

Service user and community clinician design of a partially virtual diabetic service improves access to care and education and reduces amputation incidence

Alastair Watt,¹ Andrea Beacham,² Lynne Palmer-Mann,² Amy Williams,² Jacqueline White,¹ Rebecca Brown,¹ Ellena Williams,¹ Gayle Richards,¹ Lyndon White,¹ Pauline Budge,¹ Katy Darvall,¹ Ed Bond,³ Richard Paisey ¹

To cite: Watt A, Beacham A, Palmer-Mann L, *et al*. Service user and community clinician design of a partially virtual diabetic service improves access to care and education and reduces amputation incidence. *BMJ Open Diab Res Care* 2021;**9**:e001657. doi:10.1136/bmjdr-2020-001657

► Supplemental material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bmjdr-2020-001657>).

AIW deceased since 13th December 2017.

Received 9 June 2020
Revised 12 November 2020
Accepted 25 November 2020



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Richard Paisey;
richard.paisey@nhs.net

ABSTRACT

Introduction Design of an integrated diabetes service based on needs of service users (persons living with diabetes) and community clinicians in a semirural low-income health district of the UK.

Research design and methods One hundred and eighty-five service users engaged through public meetings, questionnaires and focus groups. General practice staff contributed views through workshops and questionnaires. Analysis of feedback indicated service user needs for better access to education, dietary advice and foot care. General practice staff endorsed these views and requested regular access to secondary care in the community. Seven hundred persons registered with diabetes attended eight well-being events in the community. From 2017 virtual practice multidisciplinary patient reviews, virtual referral of foot cases and non-face-to-face helplines were developed. A National Health Service (NHS) approved 'App' and web-based personalized education support for those recently diagnosed with diabetes was introduced.

Results Engagement in education for those recently diagnosed with diabetes increased from 5% to 71%. Weight and hemoglobin A1c (HbA1c) levels before and 6 months after starting the program were 99.4±25 and 95.5±24.2 kg and 59.3±16 and 54.8±12.9 mmol/mol, respectively, $p=0.00003$ and 0.003 . Of those engaging at well-being events, 44 had missed regular follow-up. One hundred and seventy-five cases were reviewed virtually with practice staff by the secondary care team avoiding referral to the hospital diabetic clinic. One hundred and seventy-six referrals were made to the virtual multidisciplinary diabetic foot team clinic. Major amputation incidence declined from 13 to 3 major procedures/10 000 per annum and minor amputation from 26 to 18/10 000. Percentage bed day occupancy by persons with diabetes fell significantly in the district general hospital.

Conclusions Integrated community-based diabetes care delivery has been achieved with partially virtual reviews. Patient education, secondary care in the community, access to dietetic advice and foot care outcomes have all improved.

Significance of this study

What is already known about this subject?

► Quality outcome framework, education and multi-disciplinary secondary care have improved services for diabetes in England. However, access to services remains difficult for many patients.

What are the new findings?

► Codesign of integrated diabetes care by service users has been shown to:

- Improve access to education and dietary advice with improvement in weight and hemoglobin A1c.
- Reduce major and minor lower extremity amputation incidence sustained for 3 years.
- Achieve improved outcomes with a partly virtual service.

How might these results change the focus of research or clinical practice?

► This study provides a model to enhance access to diabetes care and reduce foot complications. The virtual clinic aspects of the service can safely reduce direct contact between patient and clinician now advisable to reduce risk of COVID-19.

INTRODUCTION

Diabetes and its complications account for 10% of the total National Health Service (NHS) budget, and diabetes incidence is rising.¹ The quality outcome framework (QOF) process, Public Health England cardiovascular disease profiles, National Diabetes Audit and National Diabetes Foot Audit have regularly and extensively audited diabetes care across England.^{2–4} National Institute for Health and Care Excellence (NICE) guidelines, National Service Framework documents and Diabetes UK have developed standards of diabetes care

expected from NHS providers.^{5 6} Three key targets to be monitored at annual review are hemoglobin A1c (HbA1c), serum lipids and blood pressure. These risk factors are powerful predictors of diabetic microvascular and macrovascular complications,^{7 8} which can best be addressed in general practice. In 2019, QOF for diabetes was revised to allow for frailty and rationalization of statin and blood pressure therapy and avoidance of harm from overtreatment.⁹

It is now widely recognized that greater integration of diabetes services is essential in order to meet these needs, enhance access to diabetes care and improve QOF outcomes.^{10–12} Most importantly, the person living with diabetes should be helped to explore their own preferences for lifestyle change enhanced by lifestyle opportunities in their local area.^{13 14}

