COMPARISON OF PRESCRIBING AND NON-PRESCRIBING NURSES IN THE MANAGEMENT OF PEOPLE WITH DIABETES IN ENGLISH GENERAL PRACTICE

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Running head: Prescribing nurses in English general practice

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ABSTRACT

Aim: To compare nurse prescribers and non-prescribers managing people with diabetes in English general practice regarding: a) characteristics of patients,  b) activities and processes of care, c) patient outcomes (self-management, clinical indicators, satisfaction), d) resource implications and costs

Background: Over 35,000 nurses in United Kingdom are able to prescribe the same medicines as doctors provided that it is within their level of experience and competence. Over 30% of them, mostly in general practice, prescribe medicines for patients with diabetes.

Design: A comparative case study.

Method: Nurses managing care of people with diabetes were recruited in twelve general practices in England; six had prescribing capability, six did not. Patients, recruited by nurses, were followed for six months (2011-2012).

Results: The patient sample comprised 131 in nurse prescriber sites, 83 in non-prescriber sites. Patients of prescribers had been diagnosed, and cared for by the nurse longer than those of non-prescribers. There were no differences in reported self-care activities or HbA1c test results, between the patients of the two types of nurse; the mean HbA1c decreased significantly in both groups. Patients of prescribers were more satisfied. Consultations frequency was similar, but duration was longer for prescribers (by average of 7.7 minutes). Non-prescribing nurses sought support from other healthcare professionals more frequently. Most prescribing nurses were on a higher grade/salary band than non-prescribers.

Conclusion: Clinical outcomes of patients managed by prescribing and non-prescribing diabetes nurses are similar. Prescribing nurses had longer relationships with their patients, and longer consultations, possibly contributing to higher satisfaction with their care. Employment costs of prescribing nurses are likely to be higher.

250 words

KEY WORDS

Nurse       Prescribing        Diabetes        General practice        England
SUMMARY STATEMENT

Why this research is needed:

- Care for people with diabetes is increasingly managed within general practice in the United Kingdom
- Non-medical prescribing is a successful policy initiative and over 35,000 nurses are able to prescribe the same medicines as doctors (provided that it is within their level of experience and competence), of whom one third are in general practice and prescribe medicines for people with diabetes
- Little is known about the value added of nurse prescribers, compared to nurses without prescribing capability, in the care of people with diabetes in general practice in England

Key findings:

- Management of people with diabetes in general practice by a nurse with prescribing capability, compared to a non-prescribing nurse, may not affect self-care or HbA1c outcomes
- Longer consultations of nurse prescribers may enable extra information exchange and advice-giving, and result in higher patient satisfaction
- Nurse prescribers managing people with diabetes work more independently than non-prescribing nurses but their additional qualifications may incur higher employment costs for the practice

Implications for practice and research:

- Careful planning of task shifting between professionals according to competencies is needed within general practice
- More research is needed on the effects of nurse prescribing for people with diabetes from the patient perspective
INTRODUCTION

Over the past decade, the United Kingdom (UK) government has introduced plans for more flexible and innovative ways of working in the National Health Service (NHS) in order to deliver healthcare improvements (Department of Health (DoH) 2000). This modernisation process has involved the development and enhancement of the roles of healthcare professionals (DoH, 1999), an important part of which has been the introduction of prescribing capability for a range of health professionals. Non-medical Prescribing (NMP) was primarily introduced as a means to increase service efficiency and medicines access (DoH, 2006a). Nurse prescribing has also been introduced in a number of other countries including Australia, Canada, New Zealand, Sweden, Netherlands, Spain, and the US (Ball et al 2009), although in contrast to the UK, nurse prescribing in these countries addresses physician shortage and the unmet medicines needs of patients in remote areas (Kroezen et al 2011).

There are approximately 38,000 NMPs (nurses, pharmacists, allied health professionals) in the UK and over 35,000 of these nurses (DoH, 2014) are able to prescribe the same medicines as doctors provided that it is within their level of experience and competence (Nursing and Midwifery Council (NMC) 2006). The majority are working at an advanced or specialist level (Courtenay & Carey 2008a, Courtenay et al 2012). NMP is a successful policy initiative, enabling faster medicines access, flexible, patient-centred care, service efficiency gains (Stenner et al, 2010, Courtenay et al, 2009a, Carey et al, 2014), and is safe and acceptable to clinicians and patients (Latter et al 2010, Courtenay et al, 2011, Courtenay et al, 2010). Despite the importance of diabetes management, which absorbs 10% of NHS expenditure (DoH 2006b), and the significant role that nurses play in this area of care, there is no evidence on the value added by nurse prescribers, compared to those without prescribing capability.

Background

In the UK, the number of people diagnosed with diabetes is 2.6 million and by 2025, this figure is expected to rise to 4 million (Diabetes UK 2010). Most of these cases will be Type 2 diabetes, Type 1 accounting for approximately 10% of all cases (Diabetes UK 2010). Since the 1990s, care for people with diabetes has been increasingly managed within primary care, with referrals to specialist services for unstable or complex patients (DoH, 2003). Primary care teams provide routine care for about 75% of diabetic patients and approximately 80% of general practices have a nurse with training in diabetes (Audit Commission 2000). One third of diabetes clinics in primary care are run by practice nurses (National Audit Office, 2012). These nurses provide individualised care, education and promote patient safety, acquisition of physical skills and self-care. Nurse management in
primary care has been reported to result in improved outcomes, including glycaemia control, blood pressure, lipid profiles, and patient satisfaction (Carey & Courtenay, 2007, Cook-Johnson et al 2012).

