2	1	1	decreased
Nottingham City CCG	1	1	1	Stayed the same
Newcastle North and East CCG	5	4	5	changed
Greater Huddersfield CCG	2	4	4	increased

This action was repeated for all PCOs, all indicators and for each of the three years of the study period.

5.3.2. Multiple regression analysis

The individual indicators in the structure and process domains were also used to explore the relationship between them and the outcome indicators. For this part of the analysis the underlying data that made up the indicators was used before it was scored

into quintiles. The two dependent variables (in this case the two outcome indicators; LA insulin analogues and GLP-1 agonists) and their PCO indicators (all the indicators in the structure and process domains) for all 211 PCOs were compiled for the three successive years into separate Excel spreadsheets. They were then categorised using Excel functions according to the type of data (continuous / categorical for example); and explained according to standard mathematical descriptions (mean / median/ range etc.). Details of each indicators are described in Appendix 4.

The two classes of drugs were considered separately for this analyses so the regression was run twice for each years' data (once when the explanatory variable was the prescribing rate of LA insulin analogues and once when the explanatory variable was GLP-1 agonist prescribing). All the PCO indicators were the same EXCEPT for the specific LA insulin analogue and GLP-1 agonist formulary guidance. Only the relevant guidance for the particular class of drug was included in each analyses. Both multiple regression analyses was repeated for the three years from 2011/12 to 2013/14.

A general statistical software package called STATA was used to perform the multiple regression analysis (version 14.1) The official reference manual on performing multivariate statistics was used to ensure the software was used correctly (StataCorp, 2015). In addition, online tutorials produced by STATA describing how to carry out a multiple regression using their software were followed.

5.4. Results

5.4.1. Changes in quintile scoring for the indicators over the 3 years

The movement in quintile score for the indicators over the 3 years has been summarised in Table 41. A number of the PCOs had stable indicators over the three

year period of study. This is to be expected in most of the cases; diabetes prevalence for example while increasing over the time period is likely to stay the same for the PCOs unless there has been a significant change in the patient population. The secondary care – area prescribing committee analysis has also mostly remained stable and this is to be expected because working relationships between organisations within the NHS tend to remain the same because of historical referral behaviour and groupings of primary and secondary care organisations within regions and geographical siting of acute trusts and neighbouring PCOs. Similarly, a large change in the number of male GPs in any PCO would be unexpected.

Table 40: Changes in quintiles over the three years for the PCO profile indicators

Structure Domain		Number of PCOs in each category				
Grouping	Indicator	Changed	decreased	increased	Stayed the same	Total
Diabetes service plans and provision	Diabetes organisational priorities	104 (49%)	51 (24%)	42 (20%)	14 (7%)	211
Diabetes service plans and provision	Diabetes total spend	64 (30%)	49 (23%)	58 (28%)	40 (19%)	211
Diabetes population	Diabetes prevalence	4 (2%)	24 (11%)	24 (11%)	159 (76%)	211
Diabetes population	Population classification	1 dataset	1 dataset	1 dataset	1 dataset	
Organisation	Organisation culture	56 (26%)	46 (22%)	70 (33%)	39 (19%)	211
Organisation	Organisation profile	113 (54%)	36 (17%)	25 (12%)	37 (17%)	211
Organisation	Organisation size	1 (0.005)	4 (0.02)	3 (0.014)	203 (96%)	211
Organisation	GP gender	34 (16%)	39 (19%)	43 (20%)	95 (45%)	211
Organisation	GP age	55 (26%)	48 (23%)	49 (23%)	59 (28%)	211
Collaboration	Area prescribing committees	0 (0%)	48 (23%)	41(19%)	122 (58%)	211
Collaboration	Local joint Formulary	104 (49%)	47 (22%)	37 (18%)	23 (11%)	211
Collaboration	Influence of secondary care	45 (21%)	77 (37%(	73 (35%)	16 (7%)	211
Process Domain						
Diabetes specific	Audit and education	59 (28%)	55 (26%)	42 (20%)	55 (26%)	211

Diabetes specific	Clinical Guidelines	44 (21%)	54 (25%)	58 28%)	55 (26%)	211
Diabetes specific	LA Insulin analogue formulary guidance	15 (7%)	12 (6%)	102 (48%)	82 (39%)	211
Diabetes specific	GLP-1 agonist formulary guidance	40 (19%)	10 (5%)	149 (70%)	12 (6%)	211
Diabetes specific	Prescribing control	38 (18%)	52 (24%)	54 (25%)	67 (33%)	211
Generic	GP prescribing behaviour	72 (34%)	50 (24%)	42 (20%)	46 (22%)	211
Outcome Domain						
LA insulin analogues	Prescribing rate	7 (3%)	31 (15%)	33 (16%)	140 (66%)	211
GLP-1 agonists	Prescribing rate	6 (3%)	45 (21%)	45 (21%)	115 (55%)	211

The results for the prescribing rates of LA insulin analogues and GLP-1 agonists are important because despite the overall trend for increased prescribing costs for this group over the three years the relative position of individual CCGs remained remarkably stable throughout the three years. Regardless of the pressures on PCOs to reduce prescribing of LA insulin analogues two thirds (66.7%) of them remained in the same quintile for the three year period. Of the rest, only a small number (7) did not follow a trend to either increase or decrease over the three years. The prescribing habits for the GLP-1 agonists showed the same trend as the prescribing behaviour of the LA insulin analogues but the differences were less marked with just under half 44% remaining in the same quintile over the 3year period.

5.4.2. Individual PCO profiles over 3 years (changes in indicator scores)

The below list all the PCOs and indicators with a description of the changes in quintile scoring that were recorded over the 3year period. For ease of understanding, only the decreasing (blue) or increasing (orange) indicators have been coloured. There are no obvious patterns between the changing of indicator scores in the structure or process

domains with either of the outcomes scores. Using Excel to detect duplicates, it was also possible to confirm that all the PCOs had a unique set of indicator changes.

Table 41: **Individual PCO Profiles over 3 years (changes in indicator scores)**

CCG	Diabetes prevalence pattern	Diabetes org priorities pattern	Diabetes total spend pattern	Org Culture Pattern	Org Profile pattern	GP gender pattern	GP age pattern	influence 2 care pattern	APC pattern	Local formulary pattern	LA insulin analogue formulary guidance	GLP-1 formulary guidance	Audit education pattern	Clinical guidelines pattern	Prescribing control pattern	GP Prescribing pattern	LA insulin analogues prescribing	GLP-1 agonist prescribing
NHS CALDERDALE CCG	stayed the same	changed	stayed the same	stayed the same	changed	changed	change	decreased	stayed the same	decreased	stayed the same	stayed the same	changed	changed	stayed the same	decreased	stayed the same	changed
NHS LEEDS NORTH CCG	stayed the same	stayed the same	decreased	increased	changed	stayed the same	decreased	changed	increased	changed	increased	increased	changed	changed	changed	stayed the same	stayed the same	changed
NHS LINCOLNSHIRE WEST CCG	stayed the same	decreased	decreased	increased	changed	stayed the same	decreased	changed	stayed the same	changed	stayed the same	increased	stayed the same	changed	decreased	decreased	increased	changed
NHS BEDFORDSHIRE CCG	stayed the same	decreased	changed	stayed the same	changed	increased	increased	changed	stayed the same	stayed the same	increased	increased	changed	changed	stayed the same	changed	stayed the same	changed
NHS SOUTH NORFOLK CCG	stayed the same	changed	increased	increased	changed	changed	decreased	increased	decreased		decreased	changed	changed	decreased	increased	changed	decreased	changed
NHS BRACKNELL AND ASCOT CC	stayed the same	changed	decreased	changed	increased	increased	decreased	decreased	stayed the same	changed	increased	increased	stayed the same	changed	decreased	stayed the same	stayed the same	changed
NHS GATESHEAD CCG	stayed the same	changed	decreased	decreased	changed	decreased	decreased	decreased	increased	changed	increased	increased	changed	increased	stayed the same	changed	stayed the same	decreased
NHS NEWCASTLE NORTH AND EA	stayed the same	decreased	stayed the same	increased	changed	stayed the same	decreased	decreased	stayed the same	decreased	stayed the same	increased	changed	decreased	stayed the same	decreased	stayed the same	decreased
NHS NEWCASTLE WEST CCG	increased	decreased	stayed the same	stayed the same	decreased	stayed the same	increased	decreased	stayed the same	changed	stayed the sa	increased	changed	decreased	increased	decreased	stayed the same	decreased
NHS SOUTH TYNESIDE CCG	decreased	changed	changed	changed	decreased	stayed the same	decreased	increased	increased	changed	increased	increased	changed	decreased	increased	decreased	increased	decreased
NHS OLDHAM CCG	increased	increased	stayed the same	changed	increased	increased	decreased	increased	stayed the same	decreased	stayed the same	increased	stayed the same	stayed the same	stayed the same	changed	stayed the same	decreased
NHS GREATER PRESTON CCG	stayed the same	increased	changed	changed	stayed the same	changed	decreased	stayed the same	decreased	changed	stayed the same	increased	decreased	decreased	decreased	stayed the same	stayed the same	decreased
NHS SALFORD CCG	decreased	changed	changed	changed	increased	stayed the same	changed	decreased	stayed the same	decreased	stayed the same	increased	decreased	decreased	changed	changed	stayed the same	decreased
NHS TAMESIDE AND GLOSSOP CC	increased	changed	stayed the same	decreased	changed	changed	decreased	changed	stayed the same	decreased	stayed the same	increased	changed	increased	stayed the same	decreased	stayed the same	decreased
NHS BRADFORD DISTRICTS CCG	stayed the same	stayed the same	decreased	increased	decreased	decreased	stayed the same	decreased	increased	changed	increased	increased	changed	stayed the same	decreased	changed	decreased	decreased
NHS VALE OF YORK CCG	stayed the same	increased	changed	changed	changed	stayed the same	changed	increased	decreased	increased	increased	increased	changed	increased	decreased	changed	stayed the same	decreased
NHS NOTTINGHAM CITY CCG	stayed the same	decreased	decreased	changed	increased	decreased	stayed the same	changed	stayed the same	changed	increased	increased	stayed the same	decreased	stayed the same	changed	stayed the same	decreased
NHS NOTTINGHAM WEST CCG	stayed the same	stayed the same	decreased	changed	decreased	increased	changed	changed	stayed the same	changed	increased	changed	increased	increased	changed	decreased	stayed the same	decreased
NHS COVENTRY AND RUGBY CC	stayed the same	changed	increased	stayed the same	increased	decreased	stayed the same	increased	stayed the same	decreased	increased	increased	stayed the same	increased	increased	increased	stayed the same	decreased
NHS EAST STAFFORDSHIRE CCG	stayed the same	changed	stayed the same	changed	changed	decreased	decreased	decreased	decreased	stayed the same	increased	increased	decreased	decreased	stayed the same	increased	stayed the same	decreased
NHS WARWICKSHIRE NORTH CC	increased	changed	increased	stayed the same	decreased	stayed the same	changed	changed	stayed the same	decreased	increased	changed	increased	changed	increased	increased	stayed the same	decreased
NHS SOUTH EAST STAFFS AND SE	stayed the same	decreased	decreased	changed	decreased	changed	decreased	decreased	decreased	changed	increased	changed	decreased	decreased	decreased	stayed the same	stayed the same	decreased
NHS SOUTH WARWICKSHIRE CC	stayed the same	changed	changed	increased	changed	stayed the same	stayed the same	decreased	stayed the same	decreased	increased	increased	increased	increased	decreased	increased	stayed the same	decreased
NHS TELFORD AND WREKIN CCG	stayed the same	changed	increased	decreased	decreased	stayed the same	changed	stayed the same	stayed the same	stayed the same	increased	changed	decreased	changed	stayed the same	decreased	decreased	decreased
NHS WALSALL CCG	stayed the same	changed	changed	increased	increased	decreased	stayed the same	stayed the same	increased	changed	increased	increased	changed	changed	stayed the same	changed	changed	decreased
NHS NORTH EAST ESSEX CCG	changed	stayed the same	increased	stayed the same	stayed the same	decreased	changed	increased	stayed the same	increased	stayed the same	changed	decreased	changed	increased	stayed the same	stayed the same	decreased
NHS BARKING AND DAGENHAM	increased	decreased	stayed the same	decreased	changed	stayed the same	stayed the same	changed	decreased	increased	changed	stayed the same	stayed the same	increased	decreased	changed	increased	decreased
NHS BRENT CCG	stayed the same	decreased	stayed the same	stayed the same	stayed the same	decreased	stayed the same	changed	stayed the same	decreased	changed	increased	stayed the same	increased	stayed the same	decreased	stayed the same	decreased
NHS CITY AND HACKNEY CCG	stayed the same	changed	increased	increased	changed	decreased	decreased	increased	decreased	increased	increased	increased	increased	stayed the same	stayed the same	stayed the same	decreased	decreased
NHS ENFIELD CCG	stayed the same	changed	increased	decreased	stayed the same	increased	stayed the same	changed	increased	changed	increased	changed	decreased	stayed the same	stayed the same	changed	increased	decreased
NHS HOUNSLOW CCG	decreased	increased	stayed the same	decreased	stayed the same	stayed the same	increased	increased	stayed the same	changed	changed	decreased	stayed the same	increased	changed	decreased	changed	decreased
NHS GREENWICH CCG	increased	decreased	increased	changed	changed	decreased	stayed the same	increased	decreased	changed	increased	increased	stayed the same	stayed the same	changed	decreased	stayed the same	decreased
NHS HAMMERSMITH AND FULH	stayed the same	decreased	decreased	changed	changed	decreased	changed	changed	stayed the same	changed	changed	increased	changed	stayed the same	changed	decreased	changed	decreased
NHS HARROW CCG	stayed the same	decreased	decreased	decreased	decreased	stayed the same	stayed the same	decreased	stayed the same	decreased	increased	increased	decreased	increased	decreased	decreased	stayed the same	decreased
NHS HAVERING CCG	stayed the same	decreased	decreased	decreased	stayed the same	decreased	stayed the same	decreased	decreased	increased	changed	increased	changed	increased	changed	changed	increased	decreased
NHS HILLINGDON CCG	decreased	decreased	changed	decreased	stayed the same	stayed the same	decreased	increased	stayed the same	changed	increased	increased	stayed the same	changed	changed	changed	decreased	decreased
NHS NEWHAM CCG	stayed the same	changed	stayed the same	decreased	changed	changed	stayed the same	increased	stayed the same	increased	increased	increased	stayed the same	stayed the same	decreased	decreased	stayed the same	decreased
NHS REDBRIDGE CCG	stayed the same	changed	increased	decreased	changed	decreased	decreased	changed	decreased	increased	changed	increased	stayed the same	stayed the same	decreased	stayed the same	increased	decreased
NHS MERTON CCG	stayed the same	decreased	increased	changed	changed	stayed the same	changed	increased	decreased	stayed the same	stayed the same	changed	decreased	changed	increased	stayed the same	stayed the same	decreased
NHS WANDSWORTH CCG	stayed the same	changed	increased	increased	decreased	stayed the same	decreased	increased	decreased	changed	stayed the same	increased	stayed the same	increased	changed	decreased	stayed the same	decreased
NHS WEST LONDON (K&C & QPP	stayed the same	decreased	changed	changed	changed	changed	changed	increased	stayed the same	changed	stayed the same	increased	stayed the same	increased	changed	increased	stayed the same	decreased
NHS CANTERBURY AND COASTAL	stayed the same	changed	changed	stayed the same	changed	stayed the same	increased	decreased	stayed the same	changed	stayed the same	changed	increased	changed	decreased	changed	stayed the same	decreased
NHS COASTAL WEST SUSSEX CCG	increased	changed	decreased	changed	changed	increased	increased	decreased	stayed the same	stayed the same	increased	increased	increased	stayed the same	increased	increased	increased	decreased
NHS EAST SURREY CCG	stayed the same	changed	decreased	decreased	stayed the same	stayed the same	increased	stayed the same	stayed the same	decreased	stayed the same	increased	increased	increased	stayed the same	changed	increased	decreased

CCG	Diabetes prevalence pattern	Diabetes org priorities pattern	Diabetes total spend pattern	Org Culture Pattern	Org Profile pattern	GP gender pattern	GP age pattern	influence 2 care pattern	APC pattern	Local formulary pattern	LA insulin analogue formulary guidance	GLP-1 formulary guidance	Audit education pattern	Clinical guidelines pattern	Prescribing control pattern	GP Prescribing pattern	LA insulin analogues prescribing	GLP-1 agonist prescribing
NHS HORSHAM AND MID SUSSE	stayed the same	changed	decreased	increased	increased	stayed the same	increased	decreased	stayed the same	changed	stayed the same	changed	stayed the same	changed	decreased	changed	decreased	decreased
NHS NORTH WEST SURREY CCG	decreased	increased	increased	increased	changed	stayed the same	changed	decreased	stayed the same	changed	stayed the same	decreased	changed	stayed the same	decreased	increased	decreased	decreased
NHS NORTH HAMPSHIRE CCG	stayed the same	changed	increased	decreased	changed	stayed the same	changed	changed	increased	increased	stayed the same	stayed the same	decreased	decreased	increased	changed	increased	decreased
NHS ISLE OF WIGHT CCG	decreased	increased	increased	stayed the same	changed	stayed the same	increased	decreased	stayed the same	changed	increased	increased	increased	decreased	increased	changed	stayed the same	decreased
NHS NORTH & WEST READING CC	stayed the same	changed	stayed the same	increased	changed	stayed the same	changed	decreased	increased	increased	increased	increased	changed	changed	stayed the same	stayed the same	decreased	decreased
NHS SWINDON CCG	increased	changed	decreased	decreased	increased	decreased	changed	decreased	increased	increased	decreased	changed	increased	increased	increased	decreased	stayed the same	decreased
NHS SOUTH DEVON AND TORBAY	stayed the same	changed	stayed the same	increased	stayed the same	changed	increased	changed	stayed the same	changed	increased	increased	decreased	decreased	increased	increased	stayed the same	decreased
NHS DARLINGTON CCG	decreased	decreased	changed	decreased	decreased	changed	increased	increased	stayed the same	changed	stayed the same	increased	increased	decreased	stayed the same	changed	decreased	increased
NHS NORTH DURHAM CCG	stayed the same	changed	changed	increased	changed	decreased	changed	increased	stayed the same	changed	stayed the same	increased	changed	changed	decreased	decreased	stayed the same	increased
NHS HARTLEPOOL AND STOCKTO	stayed the same	increased	changed	increased	decreased	increased	changed	decreased	stayed the same	stayed the same	stayed the same	increased	decreased	decreased	increased	decreased	decreased	increased
NHS SOUTH TEES CCG	stayed the same	increased	changed	increased	changed	decreased	changed	increased	stayed the same	changed	stayed the same	increased	increased	decreased	increased	decreased	stayed the same	increased
NHS BOLTON CCG	stayed the same	decreased	increased	changed	decreased	increased	stayed the same	decreased	stayed the same	decreased	stayed the same	increased	changed	changed	stayed the same	stayed the same	stayed the same	increased
NHS CUMBRIA CCG	increased	changed	increased	increased	changed	stayed the same	stayed the same	changed	decreased	decreased	stayed the same	decreased	changed	stayed the same	changed	changed	decreased	increased
NHS SOUTH CHESHIRE CCG	decreased	changed	stayed the same	changed	changed	decreased	stayed the same	changed	stayed the same	changed	stayed the same	increased	stayed the same	changed	stayed the same	decreased	stayed the same	increased
NHS SOUTH SEFTON CCG	stayed the same	increased	increased	increased	changed	increased	stayed the same	increased	stayed the same	changed	changed	increased	changed	changed	stayed the same	decreased	increased	increased
NHS ST HELENS CCG	stayed the same	increased	increased	increased	changed	stayed the same	increased	increased	increased	changed	changed	increased	stayed the same	decreased	stayed the same	stayed the same	stayed the same	increased
NHS FYLDE & WYRE CCG	stayed the same	changed	changed	increased	changed	decreased	changed	changed	decreased	decreased	increased	decreased	stayed the same	changed	stayed the same	stayed the same	increased	increased
NHS BASSETLAW CCG	stayed the same	changed	stayed the same	stayed the same	changed	stayed the same	increased	stayed the same	stayed the same	changed	decreased	increased	stayed the same	decreased	stayed the same	decreased	stayed the same	increased
NHS DONCASTER CCG	stayed the same	increased	changed	decreased	decreased	increased	changed	decreased	stayed the same	increased	decreased	increased	changed	decreased	decreased	changed	stayed the same	increased
NHS HULL CCG	stayed the same	stayed the same	increased	stayed the same	decreased	decreased	stayed the same	increased	decreased	stayed the same	increased	stayed the same	decreased	decreased	stayed the same	decreased	stayed the same	increased
NHS LEEDS SOUTH AND EAST CC	increased	increased	decreased	increased	increased	stayed the same	decreased	changed	increased	changed	increased	increased	stayed the same	stayed the same	decreased	stayed the same	stayed the same	increased
NHS NORTH LINCOLNSHIRE CCG	stayed the same	increased	increased	decreased	changed	stayed the same	increased	decreased	decreased	stayed the same	increased	changed	decreased	decreased	stayed the same	stayed the same	stayed the same	increased
NHS ROTHERHAM CCG	stayed the same	stayed the same	changed	increased	increased	changed	changed	decreased	stayed the same	increased	increased	increased	decreased	increased	increased	stayed the same	decreased	increased
NHS EREWASH CCG	stayed the same	changed	stayed the same	increased	changed	increased	increased	decreased	stayed the same	decreased	increased	changed	increased	changed	changed	stayed the same	stayed the same	increased
NHS HARDWICK CCG	stayed the same	decreased	increased	increased	decreased	changed	decreased	changed	stayed the same	changed	increased	increased	increased	decreased	increased	decreased	stayed the same	increased
NHS MILTON KEYNES CCG	stayed the same	changed	increased	decreased	changed	stayed the same	stayed the same	decreased	stayed the same	changed	increased	changed	stayed the same	changed	stayed the same	stayed the same	stayed the same	increased
NHS NOTTINGHAM NORTH AND	stayed the same	stayed the same	decreased	decreased	changed	stayed the same	stayed the same	increased	stayed the same	changed	increased	increased	changed	decreased	increased	changed	stayed the same	increased
NHS SOUTHERN DERBYSHIRE CC	decreased	changed	increased	increased	changed	changed	increased	decreased	stayed the same	changed	increased	increased	changed	stayed the same	stayed the same	decreased	decreased	increased
NHS WEST LEICESTERSHIRE CCG	increased	changed	stayed the same	increased	changed	increased	changed	increased	stayed the same	decreased	increased	increased	decreased	increased	stayed the same	increased	stayed the same	increased
NHS BIRMINGHAM SOUTH AND	stayed the same	increased	changed	changed	decreased	increased	changed	increased	stayed the same	increased	decreased	increased	increased	increased	increased	changed	stayed the same	increased
NHS NORTH STAFFORDSHIRE CC	stayed the same	decreased	decreased	changed	changed	increased	decreased	decreased	decreased	changed	increased	increased	decreased	decreased	changed	increased	increased	increased
NHS REDDITCH AND BROMSGRO	increased	increased	increased	changed	changed	increased	changed	decreased	stayed the same	stayed the same	increased	increased	decreased	increased	stayed the same	changed	stayed the same	increased
NHS SOUTH WORCESTERSHIRE C	stayed the same	increased	increased	increased	changed	decreased	decreased	stayed the same	stayed the same	changed	increased	stayed the same	decreased	increased	increased	increased	stayed the same	increased
NHS STOKE ON TRENT CCG	stayed the same	decreased	stayed the same	changed	changed	stayed the same	stayed the same	changed	decreased	changed	increased	increased	decreased	changed	decreased	decreased	stayed the same	increased
NHS EAST AND NORTH HERTFOR	stayed the same	decreased	decreased	increased	changed	decreased	increased	stayed the same	stayed the same	changed	stayed the same	increased	changed	stayed the same	increased	stayed the same	stayed the same	increased
NHS WEST NORFOLK CCG	stayed the same	decreased	increased	decreased	changed	stayed the same	decreased	increased	decreased	changed	decreased	stayed the same	changed	decreased	increased	increased	stayed the same	increased
NHS WEST SUFFOLK CCG	stayed the same	decreased	increased	stayed the same	changed	changed	stayed the same	changed	decreased	changed	increased	increased	decreased	decreased	increased	changed	stayed the same	increased
NHS ISLINGTON CCG	stayed the same	increased	changed	changed	changed	stayed the same	changed	increased	increased	changed	stayed the same	stayed the same	changed	increased	stayed the same	decreased	changed	increased
NHS EASTBOURNE, HAILSHAM A	stayed the same	increased	changed	changed	changed	decreased	decreased	changed	increased	stayed the same	stayed the same	increased	increased	increased	increased	increased	increased	increased
NHS DARTFORD, GRAVESHAM A	stayed the same	changed	changed	increased	decreased	decreased	stayed the same	increased	stayed the same	changed	increased	increased	stayed the same	decreased	stayed the same	changed	increased	increased
NHS MEDWAY CCG	decreased	changed	changed	changed	increased	increased	stayed the same	decreased	stayed the same	changed	stayed the same	increased	decreased	increased	stayed the same	increased	decreased	increased
NHS SURREY HEATH CCG	stayed the same	increased	increased	stayed the same	decreased	stayed the same	increased	decreased	stayed the same	changed	stayed the same	changed	decreased	changed	decreased	increased	stayed the same	increased
NHS THANET CCG	stayed the same	changed	changed	decreased	changed	stayed the same	stayed the same	decreased	stayed the same	stayed the same	stayed the same	increased	stayed the same	changed	changed	decreased	stayed the same	increased
NHS PORTSMOUTH CCG	increased	changed	increased	stayed the same	changed	decreased	changed	increased	increased	increased	stayed the same	increased	increased	changed	increased	decreased	stayed the same	increased
NHS SOUTH READING CCG	stayed the same	changed	stayed the same	increased	changed	decreased	changed	changed	increased	increased	increased	increased	stayed the same	increased	increased	stayed the same	stayed the same	increased
NHS BRISTOL CCG	stayed the same	decreased	changed	decreased	decreased	stayed the same	increased	decreased	stayed the same	changed	stayed the same	increased	decreased	increased	increased	decreased	stayed the same	increased

