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1 **Exploring the provision of diabetes nutrition education by practice nurses in**
2 **primary care settings.**

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9 CG designed the study, performed the data collection and analysis and was the main author on the
10 paper. MJ provided supervision throughout the study and co-authored the paper.

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15 *Abstract:*

16 **Background**

17 High quality nutrition education is recommended as an essential component of diabetes care. In the
18 UK there has been a gradual shift of inter-professional boundaries for providing nutritional care for
19 people with type 2 diabetes. Only a minority now regularly receive advice from a dietitian. Instead,
20 increased demands for nutrition education are being absorbed by practice nurses. This study seeks
21 to explore this situation through the views of practice nurses, on the services they provide and the
22 issues they face.

23 **Methods**

24 A qualitative approach using semi structured interviews was used. Practice nurses were recruited
25 using purposive sampling and nine were interviewed. Data was analysed using the Framework
26 Method. The Theoretical Domains Framework from the COM-B model of behaviour change,

1 increasingly used to explore the behaviour of health care professionals, was used to further frame
2 the findings.

3 **Results**

4 Practice nurses reported that on-going diabetes nutrition education only took place at annual review
5 appointments and was limited to five to ten minutes. They described how they are expected to take
6 on a more advanced role in diabetes nutrition education than they can provide and are becoming
7 increasingly isolated in this role due to a lack of time; practical and informational support and
8 training standards and provision.

9 **Conclusion**

10 A range of service improvements led by dietitians, which focus on strengthening the working
11 environment and enhancing professional support available for practice nurses who provide diabetes
12 nutrition education, could improve quality of care and health outcomes in people with diabetes
13 within current time restraints.

14 **Keywords: diabetes; diet; education; primary care; practice nurse**

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3 *Introduction*

4 The on-going provision of dietary advice to people with diabetes (PWD) from diagnosis is
5 recommended by NICE as an essential component of diabetes care¹. To be effective, this should be
6 individualised and provided by health care practitioners with specific expertise and competencies
7 in nutrition^{1,2}.

8 As the incidence of diabetes has increased, previous recommendations that all PWD should be
9 referred to a registered dietitian (RD) for diabetes nutrition education (DNE) at diagnosis and
10 annual review have become unachievable^{3,4} and new models of care have evolved. At diagnosis,
11 DNE is provided within diabetes self-management education (DSME) by trained and quality
12 assured educators including dietitians⁵. Primary care staff, in particular practice nurses (PN), now
13 have a pivotal role in providing on-going DNE.

14 Providing nutrition education (NE) for primary prevention has been regarded as a role of primary
15 care teams for decades⁶⁻⁸ but NE for chronic disease management such as diabetes is a more recent
16 development. The role has evolved as the involvement of general practice in diabetes care^{9,10} has
17 proved essential to maintain access to services with the increased incidence of diabetes in the
18 UK^{11,12}. Care provision is monitored and incentivised through the audit and the Quality Outcome
19 Framework (QOF)¹³.

20 The critical role of PNs in the provision of diabetes care is well reported¹⁴⁻²⁰ but there are no
21 studies looking specifically at their role in the provision of DNE in the UK. Potential advantages to
22 a model where PNs are the main providers of DNE include convenience and continuity of care from
23 trusted and influential health care professionals (HCP)²¹⁻²⁵ but its effectiveness is uncertain²⁵.
24 Having sufficient time is an important factor in bringing about lifestyle change²⁴. However, lack of
25 available time is reported as being the greatest barrier to DNE²⁶ and general NE in primary care^{6,8}.
26 A minimum of two hours of NE over six months is recommended for effective dietary change^{24,27,28}
27 yet time for nutrition consultations is reported to be falling to between 4 to 25 minutes^{29,30}. The time
28 required to undertake physical checks and tasks for QOF could be contributing to this.

29 An alternative approach is for PNs to provide only brief interventions, which re-enforce more
30 expert and detailed advice provided by other sources²³. However, this requires primary care to refer

PWD to other sources of NE such as dietetics and DSME and despite evidence that it is beneficial, referral discussions with PWD are reported to be infrequent and tentative^{26,30,31}.

A UK competency framework outlines the minimum competencies required for non-dietitians who provide DNE³². However since the removal of DNE related QOF indicator DM013 there is less incentive to meet these³³. Subsequently, provision and uptake of DNE training to PNs remains opportunistic and ad hoc^{14,16} and knowledge and skills levels variable³⁴.

In summary, relevant literature suggests that the rising numbers of PWD in the UK and changes in the way diabetes services are provided has led to PNs now being a main provider of DNE yet little is known about this aspect of care. Therefore, this study aims to explore the views of practice nurses to find out more about the services they provide and the issues they face.