The use of medicines is an important component of the care of people with diabetes and nurses have become increasingly involved in this activity (James et al., 2009). A national survey identified that just over 30% of a random sample of 1992 nurse prescribers, over 60% of whom were in general practice, prescribed between 1 and 5 items each week for patients with diabetes (Courtenay and Carey, 2008b). There is evidence that nurse prescribing enables a more patient-centred and holistic approach to care, and an opportunity to increase self-management (Bradley and Nolan 2007). Specifically, nurse prescribing has been associated with improved access, continuity of care, partnership working, information exchange and medicines concordance (Jones et al 2007, Stenner and Courtenay 2008, Berry et al 2008, Courtenay et al 2009b). Through regular contact and good communication, prescribing nurses build ongoing relationships with patients that inspire confidence and trust and result in improved management (Courtenay et al 2010, Stenner et al 2010).

In parallel with pharmacological management, self-care contributes to successful metabolic control, improved quality of life and reduced complications (DoH, 2007, DoH, 2008, Healthcare Commission, 2007, Povey & Clark-Carter, 2007, American Diabetes Association, 2014, Odegard & Capoccia, 2007, Deakin et al, 2005). Self-care is an ongoing process whereby patients learn to adjust medicinal and lifestyle factors in order to manage this complex and progressive condition (Paterson & Thorne, 2000). Widespread use of glycosylated haemoglobin as an indicator of metabolic control, and use of blood glucose monitoring, has contributed to this shift in responsibility of care to the patient. Nurses play an important role in educating and supporting people with diabetes so they are prepared to successfully self-manage the condition through healthy diet, exercise, medicines adherence and problem solving/coping skills.

THE STUDY

Aims
The overall aim of the study was to compare the processes, outcomes and costs of care of people with diabetes managed in English general practice by nurse prescribers, compared to those of nurses without a prescribing capability, in order to inform the decisions of those engaged in service organisation and care delivery.
The specific objectives were to compare nurse prescribers and non-prescribers with respect to a) the characteristics of the people with diabetes that they manage, b) activities and processes of care, especially around medicines management, c) patient outcomes over a six month period, specifically self-management behaviours, clinical indicators, satisfaction, d) resource implications and costs for general practice.

**Design**

A case study design was used as the overarching framework for a comparative investigation using multiple data collection methods in a real life context (Jick, 1979, Yin, 1994).

**Participants**

Six general practices in which care for patients with diabetes was provided by a practice nurse with a prescribing qualification were matched with six practices in which care for patients with diabetes was provided by a practice nurse without a prescribing qualification (12 case study sites in total). Sites with prescribing nurses were purposively selected from earlier national survey (Courtenay & Carey 2008a) and case study research (Stenner et al 2010) to include different geographical locations throughout England, and both rural and urban settings.

Initial telephone contact was made with the nurse prescribers to explain the research. Those interested were sent the study protocol so that their involvement could be discussed within the general practice, and permission obtained. Each of the six nurse prescribers recruited were asked to identify a ‘matched’ site i.e. a general practice in the same geographical area, with a practice nurse with similar specialist training but without prescribing capability, and who had a similar case load of patients with diabetes. These nurses were contacted by the research team and recruited following the same process as for prescribers. Each nurse was asked to approach 30 consecutive patients (see sample size calculations below) attending for either annual or six month diabetes review, and who met inclusion criteria including:

- Have a diagnosis of Type 2 diabetes
- Taking oral hypoglycaemic medication insulin or a mixture of both for their diabetic condition
- Aged 16 years or over
- Been a patient of the nurse for at least one year
- Well enough (mentally and physically) to take part and give informed consent
- Capable of understanding English language /written or verbal instruction, or have a companion willing to help translate/complete questionnaires
- Most recent HBA1c at or above 6.5% (normal parameters 4%-5.9%), to enable possibility of showing improvement over the period of the study.

People with Type 2 diabetes being treated by diet alone (not on any diabetes medication) were excluded.

Patients meeting the inclusion criteria were provided with an information sheet by the nurse and, with permission, their contact details were passed to the research team. A researcher then contacted each volunteer to answer any queries and confirm willingness to participate. Since recruitment was slow in five general practices, the medical records of patients with diabetes on the case load of each nurse were searched by an administrator to identify those who fulfilled the inclusion criteria. To aid recruitment, the requirement that patients had known the nurse for at least one year was dropped. Eligible patients were sent a letter via their General Practice inviting them to participate in the study and enclosing a return-paid envelope for response to the research team.

**Data collection**

In each case study site, mixed methods were used to collect data over a six month period. Data collection took place in all sites simultaneously between November 2011 and December 2012. Site visits and interviews with nurses were conducted to gather information about the practice and their backgrounds. Telephone interviews were conducted by researchers with patients at baseline, 3 and 6 months. Further patient–related information was gathered by nurses from clinic records. In addition, nurses kept diaries of their contacts with each patient over the study period to record care given and medicines management activities. A sample of consultations was observed. One case study site was used to pilot the data collection instruments and no refinements were required.

Data gathered covered:

- Patient socio-economic and medical characteristics
- Patient reported outcomes (self-care and satisfaction)
- Clinical outcomes (HBA1c and BMI)
- Nurse activities and processes of care
Within the other data gathering exercises, information was collected on the ways in which use of nurse prescribers (rather than non-prescribing nurses) might impact practice resource implications and costs, including:

- The seniority of the nurses (to explore whether nurses with prescribing qualifications were generally associated with different professional grades, and hence employment costs)
- Consultation frequency and duration
- Demands made by nurses on other GPs or other health professionals for support or prescription signing
- Prescribing frequency
- Patient use of other health services for diabetes-related issues other than from the diabetes nurse (to indicate the comprehensiveness of the nurse care).