CCG	Diabetes prevalence pattern	Diabetes org priorities pattern	Diabetes total spend pattern	Org Culture Pattern	Org Profile pattern	GP gender pattern	GP age pattern	influence 2 care pattern	APC pattern	Local formulary pattern	LA insulin analogue formulary guidance	GLP-1 formulary guidance	Audit education pattern	Clinical guidelines pattern	Prescribing control pattern	GP Prescribing pattern	LA insulin analogues prescribing	GLP-1 agonist prescribing
NHS NORTH SOMERSET CCG	stayed the same	decreased	stayed the same	decreased	stayed the same	increased	increased	changed	stayed the same	changed	stayed the same	increased	decreased	increased	changed	stayed the same	stayed the same	increased
NHS SOMERSET CCG	stayed the same	changed	decreased	stayed the same	stayed the same	changed	increased	decreased	increased	changed	increased	increased	decreased	decreased	stayed the same	changed	stayed the same	increased
NHS SOUTH GLOUCESTERSHIRE C	stayed the same	changed	decreased	decreased	stayed the same	stayed the same	decreased	decreased	stayed the same	decreased	stayed the same	increased	stayed the same	increased	stayed the same	stayed the same	increased	increased
NHS WIRRAL CCG	stayed the same	increased	changed	stayed the same	decreased	decreased	decreased	increased	stayed the same	increased	increased	increased	stayed the same	stayed the same	increased	changed	stayed the same	increased
NHS SOUTH LINCOLNSHIRE CCG	stayed the same	decreased	stayed the same	stayed the same	changed	increased	changed	increased	stayed the same	decreased	stayed the same	decreased	changed	stayed the same	decreased	stayed the same	changed	increased
NHS CASTLE POINT AND ROCHFO	stayed the same	decreased	changed	changed	stayed the same	stayed the same	stayed the same	decreased	stayed the same	stayed the same	increased	stayed the same	changed	changed	decreased	changed	decreased	increased
NHS DURHAM DALES, EASINGTO	stayed the same	increased	changed	increased	changed	changed	increased	changed	stayed the same	decreased	stayed the same	increased	increased	increased	decreased	stayed the same	stayed the same	stayed the same
NHS NORTHUMBERLAND CCG	stayed the same	decreased	changed	changed	stayed the same	changed	decreased	increased	stayed the same	changed	stayed the same	increased	changed	decreased	changed	changed	stayed the same	stayed the same
NHS SUNDERLAND CCG	decreased	changed	changed	stayed the same	decreased	decreased	stayed the same	changed	increased	decreased	increased	increased	changed	decreased	changed	changed	increased	stayed the same
NHS BLACKBURN WITH DARWEN	stayed the same	increased	decreased	changed	changed	stayed the same	stayed the same	increased	decreased	increased	increased	increased	increased	increased	stayed the same	changed	stayed the same	stayed the same
NHS BLACKPOOL CCG	stayed the same	stayed the same	increased	stayed the same	changed	stayed the same	decreased	changed	decreased	stayed the same	increased	changed	stayed the same	increased	stayed the same	changed	increased	stayed the same
NHS BURY CCG	increased	increased	decreased	decreased	stayed the same	stayed the same	changed	increased	stayed the same	decreased	stayed the same	increased	increased	decreased	changed	changed	decreased	stayed the same
NHS CENTRAL MANCHESTER CCG	stayed the same	stayed the same	increased	increased	increased	increased	stayed the same	changed	stayed the same	decreased	stayed the same	increased	stayed the same	increased	decreased	decreased	increased	stayed the same
NHS CHORLEY AND SOUTH RIBBI	stayed the same	changed	changed	increased	stayed the same	changed	changed	increased	decreased	increased	stayed the same	increased	decreased	stayed the same	decreased	increased	stayed the same	stayed the same
NHS EAST LANCASHIRE CCG	stayed the same	changed	changed	stayed the same	decreased	changed	decreased	changed	decreased	increased	increased	increased	changed	increased	changed	changed	decreased	stayed the same
NHS EASTERN CHESHIRE CCG	stayed the same	changed	decreased	changed	stayed the same	increased	stayed the same	increased	stayed the same	increased	stayed the same	increased	stayed the same	stayed the same	decreased	changed	stayed the same	stayed the same
NHS HEYWOOD, MIDDLETON AN	increased	changed	increased	changed	stayed the same	decreased	stayed the same	changed	stayed the same	changed	stayed the same	changed	stayed the same	stayed the same	stayed the same	increased	stayed the same	stayed the same
NHS HALTON CCG	stayed the same	changed	increased	changed	changed	changed	increased	increased	increased	changed	changed	changed	changed	changed	stayed the same	decreased	stayed the same	stayed the same
NHS KNOWSLEY CCG	decreased	increased	decreased	changed	decreased	decreased	decreased	increased	increased	changed	changed	changed	decreased	decreased	stayed the same	stayed the same	stayed the same	stayed the same
NHS LANCASHIRE NORTH CCG	increased	changed	changed	decreased	changed	stayed the same	stayed the same	decreased	decreased	changed	increased	increased	changed	increased	changed	decreased	stayed the same	stayed the same
NHS NORTH MANCHESTER CCG	stayed the same	increased	increased	stayed the same	changed	stayed the same	decreased	increased	stayed the same	decreased	stayed the same	changed	stayed the same	stayed the same	changed	decreased	decreased	stayed the same
NHS SOUTH MANCHESTER CCG	stayed the same	changed	increased	increased	changed	increased	stayed the same	increased	stayed the same	decreased	stayed the same	changed	stayed the same	increased	decreased	decreased	stayed the same	stayed the same
NHS SOUTHPORT AND FORMBY	decreased	increased	changed	increased	stayed the same	changed	increased	changed	stayed the same	changed	changed	increased	stayed the same	changed	stayed the same	changed	increased	stayed the same
NHS STOCKPORT CCG	stayed the same	stayed the same	increased	stayed the same	increased	increased	stayed the same	decreased	stayed the same	changed	stayed the same	increased	changed	stayed the same	decreased	changed	stayed the same	stayed the same
NHS TRAFFORD CCG	decreased	decreased	changed	changed	decreased	increased	increased	increased	stayed the same	decreased	stayed the same	increased	decreased	changed	stayed the same	stayed the same	stayed the same	stayed the same
NHS VALE ROYAL CCG	decreased	changed	increased	changed	changed	increased	decreased	increased	stayed the same	increased	stayed the same	stayed the same	stayed the same	stayed the same	decreased	decreased	stayed the same	stayed the same
NHS WARRINGTON CCG	stayed the same	increased	stayed the same	stayed the same	changed	increased	decreased	increased	stayed the same	increased	increased	increased	decreased	decreased	stayed the same	changed	stayed the same	stayed the same
NHS WEST CHESHIRE CCG	stayed the same	changed	decreased	increased	stayed the same	stayed the same	stayed the same	changed	increased	increased	increased	increased	increased	stayed the same	changed	stayed the same	stayed the same	stayed the same
NHS WEST LANCASHIRE CCG	stayed the same	changed	changed	increased	stayed the same	stayed the same	changed	changed	stayed the same	increased	stayed the same	increased	decreased	decreased	increased	increased	increased	stayed the same
NHS WIGAN BOROUGH CCG	stayed the same	changed	stayed the same	changed	changed	stayed the same	decreased	stayed the same	stayed the same	decreased	stayed the same	increased	stayed the same	decreased	decreased	increased	stayed the same	stayed the same
NHS AIREDALE, WHARFDALE AND	stayed the same	decreased	decreased	increased	changed	decreased	decreased	changed	increased	decreased	increased	increased	increased	changed	decreased	changed	decreased	stayed the same
NHS BARNSLEY CCG	decreased	decreased	changed	decreased	decreased	increased	stayed the same	increased	stayed the same	increased	stayed the same	increased	decreased	decreased	decreased	stayed the same	stayed the same	stayed the same
NHS BRADFORD CITY CCG	stayed the same	increased	changed	increased	changed	increased	changed	decreased	increased	stayed the same	increased	increased	stayed the same	increased	decreased	decreased	stayed the same	stayed the same
NHS EAST RIDING OF YORKSHIRE	stayed the same	changed	increased	stayed the same	changed	decreased	increased	decreased	decreased	stayed the same	increased	increased	changed	decreased	decreased	increased	stayed the same	stayed the same
NHS GREATER HUDDERSFIELD CC	stayed the same	decreased	decreased	increased	changed	increased	changed	decreased	stayed the same	changed	stayed the same	increased	increased	increased	decreased	stayed the same	stayed the same	stayed the same
NHS LEEDS WEST CCG	stayed the same	increased	decreased	changed	changed	stayed the same	stayed the same	changed	increased	changed	increased	increased	increased	increased	stayed the same	stayed the same	stayed the same	stayed the same
NHS HAMBLETON, RICHMONDSH	stayed the same	changed	changed	decreased	changed	decreased	changed	decreased	decreased	decreased	stayed the same	increased	increased	stayed the same	increased	changed	increased	stayed the same
NHS HARROGATE AND RURAL DI	stayed the same	changed	changed	decreased	changed	stayed the same	changed	increased	decreased	increased	increased	increased	stayed the same	stayed the same	increased	increased	decreased	stayed the same
NHS NORTH EAST LINCOLNSHIRE	stayed the same	changed	changed	changed	increased	stayed the same	stayed the same	changed	decreased	changed	increased	changed	changed	stayed the same	decreased	changed	stayed the same	stayed the same
NHS NORTH KIRKLEES CCG	stayed the same	changed	increased	changed	stayed the same	increased	changed	changed	stayed the same	decreased	stayed the same	increased	decreased	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same
NHS SCARBOROUGH AND RYEDA	stayed the same	changed	changed	changed	changed	stayed the same	increased	decreased	decreased	changed	increased	increased	decreased	decreased	stayed the same	increased	stayed the same	stayed the same
NHS SHEFFIELD CCG	decreased	decreased	changed	increased	changed	stayed the same	decreased	increased	stayed the same	decreased	decreased	increased	changed	stayed the same	increased	decreased	stayed the same	stayed the same
NHS WAKEFIELD CCG	stayed the same	decreased	changed	increased	increased	increased	changed	increased	stayed the same	changed	stayed the same	increased	decreased	stayed the same	decreased	stayed the same	stayed the same	stayed the same
NHS LINCOLNSHIRE EAST CCG	stayed the same	decreased	stayed the same	increased	changed	stayed the same	increased	changed	stayed the same	decreased	stayed the same	increased	decreased	increased	stayed the same	stayed the same	stayed the same	stayed the same
NHS CORBY CCG	stayed the same	decreased	decreased	increased	changed	stayed the same	increased	changed	stayed the same	decreased	increased	increased	increased	stayed the same	increased	changed	stayed the same	stayed the same

CCG	Diabetes prevalence pattern	Diabetes org priorities pattern	Diabetes total spend pattern	Org Culture Pattern	Org Profile pattern	GP gender pattern	GP age pattern	influence 2 care pattern	APC pattern	Local formulary pattern	LA insulin analogue formulary guidance	GLP-1 formulary guidance	Audit education pattern	Clinical guidelines pattern	Prescribing control pattern	GP Prescribing pattern	LA insulin analogues prescribing	GLP-1 agonist prescribing
NHS EAST LEICESTERSHIRE AND R	changed	changed	increased	increased	changed	changed	decreased	increased	stayed the same	decreased	increased	increased	changed	increased	increased	increased	stayed the same	stayed the same
NHS LEICESTER CITY CCG	stayed the same	changed	increased	increased	changed	stayed the same	decreased	increased	stayed the same	changed	increased	increased	increased	increased	decreased	changed	stayed the same	stayed the same
NHS MANSFIELD AND ASHFIELD (	stayed the same	stayed the same	changed	increased	decreased	stayed the same	increased	increased	stayed the same	changed	increased	changed	stayed the same	decreased	increased	decreased	stayed the same	stayed the same
NHS NENE CCG	stayed the same	changed	changed	increased	changed	stayed the same	changed	stayed the same	stayed the same	changed	stayed the same	increased	changed	decreased	changed	changed	decreased	stayed the same
NHS NEWARK & SHERWOOD CC(	stayed the same	decreased	changed	increased	increased	stayed the same	decreased	increased	stayed the same	changed	increased	increased	increased	stayed the same	increased	changed	stayed the same	stayed the same
NHS NORTH DERBYSHIRE CCG	stayed the same	changed	stayed the same	increased	changed	changed	stayed the same	decreased	stayed the same	decreased	increased	decreased	changed	increased	stayed the same	changed	decreased	stayed the same
NHS RUSHCLIFFE CCG	stayed the same	decreased	decreased	increased	changed	changed	changed	increased	stayed the same	decreased	increased	changed	increased	decreased	increased	changed	stayed the same	stayed the same
NHS SOUTH WEST LINCOLNSHIRE	increased	decreased	stayed the same	decreased	changed	increased	decreased	changed	stayed the same	changed	stayed the same	increased	changed	increased	decreased	decreased	increased	stayed the same
NHS CANNOCK CHASE CCG	increased	changed	decreased	decreased	decreased	stayed the same	changed	decreased	decreased	decreased	stayed the same	increased	stayed the same	changed	changed	increased	stayed the same	stayed the same
NHS DUDLEY CCG	stayed the same	changed	changed	increased	stayed the same	changed	decreased	increased	increased	stayed the same	increased	increased	changed	changed	changed	changed	increased	stayed the same
NHS HEREFORDSHIRE CCG	stayed the same	changed	increased	decreased	stayed the same	increased	increased	increased	stayed the same	changed	increased	increased	changed	changed	stayed the same	increased	decreased	stayed the same
NHS SANDWELL AND WEST BIRM	stayed the same	changed	stayed the same	increased	changed	stayed the same	stayed the same	increased	increased	stayed the same	increased	increased	decreased	increased	increased	increased	stayed the same	stayed the same
NHS SHROPSHIRE CCG	stayed the same	changed	changed	changed	changed	changed	changed	stayed the same	stayed the same	changed	increased	changed	decreased	changed	changed	stayed the same	changed	stayed the same
NHS SOLIHULL CCG	increased	increased	stayed the same	decreased	changed	changed	decreased	increased	stayed the same	changed	increased	increased	increased	stayed the same	increased	increased	stayed the same	stayed the same
NHS STAFFORD AND SURROUND	increased	changed	decreased	changed	changed	changed	changed	decreased	stayed the same	changed	increased	changed	increased	stayed the same	increased		increased	stayed the same
NHS WOLVERHAMPTON CCG	stayed the same	stayed the same	stayed the same	stayed the same	decreased	stayed the same	stayed the same	increased	increased	changed	increased	changed	stayed the same	increased	decreased	decreased	increased	stayed the same
NHS WYRE FOREST CCG	increased	changed	increased	increased	stayed the same	increased	stayed the same	changed	stayed the same	stayed the same	increased	increased	changed	changed	decreased	decreased	stayed the same	stayed the same
NHS CAMBRIDGESHIRE AND PETI	stayed the same	changed	decreased	changed	changed	changed	increased	stayed the same	increased	decreased	stayed the same	changed	decreased	decreased	stayed the same	increased	decreased	stayed the same
NHS IPSWICH AND EAST SUFFOLI	stayed the same	changed	increased	increased	changed	stayed the same	stayed the same	increased	decreased	decreased	decreased	changed	changed	decreased	increased	decreased	stayed the same	stayed the same
NHS GREAT YARMOUTH AND WA	stayed the same	changed	stayed the same	increased	changed	stayed the same	increased	decreased	decreased	changed	decreased	decreased	increased	decreased	increased	changed	stayed the same	stayed the same
NHS HERTS VALLEYS CCG	stayed the same	changed	decreased	increased	increased	decreased	stayed the same	decreased	stayed the same	changed	stayed the same	changed	increased	increased	decreased	stayed the same	stayed the same	stayed the same
NHS LUTON CCG	stayed the same	changed	changed	decreased	stayed the same	increased	decreased	changed	stayed the same	changed	increased	increased	decreased	stayed the same	decreased	changed	stayed the same	stayed the same
NHS MID ESSEX CCG	stayed the same	decreased	changed	decreased	changed	increased	increased	increased	stayed the same	changed	increased	increased	decreased	stayed the same	stayed the same	changed	stayed the same	stayed the same
NHS NORTH NORFOLK CCG	stayed the same	decreased	increased	stayed the same	changed	increased	increased	increased	decreased	changed	decreased	increased	decreased	decreased	increased	decreased	decreased	stayed the same
NHS NORWICH CCG	stayed the same	changed	increased	stayed the same	changed	changed	increased	increased	decreased	changed	decreased	increased	changed	decreased	increased	changed	stayed the same	stayed the same
NHS THURROCK CCG	stayed the same	changed	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same	decreased	stayed the same	decreased	stayed the same	increased	stayed the same	stayed the same	decreased	decreased	stayed the same	stayed the same
NHS WEST ESSEX CCG	stayed the same	decreased	stayed the same	changed	increased	changed	increased	decreased	stayed the same	increased	increased	changed	stayed the same	stayed the same	decreased	changed	decreased	stayed the same
NHS BARNET CCG	decreased	stayed the same	decreased	decreased	increased	stayed the same	stayed the same	decreased	increased	changed	increased	stayed the same	increased	increased	stayed the same	increased	increased	stayed the same
NHS BEXLEY CCG	stayed the same	decreased	increased	decreased	changed	stayed the same	decreased	increased	decreased	decreased	increased	increased	decreased	changed	changed	stayed the same	stayed the same	stayed the same
NHS BROMLEY CCG	stayed the same	changed	increased	decreased	changed	stayed the same	changed	decreased	decreased	stayed the same	increased	increased	changed	stayed the same	changed	stayed the same	stayed the same	stayed the same
NHS CAMDEN CCG	stayed the same	changed	stayed the same	decreased	increased	stayed the same	stayed the same	decreased	increased	changed	increased	stayed the same	decreased	changed	changed	stayed the same	stayed the same	stayed the same
NHS CROYDON CCG	decreased	increased	increased	decreased	decreased	increased	increased	decreased	decreased	increased	increased	increased	changed	stayed the same	changed	stayed the same	stayed the same	stayed the same
NHS EALING CCG	decreased	stayed the same	decreased	changed	increased	changed	stayed the same	increased	stayed the same	decreased	changed	increased	stayed the same	increased	decreased	decreased	stayed the same	stayed the same
NHS HARINGEY CCG	stayed the same	changed	changed	decreased	changed	decreased	stayed the same	changed	increased	stayed the same	increased	changed	decreased	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same
NHS KINGSTON CCG	stayed the same	changed	increased	stayed the same	changed	stayed the same	decreased	increased	decreased	increased	increased	changed	changed	increased	stayed the same	stayed the same	stayed the same	stayed the same
NHS LAMBETH CCG	stayed the same	changed	changed	increased	decreased	stayed the same	decreased	increased	decreased	changed	increased	increased	increased	increased	decreased	decreased	increased	stayed the same
NHS LEWISHAM CCG	stayed the same	changed	decreased	changed	changed	stayed the same	increased	increased	decreased	increased	increased	increased	stayed the same	stayed the same	stayed the same	decreased	stayed the same	stayed the same
NHS RICHMOND CCG	stayed the same	decreased	increased	decreased	increased	stayed the same	increased	decreased	decreased	changed	stayed the same	changed	changed	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same
NHS SOUTHWARK CCG	increased	changed	changed	stayed the same	decreased	increased	decreased	increased	decreased	changed	increased	increased	changed	increased	decreased	stayed the same	stayed the same	stayed the same
NHS SUTTON CCG	stayed the same	decreased	increased	increased	changed	increased	changed	decreased	decreased	changed	stayed the same	changed	stayed the same	stayed the same	increased	increased	stayed the same	stayed the same
NHS TOWER HAMLETS CCG	stayed the same	changed	decreased	decreased	decreased	increased	decreased	increased	decreased	increased	stayed the same	changed	stayed the same	stayed the same	stayed the same	increased	decreased	stayed the same
NHS WALTHAM FOREST CCG	changed	changed	decreased	decreased	increased	changed	stayed the same	changed	stayed the same	increased	changed	increased	stayed the same	stayed the same	changed	stayed the same	stayed the same	stayed the same
NHS CENTRAL LONDON (WESTMI	stayed the same	decreased	changed	increased	increased	changed	increased	increased	stayed the same	decreased	changed	increased	stayed the same	stayed the same	stayed the same	increased	stayed the same	stayed the same
NHS ASHFORD CCG	stayed the same	changed	changed	changed	changed	stayed the same	changed	decreased	stayed the same	changed	stayed the same	changed	stayed the same	changed	decreased	changed	stayed the same	stayed the same
NHS BRIGHTON AND HOVE CCG	stayed the same	increased	decreased	decreased	changed	stayed the same	decreased	stayed the same	stayed the same	changed	increased	increased	increased	increased	stayed the same	changed	changed	stayed the same