Methods:

As this is a relatively unexplored topic, a qualitative approach was chosen so that the findings could inform subsequent research^{35,36}. Resource was limited due to the study being part of a Masters degree carried out by one of the authors (CG). Therefore only one professional group was chosen, and all the interviews and analysis were undertaken by the one researcher (CG). Semi structured interviews were chosen to encourage individuals' own interpretations of the questions and allow the iterative development of these over the study as new relevant topics emerge³⁷. These also allowed for representation of the diversity of the nurses and their workplace³⁶ as described in Table 1.

Ethical approval was granted by the University of Sheffield Research Management System (URMS 143367).

Setting

The study took place in a UK city with a population of 550,000 and a diabetes prevalence of 6.1%. The provision of community dietitians for people with diabetes was 1.5 whole time equivalents.

Sampling

Taking into consideration the limited resource, the aim was to recruit a purposive sample of up to 10 PN currently providing diabetes care from 88 general practices.^{38,39}

To obtain a diverse sample, albeit within a relatively narrow group, a sampling frame which included 58 practices was produced based on demographic and national audit data across target

1 practices available at the time⁴⁰ (Supplementary information 1). From this a typology of practices
2 was used to select iteratively those agreeing to participate, in order to represent a diverse range of
3 characteristics⁴¹.

4 **Recruitment**

5 Of the 58 practices, permission to contact PN was granted from 19 practice managers. Information
6 letters from the Clinical Lead for Diabetes were sent out in two waves to assess response rates and
7 to meet the recruitment target. From the respondents of the first wave, six interviews were arranged
8 and completed. Following this, the diversity of the sample was reviewed, and further targeted
9 recruitment then followed. In total, 10 nurses agreed to be interviewed.

10 **Data Collection**

11 The interview topic guide is provided. (Supplementary information 2). Of the ten interviews
12 scheduled, nine went ahead with one nurse withdrawing due to lack of time. Although the sample
13 was small, there appeared to be no new information coming out of the final interviews.

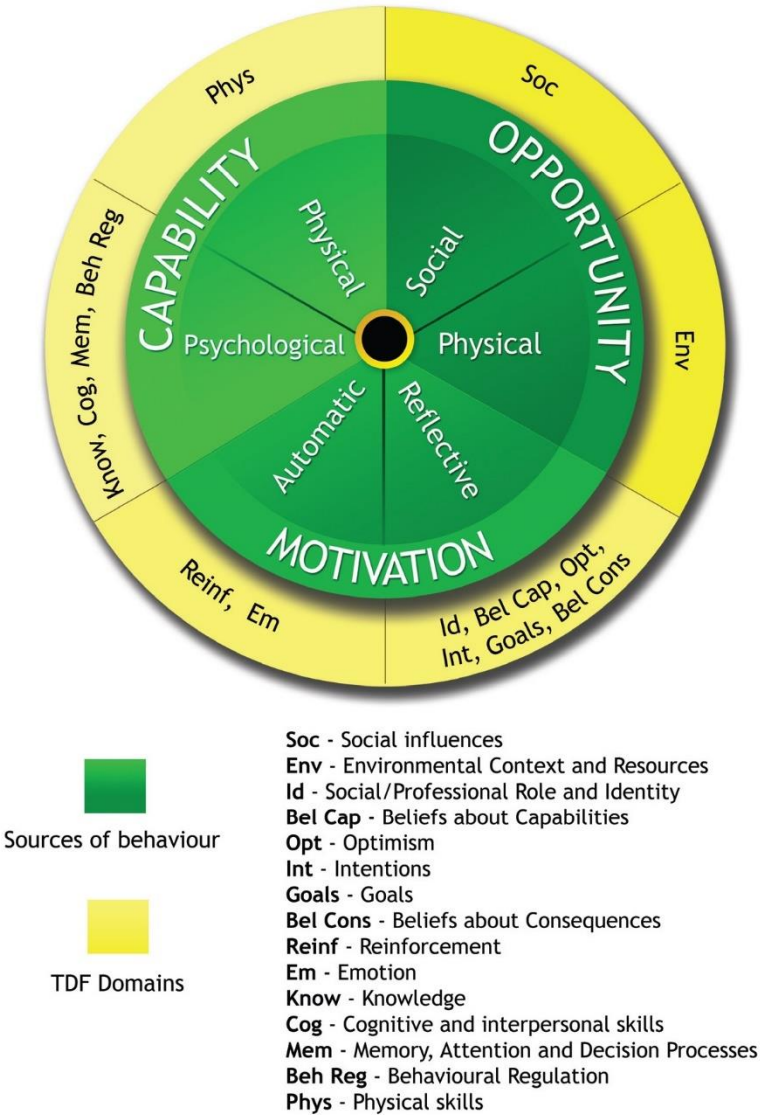
14 **Data Analysis**

15 The data was transcribed verbatim, anonymised and imported into NVivo v10 qualitative software
16 package (QSR International, Cambridge, MA,USA). Identifiers were pseudonymised. It was
17 analysed using the Framework Method⁴² which fits well with the study aims and timescale, and
18 provides transparency to the data analysis³⁵. Themes and subthemes were identified following
19 categorisation within the software. During the late stages of analysis, the COM-B model of
20 behaviour and associated Theoretical Domains Framework (TDF) shown in Figure 1 was identified
21 as relevant to the category groupings. The model detailed in supplementary information 3,
22 recognises that behaviours (B) come about through the interaction of capability, opportunity,
23 motivation (COM) and the TDF has 14 domains each linked to one of the COM components^{43–46}. It
24 is used most commonly to inform the implementation of health care interventions, but also at any
25 stage of health research⁴⁵. This includes using it at the descriptive and analytical stages of
26 qualitative research as has been done in this study⁴⁶.