Details of the data collection and instruments are presented in Table 1. Wherever possible, validated instruments were used.

Table 1 goes here

Self-care, was selected as the primary outcome because education and support for self-care is an important component of care for people with diabetes (DoH, 2003, DoH, 2007, DoH, 2008, Healthcare Commission 2007), and the promotion of self-care is a specific area of care in which nurses are involved (Carey & Courtenay, 2007). Three satisfaction instruments were used to indicate different aspects of quality of care, including information about medicines, general management of chronic conditions and convenience of appointment making and waiting. Nurses were asked to extract a range of clinical indicators from individual patient records, including HbA1c test results, blood pressure, lipid profile, body mass index (BMI), smoking status, microalbumin urea, foot examination, and retinal screening. However, it transpired that much of the requested information was not available for the required time period for many patients, so only the most frequently recorded indicators (HbA1c and BMI) could be analysed.

**Ethical considerations**

Ethical approval for the study was obtained from both University and NHS Research Ethics Committee (REC) i.e. Surrey REC (Ref: 11/LO/0053). Research and development approval was obtained in each Primary Care Trust.

**Sample size**
With regard to the primary outcome of self-care management, as measured by the revised SCSDA, Lin et al (2006) report a maximum standard deviation of 2.5 amongst the diabetes self-care activities. On this basis, in order to detect an underlying mean difference of 2 days in frequency of any activity, with size = 5% and power = 80%, using a 2 sided test, a minimum of 26 subjects are needed in each nurse prescribing and non-prescribing nurse site. Allowing for a drop out rate of 10% with regard to provision of information on such a primary outcome variable, a total of at least 29 consecutive patients were needed from each site, to enable a statistically sound comparison to be made between any specific pair of nurse prescriber and non-prescribing nurse sites at any time point during the study. A target recruitment of 30 patients per site was therefore set.

Data Analysis
Quantitative patient level data were entered onto SPSS version 21, IBM Corporation 2012©. Although the intention had been to consider each matched pair or nurses as a unit only two pairs approached the target of 30 patients for the prescribing nurse and 30 patients for the non-prescriber. Hence paired comparisons would not be statistically credible in the remaining four pairs. A decision was therefore made to combine data from the six sites at which nurses were able to prescribe, and to conduct a global comparison with the combined data from the six sites at which nurses did not prescribe.

The characteristics of patients of prescribing and non-prescribing nurses were compared at recruitment. Self-care, HBA1c and BMI outcomes of patients of each type of nurse were compared across the six month follow-up period, and satisfaction were compared at the six month end point. Activity data recorded in nurse diaries (such as number and duration of consultations, medication management activities), and from observations, were analysed descriptively using medians and ranges and compared between prescribing and non-prescribing sites. All comparisons were conducted using appropriate statistical tests, as indicated on the tables reporting the results.

Economic analysis
The resource implications of employing nurses with and without a prescribing qualification to manage patients with diabetes in general practice were explored from the perspective of the National Health Service. Costs were calculated in British pounds.

The costs to practices of employing prescribing and non-prescribing nurses were based on the middle of the pay band reported by nurses in the study, using national pay scales (Curtis 2013).
Where statistically significant differences existed in consultation outcomes with cost implications between the two types of nurse (i.e. consultation frequency, duration, advice seeking from GPs and other health professionals, obtaining GP signatures on prescriptions, medication reviews and changes), the differences in costs were calculated using national unit costs (Curtis 2013). Patient use of health services (other than from the nurse) between recruitment and 3 month follow-up and between 3 and 6 month follow-up was summed, by type of service, and frequencies of use were compared between patients of nurses with and without prescribing capability. No statistically significant differences were found in use of other health services, so cost implications were not calculated.

RESULTS

Characteristics of participants

Six matched pairs of sites were recruited. Pairs were well matched by geographical location, but there were minor variations within pairs in some nurse characteristics. Apart from sites 1 and 2 where annual patient reviews were conducted by GPs, and three sites where insulin initiation was by GPs, all routine care of people with diabetes was conducted by nurses (including annual and six month reviews, medication initiation and changes and telephone advice) (Table 2). Non prescribing nurses tended to refer non routine patients to GPs or other services whereas nurse prescribers tended to be the key provider for more complex patients.

Table 2 goes here

Data were collected from a total of 214 patients: 131 (61.2%) nurse prescriber sites; 83 (38.8%) in non-prescriber sites. There were no statistically significant differences between groups with respect to gender, living arrangements, employment status, type of accommodation occupied or educational level. The majority of the sample were male and aged between 62 and 64 years, lived with a partner, owned their own accommodation, and had one comorbidity. Patients at the non-prescriber sites comprised a statistically significant higher proportion of Caucasians. Those at the prescriber sites had been diagnosed with diabetes longer, and had been cared for by the nurse longer (Table 3).

Table 3 goes here

Self-care behaviours
Patient-reported diabetes self-care activities mean scores across recruitment, 3 months and 6 months follow ups, were not significantly different between the prescribing and non-prescribing nurse groups. Blood glucose testing was found to be more prevalent in the nurse prescriber group (mean 3.4 days per week over six month period, compared with 2.1 for the non-prescribing nurse patients; p=0.001). However the difference is non-significant when considering only patients who reported at each assessment point that they were asked by their nurse to test their own blood sugar, which was significantly higher in the prescribing nurse group (Supplementary information Table S1).