CCG	Diabetes prevalence pattern	Diabetes org priorities pattern	Diabetes total spend pattern	Org Culture Pattern	Org Profile pattern	GP gender pattern	GP age pattern	influence 2 care pattern	APC pattern	Local formulary pattern	LA insulin analogue formulary guidance	GLP-1 formulary guidance	Audit education pattern	Clinical guidelines pattern	Prescribing control pattern	GP Prescribing pattern	LA insulin analogues prescribing	GLP-1 agonist prescribing
NHS CRAWLEY CCG	stayed the same	changed	stayed the same	increased	changed	stayed the same	decreased	decreased	stayed the same	stayed the same	stayed the same	increased	decreased	changed	increased	changed	stayed the same	stayed the same
NHS GUILDFORD AND WAVERLEY	stayed the same	changed	stayed the same	increased	changed	stayed the same	changed	decreased	stayed the same	changed	stayed the same	increased	decreased	increased	changed	increased	stayed the same	stayed the same
NHS HASTINGS AND ROTHER CC	stayed the same	changed	changed	changed	changed	stayed the same	increased	stayed the same	increased	stayed the same	stayed the same	increased	decreased	decreased	stayed the same	increased	stayed the same	stayed the same
NHS SOUTH KENT COAST CCG	decreased	increased	changed	stayed the same	changed	increased	increased	decreased	stayed the same	changed	stayed the same	increased	decreased	decreased	increased	increased	stayed the same	stayed the same
NHS SWALE CCG	stayed the same	changed	changed	stayed the same	stayed the same	stayed the same	stayed the same	decreased	stayed the same	increased	stayed the same	increased	stayed the same	increased	stayed the same	decreased	stayed the same	stayed the same
NHS CHILTERN CCG	stayed the same	changed	decreased	increased	changed	decreased	decreased	decreased	stayed the same	changed	stayed the same	increased	changed	increased	changed	changed	decreased	stayed the same
NHS FAREHAM AND GOSPORT C	changed	changed	changed	changed	changed	decreased	increased	stayed the same	increased	changed	stayed the same	increased	changed	stayed the same	increased	changed	decreased	stayed the same
NHS NEWBURY AND DISTRICT CC	stayed the same	changed	stayed the same	changed	changed	stayed the same	changed	decreased	increased	decreased	increased	increased	decreased	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same
NHS OXFORDSHIRE CCG	stayed the same	decreased	decreased	changed	stayed the same	stayed the same	stayed the same	decreased	increased	increased	increased	changed	increased	stayed the same	changed	changed	stayed the same	stayed the same
NHS SLOUGH CCG	stayed the same	increased	increased	changed	changed	decreased	decreased	decreased	increased	changed	increased	increased	increased	increased	decreased	stayed the same	stayed the same	stayed the same
NHS SOUTH EASTERN HAMPSHIR	stayed the same	changed	changed	changed	changed	stayed the same	changed	stayed the same	increased	changed	stayed the same	increased	stayed the same	stayed the same	increased	changed	increased	stayed the same
NHS SOUTHAMPTON CCG	decreased	changed	increased	decreased	changed	decreased	stayed the same	decreased	increased	changed	increased	increased	increased	decreased	increased	increased	stayed the same	stayed the same
NHS AYLESBURY VALE CCG	stayed the same	changed	decreased	increased	changed	stayed the same	changed	decreased	stayed the same	changed	stayed the same	increased	changed	stayed the same	decreased	changed	stayed the same	stayed the same
NHS WEST HAMPSHIRE CCG	stayed the same	changed	changed	increased	changed	increased	changed	decreased	increased	increased	increased	increased	increased	stayed the same	stayed the same	changed	increased	stayed the same
NHS WINDSOR, ASCOT AND MAI	stayed the same	changed	decreased	changed	increased	stayed the same	stayed the same	decreased	increased	changed	increased	changed	increased	changed	stayed the same	increased	stayed the same	stayed the same
NHS WOKINGHAM CCG	stayed the same	increased	stayed the same	increased	decreased	increased	increased	decreased	increased	changed	stayed the same	decreased	decreased	decreased	stayed the same	stayed the same	decreased	stayed the same
NHS BATH AND NORTH EAST SO	stayed the same	increased	decreased	changed	stayed the same	stayed the same	stayed the same	decreased	stayed the same	increased	decreased	increased	changed	increased	decreased	changed	increased	stayed the same
NHS DORSET CCG	stayed the same	decreased	decreased	changed	stayed the same	stayed the same	increased	increased	increased	decreased	stayed the same	increased	increased	decreased	increased	changed	increased	stayed the same
NHS GLOUCESTERSHIRE CCG	decreased	changed	decreased	changed	changed	decreased	stayed the same	decreased	stayed the same	changed	increased	increased	changed	increased	changed	increased	increased	stayed the same
NHS KERNOW CCG	stayed the same	changed	increased	increased	changed	stayed the same	increased	decreased	stayed the same	changed	stayed the same	increased	stayed the same	changed	changed	changed	decreased	stayed the same
NHS BIRMINGHAM CROSSCITY C	stayed the same	increased	stayed the same	stayed the same	decreased	stayed the same	changed	increased	stayed the same	stayed the same	decreased	increased	changed	decreased	changed	increased	stayed the same	stayed the same
NHS LIVERPOOL CCG	stayed the same	increased	increased	stayed the same	stayed the same	stayed the same	changed	increased	stayed the same	changed	changed	increased	decreased	decreased	stayed the same	changed	increased	stayed the same
NHS NORTH TYNESIDE CCG	stayed the same	decreased	stayed the same	increased	stayed the same	stayed the same	increased	increased	stayed the same	changed	stayed the same	increased	changed	increased	changed	decreased	stayed the same	stayed the same
NHS BASILDON AND BRENTWOO	stayed the same	decreased	decreased	stayed the same	stayed the same	stayed the same	stayed the same	decreased	stayed the same	decreased	increased	changed	decreased	decreased	decreased	increased	stayed the same	stayed the same
NHS SOUTHEND CCG	increased	decreased	changed	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same	changed	stayed the same	stayed the same	stayed the same	stayed the same	stayed the same	changed	stayed the same	stayed the same
NHS SURREY DOWNS CCG	stayed the same	increased	stayed the same	stayed the same	decreased	stayed the same	decreased	changed	stayed the same	changed	increased	decreased	stayed the same	decreased	increased	increased	stayed the same	stayed the same
NHS WEST KENT CCG	stayed the same	changed	changed	stayed the same	changed	stayed the same	increased	increased	stayed the same	changed	increased	increased	changed	stayed the same	stayed the same	changed	stayed the same	stayed the same
NHS HIGH WEALD LEWES HAVEN	decreased	increased	changed	stayed the same	stayed the same	changed	decreased	decreased	decreased	changed	stayed the same	increased	stayed the same	changed	increased	increased	stayed the same	stayed the same
NHS NORTH EAST HAMPSHIRE A	stayed the same	changed	increased	changed	decreased	stayed the same	decreased	decreased	decreased	changed	increased	increased	decreased	changed	increased	changed	stayed the same	stayed the same
NHS WILTSHIRE CCG	stayed the same	increased	increased	increased	changed	stayed the same	stayed the same	decreased	decreased	decreased	stayed the same	decreased	increased	stayed the same	stayed the same	changed	stayed the same	stayed the same
NHS NORTH, EAST, WEST DEVON	increased	increased	stayed the same	increased	stayed the same	stayed the same	stayed the same	increased	stayed the same	decreased	increased	increased	decreased	changed	increased	changed	stayed the same	stayed the same

5.4.3. Indicators where the indicator value was in the same quintile for all three years (stayed the same)

The indicators that remained in the same quintile for the 3 years have been summarised in Table 42 below:

Table 42: Indicators that have remained the same for 3years

Indicator	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	total PCOs that stayed the same
Diabetes organisational priorities	1	6	0	5	2	14
Diabetes total spend	13	4	5	3	15	40
Diabetes prevalence	39	36	25	24	35	159
Population classification	1 dataset	1 dataset	1 dataset	1 dataset	1 dataset	1 dataset
Organisation culture	15	4	3	3	14	39
Organisation profile	14	5	2	3	13	37
Organisation size	41	39	40	41	42	203
GP gender	29	13	12	14	27	95
GP age	12	8	5	9	25	59
Influence of secondary care	0	1	13	2	0	16
Area prescribing committees	6	41	37	25	13	122
Local joint Formulary	2	6	13	0	0	
Audit and education	25	7	4	5	14	55
Clinical Guidelines	19	7	7	8	14	55
LA Insulin analogue formulary guidance	5	1	0	42	34	82

GLP-1 agonist formulary guidance	0	6	6	0	0	12
Prescribing control	20	7	9	7	24	67
GP prescribing behaviour	17	6	3	9	11	46
LA insulin analogues Prescribing rate	36 (86%)	25 (59.5%)	23 (55%)	22 (52%)	34 (81%)	140
GLP-1 agonist Prescribing rate	33 (78.6%)	17 (40%)	15 (35.7%)	20 (47.6%)	30 (69.7%)	115

5.4.4. Outcome indicators (changes over time)

The prescribing rate for LA insulin analogues for the 3 year study period remained in the same quintile for all three years for 66% of PCOs. So, although the prescribing rate had generally increased throughout the time, the PCOs have tended to keep the same prescribing behaviour. This was more marked in those PCOs in either the top or bottom quintiles with 86% of PCOs in the bottom quintile (lowest prescribing rate) remaining there for all three years and 81% doing the same in the top quintile. Those PCOs that had changed over the three years had mostly moved in one direction (33 had increased prescribing rates to move to another quintile, and 31 had decreased over the same period). The prescribing habits for the GLP-1 agonists showed the same trend as the prescribing behaviour of the LA insulin analogues group but the differences were less marked with just under half 44% remaining in the same quintile over the 3 year period. The same trend whereby the top and bottom quintiles showed greater stability was seen with the GLP-1 agonists prescribing as it was for the LA insulin analogues prescribing, but again the differences were less marked for the GLP-1 agonists prescribing.

5.4.5. Structure and process indicators (changes over time)

The pattern of change over time with the PCO indicators showed a range of behaviour with the majority of them (audit and education, clinical guidelines, GP prescribing behaviour, financial - diabetes spend) being quite evenly spread across the categories (changed, decreased, increased or stayed the same). A few variables showed that most of the PCOs have stayed in the same quintile for the three years (secondary care – area prescribing committees, GP gender, diabetes prevalence and LA insulin analogues formulary guidance). One variable, secondary care – unnecessary referrals to secondary care showed a trend to either decrease or increase (150 PCOs) – demonstrating a change in the referral behaviour of PCOs over the period. Two variables had recorded a trend in moving from a lower to higher quintile - the organisation culture (70 PCOs have increased in sophistication over the three years) and GLP-1 agonists formulary guidance (176 have increased in the approval of use for GLP-1 agonists). Two variables had shown a marked move up or down to a different quintile in 2012/13 only to change direction the following year with Organisation – diabetes priorities having 104 PCOs and GP prescribing behaviour having 72 PCOs in this category.

Despite the trends in results across all organisations, when each PCO scoring was examined individually, it could be seen that two PCOs that scored equally for prescribing could be quite different in their scores for individual PCO profile indicators. There were only a small number of PCOs that scored in the top or bottom quintile for both drug classes for all three years and when examining the indicator scores for these PCOs across the three years we find that although they may have similar prescribing

spend on both drugs groups for the three years the scores for their corresponding PCO profile indicators were quite different.

5.4.6. Identification of PCOs with similar prescribing behaviour over 3 years

In order to examine the changes in indicator scores over the 3 years in PCOs with similar prescribing behaviour Table 43 has been compiled. The PCOs were chosen to represent different prescribing behaviour over the 3 years. The first six CCGs all prescribed the lowest rate of LA insulin analogues and GLP-1 for all 3 years; the next 4 PCOs prescribed the largest amount of the two classes of drugs; the next 3 PCOs had all seen a reduction in prescribing rate from high to the lowest quintile and the final CCG had increased. The shading of each indicator reflects the quintile score so that the lightest colour represents the lowest quintile score. The colours chosen represent the sub domain groupings in the Donabedian SPO model (see the Model described in Chapter 3 page), namely:

- Structure domain, subgroup: Diabetes specific indicators: blue
- Structure domain, subgroup: Generic indicators: green
- Process domain, subgroup: Diabetes indicators: orange
- Process domain, subgroup: Generic indicators: yellow
- Outcomes domain: indicators: grey

Table 43: Identification of PCOs with similar prescribing behaviour (outcomes) over 3years

CCG	influence 2 care quintiles	APC	Local formulary	Org Culture	Organisation Profile	Organisation Size	Gp gender	Gp age	Diabetes Prevalance	Diabetes Organisation Priorities	Diabetes total spend	LA insulin analogues formulary guidance	GLP-1 agonist formulary guidance	Audit & education	Clinical Guidelines	Prescribing control	GP prescribing behaviour	LA insulin analogue prescribing	GLP-1 agonist prescribing	Year
NHS NORTH TYNESIDE CCG	1	3	4	1	5	3	1	1	4	5	5	4	2	4	2	3	5	1	1	2011/12
NHS NORTH TYNESIDE CCG	5	3	1	3	5	3	1	2	4	3	5	4	3	3	2	2	4	1	1	2012/13
NHS NORTH TYNESIDE CCG	5	3	3	3	5	3	1	1	4	2	5	4	4	4	4	3	4	1	1	2013/14
NHS RICHMOND CCG	4	3	1	4	1	2	1	3	1	4	1	4	2	4	2	1	1	1	1	2011/12
NHS RICHMOND CCG	2	3	3	3	2	2	1	3	1	3	1	4	1	2	2	1	1	1	1	2012/13
NHS RICHMOND CCG	2	2	1	3	3	2	1	4	1	1	4	4	3	3	2	1	1	1	1	2013/14
NHS LUTON CCG	5	3	3	3	1	3	4	5	5	4	4	1	2	3	1	4	1	1	1	2011/12
NHS LUTON CCG	2	3	1	3	1	3	5	4	5	5	1	1	3	2	1	4	3	1	1	2012/13
NHS LUTON CCG	5	3	3	2	1	3	5	4	5	1	3	2	4	1	1	3	1	1	1	2013/14
NHS IPSWICH AND EAST SUFFOLK CCG	2	4	3	1	4	5	4	1	2	5	2	2	2	2	4	2	4	1	1	2011/12
NHS IPSWICH AND EAST SUFFOLK CCG	4	4	3	2	3	5	4	1	2	2	2	2	3	3	3	3	3	1	1	2012/13
NHS IPSWICH AND EAST SUFFOLK CCG	5	3	2	3	4	5	4	1	2	4	5	1	1	2	1	4	3	1	1	2013/14
NHS BRADFORD CITY CCG	4	2	2	3	2	1	4	4	5	4	5	1	1	1	1	4	5	1	1	2011/12
NHS BRADFORD CITY CCG	2	2	2	5	5	1	5	1	5	4	4	2	1	1	1	2	1	1	1	2012/13
NHS BRADFORD CITY CCG	2	3	2	5	4	1	5	4	5	5	5	3	2	1	2	1	1	1	1	2013/14
NHS SOUTHWARK CCG	1	3	2	5	4	4	1	4	1	5	3	2	2	1	1	3	1	1	1	2011/12
NHS SOUTHWARK CCG	4	3	4	5	4	4	2	3	1	4	1	2	2	2	1	3	1	1	1	2012/13
NHS SOUTHWARK CCG	4	2	3	5	3	4	2	3	2	5	4	3	3	1	3	2	1	1	1	2013/14
NHS DURHAM DALES, EASINGTON AND SEDGEFIELD C	1	4	4	1	4	4	5	4	5	3	5	4	1	2	3	2	5	5	5	2011/12
NHS DURHAM DALES, EASINGTON AND SEDGEFIELD C	5	4	3	4	3	4	4	4	5	3	2	4	2	2	3	1	5	5	5	2012/13
NHS DURHAM DALES, EASINGTON AND SEDGEFIELD C	4	4	3	4	5	4	5	5	5	4	4	4	4	4	4	1	5	5	5	2013/14
NHS NORTH EAST LINCOLNSHIRE CCG	2	4	3	5	1	2	5	5	4	5	2	2	3	4	5	5	4	5	5	2011/12
NHS NORTH EAST LINCOLNSHIRE CCG	4	4	1	4	1	2	5	5	4	1	1	2	2	2	5	4	3	5	5	2012/13
NHS NORTH EAST LINCOLNSHIRE CCG	3	2	3	5	2	2	5	5	4	2	3	3	5	3	5	4	4	5	5	2013/14
NHS SOUTH KENT COAST CCG	5	2	2	1	3	2	4	4	5	2	3	4	2	5	4	4	3	5	5	2011/12
NHS SOUTH KENT COAST CCG	2	2	3	1	1	2	5	5	4	3	4	4	3	5	4	4	5	5	5	2012/13
NHS SOUTH KENT COAST CCG	1	2	2	1	2	2	5	5	4	3	3	4	5	4	3	5	5	5	5	2013/14
NHS SANDWELL AND WEST BIRMINGHAM CCG	1	2	2	1	2	5	5	5	5	4	5	4	2	3	3	3	1	5	5	2011/12
NHS SANDWELL AND WEST BIRMINGHAM CCG	5	2	2	4	3	5	5	5	5	3	5	4	2	2	3	4	2	5	5	2012/13
NHS SANDWELL AND WEST BIRMINGHAM CCG	5	5	2	4	1	5	5	5	5	4	5	5	3	2	4	4	3	5	5	2013/14
NHS NORTH STAFFORDSHIRE CCG	5	4	3	5	2	3	3	3	5	4	3	4	2	3	2	3	2	4	1	2011/12
NHS NORTH STAFFORDSHIRE CCG	2	4	1	3	1	3	3	3	5	3	3	4	3	3	2	2	3	4	1	2012/13
NHS NORTH STAFFORDSHIRE CCG	2	3	3	4	3	2	4	2	5	2	2	5	3	1	1	4	5	5	4	2013/14
NHS BRIGHTON AND HOVE CCG	3	3	3	3	1	4	3	2	1	1	5	1	2	3	1	3	3	4	1	2011/12
NHS BRIGHTON AND HOVE CCG	3	3	1	2	2	4	3	1	1	3	3	4	3	5	1	3	4	5	1	2012/13
NHS BRIGHTON AND HOVE CCG	3	3	3	2	1	4	3	1	1	3	1	4	4	5	2	3	2	4	1	2013/14
NHS EASTERN CHESHIRE CCG	2	4	1	3	4	2	1	1	3	4	3	4	1	5	5	2	4	4	1	2011/12
NHS EASTERN CHESHIRE CCG	3	4	3	5	4	2	2	1	2	1	3	4	3	5	5	1	2	4	1	2012/13
NHS EASTERN CHESHIRE CCG	3	4	3	4	4	2	2	1	2	3	2	4	3	5	5	1	4	4	1	2013/14
NHS BRISTOL CCG	5	3	4	3	5	5	1	1	1	5	3	5	2	3	3	2	2	1	2	2011/12
NHS BRISTOL CCG	1	3	1	1	5	5	1	2	1	3	2	5	3	2	3	2	2	1	3	2012/13
NHS BRISTOL CCG	1	3	3	1	4	5	1	3	1	1	4	5	3	2	4	3	1	1	3	2013/14

5.4.7. Individual organisation – change in PCO profiles over time

There are only a small number of PCOs that exhibit the same prescribing behaviour for both classes of drug. A summary of this is shown in Table 44.