27 The TDF structure was found to be useful for capturing and presenting relevant data and developing
28 explanatory accounts by providing an understanding of how the categories were related, supporting
29 the meaning of explanations. Questioning the data was also an important part of developing
30 explanations. Considerations included: how outcomes changed under different conditions; the

1 strategies nurses were using in their work and the possible reasons behind these; and the impact of
2 the environmental context they were working in.

3
4 **Figure 1: Theoretical Domains Framework linked to COM-B components.**
5 **Reproduced with permission⁴⁷.**
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8

9 *Results*

10 *Characteristics of the nurses and practices*

11 Of the final sample of nine nurses, all were female. Five were employed as PNs and their
12 experience in this role ranged between one and 10 years (median average of 7 years). Four were

1 employed at the higher grade of Advanced Nurse Practitioner (ANP) with practice nursing
 2 experience ranging from 10 to 26 years (median average of 24 years). An overview of the general
 3 practice demographics can be found in Table 1. Three of the practices (P1, P3,P5) had high
 4 numbers of patients from BME groups. All practices had a higher prevalence of diabetes than the
 5 national or city average .

6 **Table 1: Description of General Practice population and staff**

7

Practice identifier	Participant identifier	Deprivation score [∞] 1 to 5 (1 = lowest level)	Diabetes Prevalence [∞] (% of practice with Diabetes)	% of patients with optimal blood glucose control [∞]	Total number of patients in practice ^β	Number of Staff ^β GP:Nurse:Health care assistant
City Average ¹			6.1	62		
P1	N1	4	8.1	66	9000	10:3:3
P2	N2	1	6.5	69	9500	9:3:3
P3*	N3, N9	5	8.2	55	6500	4:2:3
P4	N4	3	7.6	51	8000	6:3:2
P5	N5	4	9.7	56	2600	1:1:0
P6	N6	4	7.1	64	8000	8:4: NK
P7	N7	3	8.6	63	7500	7:5:2
P8	N8	2	7.2	63	18000	NK:6:2

8

9 [∞] Source ⁴⁰; ^β estimated by nurse;* P3 employed two of the nurses N3 and N9; NK = not known

10

11

12 *Care provision*

13 In all practices, DNE occurred in one to one diabetes clinic appointments. This was always
 14 provided by nurses but their grade varied between practices. ANP made autonomous decisions
 15 about diabetes management and diabetes medications including insulin initiation. The PN role
 16 differed in that they followed care plans provided by GPs. Experience of working in diabetes
 17 ranged from a few months to twenty years. Newly diagnosed patients were offered on average three
 18 diabetes appointments over three months, each of 15 to 30 minutes duration. For most with
 19 established diabetes, review appointments were offered annually and ranged from 10 to 30 minutes.
 20 The consultation was structured around meeting QOF indicators for diabetes using an electronic
 21 template as a prompt. Any remaining time, estimated to be five to ten minutes, was spent on
 22 education, with nutrition and physical activity mentioned most often.

23

24 *Themes*

1 Seven domains of the TDF were identified as relevant to this study and used as themes:
2 environmental context and resources; social influences; knowledge; skills; professional role and
3 identity; beliefs about capabilities; and beliefs about consequences.

4 **Environmental Context and Resources**

5 *Nutrition education within the primary care Diabetes Service*

6 Despite attempts to free up more nursing time for education by utilising health care assistants to
7 perform essential health checks, DNE provision was still estimated to be limited to five to ten
8 minutes annually. Meeting service demands for people with diabetes was mentioned frequently and
9 described as challenging and overwhelming. Nurses with the least support and skills felt the most
10 time pressure when providing DNE.

11

12 **N6** *'We don't have enough time. That's quite important, I think. You know what I have to do in 10 minutes*
13 *is not enough because that is the whole basis of diabetes when you think about it. It is diet. And if they can't*
14 *get that right you know it's, you're on a losing battle if you don't spend time. Because we've got so much to*
15 *do with them.'*

16

17 Dietary educational resources were valued, and most nurses wanted a wider range of resources.
18 There was no consistency across practices in the choice of patient literature used and all preferred to
19 print off these off from websites as required.

20 *Nutrition education outside the primary care diabetes service*

21 Nurses regularly referred PWD to DSME programme DESMOND and the local weight
22 management service. Positive patient feedback following attendance at these services increased
23 referrals. Dietetic services however were rarely utilised. A number of reasons were given for this
24 including: lack of awareness of dietetic service provision and the referral process; strict referral
25 criteria; location of clinics; and high rates of non-attendance.