**Satisfaction**

At the end of the six month observation period, the CEP satisfaction summative score, relating to aspects of care provided by the diabetes nurse, indicated a significantly higher level of satisfaction amongst the patients of prescribing nurses than amongst those of the non-prescribing nurses (mean 4.83 vs. 4.70; p=0.035). This higher level of satisfaction arose specifically in four items: ‘the nurse knows which symptoms have been discussed before’, ‘the treatment helps to control my diabetes’, ‘the nurse provides advice that can actually be implemented’, ‘the nurse helps me to cope with diabetes’. No statistically significant differences were observed in the SIMS or UOOQHCD measures (Supplementary information Table S2).

**Clinical indicators**

No statistically significant differences between the nurse prescribing and non-prescribing groups were found with regard to the initial and changes in raw scores for HbA1c and BMI (Table 4). However, a statistically significant decrease in HbA1c was observed in both groups between recruitment and the end of the project (i.e. 6 months later). Additionally, a statistically significant decrease in mean BMI from recruitment to the end of the project was observed in the patients of the nurse prescriber (Table 4).

Table 4 goes here

**Activities, processes and medicines management**

There was no statistically significant difference in the number of face-to-face or telephone consultations over the 6 months between the patients of nurse prescribers (mean 2.67) and non-prescribing nurses (2.40). However, the face-to-face consultations of nurse prescribers were significantly longer than those of nurses without prescribing capability (median 27.7 vs. 20.0 minutes) (Table 5).
Compared to nurse prescribers, the non-prescribing nurses recorded significantly more times when they: discussed the patient’s medication with doctor or colleague and made a recommendation via letter/email or phone call to GP for medicine(s) to be prescribed (34/329, 10.3% vs. 60/199, 30.1%); issued a prescription for GP to sign immediately following/during the consultation, or later (0 vs. 42/199, 21.1%). There were no further statistically significant differences with regards to the other medicines-related activities listed on the diary template, or in giving patients information about medicines, although there was some indication that medication stopping and starting tended to be higher for the patients of nurse prescribers (Table 5). Analysis of the data from observation revealed no significant difference in the tasks undertaken by the two types of nurses, other than in prescribing of medications (Figure 1).

**Figure 1 goes here**

**Resource implications and costs**

*Employment costs of nurses:* Generally the prescribing nurses in the study were employed on higher bands than nurses without prescribing capability. Of the six prescribers (Table 2), three were band 8 (salary range £45,022 to £90,753), two band 7 (median salary £38.057), and one band 6 (median £31,752). Those without prescribing capability included three band 7, one band 6 and two unknown. The oncosts to practices of employing nurses would inflate salaries by approximately 25%. Assuming practice overheads are similar for each nursing grade, hiring a more senior nurse with prescribing qualifications could thus add some £8,000 per annum to the practice budget (band 6 vs. band 7, depending on the point on the scale) or more if an experienced band 8 nurse is employed. Whilst half of the prescribing nurses were band 8, most non prescribers (where band was known) were band 7.

*Consultation costs:* There were no differences in the frequency of consultations by patients managed by the different types of nurse, but the 7.7 minute average longer face-to-face consultation time of nurse prescribers, compared to non-prescribing nurses, comes at a cost of approximately £6.00 based on patient contact costs for band 7 nurses, without overheads (Curtis 2013), and would be greater for band 8 nurses.
Advice seeking from other professionals and GP prescription signing: No data were collected on whether nurses who needed to consult with GPs or other professionals about patients, or get GPs to sign prescriptions, undertook these tasks within the recorded consultation time, or additionally. Similarly the time expended by GPs or other colleagues on these tasks was not recorded. Following discussion amongst the researchers who had collected information from nurses, it was assumed that advice seeking (verbal face-to-face or phone, email or other written communication) about patients were dealt with by GPs in 5 minutes for each enquiry, and that each prescription signed by a GPs took 2 minutes of their time. Applying the national rate (Curtis 2013) for 1 minute of GP patient contact time (£3.80), the cost of a GP providing advice to a non-prescribing nurse was thus £19 and signing a prescription was £7.60.

Non-prescribing nurses seek support from GPs in 20 more consultations in every 100 (10.3% vs, 30.1%, Table 5), which, at £19 for the estimated 5 minutes of GP time equates to £380 per 100 consultations. Similarly, they ask GPs to sign 20 prescriptions in every 100 consultations (Table 5), which, at £7.60 for an estimated 2 minutes of GP time equates to £160 per 100 consultations. The longer consultations of nurse prescribers, however, is £600 for 100 consultations, and exceeds the total additional GP time incurred by non-prescribing nurses by £60 (£0.60 per consultation).

Prescribing costs: There was no statistically significant difference in new prescribing between the two types of nurses. The trend for nurse prescribers to stop or amend medications was not costed.

Utilisation of other health services: No significant differences were found between the patients of prescribing and non-prescribing nurses in their utilisation of any other health services (Supplementary information Table S3).

Summary of cost differences: On both the fixed costs of employing prescribing nurses, and the variable costs associated with their consultations, nurse prescribers appear to be more costly to general practices. If the apparent tendency for nurse prescribers to engage in more medication changes and new prescribing is also considered, this would add to the differential. Use of other health services by patients or prescribing and non-prescribing nurses did not differ. (Full summary of cost differences, see Supplementary information Table S4).