Table 44: PCOs with the same prescribing behaviour for both LA insulin analogues and GLP-1 agonists in the same PCO for all 3 years

Prescribing rates	Number of PCOs in the same quintile for LA insulin analogues and GLP-1 agonists prescribing rate
Quintile 1 (lowest rate of prescribing)	11 PCOs
Quintile 2 (second lowest rate of prescribing)	4 PCOs
Quintile 3 (middle rate of prescribing)	0 PCOs
Quintile 4 (second highest rate of prescribing)	6 PCOs
Quintile 5 (highest rate of prescribing)	8 PCOs

Looking at the individual PCO profile results for dependent and PCO indicators for the PCOs that were in the two groups above (in the same quintile for LA insulin analogues and GLP-1 agonists throughout the three years at the top and bottom of the prescribing rates) we can see that there does not appear to be any pattern to the scoring of the PCO structure and process indicators despite the fact that the outcome indicators are in the same quintiles for all three years. However, it does allow us to understand more about how prescribing for diabetes is viewed within the organisation with some PCOs focusing on control of prescribing spend and others on clinical targets. This is shown in the Tables 45-50 below that describe the scoring of individual PCOs that have either the lowest rate of prescribing for both classes of drugs for 3years (Bradford City, Southwark and Ipswich and East Suffolk PCOs) or the highest rate of prescribing (Durham Dales, Easington and Sedgefield, North East Lincolnshire and South Kent Coastal PCOs).

Low prescribing PCOs

Table 45: Bradford City PCO

Scoring from the quintile analysis	What this says about the organisation
Bottom quintile for prescribing of LA insulin analogues and GLP-1 agonists for all 3 years	Very low prescribing rates of LA insulin analogues and GLP-1 agonists
Decreased unnecessary referrals to primary care over 3 year period)	Decreasing importance of secondary care for care of diabetes patients within this PCO with primary care services becoming more significant
Bottom quintile for audit and education and clinical guidelines adherence	Low achievement of audit and clinical guideline targets that have not been improved on during the three years
Moved from middle to top for organisation culture	Has become a cohesive and sophisticated organisation over three years
Bottom quintile for size	Very small population covered by PCO
Top quintile for % GPs male for all three years	Very high proportion of male GPs
Top quintile for diabetes prevalence	High level of diabetes in local population
Top or second to top for total spend	High total spend on Diabetes care throughout the three years
Second to top and top for diabetes priorities and plans	Diabetes a chosen organisational priority with plans for improving care
Moved from 4th to 2nd quintile then to 1st (bottom) quintile over 3 years for prescribing control	Low level of prescribing control within the PCO. Decreasing importance on altering prescribing behaviour via medicines management initiatives over the three years.
Moved from top (5th) to bottom (1st) quintile for adoption of new drugs in second and third years	There was a shift in willingness to adopt new drugs amongst GPs within the PCO from the top quintile in the 1st year to the bottom quintile in the 2nd and 3rd years.
LA insulin analogue formulary	The PCO has no formulary in year 1, listed the 2 LA insulin analogues (determir and glargine) with no restrictions in year 2 then added insulin degludec in 3rd year but with restrictions
GLP-1 agonist formulary	The PCO listed 2 GLP-1 agonists with exenatide twice daily as first choice for all three years. This was a more restrictive formulary than most other PCOs.

Table 46: Southwark PCO

Scoring from the quintile analysis	What this says about the organisation
Bottom quintile for prescribing of LA insulin analogues and GLP-1 agonists	Very low prescribing rates of LA insulin analogues and GLP-1 agonists for all three years.

Increased unnecessary referrals to secondary care from the bottom quintile in year 1 to the second highest (4th) quintile in years 2 and 3.	Increasing importance of secondary care for care of diabetes patients in the PCO rather than primary care.
Bottom two quintiles for audit and education	Low achievement of audit targets throughout the three years
Bottom quintile in first 2 years with improvement to middle quintile for clinical guidelines adherence in year 3	Low achievement for clinical guidelines adherence with some improvement in year 3.
Top quintile for organisation culture	Consistently a cohesive and sophisticated organisation over three years
Second to top quintile for population size	A large population covered by PCO
Bottom or second bottom quintile for % male GPs	Low proportion of male GPs
Bottom (or second bottom) quintile for diabetes prevalence	Low level of diabetes in local population
Middle quintile, then bottom then fourth quintile for total spend	Mixed pattern of total spend on Diabetes throughout the period.
Second to top (4th) and top (5th) for diabetes priorities and plans	Diabetes an organisational priority with plans for improving care
Middle quintile for prescribing control	Middle level of prescribing control within the PCO for all three years.
Bottom quintile for adoption of new drugs for all three years	Consistently low level of adoption of new drugs amongst GPs within the PCO
LA insulin analogue formulary	The PCO listed the 2 LA insulin analogues (determir and glargine) with no restrictions for years 1 and 2 then added insulin degludec in 3rd year but with restrictions.
GLP-1 agonist formulary	The PCO listed 2 GLP-1 agonists no preference in year 1 then added in a first choice of liraglutide for next 2 years.

Table 47: Ipswich and East Suffolk PCO

Scoring from the quintile analysis	What this says about the organisation
Bottom quintile for prescribing of LA insulin analogues and GLP-1 agonists	Very low prescribing rates of LA insulin analogues and GLP-1 agonists for all three years.
Increased unnecessary referrals to secondary care over three year period (2nd; 4th then 5th quintiles)	Increasing importance of secondary care for care of diabetes patients in the PCO rather than primary care.
Moved from 2nd Quintile to top quintile in last year for audit targets	Increased achievement of audit targets

Moved from 4th quintile down to bottom quintile in last year for adherence for clinical guidelines	Decreased achievement of clinical guidelines adherence
Bottom quintile for organisation culture in 2011/12 increasing to 3rd quintile in 2013/14	Low but improving score for a cohesive and sophisticated organisation over three years
Top quintile for population size	A large population covered by PCO
Second highest quintile for % male GPs	High proportion of male GPs
Second bottom) quintile for diabetes prevalence	Low level of diabetes in local population
2nd quintile for two years, then increased spending in 2013/14 to top quintile for total spend	Increasing pattern of spend on Diabetes
Mixed score (2nd quintile in 1st and 3rd year, top quintile for 2nd year) for diabetes priorities and plans	Diabetes an organisational priority with plans for improving care
2nd, 3rd then 4th quintile for prescribing control	Increasing level of prescribing control within the PCO
4th quintile for 2011/14 then 3rd quintile for other years for adoption of new drugs) LA insulin analogue formulary	Middle level of adoption of new drugs amongst GPs within the PCO
LA insulin analogue formulary	The PCO listed the 2 LA insulin analogues (determir and glargine) with no restrictions for years 1 and 2 then all available (or none listed) in year 3.
GLP-1 agonist formulary	The directions for GLP-1 agonist use have been mixed over the 3 years with 2 GLP-1 agonists (liraglutide 1st choice) in year 1; 3 listed in year 2 and 2 listed in year 3.

Highest prescribing PCOs

Table 48: Durham Dales, Easington and Sedgefield PCO

Scoring from the quintile analysis	What this says about the organisation
top quintile for prescribing of LA insulin analogues and GLP-1 agonists	Very high prescribing rates of LA insulin analogues and GLP-1 agonists for all 3 years.
Increased unnecessary referrals from 1 to 5 then 4th quintiles to secondary care over three year period	Increasing importance of secondary care for care of diabetes patients within the PCO.
Moved from 2nd Quintile to 4th quintile in last year for audit targets	Increased achievement of audit targets over the three years.
Moved from 3rd quintile up to 4th quintile in last year for adherence for clinical guidelines	Increased level achievement of clinical guidelines adherence
Bottom quintile for organisation culture in 2011/12 increasing to 4th quintile for remaining 2 years	Low but improving score for a cohesive and sophisticated organisation over three years

4th quintile for population size	A large population covered by PCO
4th or 5th quintile for % male GPs	High proportion of male GPs
5th quintile for diabetes prevalence	Highest level of diabetes in local population
2nd quintile for two years, then increased spending in 2013/14 to top quintile for total spend	Increasing pattern of total spend on Diabetes
Middle score (3rd quintile in 1st and 2nd years, and 4th quintile for 3rd year) for diabetes priorities and plans	Diabetes an organisational priority with plans for improving care
Bottom or 2nd bottom quintile for prescribing control	Low level of prescribing control within the PCO (less importance on altering prescribing behaviour via medicines management initiatives for the three years).
Top quintile for all years for adoption of new drugs)	Highest level of adoption of new drugs amongst GPs within the PCO
LA insulin analogue formulary	The PCO listed the 2 LA insulin analogues (determir and glargine) but with restrictions for years 1 and 2 then added insulin degludec in 3rd year but with additional restrictions.
GLP-1 agonist formulary	Increasing scoring over the 3 years denoting greater acceptance of use of GLP-1 agonists (not listed in year 1; 2 listed in year 2 and 3 in year 3).

Table 49: North East Lincolnshire PCO

Scoring from the quintile analysis	What this says about the organisation
Top quintile for prescribing of LA insulin analogues and GLP-1 agonists	Consistently very high prescribing rates of LA insulin analogues and GLP-1 agonists
Changing quintile (2nd, 4th and 3rd) for unnecessary referrals to primary care over three year period	Mixed pattern for importance of secondary care for care of diabetes patients
Changing quintile (4th, 2nd then 3rd) for audit targets	Mixed pattern for achievement of audit targets
Top quintile for adherence to clinical guidelines	Highest achievement of clinical guidelines adherence for all three years.
Top or second to top quintile for organisation culture	High score for a cohesive and sophisticated organisation over three years
Second to bottom quintile for population size	Low population covered by PCO
Top quintile for % male GPs	High proportion of male GPs
Second top quintile for diabetes prevalence	High level of diabetes in local population
Changing quintile (2nd, 1st and 3rd) for total spend on diabetes	Mixed pattern of spend on Diabetes

Top quintile in 2011/12 decreasing to 1st then 2nd for diabetes priorities and plans	Decreasing importance of Diabetes as an organisational priority with plans for improving care
Top or second to top quintile for prescribing control	High level of prescribing control within the PCO
4th quintile in 1st and 3rd year and 3rd quintile for 2nd year for adoption of new drugs)	Middle or high level of adoption of new drugs amongst GPs within the PCO
LA insulin analogue formulary	The PCO listed the 2 LA insulin analogues with no restrictions for years 1 and 2 then added insulin degludec in 3rd year with restrictions.
GLP-1 agonist formulary	The directions for GLP-1 agonist use have been mixed over the 3 years with 3 GLP-1 agonists in year 1, 2 in year 2 and 3 in year 3 but with 1st choice identified)

Table 50: South Kent Coast PCO

Scoring from the quintile analysis	What this says about the organisation
Top quintile for prescribing of LA insulin analogues and GLP-1 agonists	Very high prescribing rates of LA insulin analogues and GLP-1 agonists
decreased quintiles from 5th to 1st for unnecessary referrals to primary care over three year period	Decreasing importance of secondary care for care of diabetes patients over the three years.
Top or second to top quintile for audit targets	High achievement of audit targets for all three years.
Moved from 4th quintile in 1st two years to middle quintile for last year for adherence for clinical guidelines	Middle score for achievement of clinical guidelines adherence
Bottom quintile for organisation culture	Low score for a cohesive and sophisticated organisation over three years
Second to bottom quintile for population size	Small population covered by PCO
Second to top or top quintile for % male GPs	High proportion of male GPs
Top or second to top quintile for diabetes prevalence	High level of diabetes in local population
3rd or 4th quintile for total spend on diabetes	Mixed middle pattern of spend on Diabetes
2nd to bottom quintile increasing to 3rd quintile in 2nd and 3rd year for diabetes priorities and plans	Low to middle score for Diabetes as an organisational priority with plans for improving care
Top or second top quintile for prescribing control	High level of prescribing control within the PCO
3rd quintile for 2011/12 moving to top quintile for other years for adoption of new drugs	Increasing level of adoption of new drugs amongst GPs within the PCO
LA insulin analogue formulary	The PCO listed the 2 LA insulin analogues (determir and glargine) but with restrictions for years 1 and 2 then added insulin degludec in 3rd year but with additional restrictions

GLP-1 agonist formulary	Increasing scoring over the 3 years denoting greater acceptance of use of GLP-1 agonists (2 listed in year 1 and 3 listed with 1st choice identified in years 2 and 3

5.4.8. Results from the multiple regression analysis

The variation accounted for by the PCO indicators for LA insulin analogues shows a similar trend for all three years. As can be seen from the result below in Table 51 , only approximately 30% of variance in prescribing of LA insulin analogues was explained by the PCO indicators, although there was a trend for the percentage to increase over the three years from 22.91% in 2011/12 to 36.21% in 2013/14.

(The adjusted R squared value reflects how well the PCO indicators account for the dependent variables)

Table 51: LA Insulin analogues results of multiple regression analysis

Year	Adjusted R square
2011/12	0.2291
2012/13	0.2754
2013 14	0.3621

5.4.9. Covariance for LA insulin analogues

Covariance describes the relationship between the PCO indicators and the dependent variables. A negative number indicated that the higher the value for the PCO indicators the lower the score of the dependent variable (Table 52).

Table 52: Covariance relationship between PCO indicators and LA insulin analogue prescribing

PCO indicators	2011/12 Negative coefficients LA insulin analogues	2012/13 Negative coefficients LA insulin analogues	2013/14 Negative coefficients LA insulin analogues
Diabetes organisational priorities	Yes	Yes	
Diabetes Total spend			

Population classification	Yes	Yes	Yes
Diabetes prevalence			
Organisation culture	Yes	Yes	Yes
Organisation profile	Yes		Yes
Organisation size	Yes	Yes	Yes
GP gender			
GP age			Yes
Area prescribing committees			Yes
Local joint formulary	Yes		
Influence of secondary care		YES	YES
Audit and education			
Clinical Guidelines			
LA insulin analogue formulary guidance		Yes	
GLP-1 agonist formulary guidance			
Prescribing control		Yes	Yes
GP prescribing behaviour	Yes		

The covariance results in Table 52 were interesting because the results were not the same for the variables for all the years apart from the effect of organisation culture and organisation size where the results consistently indicate that the more sophisticated and smaller the organisation, the lower the level of prescribing of LA insulin analogues. Other relationships may also be interesting although they were not inverse for all three years. For instance, for the last two years of the research the less the reliance on secondary care and the lower the level of prescribing control the greater the prescribing spend on LA insulin analogues.

5.4.10. Statistically significant indicators for LA insulin analogues

The probability ratios obtained from the multiple regression analyses for the PCOs indicators in the LA insulin analogues model are displayed in Table 53.

Table 53: Probability ratios for individual PCO indicators in LA insulin analogue prescribing in the multiple regression analysis

PCO indicators	2011/12 probability ratios	2012/13 probability ratios	2013/14 probability ratios
Diabetes organisational priorities	0.024	0.320	0.297
Diabetes total spend	0.031	0.000	0.000
Population classification	0.458	0.759	0.364
Diabetes prevalence	0.074	0.251	0.808
Organisation culture	0.003	0.034	0.001
Organisation profile	0.260	0.760	0.641
Organisation size	0.039	0.047	0.178
GP gender	0.034	0.005	0.013
GP age	0.570	0.398	0.831
Area prescribing committees	0.018	0.125	0.605
Local joint formulary	0.884	0.535	0.517
Influence of secondary care	0.302	0.100	0.023
Audit and education	0.225	0.075	0.591
Clinical Guidelines	0.042	0.252	0.197
LA insulin analogue formulary guidance	0.320	0.953	0.021
Prescribing control	0.816	0.754	0.402
GP prescribing behaviour	0.211	0.174	0.001

Unsurprisingly, given the small % of variance explained by these PCO indicators only some of the possible PCO indicators have a statistically significant relationship with the outcome indicators (Table 53). Those highlighted in bold have at least one statistically significant result across the three years. Only organisation culture, GP gender and financial diabetes spend are significant for more than 1 year.

5.4.11. GLP-1 agonist multiple regression analysis

Like the results from the LA insulin analogue multiple regression analysis the PCO indicators begin to show an increasing relationship with the prescribing rate of GLP-1 agonists (Table 54) so that the PCO indicators account for 37.6% of the variation in prescribing by the third year.

Table 54 : GLP-1 agonists results of multiple regression analysis

Year	Adjusted R square
2011/12	0.2078
2012/13	0.2971
2013/14	0.3760

5.4.12. Covariance for GLP-1 agonists

Covariance describes the relationship between the PCO indicators and the dependent variables. A negative number indicated that the higher the value for the PCO indicators the lower the score of the dependent variable.

Table 55 : Covariance relationship between PCO indicators and GLP-1 agonist prescribing

PCO indicators	2011/12 Negative coefficients GLP-1 agonists	2012/13 Negative coefficients GLP-1 agonists	2013/14 Negative coefficients GLP-1 agonists
Diabetes organisational priorities	YES	YES	YES
Diabetes total spend			
Population classification			
Diabetes prevalence			YES
Organisation culture	YES	YES	YES
Organisation profile	YES		YES
Organisation size	YES	YES	YES
GP gender			
GP age			
Area prescribing committees	YES	YES	
Local joint formulary			YES
Influence of secondary care	YES		
Audit and education		YES	YES
Clinical Guidelines			
GLP-1 agonist formulary guidance	YES		
Prescribing control		YES	YES
GP prescribing behaviour	YES		

The indicators that were inversely related to the prescribing of GLP-1 agonists drugs (Table 55) were in some cases the same as those in the LA insulin analogue analysis as in organisation culture and size (all three years), but there was another one, diabetes priorities and plans, that had an inverse relationship for GLP-1 agonist drugs which would imply that the more focus that is spent on improving diabetes services, patient care and treatment the less the spend on newer more expensive drugs such as GLP-1 agonists. Perhaps the most interesting inverse relationship apart from these two, was the one for audit and education. This measure is specifically linked with the close management HbA1C levels and the adding in of GLP-1 agonists to patient regimen was recommended when HbA1C control is not as good as it should be. For this reason, it is surprising that the relationship was an inverse one.

Other patterns that emerged suggested that the influence of secondary care (measured by three different individual PCO indicators – referrals to secondary care, LHE and local formulary influence) was an inverse one as well for both LA insulin analogues and GLP-1 agonist prescribing. This suggested that for newer drugs in type 2 diabetes there was a greater tendency to adopt them in primary care where there was less influence from secondary care. Another interesting result was the inverse relationship between prescribing control and GLP-1 agonist prescribing. Even as the PCOs succeeded in exerting more control on the prescribing behaviour of the GPs in an effort to control overall prescribing costs, so these organisations appeared to be prescribing more of both LA insulin analogues or GLP-1 agonists.

5.4.13. Statistically significant indicators for GLP-1 agonists

The probability ratios obtained from the multiple regression analyses for the PCOs indicators in the GLP-1 agonist model are displayed in Table 56.

Table 56: Probability ratios for individual PCO indicators in GLP-1 agonist multiple regression analysis

PCO indicators	2011/12 probability ratios	2012/13 probability ratios	2013/14 probability ratios
Diabetes organisational priorities	0.152	0.880	0.470
Diabetes total spend	0.072	0.012	0.000
Population classification	0.025	0.064	0.245
Diabetes prevalence	0.324	0.494	0.916
Organisation culture	0.373	0.445	0.409
Organisation profile	0.390	0.851	0.668
Organisation size	0.029	0.003	0.126
GP gender	0.176	0.083	0.072
GP age	0.457	0.135	0.508
Area prescribing committees	0.113	0.021	0.874
Local joint formulary	0.300	0.163	0.565
Influence of secondary care	0.049	0.151	0.235
Audit and education	0.673	0.080	0.017
Clinical Guidelines	0.631	0.509	0.030
GLP-1 agonist formulary guidance	0.999	0.792	0.000
Prescribing control	0.021	0.493	0.503
GP prescribing behaviour	0.750	0.000	0.000

The results for the GLP-1 agonist statistical analysis (Table 56) were interesting because the statistically significant variables were not the same as those identified in the LA insulin analogue analysis. Organisation culture was no longer significant nor was GP gender (although the results for 2012/13 and 2013/14 were close to significance). The audit and education variable was significant in 2013/14 and close to significance in 2012/13. In contrast, GP prescribing behaviour for new drugs and Programme Budgeting spend were still statistically significant for both groups for two out of three of the years.

In summary, the statistically significant PCO indicators for LA insulin analogues were different from those found to be significant for GLP-1 agonists.