26

27 **N8** *'I know, you know a few years ago they seemed to be more prominent, the dietitians and then again it's*
28 *been a while since I've seen anyone and we never really seem to get to find out what services are available*
29 *and what's no longer available in terms of things like that.'*

30

1 **Social influences**

2 Support from other health care professionals, mainly related to medical management, was identified
3 as a main influence on nurses delivering diabetes care. Nurses had higher levels of job satisfaction
4 and self-efficacy when supported by GPs, and Diabetes Teams.

5

6 ***N1** 'I feel really happy with the way it's organised here to be honest; I do. I think that's why if we do seem*
7 *like a reasonably good practice it's because it is well organised and we do have good time for our diabetes*
8 *patients and I get the debrief with Dr and we've got access to people outside the practice who are experts. '*

9

10 Whereas, inadequate support from the GPs isolated nurses which impacted on their confidence.

11

12 ***N8** 'Yeah you know if somebody did question something and I was like I don't know but if I knew that I could*
13 *go to somebody , one of them and ask. I mean we will send them messages and ask and see if they know*
14 *the answer but a lot of the time they don't. So, then we are looking elsewhere for the answers.'*

15

16 Some practice staff felt they benefited from shadowing diabetes nurses in clinics, observing DSME
17 and from opportunities to discuss complex cases at practice meetings with diabetes teams.

18 Generally, nurses did not seek out support specifically relating to DNE due to insufficient time and
19 a lack of certainty about where to access it, although ANP were more likely to do so. Nurses with
20 inadequate support expressed feelings associated with isolation, uncertainty and despair.

21 **Knowledge and skills**

22 All nurses made reference to shortfalls in their knowledge and skills to provide DNE. Commonly,
23 nurses felt unable to answer patient questions on diet or provide sufficient detail, including practical
24 suggestions. Having to respond with a 'best guess' had a negative impact on their self-efficacy.

25

26 ***N6** '....when someone asks you how many slices of bread, they should have a day and things like that.*
27 *Because you don't have ongoing education and things sometimes, I think , "Do you know, I've got absolutely*
28 *no idea." So, it affects your confidence quite a bit that you've got no idea.'*

29

1 *Training in NE*

2 Training levels in diabetes care were highly variable and did not necessarily relate to the grade,
3 position or length of experience of the nurse. No reference was made to the national dietetic
4 competencies for healthcare professionals working in diabetes³² and of those asked, none were
5 aware of them. National recommendations for nurses to be skilled in DNE were not reflected in
6 available local training. For example, the twelve-month PN induction programme contained no
7 education on diabetes or nutrition in relation to chronic disease management.

8 Although practice management supported requests for training, they did not actively propose any
9 minimum levels of training. One nurse recalled this had been different in the past when dietary
10 advice was briefly made a QOF indicator.

11

12 **N3** *'So what we did then was, because we were saying, we can't legitimately tick that they've had the thing.*
13 *So that's when I suggested, if I go and do the Blatcham diabetes thing [Diploma in Primary Care*
14 *Management of Diabetes], because there's quite a big dietary section in that, you were able to give advice.*
15 *So, we were sort of saying that I could educate other members of staff and would that count for our...? Yes,*
16 *we were sort of using me as a suitably qualified health professional.'*

17

18 Commonly, nurses obtained nutritional information from patient resources and personal
19 experiences. Training by dietitians was helpful but was ad hoc, infrequent and felt too advanced to
20 less experienced nurses. Nurses identified a need for tiered levels of formal and informal training
21 and support, provided locally and regularly, containing a practical element.

22 **Professional role and identity**

23 Aside from diabetes, primary care nurses provided nutrition advice to people of all ages for a range
24 of reasons. Consequently, most nurses perceived providing DNE as their responsibility and did not
25 seek out alternative sources of education for patients. It was suggested that this was also the
26 expectation of patients and GPs. For some, this led to working at a more advanced level than they
27 felt capable of. One exception to this was an ANP who described seeking alternative sources of NE
28 for PWD to supplement what she could provide with her limited time and skills.

29

30 **N1** *' I think I am a bit of a signpost person. So yes, I'll talk to people about healthy eating but I'll also see*
31 *who else could get involved because I think it's important because they only see me fairly rarely so try and*
32 *get as many people on board as possible actually.'*

1

2 With little contact with dietitians, there was a lack of clarity about the dietitian's role especially
3 with less experienced nurses, which affected referrals.

4

5 ***N9** 'Probably not for diabetes. You know if there was somebody that had got an oesophageal cancer or
6 something, we would refer them to dietitians for that, but it is really quite specific things that we would do
7 that for.'*

8

9 **Beliefs about capabilities**

10 The awareness of gaps in their nutritional knowledge and skills, negatively influenced nurses' belief
11 in their capabilities to provide DNE.