DISCUSSION
There was a higher proportion of Caucasian patients amongst those treated by the non-prescribing nurses. Otherwise the demographic characteristics of the patients with diabetes managed by prescribing nurses and non-prescribing nurses were similar, and they had an equivalent number of diabetes-related comorbidities. The patients of prescribing nurses had been diagnosed longer and been with the nurse longer than the patients of non-prescribing nurses, and the reason for this is not known, but may reflect staff turnover in the practices. The analysis of outcomes shows that patients are more satisfied with consultations with prescribing nurses (including nurses knowledge of what symptoms had been discussed previously, and the extra information and advice they received), and this may reflect the longer term relationship prescribers had with their patients, and the longer than average length of consultations of prescribing nurses. However, the analysis did not suggest that this extra attention resulted in better HBA1c, or self-management behaviours amongst the patients of nurse prescribers, and no differences were observed in utilisation of other services between the patients of the two types of nurses.

The nurse prescribers in this study were mostly higher band than the non-prescribing nurses and this increases the salary cost to practices. Furthermore, prescribing nurses incurred extra costs due to their longer patient consultations (by an average of 7.7 minutes), that would manifest in the practice as reduced patient throughput. We do not know why prescribing nurses had longer consultations but this possibly reflects practice policy on the duration of appointment slots, and the expectation that prescribing nurses would engage in more activities and information exchange with patients. Non prescribing nurses incurred costs of GP time by seeking advice from them more frequently than prescribing nurses, and also for getting prescriptions signed, but the cost of this did not offset the higher salary and reduced patient throughput of prescribing nurses. Cost differences between the two groups of nurses are sensitive to the band of nurse employed, and point within the band; the difference to GP practice costs is likely to be minimal if a nurse with prescribing capability can be hired on the same band as those without, but this would imply no return for nurses from investing in the additional qualification.

Self-care was reported as high across the whole patient sample. In-line with other work, patients reported the highest levels of self-care for medicine taking, and greater dietary than exercise self-care (Toobert et al 2000). However, blood glucose testing was low, in contrast to Toobert et al (2000), who reported the highest levels of self-care for in this activity. Although it is advocated that access to equipment for self-monitoring of blood glucose for people on medicines such as metformin should be based on an individual assessment, it is evident that in the UK, a number of primary care
organizations have policies which restrict the provision of blood glucose test strips (Diabetes UK, 2013), which may account for these lower levels. Nurse prescribers were more likely to recommend blood glucose testing to their patients, and this activity was more prevalent in this group than amongst the patients of non-prescribing nurses. An inclusion criteria for the study was that patients were recruited with mildly elevated HBA1c, and during the 6 month study period, there was a significant decrease in HbA1c across patients of both prescribing and non-prescribing nurses. BMI was also significantly decreased in patients of prescribers. These trends indicate, in line with other evidence, that nurse-led care benefits patient health (Cook-Johnson, 2012).

In-line with systematic reviews of nurse and doctor-led care, (Laurent et al, 2008, Horrocks et al, 2002), patients of both types of nurse reported high levels of satisfaction, including regarding information on medicines.

Nurse’s knowledge of symptoms discussed previously, confidence in treatment, the provision of implementable advice, and support to cope with the disease, were aspects of care rated more highly by patients of nurse prescribers. Support to cope with chronic illness has been rated more highly within nurse led care (compared to doctor-led) in other studies, and attributed to longer time nurses spend in consultations which enables more health information to be provided (Laurant et al 2004). Greater information exchange due to longer consultations may also explain the higher levels of satisfaction amongst patients of nurse prescribers in our study. Furthermore, the longer relationships nurse prescribers had with patients may have meant better continuity of care. Since satisfied patients are more likely to cooperate with treatment, to maintain a continuing relationship with a practitioner, and enjoy better health outcomes (Gasquet et al, 2004), the impact of nurse prescribers on satisfaction is important.

Limitations
The case study design renders the findings context specific. Moreover, outcomes such as satisfaction may be affected by the personal characteristics of individual nurses. Patient recruitment problems encountered meant that the planned comparisons between matched pairs had to be abandoned. Resource limitations meant that nurses, rather than an independent researcher, recorded data in the diaries, and guidelines may not have been followed. Inconsistencies were observed for the recording of some tests meaning information items could not be analysed. Other limitations include reliance on patient self-report of some outcomes and recall for service use information. Also the follow-up period was only six months, so longer term trends could not be identified. Six months is a
limited time to establish changes in behaviour and key outcomes in the context of the long period
over which most of these patients had already been managed.

Consultation times were self-reported by nurses and not validated but, we have no reason to
assume inaccurate estimation differed between groups. Other uncertainties in the costing study
relate to the GP time taken outside nurse consultations to provide advice or write prescriptions for
non-prescribing nurses. Since no statistically significant difference in medicine management tasks
was found, the costs of prescribing were not calculated although the data suggested a slight trend
for nurse prescribers to engage in more medicine changes and new prescribing than non-prescribing
nurses. Moreover, the study focussed on provider costs and did not consider costs to patients, such
as the possible need to return to the practice to collect prescriptions that non-prescribing nurses had
to ask GPs to sign after the consultation. While no differences between the groups were identified
using the work sampling method, observer field notes indicated that prescribing nurses spent more
time discussing medicines management than non-prescribing nurses who focused more on routine
testing and general lifestyle advice. It is possible that a more refined tool that is specifically designed
to measure differences relating to medicines management may produce more accurate results.