For the LA insulin analogues analysis, there were three PCO indicators that have a probability of 0.05 (or near) or lower for all of the three years:

- Organisation Culture (3 years)
- GP gender (3 years)
- diabetes total spend (3 years)

For the GLP-1 agonist analysis, no PCO indicators were statistically significant for all three years but the following were significant for 2 years:

- Audit and education (2 years – 1 close to 0.05)
- Organisation size (2 years)
- Patient – diabetes classification group (2 years – 1 close to 0.05)
- GP prescribing behaviour (2 years)
- diabetes total spend (2 years and 1 close to 0.05)

The other statistically significant PCO indicators were not necessarily the same for each year. One out of three of the PCO indicators covering the influence of other organisations were statistically significant in two out of three of the years for LA insulin analogues and GLP-1 agonists indicating that this was possibly an important explanatory variable as well as those identified above. Two other PCO indicators that would be expected to be linked with the prescribing of a new drug such as GLP-1 agonists have indeed been shown to do so. These were Audit and Education and GP Prescribing Behaviour (both statistically significant for 2012/13 and 2013/14). This was not the same for the LA insulin analogues prescribing, a fact that might be explained by the different profiles of the two drug classes.

Crucially, prescribing rates did not appear to be associated with diabetes prevalence with no statistically significant results in any of the years for LA insulin analogues or GLP-1 agonists. Nor was the explanatory variable scoring the local prescribing guidance for LA insulin analogues or GLP-1 agonists statistically significant until 2013/14 when the p value for LA insulin analogues is 0.021 and 0.00 for GLP-1 agonists. Looking at the changing guidance for both these groups over the period they showed a very different pattern. The specific formulary guidance across the three years for LA insulin analogues were very similar whilst the formulary guidance for GLP-1 agonists showed a significant change with all the 4 GLP-1 agonists being added to the formularies in 2013/14 influencing 93 PCOs.

Organisation culture and organisation size consistently demonstrated a negative association with the increased prescribing of LA insulin analogues and GLP-1 agonists for all three years of the study. In addition, another negative correlation was seen with the patient diabetes classification group for LA insulin analogues; and the organisation diabetes priorities for GLP-1 agonists.

5.5. Discussion

The analyses of prescribing rates for LA insulin analogues and GLP-1 agonists) found that there was an increasing amount of money spent on these two classes of drugs over the period of this study. This reinforced findings of previous reports on diabetes prescribing (Health and Social Care Information Centre, 2014d). However, this research has also discovered that, when NIC per 100,000 is compared, the position of PCOs in relation to other organisations does not change very much. In fact, when the prescribing spend was allocated to one of 5 quintiles for each year based on the NIC per 100,000 for LA insulin analogues then 140 of the 211 PCOs remained in the same

quintile for all of the three years. This pattern was seen to a slightly lesser degree with the GLP-1 agonists with 115 out of 211 remaining in the same quintile and this difference between the two classes of drugs may suggest that they might be affected differently by the explanatory variables. This is an important result considering the pressure on PCOs during this time to curb spending on these drugs in accordance with national guidelines. It suggests that whilst adoption of the drugs has increased year on year over the period, that the prescribing behaviour of GPs in different PCOs when using these drugs has remained relatively stable.

In contrast there was no clear -cut pattern of scoring over the 3 years for the indicators in the structure and process domains that made up the PCO profiles.

This research allowed for the opportunity to assess the importance of PCOs themselves and to test out whether changing the organisations (from PCTs to CCGs) had any fundamental impact on the results. What is more interesting is that despite the change in PCO organisations during the 3year period of the research, the prescribing behaviour of the organisations has remained relatively stable. When the prescribing rates are put into quintiles for each of three years although the prescribing rate has on average increased, the PCOs have tended to remain in the same quintile. For the LA insulin analogues this is more marked in those PCOs in either the top or bottom quintiles with 86% of PCOs in the bottom quintile (lowest prescribing rate) remaining there for all three years and 81% doing the same in the top quintile. Prescribing for GLP-1 agonists showed the same trend although this stability was less marked.

The statistical analysis using multiple regression analysis showed up several important facts. Firstly, that the explanatory variables (structure and process indicators) only

account for a relatively small percentage of variability in the prescribing rates for either drug group in any of the years. The biggest % was in the last year of the study but this only account for 36% of variation in prescribing of LA insulin analogues and 37% of variation in GLP-1 agonists. This fits with the results from most other quantitative studies measuring multiple explanatory variables that might be influencing prescribing behaviour. There were a few exceptions to this in the systematic review such as the study by Hull et al. (2001) where they found that 47.7% of variance in prescribing for antidepressants could be accounted for 10 explanatory variables and work in Denmark where 56% of variation could be accounted for the explanatory factors in one study comparing polypharmacy (Bjerrum, 1999) in 173 GPs and in another study where they found that four explanatory variables accounted for 74% of variation (Bjerrum and Bergman, 2000). Morton-Jones and Pringle (1993) investigated total prescribing costs and could explain 81% of variation in spend with just four explanatory variables that were all associated with GP demographics, patient characteristics and some organisational attributes (number of GPs per population, age, other staff, dispensing and single handed practices).

However, despite the much higher percentages being attributed to the explanatory variables in some of the published quantitative studies they are all one-off analyses and have not been repeated in subsequent years. One of the other very important findings from this research was that the statistically significant variables were different in successive years so that in one-year explanatory factor such as GP gender can be statistically significant but not in other years. This is a crucial finding because previous quantitative studies identified by the systematic review looking at multiple factors have sometimes identified single issues that appear to explain a large percentage of

variability and have subsequently been focused on as being crucially important in changing prescribing. There is also a difference between the results for the two drug classes. This has not been studied previous quantitative studies and it would be useful to see if this is a situation found in other disease areas for different drug classes, as well as repeating the work in this research for different years and possibly other drugs used in treating diabetes.

One criticism of this choice of statistical analysis is that it does not take into account the linear relationship between indicators in the SPO model whereby the structural domain influences the process domain and the process domain influences the outcomes domain. Other research (Ameh et al., 2017) has focused on the development of a statistical modelling tool to do this and explore whether this linear relationship is crucial to understanding the relationship between the indicators. They found that the analysis whereby structure domain indicators could also have a direct influence on outcome indicators provided the best fit for the data they used. This would justify in some way the choice of using a simple multiple regression to look at the influence of all the indicators on the outcome indicators. However, they discarded indicators that were not found to be statistically significant. This approach was not adopted in my research project because I was primarily interested in identifying the indicators and populating the model with the corresponding data for all PCOs. The multiple regression analysis was performed to look for any important relationships between the indicators in the model, but the results of this analysis on all PCOs do not correspond to those for the individual PCOs. Therefore, it would not make sense to discard indicators that may be important to the individual PCOs within their local health economy.

A number of the relationships between the indicators in the structure and process domains and the two outcome indicators were found to be inverse (or negative) ones. Again, other than organisation size the negative relationships were different for the two classes of drugs. For LA insulin analogues the results indicated that the more sophisticated and cohesive the organisation, the smaller the organisation, and the lower the score for diabetes as a priority within the organisation the lower the level of prescribing of the drugs. For GLP-1 agonists the results are very interesting with a negative relationship over the three years for degree of reliance on secondary care, audit and education, clinical guidelines and organisation size. An inverse relationship for audit and education and adherence to clinical guidelines (although this variable was not statistically significant over three years) is perverse, particularly given the fact the audit and education measures the level of control of blood sugar HbA1C and one of the indications for use of the drug is to help gain better control of HbA1C. Similarly, one would have expected closer management of diabetes by better adherence to clinical targets such as weight control would be mirrored with greater use of the drugs. One of the limitations of this research was that it did not explore at specific patient prescribing decisions and this would be necessary to ascertain the exact reasons for deciding to prescribe GLP-1 agonists.

Perhaps we should expect a difference between the statistically significant indicators in the two drug groups and should be aware of specific issues that might affect prescribing behaviour. The LA insulin analogues were introduced into the market as alternatives to the older and cheaper NPH (neutral protamine hagedorn) insulin (NICE Final Appraisal Determination, 2002, NICE Technology Appraisal TA53, 2002). They were indicated and approved for patients who have problems with the twice daily

regimen (hypoglycaemia, failure to reach HbA1C target, cannot use the NPH device or need someone else to administer it) and who would benefit from a once daily long acting insulin analogue. They were specifically identified as a class of drugs that should be discouraged as a first line option during this research period because of their greater cost and limited clinical benefit over the cheaper NPH insulin. However, it was found by looking at the local formulary information that two of the LA insulin analogues (determir and glargine) were available in the local formularies as an option for use over the three years either with no restrictions on their use or where insulins were all classified as green or not listed in over a third of all local documents. So it would appear that the push to limit their use was often only a national QIPP and medicines management target rather than one linked to local disease management and practice.

The guidance for use of GLP-1 agonists changed over the time 2011/12 to 2013/14. They were originally restricted as third line therapy for patients with type 2 diabetes inadequately controlled (in terms of HbA1C) on metformin and sulphonylureas (NICE Technology Appraisal TA203, 2010, NICE Guidance CC87, 2009, NICE Guidance Costing Statement, 2012). Patients had to have a BMI of over 35 (or if under 35 have reasons for not using insulin or have complications of obesity). However, their ability to help weight loss, the introduction of two once daily preparations and then a once weekly injection, and their role in reducing HbA1C (a target from QOF) has led to subsequent guidelines widening their use (NICE Evidence Summary ESNM26, 2013, NICE Guidance Costing Statement, 2012, NICE Technology Appraisal TA203, 2010). In this case and in contrast to the situation with the LA insulin analogues, the local formularies have changed significantly over the period with four GLP agonists included in the formularies in 2013/14 in 22% of documents compared to 0% in 2011/12 and

2012/13. Another change that might go some way to explaining the increased use of GLP-1 agonists over the time was the increased awareness of the significant number of obese patients with type 2 diabetes and how this group of drugs could play a role in helping them to lose weight. However, if treatment was being used in a targeted way towards obese patients we would have expected to see a correlation between diabetes prevalence and GLP-1 agonist use. Ninety five per cent of type 2 diabetes patients are assessed as obese (Public Health England, 2014). This link between diabetes prevalence and GLP-1 agonist prescribing was not something found in this research.

5.6. Conclusion

The analysis of the data that populated the Donabedian SPO model to create PCO profiles showed that PCOs with similar prescribing behaviour could have quite different individual scores for indicators in the structure and process domains.

The Profiles provided a useful means to examine the effect on prescribing of changing a specific influence in individual PCOs over time. The profiles give an overview of how prescribing habits of an organisation are balanced against other clinical targets for the disease area.

A multiple regression to explore the relationship between outcomes (prescribing rates) and influences is the traditional way of examining the effect of several explanatory variables on a dependent variable. This analysis provided interesting conclusions about the possible importance of influences on prescribing behaviour. The statistically significant influences varied according to year and were different according to the drug class studied. This explains the differening results obtained from previously published

research included in the systematic review. It also justifies creating separate PCO profiles for different drug classes and repeating this exercise over several years.

The results of multiple regression analysis are based on the aggregated statistics across all 211 PCOs and implied that associations between the dependent and PCO indicators in the total population of PCOs reflected the situation in individual PCOs. However, this is not the case when the individual PCO profiles are examined. Similar prescribing behaviour can be linked to quite different individual PCO Profiles . This phenomenon is not unknown and has been described as the ecological fallacy (Greenland, 2001). It does not mean that multiple regression analysis is not useful, but it does mean that both population level analyses and individual (in this case individual PCOs) should be performed (PEARCE, 2000).

5.7. Summary

The Donabedian SPO model for prescribing was a useful framework to create PCO Profiles that provided insight into the influences on prescribing in individual PCOs. The profiles could act as a tool to enable organisations to evaluate the effect of changing an influence on prescribing behaviour.

CHAPTER 6: GENERAL DISCUSSION AND CONCLUSIONS

6.1. Discussion

This thesis has examined organisational influences on prescribing within the primary care sector. A number of separate influences have been suggested in the literature, and results from the systematic review in chapter 2 concluded that the influences upon prescribing activity in primary care are multifactorial with no clear hierarchy of influences. They interact with each other and some are more important than others in particular local situations. International studies can provide some useful information, but the local influences and national framework within which care is provided (including national guidelines, health policies and targets) as well as the organisational structures, management and culture were all found to be important when attempting to understand influences on prescribing. The qualitative studies identified a wide range of influencing factors such as specialist training and education of GPs; influence of consultants and other hospital specialist staff; the way local service provision is provided and organisations interact; the importance of the type of organisation that the GP is part of and influence of other GPs within the organisation.

The systematic review identified a number of limitations in the current knowledge of influences on prescribing. Only 5 out of 48 papers included in the review had utilised conceptual models and four of these were based on sociological (qualitative research papers) and 1 on economic models (quantitative research). The quantitative research in this area were also confined to one off analyses of a limited set of influences. Results identifying the statistically significant influences on prescribing vary across the published research with no agreed list of influences. Finally, the majority of research has concentrated on influences when prescribing antibiotics whereas in type 2

diabetes, as in other chronic diseases, disease management is more complex and depends on how care is delivered locally for patients, with local interactions between primary and secondary care being particularly important. The quantitative research did not measure this as an influence on prescribing. There are also often several options for drug treatment in chronic disease management and there is even less research specifically comparing influences in different classes of drugs treating the same disease.

One of the aims of this research was to investigate the use of a conceptual model as a means of understanding and ordering the known prescribing influences in primary care. Since the papers included in the systematic review did not routinely use this method to evaluate the prescribing influences, I turned towards the field of health services research to see if there were conceptual models that could be adapted to be used in this research project. A literature review of papers was carried out to find healthcare research papers that have utilised conceptual models to measure and monitor health services, quality intiatives in healthcare, performance targets in healthcare. This resulted in the identification of the Donabedian SPO conceptual model as a viable option to base the building of PCO profiles upon. The Donabedian SPO model is particularly popular when investigating the relationship between indicators that make up the three domains of structure, process and outcomes at an organisational level. Using the generic descriptions of indicators that have been included in the Donabedian SPO model, I went through an exercise of allocating the prescribing influences identified from the systematic review into the structure and process domains. Since the aim of this research project was to create PCO profiles measure prescribing influences it was logical to choose outcome indicators reflecting

prescribing activity. This enabled the indicators in the domains to be specifically adapted to this project in a manner described in numerous papers (Mainz, 2003, Donabedian A, 2003, Nocella et al., 2016, Ameh et al., 2017, Gardner and Mazza, 2012, Reeve et al., 2015, Kunkel et al., 2007, Neville et al., 1996, Nuckols et al., 2013). The prescribing influences identified in chapter 2 were all included in this conceptual model.

Having chosen the Donabedian SPO model as the conceptual framework to structure the prescribing influences the next stage of this research was to look for publically available data and information to populate the model. Nationally produced data and local NHS organisation information were used in the creation of datasets that reflected the individual indicators in the PCO profile. The nationally produced data has the advantage of being collected for all PCOs and having been audited and tested for consistency in many situations, for the example the QOF data; the National Diabetes Audit data; the NICE prescribing data for new drugs; demographic data; practice workforce data and the practice level prescribing data. Local qualitative information produced by PCOs, acute trusts and local NHS organisations (such as area prescribing committees) was also sought. Local information allowed for a greater understanding of the way in which individual local health economies interacted and organisations developed and behaved. For example, how PCOs had managed the organisational changes required by government reforms and how local formularies responded to the changing NICE guidelines for LA insulin analogues and GLP-1 agonists. This qualitative information was collected, coded and scored to allow for its inclusion ino the qualitative analysis. This has not been done in any other research into prescribing influences.

Chapter 5 described the comparison of the PCO profiles for the 3 years of the study. Two main methods were employed to compare the profiles. The data for all the indicators was divided into quintiles and the movement over the 3years was analysed for each PCO. This method of analysis showed that PCOs with the similar prescribing of LA insulin analogues and GLP-1 agonists could have quite different PCO profiles. It also showed that prescribing for the two drug classes remained similar for the three years in the majority of PCOs. This is despite the period of study encompassing a time of significant organisation change for some PCOs in England.

The second method of analysis was to perform three multiple regression analyses for both of the outcome indicators to determine how much of the variability in prescribing of LA insulin analogues and GLP-1 agonists could be attributed to the influencing indicators. In all 3 years only approximately 30% of variability in prescribing could be accounted for by the influencing indicators. The multiple regression analysis also looked for any statistically significant relationships between the indicators in the structure and process domains and the two outcomes indicators (prescribing behaviour). This analysis found that the statistically significant indicators varied in the different years and according to the drug class studied.

6.2. Limitations

There were two potential major limitations to this research project. The first was that it was not possible to find data or information for all the possible influences on prescribing identified in the literature review for all 211 PCOs. The most important one not to be included was probably the measure of pharmaceutical company influence. This may be significant in this project because companies benefit significantly if they can get their brand of specific diabetes drug used within a LHE. However, this influence was

partly covered by the changes in formulary recommendations over the three years for both of the drug classes studied (section 4.5.2.3. Specific formulary guidance for use of LA Insulin analogues and GLP-1 agonists). Distinct differences in brand endorsement are seen across different geographical areas over this time. Although It would have been good to understand the relative pressure exerted by different companies upon individual PCOs, we can perhaps discern the success of the different companies by the adoption of individual brands in the different local formularies. Linked to this was a lack of acute trust prescribing information. Again, the formulary changes applied to acute trusts within the LHE, but having actual prescribing data from the acute trusts would have enhanced understanding of how adoption of a drug in an acute trust filtered down to the PCOs within the LHE. The second potential limitation was that the project focused on PCOs and therefore the degree of variation of individual influences at practice level were not measured. If this had been examined, then we could have seen significant differences in PCOs that at organisational level appeared similar. Future research could potentially include a measure of the degree of variability in practice prescribing behaviour across a PCO. Such a measure could be included in the structure domain as a measure of organisational variability/cohesiveness. However, this approach is not without problems because practice level variability in prescribing would need to be understood in relation to variation to other practice level data. Some practices within a PCO might have completely different profiles in terms of patient demographics; size; management and arguably it would be better to create practice level profiles based on the Donabedian SPO model to enhance the results of the PCO profiles. This level of data collection and analysis would be beyond the scope of this doctoral research project.

6.3. Future research

This research has created the starting point for understanding prescribing in primary care organizations by using a Donadbedian SPO conceptual model. Future research to continue this work should:

- Expand the use of the Donadbedian SPO model to include other drugs used to treat diabetes and update the current PCO Profiles for these 2 classes of drugs. This would build on the results obtained here and allow for a identification of the key influences on diabetes prescribing in each individual PCO. It would then be possible for PCOs to focus resources more effectively towards those influences that are significant in their organisations. The PCO profiles need to be updated because since 2013/14 there have been more organisational changes (including mergers between CCGs and joint sharing of budgets across different organisations (Manchester LHE); additional financial pressures on PCOs which have led to changes in service provision and developments.
- Create PCO profles for drugs used to treat other conditions managed in primary care. A number of the influences on prescribing were not disease specific so the creation of PCO profiles for other disease areas would not be an onerous task. The creation of such PCO Profiles would allow for examination of repeating patterns of behaviour within PCOs. Knowing the interaction and level of importance between influences would allow for targeted actions to alter prescribing behaviour. For instance, in some PCOs the restrictive formulary guidance had no effect on prescribing behaviour so it is of secondary importance as an influence.
- Work with individual PCOs to further refine the PCO profile. Direct work with PCO and acute trust staff within a local health economy would allow for qualitative

research to refine the profiles. Additional understanding of practice variation within the organisation; identification of key local opinion leaders; local major issues affecting prescribing behaviour; and important local interactions between organisations and groups could be captured within the model. This exercise would also validate the results of the quantitative analysis because, as previously discussed, the data used to populate the PCO profiles has not primarily been collected for this purpose. There is potential danger in relying solely on this secondary data when seeking to understand local situations. This was exemplified by the recent assertion that weekend mortality rates in hospitals in England are higher than during the week (Freemantle et al., 2012). This was based on quantitative data collected for national analysis but more detailed research in the area has found that a proper investigation of the local situation is required to truly understand what the data means and is telling up about the pattern in mortality rates (Wise, 2016).

6.4. Conclusion

The present study is the first to apply the Donabedian SPO model to influences on prescribing. This conceptual model provided a good fit for all the known influences on prescribing identified in the systematic review. Use of this conceptual model to measure changes in healthcare are evident in other branches of health services research where the model provides a useful framework for comparing effectiveness and quality of healthcare interventions. This research has demonstrated that adopting a similar approach to understand prescribing variation in PCOs is a valid one and pulls together previously unconnected influences to provide a good summary of how prescribing is influenced in a PCO.

There was adequate publically available data and information to populate this model for all PCOs in England. The resulting PCO profiles provided insight into the relative importance of the individual influences on prescribing in each PCO. Focusing on individual classes of drugs and adapting the Donabedian SPO model accordingly afforded a picture of varied uptake patterns in PCOs across the country. By creating the PCO profiles for several consecutive years it was possible to see the effect of different influences of prescribing behaviour over time in different organisations.

Continuing to create PCO profiles each year for a range of classes of drugs for other disease areas would build up an in depth knowledge of how individual PCOs react to national and local pressures when prescribing. This in turn could lead to more appropriate allocation of time and resources when prescribing change is required.