12 ***N6** '....when someone asks you how many slices of bread they should have a day and things like that.
13 Because you don't have ongoing education and things sometimes, I think do you know, I've got absolutely
14 no idea. So it affects your confidence quite a bit that you've got no idea.'*

15

16 Yet other factors seemed to have a more positive impact. The most commonly reported one being
17 the confirmatory messages they received from GPs and PWD that they were the nutrition experts
18 within the practice. Not having the opportunity to compare levels of competency with experts such
19 as dietitians, appeared to make it more difficult for nurses to reflect objectively on their own
20 practice, also positively influencing belief in their capabilities.

21 **Belief in consequences**

22 All nurses held a strong belief in the impact of dietary change on the physical wellbeing of PWD
23 and this appears to be one of the most significant factors motivating nurses to provide DNE.

24 ***N1** 'I can think of quite a few people who have lost weight and their diabetes has practically disappeared.'*

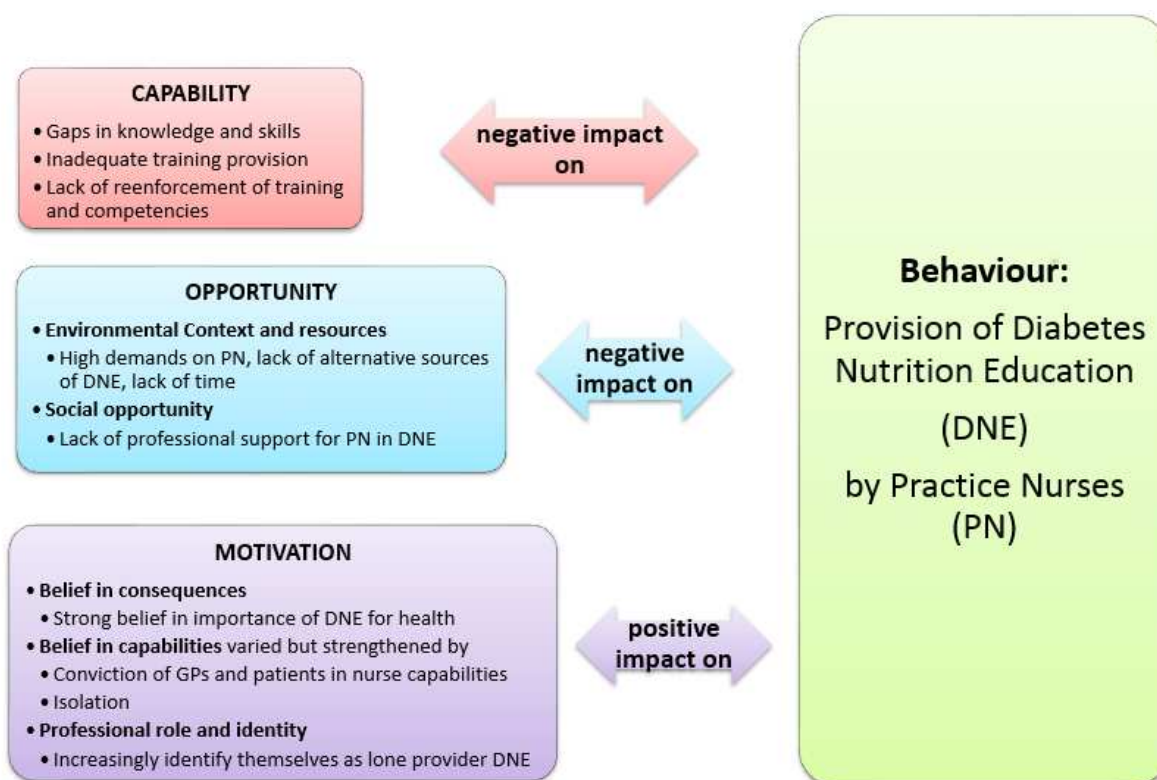
25

26 *Discussion*

27 Themes from the data are presented using the relevant domains of the TDF and associated COM-B
28 model to describe the influences on DNE provided by nurses. This is presented in Figure 2. Nurse
29 **capabilities** in NE were negatively affected by a lack of knowledge and skills in this area and a
30 shortage of appropriate training provision. The absence of any mandate for training and competency

standards in NE⁴⁸ may in part contribute to this situation. **Opportunities** to provide effective DNE were negatively affected by; the high demands on nurse time; inadequate referral rates to alternative sources of NE; and inadequate support from within the primary care team and the wider diabetes specialist team including dietitians. In many cases, this lack of support led to nurses being isolated, negatively impacting further on capability and opportunity. Unexpectedly though their **motivation** to provide DNE seemed unaffected by this possibly due to situations that arose from it. Working in isolation led to nurses not being able to recognise what they did not know and compounded their perception of being solely responsible for DNE.

Figure 2: TDF domains identified as themes and their impact on Diabetes Nutrition Education



Comparison with existing literature

This is the first UK study to specifically explore the PN role of providing DNE. Similarities were found with other studies which examined primary care NE more broadly for disease prevention and chronic disease management.