The progression to more community-based care in the UK began with a randomized trial of delegation of diabetes care to general practice in Cardiff and reported in 1984.¹⁵ Attendance was poorer in general practice, and 5-year outcomes including mortality were worse in the general practice care group. More recently, integration of diabetes secondary care with general practice has been more successful with definition of aspects of the service that still require management in secondary care: ‘the super six model’.¹⁶ In 2005 in Newham, East London, the need for patient engagement in a multiethnic population was met by structured community delivery of care and enhancement of general practice competencies.¹⁷ From 2013, the WISDOM project has placed secondary care for diabetes almost entirely in the community.¹⁸ In Alaska, there has been an impressive success from complete reorganization of all health services based on service user ownership of the whole process.¹⁹ These innovations have highlighted the need for diabetes care to be integrated into communities with involvement of service users.

North Devon has a population of 166 000 people and a slightly higher than the NHS England average incidence of diabetes at 7.5%. However, variation exists as there are areas of affluence and pockets of high deprivation²⁰ in association with stark inequalities in health outcomes. Seventeen general practices (community physicians and allied health professionals) provide services for a population spread over six main towns and an additional rural population spread over 419 square miles. Access to secondary care can be difficult because of limited public transport and a challenging minor road network.

A more integrated diabetes service was considered to be the most appropriate approach to improve access to care and outcomes. Sustainability and Transformation Programme (STP) funding provided the opportunity to initiate these changes.²¹ This work was inspired and begun by the late AIW, physician and diabetes consultant. This report describes the development and successful delivery of a partially virtual integrated diabetes care in North Devon based on needs expressed by service users and healthcare providers.

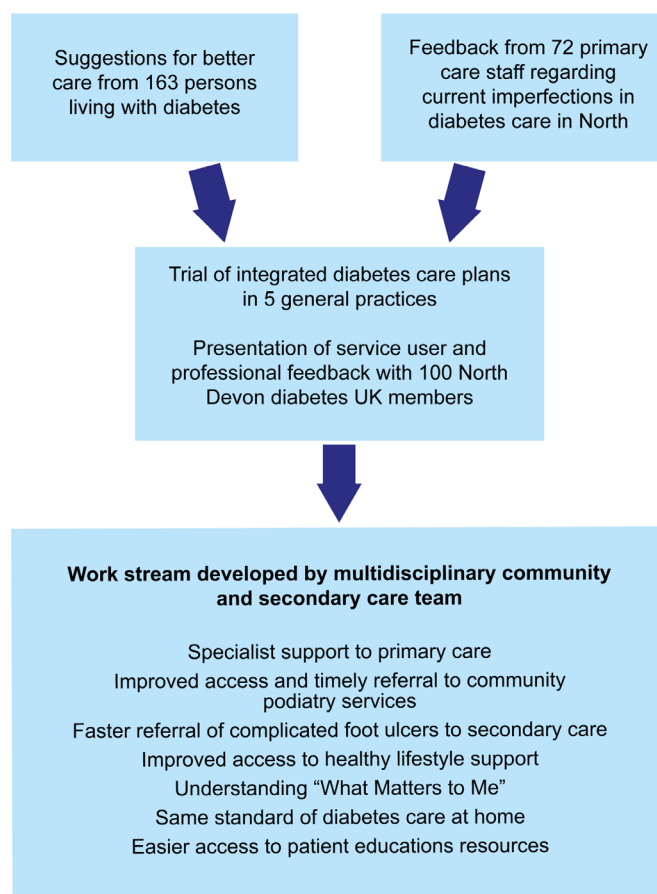


Figure 1 Flow chart outlining development of integrated diabetes care in North Devon.

PARTICIPANTS AND METHODS

The flow chart [figure 1](#) shows the outline of information gathered from service users and community clinicians that provided the framework for development of the integrated care work streams. Details of the engagement with respondents and care improvements were presented to the clinical commissioning group (CCG) in early 2018 (online supplemental documents 1 and 2). Questionnaire responses and focus group transcriptions from service users and community staff are available from North Devon District Health Foundation Trust.

Service user (persons living with diabetes) engagement

Issues felt by people with diabetes to be most relevant to them were gathered by a patient focus group of eight participants and 22 individual in-depth interviews. The main themes of their responses were incorporated into a questionnaire, which was disseminated by the North Devon Diabetes UK patient support group; invitation from general practice staff; and the secondary care diabetes team. Written consent was obtained. Two further patient focus groups (number 7–8 in each) were held to discuss the best ways of implementing some of the insights that were highlighted from responses to the questionnaire. A progress report was made to 100 members of the North Devon Diabetes UK group after 4 months to refine the implementation of the integrated care plan.