Appendix 1

Nationally available diabetes datasets covering the period 2011/12 to 2013/14

Table 57: Sources and descriptions of datasets relevant to this research

Dataset	Coverage (rates of participation and relevant year)	Limitations	Assessment of relevance within NHS	Assessment of relevance to this research
QOF data. The Quality Management and Analysis System (QMAS) was used for the extraction of QOF data in 2011/12 and 2012/13. Now it is Calculating Quality Reporting Service (CQRS), together with the General Practice Extraction Service (GPES). Reported by HSCIC.	Over 90% of practices participated in each year. All three years available.	Collected for purpose of incentive scheme for practices. Score does not reflect patient population, practice infrastructure (single handed practices for example), list size or conditions. (HSCIC Quality and Outcomes Framework – Prevalence, Achievements and Exceptions Report. 28 October 2014).	Accepted by National Bodies (Public Health England, Right Care, HSCIC, NHS England, Diabetes UK) as important measure of clinical care, outcomes and disease prevalence. QOF Diabetes prevalence is used as the most accurate number available of identified patients. QOF data is used extensively in various data packs produced by a number of organisations, as well as being used to identify performance such as: 1. Healthier Lives Tool (Public Health England) 2. DOVE outcomes (Public Health England) 3. CCG Diabetes Profiles (Right Care) 4. Atlas of Variation (Right Care) 5. HSCIC Diabetes Compendium data set (HSCIC) 6. Spend and Outcome Tool	Very relevant. QOF gives an important insight into practice achievement of nationally agreed clinical targets.
National Diabetes Audit (NDA) primary care. Commissioned by The Healthcare Quality Improvement Partnership (HQIP)	Participation rates falling to around 70% by 2012/13 with36 PCOs reporting less than 50% of	Participation rate progressively worse and much less than QOF data. 15 month	Accepted by National Bodies (Public Health England, Right Care, HSCIC, NHS England, Diabetes	Not so relevant because of the limitations and because QOF data more

as part of the National Clinical Audit Programme and delivered by HSCIC in partnership with Diabetes UK and The National Cardiovascular Intelligence Network (part of Public Health England	practices being involved in the audit and 19 returning less than 25%. No 2013/14 data	data used (so not directly comparable with other yearly data). No 2013/14 data available. Complications data analysis for previous years.	UK) as important measure of clinical care, outcomes and complications. NDA data is available on the HSCIC website. It is also available as part of other datasets: 1. Healthier Lives Analysis 2. CCG Outcomes Tool – 3. Diabetes Community profile 4. Diabetes CCG profile 5. Diabetes CCG Profiles	applicable for this research unless no other data is available (in the case of education of patients with diabetes in 2011/12 and 2012/13) .
Prescribing Data (ePACT data) produced by HSCIC	100% coverage of all practices in England. The PCO where the prescriber is located is used not the PCO area where the prescription was dispensed.	It does not include prescriptions written or dispensed in hospitals, dental prescriptions or private prescriptions.	Accepted by National Bodies (Public Health England, Right Care, HSCIC, NHS England, Diabetes UK) as important measure of prescribing behaviour. Prescribing Data used extensively in other data sets: 1. QIPP Prescribing comparators 2. Innovation scorecard 3. HSCIC Prescribing in Diabetes Annual Reports 4. NICE Innovation Scorecard 5. DOVE tool 6. CCG Commissioning Insight Value Pack 7. CCG Diabetes Profiles 8. Atlas Variation 9. SPOT Tool	Very relevant. Practice level data built up to PCO level provides the most accurate data.
Innovation Scorecard. Produced by HSCIC.	NICE uptake of a specified range of new drugs in primary care. It is intended to identify where variation in the	Variation in the use of medicines may be due to many reasons such as Differences in the patient	Data is viewed as experimental by HSCIC and changes are expected. Comparisons of expected and observed based on	Relevant as a general view of the trend in adoption of new drugs (although not specific to

	adoption of TAs may exist between healthcare organisations. Quarterly data (experimental data) uses EPACT. Individual drugs different in the three years to reflect the adoption rates of new drugs across PCOs in England.	demographic profiles and disease prevalence in PCOs. Variation in the choice of drugs preferred in secondary care and differing usage of alternative medication. Differences in service provision across primary and secondary care (reference)	estimated numbers. The Scorecard is intended as a means of stimulating the monitoring of uptake of drugs in accordance with NICE Guidelines of local NHS organisations. (NICE Technology Appraisals in the NHS in England (innovation Scorecard) to December 2013)	diabetes for all three years.
Better Care Better Value. NHS Improving Quality (NHS IQ) responsible	Identification of inappropriate diabetes outpatient referrals and diabetes emergency admissions at PCO (PCT and CCG). Quarterly data published. Analysis uses HES and SUS referral data (analysed by Dr Forster).	PCO level data only for 2011/12. Low referral rates to secondary care may reflect the way that local diabetes services are delivered rather than inefficient use of secondary care.	They are produced to stimulate investigation into potential efficiency savings.	Very relevant. Allow us to understand the balance between primary and secondary care in each local health economy.
Programme Budgeting Spend / Analysis. Produced by NHS England	The programme Budgeting data is an analysis of commissioning expenditure by category (healthcare condition) and care setting (for example primary, secondary or community care). Data collected every year from CCGs / PCTs. Area Teams responsible for ensuring data is complete.	PCO level data only in 2011/12. Care settings analysis included in 2012/13 and 2013/14. Expenditure and breakdown of care settings analysis undertaken by individual PCOs so no way to ensure uniformity with expenditure allocation.	Accepted by National Bodies (Public Health England, Right Care, HSCIC, NHS England, Diabetes UK) as important measure of spending analysis. Used in various data sets: Right Care: (CCG Commissioning Insight Packs); Atlas of Variation; Spend and Outcomes Tool (SPOT Diabetes Community Profile 2012; Diabetes CCG Profiles 2013. DOVE tool	Relevant. Will add to other data to allow us to understand relative spend in care settings for each PCO.
Prescribing QIPP comparators	Quarterly prescribing data	The QIPP target drug areas are	The purpose of the comparators is to	Relevant. Provides a

	of for all the target drug groups in the Medicines Management QIPP Plan.	not mandatory and PCOs may chose not to focus on changing prescribing practice in all or any of these areas. Prescribing data is not linked to numbers of patients, severity of condition or clinical outcomes.	highlight variation and support local discussion and decisions regarding QIPP, with the aim of reducing inappropriate variation. (HSCIC Feedback April 2013)	useful view of how effective the PCO is at controlling prescribing across a range of key therapeutic areas.
Hospital Episode Statistics. Collated by HSCIC.	Bespoke data about inpatient, outpatient, health resource groups, analysis by disease / condition linked to commissioning unit, practice and provider unit.	Admissions data does not take into account the differing patient population for each acute trust. HES data linked to acute trust and PCO is currently not available due to issues with data security. The quality of HES data has been rated as variable by a report in 2013 (HSCIC) and coding discrepancies are an issue in some organisations, so the data is not always useful as a measure of secondary care referrals.	HES data used to create Better Care Better Value indicators (although used in conjunction with other data). Data quality issues have been identified. Also used in Public Health analyses, NDA analyses, CCG Outcomes Indicator set.	Relevant to this research where a linking of referrals between PCO and acute trust were required. However, due to lack of availability this is less relevant.
CCG Diabetes Classification groups. Produced by Public Health England.	The CCG Classification Groups provide a grouping of CCGs that have similar characteristics to allow appropriate benchmarking. It uses the a range of data to assign CCGs to the best	Data used to build up the CCG Classification groupings: 1. Age structure of population 2. % of population from Asian ethnic groups	Grouping together several risk factors may obscure specific links with individual risk factors. Public Health England Diabetes Classification Groups. Also in 1. CCG Diabetes profiles	Very Relevant. Many of the limitations of the other data described here are linked to an inability to compare similar populations. This data and

	match based on the main risk factors for diabetes.	3. % population from Black ethnic groups 4. Indices of deprivation (average score) 5. Population density	2. Joint Strategic Needs Assessments	classification will allow the patient demographic to be included in the analysis.
Similar CCGs	The similar CCGs classification has been used to group GGCs according to their population characteristics	Similar CCG groupings are based on the following: 1. deprivation 2. Average of the health domain from the multiple deprivation index 3. Total population registered with the CCG 4. Age profile populations 5. Population density and 6. Ethnic origin of population.	This ranking system is used in the Right Care Commissioning for Value packs. It is similar to the Diabetes Classification	Relevant but not included in this analysis because the Diabetes Classification groups above are used more extensively.
Mortality Data. HSCIC Indicator Portal.	Mortality data from diabetes is collected (ICD-10 E10-E14 equivalent to ICD-9 250, extracted from ONS original causes of death (there is a significant under recording of diabetes as an underlying cause of death because the deaths are often coded according to the secondary complications associated with diabetes.	Mortality from diabetes: 1. Number by age group annually; 2. indirectly standardised ratio (SMR) all ages or different age ranges, 3. directly standardised rate (3 year average) for different age ranges.	HSCIC Indicator Portal 2011/12 the latest data available	Not relevant. Data is not available for 2012/13 or 2013/14.
Years Lost. HSCIC Indicator Portal.	Years of life lost (YLL) is a measure of premature mortality. Its primary purpose is to compare the	Years of life lost due to mortality from diabetes: 1. directly standardised rate, 1-74 years, 3-year average,	HSCIC Indicator Portal 2011/12 the latest data available	Not relevant. Data is not available for 2012/13 or 2013/14

	relative importance of different causes of premature death within a particular population and it can therefore be used by health planners to define priorities for the prevention of such deaths	MFP 2. Crude rate 1-74 years 3 year average		
Potential years of life lost (PYLL) from causes considered amenable to healthcare	NHS Outcomes Indicator Set (Domain 1). Directly standardised rate per 100,000 population at lower tier local authority level) Specific conditions recorded with nutritional, endocrine and metabolic being the one containing diabetes data.	The most recent data available is for 2011/12; the figures include type 1 and type 2 diabetes and the data is available at local authority level rather than PCO level.	HSCIC. Part of the NHS Outcomes Indicator Set (Domain 1).	Not relevant. Data is not available for 2012/13 or 2013/14

As has been described in the table 58 below a number of the datasets described above have been combined with others to create a specific dataset for analysis. However, there are several issues with using the data from these tools. The data used in each of the tools is based on previous years, for example, NHS Atlas of Variation in Healthcare for people with diabetes was made available in June 2012 Atlas of Variation (Right Care Atlas Series, 2012). The data sources were Net Ingredient Cost 2010/11 and National Diabetes Audit data for 2009/10. Some of the tools have used the relevant years' data in terms of this research, but the tools were not available to the PCOs during the period of planning and prioritisation (roughly 6 months prior to the start of each financial year in April). For example, the Right Care Analysis was released in

October 2013 but, although it is based on information and data 2011/12, was not available for the PCOs when they were identifying clinical priorities areas for 2013/14. Finally, the underlying data used in these tools has already been used in the creation of influences on prescribing.

Table 58: Combined data available in tools

Dataset name	Dataset description	Content
Healthier Lives Produced by Public Health England. Available at: http://healthierlives.phe.org.uk/	The interactive 'heat map' includes information on prevalence of the conditions and their complications, levels of care provided and the quality of care achieved in each area by local authority (LA), clinical commissioning group (CCG) and general practice, compared to the England average.	1. National Diabetes Audit data (primary care) 2. National Diabetes Audit (secondary care) 3. QOF data 4. HES referral data 5. Deprivation
CCG Commissioning for Value Insight Pack. Produced by Right Care. Available at: https://www.england.nhs.uk/resources/resources-for-ccgs/comm-for-value/	Right Care. October 2013. Identification of disease areas that could be improved according to quality; financial measures and patient outcome measures	1. Programme Budgeting Spend analysis. 2011/12 Health Outcomes and healthcare variation. Potential lives saved per year 2011/12. Diabetes QOF outcomes 2011/12. Prescribing data. Identification of similar CCGs (in terms of population)
CCG Commissioning for Value Pathways on a Page. Produced by Right Care. Available at: https://www.england.nhs.uk/resources/resources-for-ccgs/comm-for-value/	Identification of clinical areas that CCGs could make improvements in based on data analysis and comparison of similar CCGs. This is the second set of information and analysis in the Commissioning for Value support pack for CCGs and provides a more detailed look at the clinical areas where the CCGs could probably make the largest improvements in terms of spend and quality / outcomes. The packs identify CCGs with a similar population that are better or worse at meeting specific disease targets for diabetes.	Analysis based on similar CCGs (population analysis); Diabetes QOF 2012/13; Diabetes NDA 2012/13; Programme Budgeting spend 2012/13
The Diabetes Outcomes Versus Expenditure (DOVE) Outcomes tool. Tool for CCGs (PCTs) and practices. Produced by National Cardiovascular Intelligence	The DOVE tool allows spending on diabetes care to be compared with clinical outcomes by Clinical Commissioning Group (CCG). A CCG can be compared with other	1. QOF 2012/13 data 2. Deprivation 3. Prescribing data 2012/13

network and Public Health England. Available at: http://www.yhpho.org.uk/resource/item.aspx?RID=192325	CCGs with similar populations and all other CCGs. The tool also identifies the potential changes to costs that would result from changing outcomes or expenditure to benchmarked levels.	
Spend and Outcome Tool (SPOT). Produced by Right Care, Public Health England and NHS England. Available at: http://www.apho.org.uk/resource/item.aspx?RID=153830	The tool has been designed to compare spend and outcome for CCGs in England. It is an aid to identify programmes that may be outliers and need further investigation.	Outcomes from QOF 2011/12, 2009/10 diabetes complications. Spend analysis uses Programme Budgeting data 2011/12
Atlas of variation in treatment of diabetes June 2012. Developed by Right Care. Available at: http://www.rightcare.nhs.uk/index.php/atlas/diabetes/	The aim of the Diabetes Atlas is to identify and quantify the extent of 'unwarranted' variation that may be due to unjustified geographical differences in medical practice and/or patients not gaining access to the appropriate level of intervention for their need. It includes 22 maps of indicators relating to the key care processes and outcomes, utilisation of secondary care, diabetic complications and prescribing.	National Diabetes Audit. DOVE tool, PCT spend and outcome factsheets (SPOT) Prescribing analysis. Use of inpatient services
Diabetes Clinical data sets. Available at: http://www.hscic.gov.uk/datasets	Diabetes Compendium of Population Health Indicators - Years of life lost due to mortality from diabetes: directly standardised rate, 1-74 years, 3-year average, MFP	Diabetes specific data

Organisations responsible for production / output of data

The Health and Social Care Information Centre (HSCIC) was established on 1st April 2013. It was formed from the amalgamation of several organisations: The NHS Information Centre, Connecting for Health and informatics functions previously sited in Strategic Health Authorities and Primary Care Trusts. NHS Choices (previously managed by Capital) was transferred to HSCIC in August 2013 and some functions from NHS Direct were transferred in April 2014. The Centre provided national information and information technology systems to health and social care organisations so they could provide better services and improve health standards. It

analysed, published and disseminated health and social care data (Health and Social Care Information Centre, 2014a).

NHS England was established on 1st April 2013 and took on many of the functions of the former primary care trusts (PCTs) with regard to the commissioning of primary care health services, as well as some nationally-based functions previously undertaken by the Department of Health. NHS England commissioned specialised services and had 27 area teams to help with supporting clinical commissioning groups in their commissioning role. NHS England also published a range of statistics on health and care subjects although much of these were also published by HSCIC. The organisation was responsible for setting out plans and priorities for NHS organisations in England as well as improving patients experience and quality within the NHS.

The NHS Improving Quality (NHS IQ) was established on 1 April 2013 and is hosted by NHS England. It is responsible for improving health outcomes for people by focusing on the five domains outlined in the NHS Outcomes Framework. The organisation works to facilitate partnerships across NHS organisations and works to help them improve capacity and capability so that health outcomes can be improved for the population. This organisation has taken over responsibility for the Better Care Better Value Initiative. This Initiative was set up to identify potential areas where NHS organisations could make savings through changing practice. Primary Commissioning Organisations and Acute Trusts were included in this initiative and it was focused around changing referral patterns – reducing emergency admissions; bed days, follow up appointments; secondary care outpatient appointments and readmissions (all with the aim of reducing the more expensive secondary care based care in favour of primary care); reducing costs in prescribing; and improving efficiency by reducing the workforce sickness.

Opportunities were identified by estimating the savings an organisation could make by changing their behaviour to match the best performing organisations. One of the disease areas where data is collected and reported is diabetes outpatient referrals to secondary care.

The role of Public Health England (PHE) was to protect and improve the nation's health and tackles health inequalities. It was established on 1 April 2013. The National Cardiovascular Intelligence network (NCVIN) was part of Public Health England. Historically diabetes data was produced under the auspices of The National Diabetes Information Service. This has been merged to form the National Cardiovascular Intelligence Network. part of this network). The NCVIN brought together epidemiologist, clinicians, analysts and patient representatives. Public Health England coordinated a number of other disease specific networks. One of the key roles of the NCVIN was to analyse health data from surveys, audits and statistics and display the results of the analyses in easily understandable products such as interactive profiles, maps and charts.

There was a wide array of nationally available quantitative data that has been collected and made available publically.

The majority of the datasets described above were relatively simple with the exceptions of the Quality Outcomes Framework data, The National Diabetes Audit data and the NICE Innovation Scorecard.

Quality Outcomes Framework (QOF) Diabetes dataset

Description: Annual Incentive Scheme for GP practices and CCGs to meet a range of clinical targets (including diabetes). Coverage:

- 2011/12 QOF - 8,123 general practices in England
- 2012/13 QOF - 8,020 general practices in England
- 2013/14 QOF - 7,921 general practices in England

Type of Information: Diabetes has been included as one of the clinical targets since inception of the scheme. Individual comparators making up the diabetes section have changed over time with 2013/14 scheme having 16 individual targets compared to 14 in 2011/12. They have been changed over the years to reflect changing clinical practice and priorities. The diabetes register (indicator DM32) was redefined for 2012/13 and expanded to include all types of diabetes (with the exception of gestational diabetes). The QOF diabetes register does not distinguish between types of diabetes and patients are captured to a single register (Health and Social Care Information Centre, 2014f). In terms of this research project, this is not an issue because type 2 diabetes accounts for over 90% of all diabetes in adults. Prevalence of type 1 diabetes is also evenly spread across PCOs and so is unlikely to influence the results (National Diabetes Audit, 2011/12b) . Moreover, HSCIC, NICE, Public Health England all use the total diabetes prevalence in patients over 17 as their reference number.

One of the decisions that needed to be taken when considering the data to be used in this doctoral research was the exact measurement that should be used for the individual measure of attainment of QOF measurements. There were two options; firstly, to use the underlying % of patients attaining a specific target (net of exceptions). Patient exceptions being defined as people to whom the indicator applies but who are not included in the indicator denominator because they are part of the agreed exception criteria (see below). Secondly, there was the option to use the percentage of patients receiving the intervention. This gives a more accurate indication of the rate

of the provision of interventions as the denominator for this measure covers all patients to whom the indicator applies, regardless of exception status (i.e. indicator exceptions and indicator denominator). However, it is common practice to use the underlying % of patients attaining a specific target (Health and Social Care Information Centre, 2014f) and so this figure has been used in this research project.

The following criteria have been agreed for exception reporting of QOF data:

- patients who have been recorded as refusing to attend review who have been invited on at least three occasions during the preceding twelve months
- patients for whom it is not appropriate to review the chronic disease parameters due to particular circumstances e.g. terminal illness, extreme frailty
- patients newly diagnosed within the practice or who have recently registered with the practice, who should have measurements made within three months and delivery of clinical standards within nine months e.g. blood pressure or cholesterol measurements within target levels
- patients who are on maximum tolerated doses of medication whose levels remain sub-optimal
- patients for whom prescribing a medication is not clinically appropriate e.g. those who have an allergy, another contraindication or have experienced an adverse reaction
- where a patient has not tolerated medication
- where a patient does not agree to investigation or treatment (informed dissent), and this has been recorded in their medical records

- where the patient has a supervening condition which makes treatment of their condition inappropriate e.g. cholesterol reduction where the patient has liver disease
- where an investigative service or secondary care service is unavailable (Checkland et al., 2013).

National Diabetes Audit (NDA) primary care dataset

Description: The National Diabetes Audit (NDA) answers four key questions based on the diabetes National Service Framework (NSF):

1. Is everyone with diabetes diagnosed and recorded on a practice diabetes register?
2. What percentage of people registered with diabetes received the nine NICE key processes of diabetes care?
3. What percentage of people registered with diabetes achieved NICE defined treatment targets for glucose control, blood pressure and blood cholesterol?
4. For people with registered diabetes what are the rates of acute and long term complications (disease outcomes)?

Audit participation in primary and secondary care. Data tables with information about care processes (percentage recorded), HbA1c results, patient age distribution, average age and BMI, diabetes type distribution and ketoacidosis episodes. Further in-depth analysis at a national and local level on: registration and prevalence; complications; care processes and treatment targets. Comparative spreadsheets and separate organisation profiles are available on the Health and Social Care Information Centre website under the heading “National Diabetes Audit”.

NDA data is collected over a fifteen month period, between 1st January and 31st March of the next year, whereas QOF data is collected over a 12 month period, between 1st April and the 31st March. Therefore, the figures are not directly comparable. Participation in the NDA is voluntary; however, it does cover 71.1% of the people diagnosed with diabetes in England (when compared with QOF).

The National Diabetes Audit covers all PCOs in England and Wales but one of the major caveats in using this information is that participation in the audit is voluntary. The participation rate decreased in the 2012/13 audit to 70.6% of GP practices from 87.9% for the 2011/12 audit and 82.8% in the 2010/11 audit. The % of practices involved varies sharply across PCOs in England with 36 PCOs reporting less than 50% of practices being involved in the audit and 19 returning less than 25%. (National Diabetes Audit, 2011/12a)

The complications data whilst being extremely useful reported complications recorded in years before the timeframe of this research with the most recent data being 2011/12 (National Diabetes Audit, 2012/13).

Finally, the NDA was collected retrospectively and the collection period for the 2013/14 year (1st January 2013 to 31st March 2014) is from March 2015 to June 2015. Therefore, there was no NDA data available for 2013/14 when the data collection was undertaken.

NICE Innovation Scorecard

There were two types of analysis that are relevant to this research. Firstly, there was an in depth analysis of a handful of new drugs that have NICE guidelines to advise GPs in how to use them and that were mainly prescribed in primary care. For these

drugs, an estimate of the likely numbers of patients who would be eligible to receive the drug (eligible population) has been calculated for each CCG, the expected prescribing levels based on prescribing of the drug in accordance with the guidelines is calculated and then the actual prescribing rate for each drug was measured and a ratio of observed against expected was obtained.