The time reportedly spent on NE was similar to that reported in other studies and was significantly less than that suggested as adequate^{27,28}. Despite this, there are advantages to receiving NE in primary care such as; improved uptake of care; good relationships; and short, frequent

1 appointments^{21–25}. This study supports the suggestion that increasing levels of professional support
2 could have the biggest impact on nurse behaviours and improve the quality of care within this
3 current model²⁹. Yet as identified elsewhere, this can be adhoc and access inequitable¹⁴.

4 Feelings of isolation experienced in particular by PN compared to ANP is recognised in other
5 studies and is suggested to be due to the wider range of duties of PN compared to ANP and the
6 uncertainty this brings to their roles⁴⁹. The lack of inter-professional working between nurses and
7 dietitians identified in this study and found elsewhere, appears to worsen the situation for a number
8 of reasons²⁶ including undefined professional roles and no clear pathway for when to refer on.
9 Despite nurses recognising that they should only provide ‘basic’ care, this situation appears to lead
10 to nurses providing DNE beyond their skill level^{34,50}.

11 It was more likely for PNs to feel their level of knowledge and skills was insufficient for this role,
12 compared to ANPs. This diabetes knowledge gap is reported elsewhere^{26,50,51} as a consistent feature
13 of nursing in a range of settings³⁴. The lack of courses was cited as the main obstacle to training,
14 however other studies highlight more barriers^{16,50,52}. QOF incentives may have increased demand
15 for training in DNE in the past, but with this now removed and no current mandated minimum level
16 of competency, these barriers will remain. As significant numbers of nurses in primary care reach
17 retirement age⁵³ an increasing proportion of inexperienced PNs and health care and physician
18 assistants, will provide diabetes care. Competency levels could therefore fall further if training
19 levels remain unchanged.

20 Nurses’ strong belief in the benefits of NE on health outcomes was evident in this study.
21 Subsequent dissemination of the DiRECT study findings, which demonstrates diabetes remission
22 is attainable through weight loss, should strengthen this further^{54–56}. As a result of DiRECT,
23 services are re-designing diabetes care to introduce a local remission service. The trial used expert
24 dietitians to provide training and on-going support to dietitians and PNs who delivered the
25 remission service in primary care. Our findings highlight how important the training and support
26 element will be for the continued success of remission services outside of the trial.

27 **Implications for future care.**

28 This study suggests that the quality of DNE for people with Type 2 Diabetes in the UK could be
29 improved by developing a robust support system for primary care nurses to improve the
30 environment within which the PN provides DNE and the range of support received.

31 The environmental context could be improved by agreeing an expected level of DNE provision in
32 primary care through a local review of interprofessional roles and boundaries. This would raise

1 awareness among GPs, support PN to work within these boundaries and identify training and
2 service needs. Resources which provide accessible, up to date information on services, referral
3 criteria and processes, educational resources and patient information could improve referral rates
4 and improving consistency of care⁵⁷.

5 Professional support through improved access to dietitians including shadowing, responsive email
6 access for troubleshooting, service updates and coaching could reduce isolation, increase
7 knowledge of sources of NE outside of the practice and be a valuable opportunity for skill
8 development particularly for less experienced nurses^{58,59}.

9 An alternative model which fits with NHS strategic plans to make better use of wider primary care
10 workforce is the expansion of dietitians into the primary care team⁶⁰ and this is currently being
11 evaluated⁶¹. Practice staff could be upskilled⁵⁸ and provide brief nutrition interventions to re-
12 enforce advice from elsewhere, but the burden on the PN described in this study would reduce.

13 Nationally more consideration could be given to how to reinforce training and competency
14 standards. Education and training should continue to be developed in a variety of forms to meet the
15 diverse needs of the primary care team⁵⁸. Innovative approaches such as webinars, e-learning and
16 video as well as innovative face to face training could improve uptake and support translating
17 knowledge into practice^{33,34}.

18

19 **Strengths and limitations of the study**

20 This study had several strengths. The broad research question was useful for this area which has not
21 been previously researched. The iterative recruitment process led to a diverse sample for the study
22 and by selecting just one stakeholder sufficient depth of data was generated to enable the
23 development of explanatory accounts. Using the TDF as a framework for data analysis strengthened
24 the study by providing an understanding of how the themes related to one another and a broader
25 range of factors that impact on behaviour were considered. Although there is a risk in using such a
26 model, of only reporting data that fits the model (and losing data that doesn't), care was taken to
27 ensure all relevant information in the data was captured by at least one domain of the TDF.

28

29 This study was part of a degree and therefore with resource limited to one researcher, this had the
30 potential to introduce bias and limited the sample size. The Framework Method used was a
31 systematic and thorough approach to the data analysis which aimed to reduce personal opinion,
32 increase rigor and providing transparency. In the development of explanatory accounts, the data was
33 always revisited to verify or dismiss ideas, and empirical studies also supported the generation of

1 hypotheses. Data saturation appeared to be achieved within the sample recruited. However, if the
2 sample had been larger, it would have been more likely that nurses who regularly referred PWD to
3 dietitians would have been recruited, providing another perspective.