Clinical engagement

Clinicians were engaged through general practitioner (GP) questionnaires, three GP forums and four primary care workshops attended by 72 diabetes trained health-care professionals from 13 GP practices.

Program development

During 2017, the program management team initially led by the consultant diabetes lead AIW also included a service user, a lead podiatrist, a specialist nurse, a CCG representative, a general practitioner (GP), a pharmacist, a Diabetes UK representative, and a project manager. Four diabetes services were retained in secondary care in North Devon District Hospital: antenatal diabetes; the multidisciplinary diabetic foot clinic; insulin pump delivery; and the type 1 diabetes education course (Barnstaple Area Re-education, Nutrition & Insulin (BARNI), Quismet approved and based on the Dose Adjustment For Normal Eating (DAFNE) program). The need expressed by service users for more locally based diabetes care and prompt access to education and dietary advice was integrated with community professional's aspirations to propose work streams.

Development of work streams

Seven work streams (interventions) were developed to address the feedback from engagement and delivered in 2018 and 2019:

1. Specialist support to primary care based on virtual clinics.
2. Improved access and timely referral to community podiatry services.
3. Provision of a weekly virtual multidisciplinary foot (MDFT) clinic led by the vascular surgeon.
4. Improved access to healthy lifestyle support.
5. Understanding patient needs through the 'What Matters to You' program.²²
6. Same standard of diabetes care for hard-to-reach patients.
7. Easier access to patient education resources.



Figure 2 Summative analysis of 163 responses to questionnaire about diabetes services.

Statistical analysis

Significances of change from baseline to 6 months in weight and HbA1c after structured education were investigated with paired Student's t-tests. The incidences of amputation for North Devon only (part of Devon CCG) were analysed for patients residing in North Devon and compared with PHE diabetic foot care outcomes²³ from 2012 to 2019. Details of the amputation data and analysis of outcomes after diabetes structured education are shown in online supplemental document 3. Bed occupancy in North Devon District Hospital was assessed by analysis as decomposition of time series to show trend of percentage bed occupancy (shown in online supplemental figures 1–3). Significance is expressed as linear regression.

RESULTS

Initial scoping phase

One hundred and sixty-three people living with diabetes responded to the questionnaire. The summative responses are shown in figure 2.

Service users reported that Diabetes Specialist Education (DSE) group sessions in centers away from their locality were inconvenient and too time consuming to attend. Consistent themes expressed by service users indicated enthusiastic support for diabetes care to be delivered by practice staff and specialists in their own locality, but a recognition that the quality of existing primary care diabetes support in the locality varied. General practice staff felt that they should be reskilled to take over more complex diabetes-related problems. They highlighted that more effective pathways for referral for non-face-to-face advice would avoid unnecessary hospital appointments. There was also a wish to demedicalize type 2 diabetes treatments and focus on wider lifestyle issues. Comments most commonly expressed by general practitioners about the provision for diabetes care in North Devon before the integrated care programs are shown in the online supplemental table 1. The need expressed by service users for more locally based diabetes care and prompt access to education and dietary advice was integrated with community professional's aspirations to propose work streams.

Problems encountered, interventions and outcomes of integrated diabetes care are shown in table 1.

Table 2 shows in detail the clinical outcomes of diabetic case reviews in multidisciplinary secondary care visits to primary care 2018–2019.

Intervention 1: specialist support to primary care based on virtual clinics

Virtual reviews of cases in general practice were initiated. Practice nurses and GPs presented individual histories of persons living with diabetes with diagnostic or treatment challenges. These case discussions were documented by the practice and progress followed up at subsequent annual review.