A number of estimates and assumptions were made in this analysis. The eligible patient population was estimated using The NICE Costing Tool. This was designed to help local NHS organisations to estimate the local cost impact of implementing guidance at the time of publication. However, it was used in this analysis to establish an estimate for eligible populations. The figures used were based on various literature sources (peer based reviews, expert opinions and other data sources). Where available, Defined Daily Doses (DDDs) as defined by the World Health Organisation (WHO) were also used (rather than the more commonly used net ingredient cost (NIC). The Observed use of the medicines under consideration was obtained by using prescription data in primary care provided by the HSCIC. Finally, a comparison of estimates of predicted use and observed use could be made. It was concluded by NICE that variation in the use of medicines may be due to a number of factors such as a local variation in population; presentation to the NHS organisations and keenness to adopt a specific treatment both at patient and across LHE. The data was accessible on the Health and Social Care Information Centre (HSCIC) website under the heading: NICE technology Appraisals.

Drugs have been chosen where it was possible to estimate the number of patients who would be expected to receive the drug against the actual prescribing rate. This was difficult to achieve for several reasons – many drugs have several indications; there

are usually alternatives to them and NICE guidance usually recommends a number of treatment options that are not always drugs (Health and Social Care Information Centre, 2015b).

The second type of analysis is one where a range of new drugs was monitored over the period to measure uptake across the CCGs. The predominant use of these medications was in primary care (97% or more). For this analysis prescription data had again be obtained from HSCIC and the data was presented in Defined Daily Doses (DDDs) per 100,000 resident population. It should be noted that in this analysis a volume per head of population is obtained but this did not linked to any calculation of the numbers of patients per organisation and takes no account of differences in gender or age distribution (Health and Social Care Information Centre, 2014b).

The Innovation Scorecard was not intended to be used for performance management. It was intended to identify where variation in the adoption of TAs may have existed between healthcare organisations and for these organisations to understand, be challenged and explain any variation that had occurred. This was based on the assumption that reduced variation will result in improved quality of care.

The observed use of a medicine or technology may have differed for a range of reasons and should not be assumed to definitely indicate either ‘under’ or ‘over prescribing or implementation. A technology may not be the only treatment for a particular condition recommended in NICE guidance, or otherwise available in the NHS. Medicines are generally recommended as options for treatments. Other options may include non-appraised medicines or other appraised medicines. Therefore, variation in the use of individual medicines would be expected. Assessment of compliance cannot be made

using currently available data. Variation in the use of medicines or medical technologies between NHS organisations may be due to a number of valid factors described in the Innovation Scorecard including:

1. Natural variation in populations, both in demographic profile and disease prevalence.
2. Variation in presentation to the NHS by the relevant populations.
3. Variation in choice of preferred treatment option at the local level.
4. Variation in the use of alternative products or procedures.
5. Differences in the extent to which local utilisation information is available.
6. Differences in services provided between organisations, for example differences in
7. The extent to which a service is provided in primary or secondary care.

   Difference in levels of informed patient dissent to intervention (Health and Social Care Information Centre, 2013a, Health and Social Care Information Centre, 2014b, Health and Social Care Information Centre, 2015b) .

Appendix 2

Organisational changes from PCT to CCG

Source of Information: NHS England Website. Available at: http//www.england.nhs.uk/ccgs/. Accessed 01 May 2012 – 15 May 2015.

Table 59: PCTs that have merged with other PCTs to form a single CCG

Name of PCT	Description of organisational change	New CCG
Bournemouth and Poole PCT	Merger with neighbouring PCT	Dorset CCG
Dorset PCT	Merger with neighbouring PCT	Dorset CCG
Cambridge PCT	Merger with neighbouring PCT	Cambridge and Peterborough CCG
Peterborough PCT	Merger with neighbouring PCT	Cambridge and Peterborough CCG
Hartlepool PCT	Merger with neighbouring PCT	Hartlepool and Stockton on Tees CCG
Stockton on Tees PCT	Merger with neighbouring PCT	Hartlepool and Stockton on Tees CCG
Redcar and Cleveland PCT	Merger with neighbouring PCT	South Tees CCG
Middlesbrough PCT	Merger with neighbouring PCT	South Tees CCG

Table 60: PCTs that have split up to create CCGs with new boundaries

Name of PCT	Description of organisational change	New CCG
Heart of Birmingham Teaching PCT	Practices from part of one PCT merged with practices from another PCT	Birmingham South and Central CCG
South Birmingham PCT	Practices from part of one PCT merged with practices from another PCT	Birmingham South and Central CCG
Heart of Birmingham Teaching PCT	Practices from part of one PCT merged with practices from another PCT	Sandwell and West Birmingham CCG
Sandwell PCT	PCT merged with practices from another PCT	Sandwell and West Birmingham CCG
Birmingham East and North PCT	PCT merged with practices from another PCT	Birmingham CrossCity CCG
South Birmingham PCT	Practices from part of one PCT merged with practices from another PCT	Birmingham CrossCity CCG
Derby City PCT	PCT merged with practices from another PCT	Southern Derbyshire CCG

Derbyshire County PCT	Practices from part of one PCT merged with practices from another PCT	Southern Derbyshire CCG
Devon PCT	Practices from part of one PCT merged with practices from another PCT	North East West (NEW) Devon CCG
Plymouth Teaching PCT	PCT merged with practices from another PCT	North East West (NEW) Devon CCG
Devon PCT	Practices from part of one PCT merged with practices from another PCT	South Devon and Torbay CCG
Torbay Care Trust	PCT merged with practices from another PCT	South Devon and Torbay CCG

Table 61: PCTs that split up to form smaller CCGs

Name of PCT that split to form smaller CCGs	Name of CCG
Berkshire East PCT	Bracknell and Ascot CCG
	Slough CCG
	Windsor, Ascot and Maidenhead CCG
Berkshire West PCT	Newbury and District CCG
	North and West Reading CCG
	South Reading CCG
	Wokingham CCG
Bradford and Airedale Teaching PCT	Airedale, Wharfedale and Craven CCG
	Bradford City CCG
	Bradford Districts CCG
Buckinghamshire PCT	Aylesbury Vale CCG
	Chiltern CCG
Central and Eastern Cheshire PCT	Eastern Cheshire CCG
	South Cheshire CCG
	Vale Royal CCG
Central Lancashire PCT	Chorley and South Ribble CCG
	Greater Preston CCG
	West Lancashire CCG
County Durham PCT	Durham Dales, Easington and Sedgefield CCG
	North Durham CCG
Derbyshire County PCT	Southern Derbyshire CCG (with practices from Derby City CCG)
	Erewash CCG
	Hardwick CCG
	North Derbyshire CCG
East Sussex Downs and Weald PCT	Eastbourne, Hailsham and Seaford CCG
	High Weald, Lewes and Havens CCG
Eastern Coastal Kent PCT	Ashford CCG
	Canterbury and Coastal CCG
	South Kent Coast CCG
	Swale CCG
	Thanet CCG
Halton and St Helens PCT	Halton CCG
	St Helens CCG
Hampshire PCT	Fareham and Gosport CCG

	North East Hampshire and Farnham CCG
	North Hampshire CCG
	South Eastern Hampshire CCG
	West Hampshire CCG
Hertfordshire PCT	East and North Hertfordshire CCG
	Herts Valley CCG
Kirklees PCT	Greater Huddersfield CCG
	North Kirklees CCG
Leeds PCT	Leeds North CCG
	Leeds South and East CCG
	Leeds West CCG
Leicestershire County and Rutland PCT	East Leicestershire and Rutland CCG
	West Leicestershire CCG
Lincolnshire Teaching PCT	Lincolnshire East CCG
	Lincolnshire West CCG
	South Lincolnshire CCG
	South West Lincolnshire CCG
Manchester PCT	Central Manchester CCG
	North Manchester CCG
	South Manchester CCG
Newcastle PCT	Newcastle North and East CCG
	Newcastle West CCG
Norfolk PCT	North Norfolk CCG
	Norwich CCG
	South Norfolk CCG
	West Norfolk CCG
North Lancashire PCT	Fylde and Wyre CCG
	Lancashire North CCG
North Yorkshire and York PCT	Hambleton Richmondshire and Whitby CCG
	Harrogate and Rural District CCG
	Scarborough and Ryedale CCG
	Vale of York CCG
Nottinghamshire County PCT	Mansfield and Ashfield CCG
	Newark and Sherwood CCG
	Nottingham North and East CCG
	Nottingham West CCG
	Rushcliffe CCG
Sefton PCT	South Sefton CCG
	Southport and Formby CCG
South Staffordshire PCT	Cannock Chase CCG
	East Staffordshire CCG
	South East Staffs and Seisdon Peninsula CCG
	Stafford and Surrounds CCG
South West Essex PCT	Basildon and Brentwood CCG
	Thurrock CCG
Suffolk PCT	Ipswich CCG
	West Suffolk CCG
Surrey PCT	East Surrey CCG
	Guildford and Waverley CCG
	North West Surrey CCG
	Surrey Downs CCG
	Surrey Heath CCG
Sutton and Merton PCT	Merton CCG
	Sutton CCG

Warwickshire PCT	South Warwickshire CCG
	Warwickshire North CCG
West Kent PCT	Dartford, Gravesham and Swanley CCG
	West Kent CCG
West Sussex PCT	Coastal West Sussex CCG
	Crawley CCG
	Horsham and Mid Sussex CCG
Worcestershire PCT	Redditch and Bromsgrove CCG
	South Worcestershire CCG
	Wyre Forest CCG

Appendix 3

Detailed background information about individual indicators

Organisation culture variable - Detailed information

Clinical engagement and enthusiasm to set up a new PCO

During the period of this study, primary care trusts were grouped together to form primary care clusters and CCGs were formed. This evolution has not been the same for all organisations and there has been a significant difference between the speed and enthusiasm that local GPs and practices have come together to set up the new local CCGs and have been able to agree plans and priorities going forward. The scoring for this measure has been created to assess the organisation in terms of clinical and organisational cohesiveness during the year that is being measured. This has meant that the scoring criteria is different for each year according to the challenges and targets that have been set for the year. There has also been a more extensive scoring for past commissioning experience in 2011/12 because it was the first year that organisations were working together as CCGs, however by 2013/14 the CCGs themselves had their own experience of working together so the number of scores based on historical organisations has been reduced.

Another important note is that the number of emerging CCGs in 2011/12 is not the same as the final number of CCGs in 2012/13 and 2013/14 because some of the original CCGs ended up merging with neighbouring organisations. This has been captured in the scoring by adding in additional score for changing organisational changes during the years 2011/12-2013/14.

CCG Risk Assessment in 2011 and subsequent authorisation wave

The authorisation of the CCGs was carried out by the NHS Commissioning Board in line with their guidance, all CCGs were required to complete a risk assessment by December 2011 to help them establish whether they would meet the criteria for authorisation (NHS Commissioning Board, 2011). Four key areas of CCG activity were assessed – proposed configuration; sign up from practices, geographical coverage and organisational viability. The risk assessment was led by the SHA clusters and supported by the Commissioning Development team in the Department of Health. The results of the risk assessment can be used to reflect how viable the organisations were according to the criteria set out in Appendix 5. However, the process of the SHA run risk assessment whereby some GP consortia were advised to merge prior to the process being carried out, meant that the final results of the analysis showed a very high number of viable CCGs scoring green on the rating although some had only recently been formed by making those organically created consortia merge with other groups. Therefore, in the analysis for 2011/12, organisations were scored on the basis of organisational changes in 2011/12 as well as for their past history of previously worked together as commissioning groups so that a more rounded understanding of the degree of clinical engagement and organisational cohesiveness could be found. The CCG Assurance Framework was updated as the process has developed with the final framework relevant to this this research being approved in November 2013 (NHS England, 2013a).

Those organisations that were authorised in the first wave had been deemed to be ready to be established as separate commissioning units and able to begin to function as PCOs for their local population (NHS Commissioning Board, 2012a). The

authorisation process was built around six domains, agreed with emerging CCGs and patient and professional organisations. Assessing CCGs through these six domains provides assurance that CCGs could safely discharge their statutory responsibilities for commissioning healthcare services. They were also intended to encourage CCGs to be organisations that were clinically led and driven by clinical added value. The domains were:

1. A strong clinical and multi-professional focus which brings real added value
2. Meaningful engagement with patients, carers and their communities
3. Clear and credible plans which continue to deliver the QIPP challenge within financial resources, in line with national requirements (including outcomes) and local joint health and wellbeing strategies
4. Proper constitutional and governance arrangements, with the capacity and capability to deliver all their duties and responsibilities, including financial control, as well as effectively commission all the services for which they are responsible
5. Collaborative arrangements for commissioning with other clinical commissioning groups, local authorities and the NHS Commissioning Board as well as the appropriate external commissioning support
6. Great leaders who individually and collectively can make a real difference.

Within each domain, the guide outlined criteria, the threshold for authorisation for those criteria, the evidence required and the sources for that evidence. The thresholds were set to ensure CCGs can be innovative in delivering improved outcomes, while also remaining safe as statutory bodies responsible for commissioning health services.

From 2011 onwards CCGs were assessed and authorised as organisations in accordance with the domains described above (NHS England, 2013b). In March 2013 The NHS Commissioning Board authorised and established the fourth and final group of CCGs, which comprised 48 in total so that the new clinical commissioning system was set up across England and 211 CCGs were ready to take up their responsibilities from 1 April 2013 (NHS Commissioning Board, 2013a) .

However, authorised CCGs were not all equal with some needing to improve in certain areas. By March 2013, there were a total of 106 CCGs that were fully authorised. The remaining were authorised with conditions and were offered support and development in order to discharge those conditions and become fully authorised. A smaller number of these (15) also needed more substantial official support – legal directions to help them to move towards authorisation (NHS Commissioning Board, 2013b) (NHS England, 2014a) (NHS England, 2014b).

CCG pathfinder status

Following on from the 2010 White Paper, Strategic Health Authorities decided to facilitate and encourage the development of clinical commissioning groups by supporting pathfinder groups and emerging CCGs. Pathfinder groups began to be formed in 2010 and they were created to allow practices to learn and share good practice with others during the transition period (until April 2013 when all PCTs were abolished and CCGs have all been authorised). This a comparator where the organisations have been ranked as to how keen the practices within the CCG have been to undertake commissioning. If all practices within a CCG have been involved

then it is likely to be easier to move forward with all practices in making commissioning decisions and changing behaviour*.*

CCG mergers and organisational changes during 2011/12

During 2011/12 a number of GP consortia were deemed unviable by the Department of Health Risk Assessment (carried out from October 2011 – December 2011) and subsequently merged with neighbouring consortia. The number of emerging GP consortia at the beginning of April 2011 was 269 but by the Department of Health Risk Assessments had reduced to 227 (March 2012) and by April 2013 was further decreased to 2012. This was confirmed by work from the Association of Public Health Observatories (APHO) in March 2012, as well as collection of information from local PCTs, PCT clusters and emerging consortia.

Capturing these mergers could be done in 2 ways. Firstly, there were a number of mergers following the Department of Health (DoH) Risk Assessments. A number of consortia were assessed as unviable and merged as a result to form new CCGs by March 2012. Other consortia were advised to merge prior to the Risk Assessment.

CCG 2012/13 Commissioning Plan: This comparator reflected the ability of the organisation to start to work together, ahead of the 2013 April deadline to formulate plans and priorities for the local population.

CCG Website 2012/13: This comparator was another reflection of the ability of the CCG to begin working as a new organisation ahead of the official deadline of April 2013.

CCG Assurance Annual Assessment 2013/14: At the end of 2013/14, CCGs were assessed to ensure that they were operating effectively and able to commission safe

and high quality services within their resources. There were 6 assurance domains and the process was designed to allow for continuous development over the year. National Data (Delivery Dashboard, 360 survey, JSNA, national data) and locally produced information (CCG plans, previous assurance reports, soft intelligence) had been used as evidence for appropriate commissioning (NHS England, 2013a).

Historical Relationships amongst practices within an organisation

The research in chapter 2 has highlighted the importance of organisational stability and previous relationships of practices working together so previous involvement with other practice based commissioning schemes, GP fundholding, locality commissioning, total purchasing pilots, practice based commissioning has been assessed to rank organisations according to their historical experience of working as one unit. The assumption being that it would be easier for organisations that have a history of working together to make decisions. Historical relationships between CCGs and PCT, PBC Group Consortia, GP fundholding, total purchasing pilots and locality commissioning have all been ranked using local and national qualitative information and the 2011 DoH CCG Risk Assessment.

The historical relationships were arguably more important in 2011/12 than in 2013/14 when the CCGs will have built up their own experience of working together, so the individual comparators for 2011/12 are separately scored for the different stages of primary care commissioning whereas for 2012/13 and 2013/14 the previous relationships with the most recent practice based commissioning group consortia has just been included. Comparators have been created using national and local data and information.

DEPARTMENT OF HEALTH RISK ANALYSIS OF EMERGING CCGs in 2011

Member Practice Engagement

GREEN: The emerging CCG has a defined geographical area, a significant majority of registered patients live in this area, and the GP practices that make up the CCG are not drawn from a dispersed area.

AMBER: The emerging CCG has a defined geographical area, a significant majority of registered patients live in this area, but the GP practices that make up the CCG come from a dispersed area. This was the pre-merger rating. Post merger the ccg is expected to be green rated

RED: The emerging CCG does not have a defined geographical area, or a significant majority of registered patients do not live in the proposed area, and/or the GP practices that make up the CCG are drawn from a widely dispersed area.

Geography: boundary and population

GREEN: The emerging CCG has a defined geographical area, a significant majority of registered patients live in this area, and the GP practices that make up the CCG are not drawn from a dispersed area.

AMBER: The emerging CCG has a defined geographical area, a significant majority of registered patients live in this area, but the GP practices that make up the CCG come from a dispersed area.

RED: The emerging CCG does not have a defined geographical area, or a significant majority of registered patients do not live in the proposed area, and/or the GP practices that make up the CCG are drawn from a widely dispersed area.

Geography: LA boundaries

GREEN: CCG geographic area is coterminous with a unitary or upper tier local authority boundary (or the boundaries of two combined local authorities); or falls wholly within a unitary or upper tier local authority boundary; or The emerging CCG can demonstrate an overriding patient/population centred reason for straddling unitary or upper tier local authority boundaries and has the demonstrable support of the local authorities for being able to discharge effective joint commissioning (for example, reflecting major patient flows along care pathways into acute healthcare).

AMBER: The emerging CCG can demonstrate an overriding population centred reason for straddling unitary or upper tier local authority boundaries but cannot yet demonstrate support of the local authorities.

RED: The emerging CCG cannot demonstrate an overriding reason for straddling unitary or upper tier local authority boundaries.

Impact of size

GREEN: The emerging CCG is very small and confident that arrangements through which it could secure the capacity and capability to carry out all its commissioning responsibilities [within its running costs] are on track; or is very large but arrangements for local practice engagement are on track.

AMBER: The emerging CCG is very small and is developing options for arrangements through which it could secure the capacity and capability to carry out all its commissioning responsibilities [within its running costs]; or is very large and is developing options to secure local practice engagement.

RED: The emerging CCG is very small and cannot identify a future arrangement through which it could secure the capacity and capability to carry out all its commissioning responsibilities [within its running costs]; or is very large and has no realistic plans to secure local practice engagement.

Organisation size – detailed information

During the period of this research project, the HSCIC produced a Quarterly Patient List Size and GP count for each practice in England. This report published the patient list size for each practice in England, split between prescribing and dispensing patients. It also published the number of GP's in each practice. Another report, "Patient List" produced by HSCIC collated the dispensing practices for each organisation on a monthly basis

The number of patients registered at a GP practice data has also been extracted as a quarterly snapshot in time from the GP Payments system maintained by the HSCIC. This has been released at GP Practice, Clinical Commissioning Group, NHS England Area Team and NHS England Region levels data in 5-year age bands, split by gender and aggregated.

A sum of the practice list sizes for each practices was also available from the QOF analysis. This has been estimated to represent over 99% of all registered patients in England (Health and Social Care Information Centre, 2015a).

Mid year estimates for 2011 PCO population are available (ONS estimates) which are different and other data sources because they estimate the resident population associated with each PCO. More patients may appear on the patient list because they have not been removed either when a patient has died or moved away or because

patients are registered at more than 1 practice or because This GP “list inflation” may be caused, for example, by patients who have not been removed from patient lists following death, emigration or moving home, patients being dual registered at practices following a change of address or due to registered patients not completing the 2011 census (Health and Social Care Information Centre, 2014h).

The most accurate comparison is the 2013/14 data because the CCGs have become official organisation on 1 April 2013. Prior to this the CCGs were not official organisations and so the CCG list size in 2011/12 has been calculated from the QOF Practice level population sizes and the practices that are linked to each CCG.

Comparing 2013/14 numbers of practices and contract type from QOF and the NHS Payments to general practices for 2013/14 (Table) we were able to compare numbers. The NHS Payments data was published for the first time in February 215 and covered the 2013/14 year so there was no comparable dataset for 2011/12 or 2012/13. However, it was an opportunity to check to accuracy of the QOF figures for practices and list size and check other datasets (dispensing practices) to allow us to estimate the accuracy of the other datasets.

Table 62: Comparison of practice numbers from 2013/14 QOF data with NHS payments data

2013/14 data	Discussion
Comparison between number of practices recorded in the QOF database and the NHS Payments system.	1 PCO has 4 less practices in the QOF data source compared with NHS Payments data source
	1 PCO has 3 less practices in the QOF data source compared with NHS Payments data source
	9 PCOs have 2 less practices in the QOF data source compared with NHS payments data source
	39 PCOs have 1 less practice in the QOF data source compared with NHS Payments data source
	The number of practices linked to each PCO is the same in 146 out of 211 PCOs for both data sources.