The costs calculated in the study concentrated on care provided by nurses for patients with diabetes,
but practice nurses see patients with a range of conditions, and people with diabetes are only one
group of patients with whom they consult and prescribe medicines. Few practices in the UK are likely
to have sufficient patients with diabetes to warrant employing one diabetes nurse on a full time
basis, although part time or shared arrangements do exist. One practice in this study had a visiting
specialist diabetes nurse, but the disadvantage of this arrangement is that nursing cover for diabetes
patients is not available at all times. To develop an overall picture of the outcomes, costs, and
benefits of hiring a general practice nurse prescriber, information on patient and clinical outcomes
would need to be collected across the whole spectrum of their work.

CONCLUSION
The finding that the diabetes management activities of nurses with and without prescribing
capability are similar is perhaps not surprising since much care for people with chronic conditions in
general practice in England is driven by the Quality and Outcomes Framework (Health and Social
Care Information Centre 2013). This rewards practices for delivery to pre-specified targets, with an
overall aim of improving quality of care and outcomes, and reducing differences in the patient
experience. From nurses’ perspectives, holding an independent prescribing qualification seems to
enhance career prospects, and may add to job satisfaction, but budget conscious GP practices may question the rationale of investing in a more expensive resource when a nurse commanding a lower salary can produce similar outcomes for QOF. Care for people with diabetes has become increasingly managed in primary care by nurses, possibly reflecting the higher cost of hiring a GP. However, there is a need for careful planning of task shifting according to competencies. Further research on the deployment of nurses with prescribing capabilities is required, including around their wider use in general practice, and their impact on the patient experience.

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<table>
<thead>
<tr>
<th>Category of data</th>
<th>Method of collection</th>
<th>Timing of collection</th>
<th>Items and instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of practices and sites</td>
<td>Site visit, interview with nurses,</td>
<td>Before baseline data collection from patients</td>
<td>Practice – Location, setting, number of GPs&lt;br&gt;Nurses- Age, highest education qualification, salary band, full/ part time status, years with practice, years with prescribing qualification (or none), diabetes training, years of experience in diabetes care, whether initiate insulin treatment, whether treat other long term conditions</td>
</tr>
<tr>
<td>Characteristics of patients</td>
<td>Telephone interview with patient</td>
<td>Baseline</td>
<td>Socio economic - living arrangements i.e. alone /with others, type of accommodation, employment status, education, ethnicity</td>
</tr>
<tr>
<td></td>
<td>Clinical records by nurse</td>
<td>Baseline</td>
<td>Clinical - date of birth, sex, when the patient was diagnosed with diabetes, diabetes related co-morbidities, length of time managed by nurse</td>
</tr>
<tr>
<td>Patient reported outcomes</td>
<td>Telephone interview with patient</td>
<td>Baseline, 3 months, 6 months</td>
<td>Self-care (primary outcome) was measured by the widely used Revised Summary of Diabetes Self-Care Activities (revised SDSCA) (Toolbert et al, 2000, Shrivastava et al 2013).&lt;br&gt;The 11 items ask: the number of days during the previous seven that they have followed dietary (4 items) and exercise (2 items) guidelines, tested their blood sugar (2 items), undertaken foot care (2 items), and the number of cigarettes smoked each day (1 item). Variables were combined to derive Diet-General, Diet-Specific, Exercise, Foot Care and Smoking, and calculated for each patient as a mean score across recruitment, 3 months and 6 months.&lt;br&gt;Additional items were added on taking medications to schedule, and whether their nurse recommended routine blood sugar testing.</td>
</tr>
<tr>
<td></td>
<td>Telephone interview with patient</td>
<td>6 months</td>
<td>3 measures of satisfaction:&lt;br&gt;- The 17 item Satisfaction with Information about Medicines Scale (SIMS) (Horne et al, 2001). Two summary indicators are calculated for ‘action and usage’ (items 1 to 9) and ‘potential problems’ (items 10 to 17), range 0 (none/ too little) to 100 (about right).&lt;br&gt;- The 14 item Chronically ill patients Evaluate general Practice (CEP) questionnaire (validated for doctor-led care by Wensing et al 1998, and nurse-led care by Laurant et al 2008) comprises a global satisfaction measure (item 1), and 13 statements reflecting communication skills, knowledge and treatment, each scored 1 (poor) to 5 (excellent). A summary score was derived from the mean of items 2-12. (Questions 13 and 14 were excluded as not relevant.)&lt;br&gt;- Appointment making and waiting time dimensions (7 items) of the Unidimensional Outpatients’ Opinion of Quality of Hospital Consultation Departments (UOOQHCD) (Gasquet et al., 2004), with wording adapted to relate to nurses, covered ease of making appointments, speed of access, and waiting time. Scoring is on a scale 1 (worst) to 5 (best) and an overall mean was computed.</td>
</tr>
<tr>
<td>Clinical indicators</td>
<td>Clinical records by nurse</td>
<td>Baseline, 6 months</td>
<td>HBA1c, in mmol/mol (indicator of glycaemic control)&lt;br&gt;Body Mass Index</td>
</tr>
<tr>
<td>Nurse activities and processes of care</td>
<td>Individual diary nurse completed for each patient</td>
<td>Over six month period that patients were in the study</td>
<td>Following each patient contact, nurses indicated, from a list in a diary template (developed by the researchers in previous work (Courtenay et al., 2012), those activities in which they had been involved, including: whether the consultation was a face-to-face or by telephone; if, following a review of the patient’s medicines, decisions to recommend, amend, stop, or prescribe medicines for patients were made; whether certain actions had been taken (such provision of advice, discussion of medication with a doctor/ other health professional, doctor asked to sign prescription, a recommendation for over-the-counter medicines).&lt;br&gt;Nurses were also asked to estimate (in minutes) the duration of each consultation.</td>
</tr>
<tr>
<td>Observations of nurse consultations</td>
<td>2 x 2 hour observation periods at each site</td>
<td>Structured observations of consultations using the work sampling instrument developed by Gardner et al. (2010). Observations of nurse activities were conducted at 5 minute intervals in 2 x 2 hour blocks randomly assigned during clinic times when nurses were scheduled to see patients with diabetes. A trained researcher identified</td>
<td></td>
</tr>
</tbody>
</table>
and categorised the main activity being undertaken by the nurse at each observation point (direct patient care (physical assessment, history taking, information exchange), indirect care (documenting patient notes, discussion with colleague, data retrieval), service related (including research, professional development, meetings)).