4
5 Various factors affected the representativeness of the sample including the willingness of practices
6 to engage in the study. Practices with a greater interest in diabetes care were more likely to respond
7 positively. With none of the nurses given time during work to be interviewed, this suggests that
8 participants were enthusiastic and committed to improving diabetes care. Finally, this study took
9 place in one geographical location in the UK. With local services for diabetes varying, the findings
10 may not be directly transferable to other settings but the details provided should assist the reader in
11 assessing generalisability⁶².

13 **Conclusion**

14 It appears that over time with health service changes and increased service demands for diabetes
15 care, there has been a shift in interprofessional boundaries for providing DNE. Structured education
16 is providing DNE for more of those newly diagnosed, however primary care nurses are now one of
17 the main providers of on-going dietary advice to people with diabetes in the UK.

18 This study has identified a number of concerns with the current situation which could be impacting
19 on the effectiveness of on-going diabetes nutrition education and consequently on morbidity and
20 mortality in T2D and the rising costs of diabetes. Nurses in this study had become isolated in this
21 role and this led to an expectation that they take on this role despite insufficient support, resources,
22 time and skills to do so.

23 However, this study hypothesises that significant improvements could be made to the quality of
24 nutrition education by primary care nurses, by making improvement to their working environment
25 and level of professional support through a range of strategies.

26 *Transparency Declaration*

27 The lead author affirms that this manuscript is an honest, accurate, and transparent account of the
28 study being reported. The lead author affirms that no important aspects of the study have been
29 omitted and that any discrepancies from the study as planned (University of Sheffield RMS143367)
30 have been explained.

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1 **Supplementary information 1 : Study Sampling frame (Based on data available at the time of the study ⁴⁰)**

Deprivation score (5 = highest deprivation)	Diabetes Prevalence in practice compared to city average	Number of practices with ABOVE average number of patients with optimal blood glucose control	BELOW average number of patients with optimal blood glucose control
5	Highest prevalence	5	3
4	Highest prevalence	0	7
4	Above average prevalence	4	4
4	Average prevalence	1	2
3	Above average prevalence	2	4
3	Average prevalence	0	1
2	Above average prevalence	5	1
1 to 2	Below average prevalence	12	3
1	Lowest prevalence	0	4

2 Shaded boxes indicate practice(s) involved in study

3

1 Supplementary information 2 : Interview Topic Guide

2

3 1. Scene setting – background information about you, your practice, patients, diabetes service and provision of 4 nutrition education (be clear about what this means)

- 5 • Background information on **nurse** – yrs as nurse, yrs as practice nurse, grade/job title
- 6 • Background information on **general practice demographics** and **structure of diabetes care**
 - 7 ○ Size, demographics of patients,
 - 8 ○ no of nurses and GPs
 - 9 ○ How is the DM care organised – who's responsible, who's involved, general or specialist clinics, time
 - 10 slots
- 11 • What is interviewees **specific involvement** in diabetes care and **history** to this.
 - 12 ○ What do they provide – prevention, screening, diagnosis, education, support, management. How
 - 13 much of daily work taken up with diabetes?
- 14 • What is **specific involvement in nut education** – solely diabetes or prevention, treatment of other conditions.
- 15 • **How frequently** are you discussing food and nutrition in general – dm, non dm
- 16

17 2. Consultations – How you provide nutrition education at the moment. If I was to be a fly on the wall – what 18 would I see?

- 19 • How **opportunities** for nutrition education come about.
(planned/unplanned, solely nutrition education/combined with other aspects of diabetes care/ duration)
- 20
- 21 • A **typical consultation** and the different stages of the consultation
 - 22 ○ Length of time
 - 23 ○ assessment/ review, sharing info- negotiating change, goal setting, education, action planning
- 24 • What **skills** are you using?
- 25 • What educational **resources** do you use – during , written info
- 26 • How **individualised** do you make it
 - 27 ○ What do you do to individualise it
- 28
- 29 • What would be required to make it **more** individualised
- 30 • How much **behaviour change counselling** incorporated?
 - 31 ○ Motivational interviewing
 - 32 ○ Goal setting and action planning
 - 33 ○ Behavioural strategies
- 34 • Whats **good about current model**
- 35 • Whats **not so good** about way nut advice provided currently
- 36

37 3. Experiences – consider your experiences in giving nut advice, primarily in dm but other conditions as well

- 38 • **Positive experiences** of giving nutrition education and thoughts on this.
 - 39 ○ What works well and why
 - 40 ○ What's worked well in the past
- 41 • **Negative experiences** of giving nutrition education and thoughts on this
 - 42 ○ What's not worked so well
 - 43 ○ What's not worked so well in the past
- 44 • What **affected your confidence** over time in giving advice in these areas? Support from PM, GPs for training
- 45 and peer support, support from specialists, more time for pts/less time
- 46 • Based on your experiences, **what changes would you make** if you could to how nut care is provided?