	12 PCOs have 1 more practice in the QOF data source compared with NHS payments data source
	2 PCOs have 2 more practices in the QOF data source compared with NHS payments data source
	1 PCO has 1 more practices in the QOF data source compared with NHS payments data source
Comparison between list sizes	List size less in QOF data source for 33 PCOs compared with NHS payments data source
	List size more in QOF data source for 178 PCOs compared with NHS payments data source

When the two patient list sizes from the QOF data and the NHS payments data are compared the list size for the majority of PCOs (143 - 67.7%) showed a difference of less than 1% between the two sources. A further 45 PCOs showed a difference of between 1 and 2%. Only 2 PCOs show a difference of more than 5% with the biggest difference was 5.34% for North East Essex PCO with the QOF data reporting 330,971 patients on the practice lists compared with 313299 in the NHS Payments practice lists.

For the purposes of this analysis we will use the QOF data source for patient list size and numbers of practices because this fits in with the other factors where QOF data has been used (audit and education; clinical guidelines; patient education; financial factors – for diabetes prevalence; and diabetes prevalence).

No similar set of data exists for comparison in 2011/12 or 2012/13, although there are data containing numbers of GPs, dispensing practices and patients on April 1st 2012 which is the equivalent of the end of year QOF data for 2011/12 and April 1st 2013 which corresponds to the 2012/13 QOF data. It should be noted that practices were not officially part of CCGs until April 2013 and hence the data was shows a link between practice and PCT rather than practice to CCG for the April 2012 data. Practice

codes are present however, so the practices have been linked to the CCGs to create a comparative file.

Organisation Profile - detailed information

Table 63: Sources of data for organisation profile and comparison of datasets available

2011/12 Data

	QOF	Patient list size and GP count	General practice – practice level data	GPs earnings and expenses
2011/12 Practices linked to CCGs	YES	Practices linked to PCOs	Practice linked to PCOs	No only PCO level
Patient list size	YES	YES	NO	Only PCO level
Dispensing practices		YES	NO	NO
Single handed practices		NO	NO	No only PCO level
Contract type		NO	NO	NO
GP numbers		YES (headcount)	YES (headcount)	No only PCO level
GP demographics		NO	YES	No only PCO level
Patient demographics		NO	NO	Only PCO level
Time of data collection	End March 2012	April 2012	30 September 2011	30 September 2011
Source of information	HSCIC	HSCIC	GP gender, age and numbers from Exeter System. HSCIC	HSCIC NHS staff 2001-2012 practice details

2012/13 Data

	QOF	Patient list size and GP count	General practice – practice level data	GPs earnings and expenses
2012/13 Practices linked to CCGs	YES	YES	YES	No only PCO level
Patient list size	Yes	YES		Only PCO level
Dispensing practices		YES		NO

Single handed practices		NO		No only PCO level
Contract type		NO		NO
GP numbers		Yes (headcount)		No only PCO level
GP demographics		NO		No only at PCO level
Patient demographics		NO		Only PCO level
Time of data collection	End March 2013	April 2013		30 September 2012
Source of information	HSCIC	HSCIC		HSCIC NHS staff 2001-2012 practice details

2013/14 Data

	QOF	**Patient list size and GP count**	**General practice – practice level data**	**NHS Payments for General Practice**
2013/14 Practices linked to CCGs	YES		YES	YES
Patient list size	YES			YES
Dispensing practices	NO			YES
Contract type				YES
GP numbers				
GP demographics				
Patient demographics				NO
Time of data collection	End March 2014		September 30 2013	1 April 2013 – 31 March 2014
Source of information	Calculating Quality Reporting Service (CQRS), together with the General Practice Extraction Service (GPES). Information in QOF 2013/14 derived from the CQRS and the GPES, national systems developed by the HSCIC		HSCIC. The general practice census is collected each year and records numbers and details of GPs in England along with information on their practices, staff, patients, and the services they provide.	HSCIC and The Technical Steering Committee. Data produced by GP Workforce team following extraction from the NHAIS GP payments System.

Diabetes Organisational Priorities - detailed information

2011/12 Priorities: Diabetes as a priority under the WCC Initiative - Identification of diabetes as a local priority in 2010 under the WCC Initiative provided an audited prioritisation process undertaken before the period of this research, so can act as a baseline assessment. However, the PCOs have changed since this time, and choices made for PCTs may not be wholly relevant for the smaller CCGs because they might have populations with needs dissimilar to that of the original PCT and may have different referral patterns and costs for their diabetes care. This choice was therefore important but not as relevant as within the 2011/14 time period.

2012/13 Priorities: Annual Report for PCTs in 2012/13 contained less information than usual in many cases because they consisted of the winding up of the organisations and were in essence official end of year annual accounts rather than reports of achievements during the year. The NHS Commissioning Board decreed that "Whilst CCGs will not produce annual accounts for 2012/13, they will need to demonstrate that they have considered the systems and processes that they will need to ensure that they can produce their annual report and accounts for 2013/14 (NHS Commissioning Board, 2012c).

2013/14 Priorities: Quality Premium Priorities 2013/14 - Another significant initiative to encourage PCOs to identify priority disease areas for their local population by offering them a financial incentive was introduced by the NHS Commissioning Board in 2013/14. The PCOs were offered financial rewards if they meet 4 national targets that were based on the Outcome Frameworks and three locally identified targets. The three local measures are supposed to "be based on local priorities that have been identified

in joint health and wellbeing strategies. These will be agreed by individual CCGs with their Health and Wellbeing Boards and with the area teams of the NHS Commissioning Board. This information has been recorded in a variety of places – commissioning plans, annual reports, and in board papers. In a small number of PCOs it was not present in any publically available information and was requested under the Freedom of Information Act 2000. The choice of diabetes as a local priority under the Quality Premium Priority Process is less important than that of a local clinical priority area because the scope of the Quality Premium Priorities is smaller. The scheme is designed to judge improvements in performance for a chosen indicator over a single year and looking at the indicators chosen, they are mostly around improving the achievement of the QOF outcomes measure of getting HbA1C figures to meet with national standards. This is mainly an achievement connected with improving prescribing and management of individual patients by their GPs rather than something involving wholesale changes in diabetes care(NHS England, 2013c) .

Limitations with the data

It has been made clear in National Prioritisation documents produced by The Department of Health and NHS Commissioning Board, that previous clinical priorities and work should continue despite yearly changes in National Directives (NHS Commissioning Board, 2012b) . It is also the case that major changes are unlikely to be achieved in one year alone. For this reason, the choice of priority from the World Class Commissioning Initiative made in 2010 has been used in the 2011/12 scoring. This initiative (Department of Health, 2007) required several independent sources within the LHE to ensure that priorities were chosen in an appropriate manner that reflected accurately the needs of the population and the state of the services providing

care. It is also true that health priorities do not change suddenly and improvements in care take many years to achieve.

Identification of diabetes as a local priority under the Joint Strategic Needs Assessment (JSNA) analysis produced by PCOs and local authorities (and latterly Health and Wellbeing Boards), have been undertaken during the time of the research and more importantly encompasses the time when the CCG have been formed. However, this is not as important as the PCO choosing diabetes as a local priority because the organisation may have many local issues to address within its local population and diabetes may not be the most important issue. For this reason, the JSNA reports have not been included in this analysis.

Prescribing control – detailed information

Table 64: Ranking for the QIPP prescribing comparators

Specific indicator	QIPP aim	Description	Indicator use
Laxatives ADQ/STAR PU	Less prescribing the better	Number average daily quantities (ADQs) for laxatives per laxatives COPST based STAR-PU	Introduced February 2012 (amendment May 2012)
ACE inhibitors % items	More prescribing the better	No prescription items for ACE inhibitors as % of total number of items for all drugs affecting the RAA system (excluding aliskiren)	Introduced March 2011
Lipid modifying drugs low cost	More prescribing the better	No prescriptions for generic statin as % total number prescriptions for all statins (including combination of simvastatin and ezetimibe and ezetimibe alone)	Introduced March 2011 (amended August 2013 Q1 2013/14)
Ezetimibe % items	Less prescribing the better	No items for ezetimibe and ezetimibe / simvastatin	Introduced February 2012

		combinations as % of total number prescriptions for all statins (including combination of simvastatin and ezetimibe and ezetimibe alone)	
Omega 3 ADQ/STAR PU	Less prescribing the better	Number ADQs for omega 3 fatty acid compounds per omega 3 fatty acid compounds ADQ based STAR PU	Introduced August 2013 (Q1 2013/14)
Hypnotics ADQ/STAR PU (ADQ based)	Less prescribing the better	Number ADQs for benzodiazepines and Z drugs per hypnotics ADQ based STAR PU	Introduced March 2011. Amended August 2013 (Q1 2013/14)
Antidepressant selected ADQ/STAR PU	Less prescribing the better	Number ADQs for selected antidepressant prescribing per antidepressants ADQ based STAR-PU	Introduced March 2011 (amended August 2013 Q1 2013/14)
Antidepressants first choice %	More prescribing the better	Number of prescription items for 1st choice generic SSRIs as % of total number of prescription items for selected other antidepressants	Introduced August 2012
Antibacterials items / STAR PU	Less prescribing the better	Number prescription items for antibacterial drugs per oral antibacterials ITEM based STAR PU	Introduced March 2011
Cephalosporins and quinolones % items	Less prescribing the better	Number prescription items for cephalosporins and quinolones as % total number of prescription items for selected antibacterial drugs	Introduced March 2011
Trimethoprim 3 days ADQ/item	More prescribing the better	Number ADQs per item for trimethoprim 200mg tablets	Introduced February 2012
Minocycline ADQ/1000 patients	Less prescribing the better	Number ADQs for minocycline per 1000 patients	Introduced February 2012
NSAIDs ADQ/STAR PU	Less prescribing the better	Number ADQs for all NSAIDs per oral NSAID Cost based STAR PU	Introduced March 2011

Ibuprofen and naproxen % items	More prescribing the better	Number prescription items for ibuprofen and naproxen as % total number prescription items for all NSAIDs	Introduced March 2011
Wound care NIC/item	Less prescribing the better	Cost (NIC) per item for wound care products	Introduced August 2012

(Health and Social Care Information Centre, 2013b, National Institute Care and Clinical Excellence, 2013)

Definitions

Average daily quantities (ADQs) are defined as a measure of prescribing volume based on prescribing behaviour in England. It represents the assumed average maintenance dose per day for a drug used for its main indication in adults. The ADQ is not a recommended dose but an analytical unit to compare prescribing activity.

ASTRO-PU weightings: ASTRO-PU stands for Age, Sex and Temporary Resident Originated Prescribing Units. This weighting is designed to weight individual practice or organisation populations for age and sex to allow for better comparison of prescribing patterns. These figures are based on the cost or volume of prescribing across all therapeutic areas, and these weightings should be used only when considering all prescribing. The number of temporary residents attending practices is no longer captured or included in funding allocations.

STAR-PU weightings: There are differences in the age and sex profiles of patients who are prescribed drugs in specific therapeutic groups. For example: drugs for dementia are generally prescribed for older people. STAR-PUs (Specific Therapeutic Group Age-sex weightings Related Prescribing Units) allow more accurate and meaningful comparisons within a specific therapeutic group by taking into account the types of

people who will be receiving that treatment. These have been developed using the same methodology as used for ASTRO-PUs but are based on costs within therapeutic groups rather than all prescribing. The STAR-PU weightings for anti-bacterials are item based, as this is more appropriate for such prescribing. These weightings should be used only for the specific therapeutic area. Note: ADQ based weightings have been introduced for hypnotics and antidepressants. (HSCIC Website accessed April 12 2015).

The data was available from the HSCIC website. The data was presented at practice level and the calculation of practice achievement of prescribing targets at PCO level has used a linking data file produced by NHE England that has allocated practices to PCOs for the period 2011/12 to 2013/14 (Health and Social Care Information Service, 2014).

Appendix 4

Description of Data used to create PCO profiles

Description of outcome indicators

Table 65: Prescribing of LA insulin analogues – description of data

Dependent variable	Data range (min-max)	Mean value	Standard deviation	Median	1st quartile	3rd quartile
Total NIC on LA insulin analogues per 100,000 2011/12	76,376-388,742.20	215,720.88	55,732.00	188,211.30	174,755,72	251,224.42
Total NIC on LA insulin analogues per 100,000 2012/13	85,464-422,832.19	216,812.92	56,522.48	183,279.18	171,097.50	254,018.67
Total NIC on LA insulin analogues per 100,000 2013/14	91,016.02-455,978.71	221,261.96	59,252.15	178585.21	172,464.71	262,172.19

The prescribing spend on LA insulin analogues (Table 65) showed a general increase year on year over the three years with the mean net ingredient cost per 100,000 increasing from 215,868.41 in 2011/12 to 262,172,19 in 2013/14. However, the median values did not show the same trend and this together with an examination of the spread of the data suggested that this increase in the mean value may have been due to a relatively small number of organisations spending significantly more over the three years.

Table 66 Prescribing of GLP-1 agonists – description of data

Dependent variable	Data range (min-max)	Mean value	Standard deviation	Median	1st quartile	3rd quartile
Total NIC on GLP-1 agonists per	13,379.58 - 295,656.77	81,375.04	34,699.04	95,629.52	57,493.68	101638.77

100,000 2011/12						
Total NIC on GLP-1 agonists per 100,000 2012/13	30,130.11-368,609.50	102,836.30	40,461.02	157,321.10	76,792.38	126920.50
Total NIC on GLP-1 agonists per 100,000 2013/14	37,233.55 – 429,423.45	117,966.63	46,453.29	136,660.38	88,192.48	142,557.21

The mean prescribing spend on GLP-1 agonists shown in Table 17 showed an increase over the three years (46%) and this increased spending was also evident when looking at the median spend. This increase was seen across the majority of organisations with the range and 1st and 3rd quartiles all showing increased values for the period studied.

Structure and process Indicators

The continuous data and the categorical ordinal data that made up the structure and process indicators for each year were the same for both the LA insulin analogues and GLP-1 agonists analysis. They are described in the Tables below. However, there were 2 variables that were specific to one of the drug classes, namely the specific formulary directives for LA insulin analogues and GLP-1 agonists and these have been described separately for the three years.

Table 67: Continuous indicator data applicable for Both LA Insulin Analogues and GLP-1 agonists– description of data

Explanatory variable	Type of data	Data range (min – max)	Mean value	Standard deviation	Median	1st quartile	3rd quartile
Audit and education 2011/12	Numerical continuous	71.27-86.97	79.53	2.91	81.71	77.69	81.79
Audit and education 2012/13	Numerical continuous	69.07-83.52	76.69	2.84	79.69	74.80	78.80
Audit and education 2013/14	Numerical continuous	69.90 - 85.20	78.76	3.04	80.65	76.54	80.96
Clinical Guidelines 2011/12	Numerical continuous	82.95-90.80	87.21	1.49	88.07	86.26	88.33
Clinical Guidelines 2012/13	Numerical continuous	82.73-91.64	87.35	1.52	87.89	86.43	88.47
Clinical Guidelines 2013/14	Numerical continuous	76.34-93.19	86.01	2.38	84.38	84.49	87.75
Organisation profile 2011/12	Numerical discrete	92-503	293.60	98.35	416.00	217.50	366.00
Organisation profile 2012/13	Numerical discrete	90-527	299.13	99.35	409.50	230.50	374.00
Organisation profile 2013/14	Numerical discrete	87-498	299.65	91.56	396.50	236.50	366.0
Organisation size 2011/12	Numerical continuous	70,502-902,363	268,202.63	141,137.16	196,267	172,165.50	300,723.00
Organisation size 2012/13	Numerical continuous	70,502-902,363	268,202.63	141,137.16	196,267.00	172,165.50	300,723.50
Organisation size 2013/14	Numerical continuous	72,187-908,496	269,721.71	142,259.04	197,257.50	172,239.50	303,411.50
GP age % over 55 2011/12	Numerical continuous	0-39.81	10.53	7.28	6.06	5.2	14.29

GP age % over 55 2012/13	Numerical continuous	9.62-42.73	23.28	6.58	22.61	18.01	26.20
GP age % over 55 2013/14	Numerical continuous	5.68-47.47	22.95	7.10	24.12	18.09	26.29
GP gender (% male) 2011/12	Numerical discrete	37.37-89.13	55.39	8.55	53.12	48.78	61.06
GP gender (% male) 2012/13	Numerical discrete	32.43-72.06	50.69	8.21	51.28	44.15	57.29
GP gender (% male) 2013/14	Numerical discrete	33.53-71.11	49.44	8.07	46.13	42.68	56.25
Patient – diabetes prevalence 2011/12	Numerical continuous	3.45-8.38	5.79	0.86	6.13	5.30	6.30
Patient – diabetes prevalence 2012/13	Numerical continuous	3.53-8.87	6.04	0.91	6.39	5.53	6.58
Patient – diabetes prevalence 2013/14	Numerical continuous	3.52-9.16	6.24	0.97	6.49	5.71	6.82
Prescribing control 2011/12	Numerical continuous	2575-7473	5077.66	1145.69	5789.50	4322.00	5875.00
Prescribing control 2012/13	Numerical continuous	2259.00-6639.00	4377.95	860.47	3423.50	3727.50	4988.00
Prescribing control 2013/14	Numerical continuous	3239-8553	5964.20	1153.54	4978.00	5180.00	6739.00
GP Prescribing behaviour 2011/12	Numerical discrete	59-605	320.19	128.79	439.00	247.50	391.50
GP Prescribing behaviour 2012/13	Numerical discrete	340-1912	1208.69	336.63	1500.00	971.50	1438.00

GP Prescribing behaviour 2013/14	Numerical discrete	253-2354	1354.80	398.14	1693	1047.50	1631.50
Financial – diabetes spend 2011/12	Numerical discrete	1,386,733.12-5,787,944.25	2,921,399.21	510,072.36	2,652,336.39	2,619,691.25	3,140,200.18
Financial – diabetes spend 2012/13	Numerical discrete	1600319.00-4498080.00	2,89,388.89	450,875.14	2,393,111.50	2,601,437.00	3,150,898.00
Financial – PB diabetes spend 2013/14	Numerical discrete	665,972.60-3,582,059.79	2,146,893.37	354,387.89	1,856,701.63	1,947,235.11	2,323,057.73
Unnecessary referrals to secondary care for diabetes 2011/12	Numeric discrete	1-211	107	61.16	63	53.50	158.50
Unnecessary referrals to secondary care for diabetes 2012/13	Numeric discrete	1-211	107	61.16	63	53.50	158.50
Unnecessary referrals to secondary care for diabetes 2013/14	Numeric discrete	1-211	107	61.16	63	53.50	158.50

Table 68 : Categorical ordinal data - applicable for both LA insulin analogues and GLP-1 agonists

Explanatory variable	Type of data	Data range (min – max)	Mean value	Standard deviation	Median	1st quartile	3rd quartile
Secondary care – area prescribing committee 2011/12	Categorical ordinal	1.00-5.00	2.82	1.03	3.00	2.00	3.50
Secondary care – area prescribing committee 2012/13	Categorical ordinal	1-5	2.82	1.03	3.00	2.00	3.50
Secondary care – area prescribing committee 2013/14	Categorical ordinal	1-5	2.82	1.20	3.00	2.00	4.00
Secondary care – local formulary influence 2011/12	Categorical ordinal	1-4	2.64	0.92	3.50	2.00	3.00
Secondary care – local formulary influence 2012/13	Categorical ordinal	1-4	2.17	1.01	1.5	1.00	3.00
Secondary care – local formulary influence 2013/14	Categorical ordinal	1-4	2.56	0.83	3.00	2.00	3.00
Organisation culture 2011/12	Categorical ordinal	1.2-3.78	3.14	0.528	2.88	2.89	3.56
Organisation culture 2012/13	Categorical ordinal	5-21	12.96	3.69	13.00	10.00	16.00
Organisation culture 2013/14	Categorical ordinal	4-19	12.62	3.68	12.00	10.00	15.00
Organisation – diabetes priorities and plans 2011/12	Categorical ordinal	2-10	5.33	2.26	5.00	4.00	7.00
Organisation – diabetes	Categorical ordinal	2-8	4.46	1.67	4.00	3.00	5.00

priorities and plans 2012/13							
Organisation – diabetes priorities and plans 2013/14	Categorical ordinal	2-10	6.04	1.95	6.50	5.00	7.00
Patient – diabetes classification group 2011/12	Categorical ordinal	1-5	3.70	0.98	3.50	3.00	4.00
Patient – diabetes classification group 2012/13	Categorical ordinal	1-5	3.70	0.98	3.50	3.00	4.00
Patient – diabetes classification group 2013/14	Categorical ordinal	1-5	3.70	0.98	3.50	3.00	4.00

Table 69: Trend in LA insulin analogue formulary directives over three years (information from local formularies collected as part of this research)

Note: PCOs may be affected by more than 1 formulary

Advice in formularies or prescribing guidelines	2011/12 Number of documents	2012/13 Number of documents	2013/14 Number of documents
Insulins not listed in formulary or all LA insulins listed	64	18	13
LA insulin analogues (determir and glargine) listed with no restrictions for use. Insulin Degludec NOT listed or classified as NON formulary.	67	162	111
LA Insulin analogues (determir and glargine) listed with no restrictions for use. Insulin Degludec listed but restricted	0	3	2
LA Insulin analogues (determir and glargine) listed but restricted Insulin Degludec Not listed	44	138	108
LA Insulin analogues (determir and glargine) listed but restricted.	0	9	9

Insulin degludec listed but more restricted.			
Insulin Glargine chosen as 1st choice.	41	91	66
Insulin Determir listed as 1st choice	4	3	2

Table 70: Trend in GLP-1 agonist formulary directives over three years (information from local formularies collected as part of this research)

Note: PCOs are affected by more than 1 formulary

Advice in formularies or prescribing guidelines	2011/12 Number of documents	2012/13 Number of documents	2013/14 Number of documents
Advice to use one of 2 GLP-1 agonists no preference	49	47	17
Advice to use one of 3 GLP-1 agonists no preference	5	68	35
Advice to use one of 4 GLP-1 agonists no preference	0	2	38
Exenatide preferred choice	55	64	57
Liraglutide once daily preferred choice	1	17	24
Lixisenatide once daily preferred choice	0	1	28

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