<table>
<thead>
<tr>
<th>Resource implications and costs</th>
<th>Interviews with nurses</th>
<th>Baseline</th>
<th>Grade / banding of each of the nurses in the study. Bands range from 5/E to 8/I, with higher bands reflecting greater clinical expertise and managerial responsibility, and attracting higher salaries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual diary nurse completed for each patient</td>
<td>Over six month period that patients were in the study</td>
<td>5 items related to consultations with individual patients, were also examined for differences between the two types of nurse: - number consultations; - duration of consultations; - frequency with which nurses sought advice from a GP or other professionals regarding patients’ medications; - frequency with which nurses asked GPs to sign prescriptions; - frequency of medication reviews, changes and new prescribing.</td>
<td></td>
</tr>
<tr>
<td>Telephone interview with patient</td>
<td>3 months, 6 months</td>
<td>Self-report use of health services for diabetes–related issues (other than those involving their diabetes nurse) in the previous 3 months including: visits to the GP surgery, phone calls to the GP and diabetes nurse specialist, visits to other nurses and health professionals and hospital outpatient clinics, Accident &amp; Emergency visits, hospital admissions and number of inpatient days.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2. Characteristics of the sites and nurses

<table>
<thead>
<tr>
<th>Pair</th>
<th>Case study site</th>
<th>Number of patients recruited</th>
<th>Type of nurse</th>
<th>Number of GPs in practice</th>
<th>Setting</th>
<th>Location in England</th>
<th>Nurse age in years</th>
<th>Salary Band</th>
<th>Full or part time</th>
<th>Education highest</th>
<th>Specialist diabetes training</th>
<th>Insulin initiated by nurse</th>
<th>Years at GP practice</th>
<th>Years of experience in diabetes care</th>
<th>Years with prescribing qualification</th>
<th>Treat other long term conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>12</td>
<td>NP</td>
<td>9</td>
<td>Urban</td>
<td>Midlands</td>
<td>57</td>
<td>8</td>
<td>FT</td>
<td>Degree</td>
<td>Yes</td>
<td>Yes</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>NNP</td>
<td>9</td>
<td>Urban</td>
<td>Midlands</td>
<td>41</td>
<td>7</td>
<td>PT 34%</td>
<td>RGN</td>
<td>Yes</td>
<td>Yes</td>
<td>12</td>
<td>5</td>
<td>-</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>30</td>
<td>NP</td>
<td>4</td>
<td>Urban</td>
<td>Middlesex</td>
<td>52</td>
<td>7</td>
<td>PT 30%</td>
<td>Degree</td>
<td>Yes</td>
<td>Yes</td>
<td>14</td>
<td>10</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>30</td>
<td>NP</td>
<td>5</td>
<td>Rural</td>
<td>Yorkshire</td>
<td>38</td>
<td>8</td>
<td>FT</td>
<td>Diploma</td>
<td>Yes</td>
<td>Yes</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>31</td>
<td>NP</td>
<td>8</td>
<td>Rural</td>
<td>Yorkshire</td>
<td>55</td>
<td>6</td>
<td>PT 30%</td>
<td>Degree</td>
<td>Yes</td>
<td>Yes</td>
<td>25</td>
<td>32</td>
<td>7</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>8</td>
<td>NNP</td>
<td>7</td>
<td>Urban</td>
<td>London</td>
<td>45</td>
<td>8</td>
<td>PT 30%</td>
<td>Masters</td>
<td>Yes</td>
<td>No</td>
<td>15</td>
<td>15</td>
<td>4</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>NNP</td>
<td>4</td>
<td>Urban</td>
<td>London</td>
<td>32</td>
<td>7</td>
<td>PT 30%</td>
<td>Degree</td>
<td>Yes</td>
<td>No</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Key: NP, Nurse Prescriber; NNP, Not a Nurse Prescriber; N/A data not available
Table 3. Background characteristics of patients*, comparison between service groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Nurse Prescriber</th>
<th>Non Prescribing Nurse</th>
<th>Chi-square value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>87</td>
<td>66.4</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living Arrangements:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live alone</td>
<td>24</td>
<td>18.3</td>
<td>18</td>
</tr>
<tr>
<td>Live with children (without partner)</td>
<td>4</td>
<td>3.1</td>
<td>3</td>
</tr>
<tr>
<td>Live with partner (without children)</td>
<td>35</td>
<td>26.7</td>
<td>22</td>
</tr>
<tr>
<td>Live with partner (with children)</td>
<td>61</td>
<td>46.6</td>
<td>37</td>
</tr>
<tr>
<td>Live with other relatives</td>
<td>6</td>
<td>4.6</td>
<td>3</td>
</tr>
<tr>
<td>Live with others</td>
<td>1</td>
<td>.8</td>
<td>0</td>
</tr>
<tr>
<td>In Paid Employment:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>47</td>
<td>35.9</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Accommodation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner-occupied</td>
<td>89</td>
<td>67.9</td>
<td>62</td>
</tr>
<tr>
<td>Privately rented</td>
<td>12</td>
<td>9.2</td>
<td>11</td>
</tr>
<tr>
<td>Rented from local authority/ housing association</td>
<td>25</td>
<td>19.1</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>3.8</td>
<td>0</td>
</tr>
<tr>
<td>University education:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25</td>
<td>19.1</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White / Caucasian ethnicity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>119</td>
<td>90.8</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>64.22 (11.32)</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years (at first interview)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>131</td>
<td>9.09 (5.91)</td>
<td>83</td>
</tr>
<tr>
<td>Number of years (at recruitment) since diagnosis of diabetes</td>
<td>128</td>
<td>5.23 (5.40)</td>
<td>74</td>
</tr>
<tr>
<td>How long patient has been treated by nurse</td>
<td>127</td>
<td>1.12 (0.78)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of diabetes-related co-morbidities</td>
<td>129</td>
<td>1.12 (0.78)</td>
<td>83</td>
</tr>
</tbody>
</table>