47 4. Challenges of providing nutrition education - if not discussed already. Identified in literature

- 48 • What **gets in the way** of giving nutrition education? **Patients – nurse – organisation**
- 49 • Time limitations – what else could be done?
- 50 • Patients response to education
- 51 • Educational resources
- 52 • Knowledge and skills
- 53 • Complexity

- Incidence
- QOF

5. HCP involved - Roles - Whats your view of the role you provide?

- Who else is involved in nutrition ed for your patients?
- How do you **think of your role** and **where it fits** within this other care?
- How are you supported in this role?
- How do you see this role changing in the future?
- What may affect your role in the future

6. Additional provision of nutrition education

- Thoughts and exp of referring **to groups**
- **Circumstances for referral**
- Perceived **advantages and disadvantages** of referral to education groups etc
- Thoughts and exp of referring **to dietitian**
- **Circumstances for referral**
- Perceived **advantages and disadvantages** of referral to dietitian
- Comparison of **practice nurse vs dietitian role**? Similarities and differences
- Where else may people get nutritional advice? Formal and informal

7. Training and competencies

- Where is your information on diet and nutrition obtained from?
- Training received – informal and formal
 - How does training come about – self, GP etc
 - What's been good about this
 - How has it affected practice
- What further training and support do you need to undertake your role
 - ?Perceived gaps in knowledge, skills, confidence
 - What form would you like this to take place – formal or informal
- Is knowledge keeping up with complexity
- What guidelines and pathways are used

8. Future provision

- How sustainable do you feel this model is for the future
- Suggestions for improving the future provision of nutrition education in primary care/ involving others to ensure future care.

Supplementary Information 3: Theoretical Domains Framework: Domain definitions, links to COM-B components, theoretical constructs and example questions ⁴⁷

COM- B Component	Domain definition linked to COM-B component	Theoretical constructs represented within each domain	Example questions
Capability	Knowledge An awareness of the existence of something	Knowledge (including knowledge of the condition /scientific rationale; procedural knowledge; knowledge of task environment	<i>Do you know about x?</i>
	Skills An ability or proficiency acquired through practice	Skills; skills development; competency; ability; interpersonal skills; practice; skills assessment	<i>Do you know how to do x?</i>
	Memory, attention and decision processes The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	Memory; attention; attention control; decision making; cognitive overload/tiredness	<i>Is x something you usually do?</i>
	Behavioural regulation Anything aimed at managing or changing objectively observed or measured actions	Self-monitoring; breaking habit; action planning	<i>Do you have systems that you could use for monitoring whether or not you have carried out x?</i>

Opportunity	Environmental context and resources Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	Environmental stressors; resources /material resources; organisational culture/climate; salient events /critical incidents; person x interaction; barriers and facilitators	<i>To what extent do physical or resource factors facilitate or hinder x?</i>
	Social influences Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours	Social pressure; social norms; group conformity; social comparisons; group norms; social support; power; intergroup conflict; alienation; group identity; modelling	<i>To what extent do social influences facilitate or hinder x?</i>
Motivation	Professional role and identity A coherent set of behaviours and displayed personal qualities of an individual in a work setting	Professional identity; professional role; identity; professional boundaries; professional confidence; group identity; leadership; organisational commitment	<i>Is doing x compatible or in conflict with professional standards/identity?</i>
	Beliefs about capabilities Acceptance of the truth , reality or validity about outcomes of behaviour in a given situation	Self-confidence; perceived competence; self efficacy; perceived behavioural control; beliefs; self esteem; empowerment; professional confidence	<i>How difficult or easy is it for you to do x?</i>
	Optimism The confidence that things will happen for the best or that desired goals will be attained	Optimism; pessimism; unrealistic optimism; identity	<i>How confident are you that the problem of implementing x will be solved?</i>

	Belief about consequences Acceptance of the truth, reality or validity about the outcome of a behaviour in a given situation	Beliefs; outcome expectancies; characteristics of outcome expectancies; anticipated regret; consequents	<i>What do you think will happen if you do x?</i>
	Intentions A conscious decision to perform a behaviour or a resolve to act in a certain way	Stability of intentions; transtheoretical model and stages of change model	<i>Have they made a decision to do x?</i>
	Goals Mental representations of outcomes or end states that an individual wants to achieve	Goals; goal priority; goal/target setting; action planning; implementation intention	<i>How much do they want to do x?</i>
	Reinforcement Increasing the probability of a response by arranging a dependent relationship or contingency, between the response and a given stimulus	Rewards; incentives; punishment; consequents; reinforcement; contingencies; sanctions	<i>Are there incentives to do x?</i>
	Emotion A complex reaction pattern involving experiential, behavioural and physiological elements by which the individual attempts to deal with a personally significant matter or event	Fear; anxiety; affect; stress; depression; positive/negative affect; burnout	<i>Does doing x evoke an emotional response?</i>