*Data were collected from a total of 214 patients: 131 (61.2%) nurse prescriber sites; 83 (38.8%) in non-prescriber sites. There were 194 patients who supplied information at both 3 and 6 month follow-up, three with data at neither point, 16 with data at 3 months but not at 6 months of which 1 had died and was excluded, 1 with data at 6 months but not at 3 months. Where data were provided at one but not both follow up points, the available data were averaged to provide a value over the whole 6 month period.
Table 4. Clinical indicators: Comparison between service groups

<table>
<thead>
<tr>
<th>Test result</th>
<th>Nurse Prescriber</th>
<th>Non Prescribing Nurse</th>
<th>Unpaired t-test: p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean (SD)</td>
<td>N</td>
</tr>
<tr>
<td>HbA1c at recruitment to study (mmol/mol)</td>
<td>128</td>
<td>63.0 (12.6)</td>
<td>83</td>
</tr>
<tr>
<td>HbA1c change (end of project - at recruitment) (mmol/mol)</td>
<td>115</td>
<td>-2.1 (10.9) Paired t-test: p=0.043</td>
<td>72</td>
</tr>
<tr>
<td>BMI at recruitment to study</td>
<td>115</td>
<td>33.0 (9.1)</td>
<td>79</td>
</tr>
<tr>
<td>BMI change (end of project - at recruitment)</td>
<td>67</td>
<td>-0.44 (1.45) Paired t-test: p=0.015</td>
<td>62</td>
</tr>
</tbody>
</table>
### Table 5. Patient contact and medicines management activities of prescribing and non prescribing nurses

<table>
<thead>
<tr>
<th>Activity</th>
<th>Nurse Prescriber</th>
<th>Non Prescribing nurse</th>
<th>Mann-Whitney U test: p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of face-to-face consultations</td>
<td>123</td>
<td>83</td>
<td>0.502</td>
</tr>
<tr>
<td>Number of telephone consultations</td>
<td>123</td>
<td>83</td>
<td>0.650</td>
</tr>
<tr>
<td>Duration of face-to-face consultation (minutes)</td>
<td>121</td>
<td>80</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Duration of telephone consultation (minutes)</td>
<td>35</td>
<td>19</td>
<td>0.478</td>
</tr>
<tr>
<td>Number of times patient's medication was reviewed</td>
<td>123</td>
<td>83</td>
<td>0.829</td>
</tr>
<tr>
<td>Number of times a change to patient's medication was required</td>
<td>123</td>
<td>83</td>
<td>0.254</td>
</tr>
<tr>
<td>Number of times existing medications had to be stopped or amended</td>
<td>123</td>
<td>83</td>
<td>0.089</td>
</tr>
<tr>
<td>Number of times new medication was required</td>
<td>123</td>
<td>83</td>
<td>0.144</td>
</tr>
<tr>
<td>Number of times advice was given to patient about medicine</td>
<td>123</td>
<td>83</td>
<td>0.987</td>
</tr>
<tr>
<td>Number of times a patient was recommended to buy an over-the-counter medicine</td>
<td>123</td>
<td>83</td>
<td>0.779</td>
</tr>
<tr>
<td>Number of times medicines were supplied or administered via PGD</td>
<td>123</td>
<td>83</td>
<td>0.153</td>
</tr>
<tr>
<td>Total consultations (face-to-face and phone)</td>
<td>123</td>
<td>83</td>
<td>0.485</td>
</tr>
<tr>
<td>Number of times patient’s medication discussed with doctor or colleague</td>
<td>123</td>
<td>83</td>
<td>&lt;.0005</td>
</tr>
<tr>
<td>Number of times GP contacted verbally or written about medications to be prescribed</td>
<td>123</td>
<td>83</td>
<td>&lt;.0005</td>
</tr>
<tr>
<td>Number of time prescription issued for GP to sign immediately / during consultation</td>
<td>123</td>
<td>83</td>
<td>&lt;.0005</td>
</tr>
<tr>
<td>Number of times prescription issued for GP to sign later</td>
<td>123</td>
<td>83</td>
<td>&lt;.0005</td>
</tr>
</tbody>
</table>
Figure 1. Mean number of times (in 5 minute windows during 2 x 2 hour observation) each CATEGORY of work activity seen as predominant, broken down by Nurse Prescriber or Non-Prescribing Nurse.