Table 1 Problems encountered, interventions and outcomes of integrated diabetes care

Problems identified	Interventions	Actions	Outcomes 2018/2019
1) Specialist support to primary care			
Specialists could intervene sooner. Lack of coherent care and advice delivered locally	A multidisciplinary team of specialists delivered 17 annual GP practice support visits.	Diabetes therapies discussion of selected patients.	176 reviews in general practice (see table 2 for detailed outcomes).
Patients said there was a variation in care between practices	Practice process mapping.	Care plan rationalized and delivered through Ardens.*	122 patient care plans revised 50/53 GPs described a benefit of the visit.
No audit of whole practice diabetes cohorts	Tabulation of glycaemic control and therapy.	6 monthly audits of treatment targets inaugurated.	Treatment intensified in 15 cases and relaxed in 36 example cases.
2) Improved access and timely referral to community podiatry services			
Delay in recognition of foot problem and referral	Appointment of three more community podiatrists.	Link podiatrist for each practice. FRAME† training for GP staff.	Decrease in minor lower extremity amputations from 26/10 000 to 18/10 000 2014/2017 to 2017/2020.
3) Improved access to multidisciplinary foot (MDFT) care team			
Accessibility and frequency of MDFT	MDFT strengthened. Referral pathway rationalized. Virtual clinic initiated.	176 diabetic foot ulcers reviewed in virtual MDFT.	Decrease in major lower extremity amputations from 13/10 000 to 3/10 000, 2014/2017 to 2017/2020.‡
4) Improved access to lifestyle support			
Most patients unaware of local exercise or weight loss groups	Well-being events open to all persons in practice with diabetes.	700 patients attended eight events. Access to multidisciplinary team and psychotherapy.	44 excepted patients attended and engaged.
5) Understanding 'What Matters to You'			
Dietetic appointments not always helpful, long waiting times	Service user facing dietetic helpline for advice.	Regular dietitian help line, Facebook page and website.	3334 Facebook contacts in 2018/2019, 67 regular users/month. ²⁴
6) Same standard of diabetes care at home			
Housebound, residential home diabetic persons not accessing care	Core of community nurses trained as link nurses.	QOF examinations and diabetic control advice delivered to hard-to-reach patients.	HbA1c and foot examination in 97% and 87%, respectively.
7) Improved and consistent access to targeted patient education resources			
5% uptake of diabetes structured group education in entire district	Telephone and text-based education commissioned for recently diagnosed persons with type 2 diabetes§	71% of referrals enrolled, 91% attended, 83% completed, 33% face to face.	Weight 99.4±25 and 95.5±24.2 kg, HbA1c 59.3±16 and 54.8±12.9 mmol/mol baseline to 3 m p=0.00003 and 0.003.
No uptake of diabetes structured group education in remote area	Low carbohydrate diet offered for new and established persons with diabetes.¶	42 of 162 on diabetic register reduced HbA1c to <48 mmol/mol on low carbohydrate diet over the past 3 years.	Weight 110.3±19 to 101.5±20 kg, HbA1c 52.9±7 to 45.3±3 mmol/mol baseline to 12 m p=0.00003 and 0.004.

*Ardens a Toolkit for SystemOne & EMIS Web Users <https://www.ardens.org.uk>.³⁵†Diabetes Foot Risk Awareness and Management Education (FRAME).³⁶‡<https://fingertips.phn.org.uk/diabetes>.§<https://www.nhs.uk/apps-library/oviva/> and website <https://oviva.com/uk/en/>.¶<https://www.diabetes.co.uk/in-depth/david-unwin-low-carb-not-just-diabetes>.

HbA1c, hemoglobin A1c; QOF, quality outcome framework.

Table 2 Outcomes of general practice virtual clinics 2018/2019

General practice ID	DM number on register†	% excluded diabetes review‡	Patients reviewed in visit to practice	Treatment optimal no change needed	Type 2 remission diet requested	Intense lifestyle advice advised	Insulin initiation	SGLT2 inhibitor or GLP1 agonist	Monogenic diabetes diagnosed	Libre issued	Intractable/terminal care the priority	Psych referral advised	Other medical specialty referral
1	850	16	30	2	1	5	7	1	2	2	-	3	7
2	190	8.6	9	3	-	1	1	1	-	1	2	-	-
3	950	11.5	11	2	-	-	-	1	-	-	1	-	-
4	510	21.7	12	3	-	4	2	1	-	-	-	1	-
5	432	13.7	5	-	1	1	-	1	-	-	-	-	2
6	1075	20.6	5	-	-	-	-	3	-	1	1	-	-
7	590	13.4	18	7	-	2	4	2	-	1	1	-	1
8	145	10.6	6	-	1	-	2	1	1	-	-	-	1
9	1057	16.4	9	1	-	4	1	1	-	-	1	-	1
10	840	16.1	11	1	1	1	2	-	2	-	2	1	-
11	280	8.1	14	3	-	7	2	1	-	-	-	1	-
12	685	17.3	10	2	1	2	3	1	-	-	-	-	1
13	568	20	3	-	-	1	-	1	-	-	-	1	-
14	795	17.8	13	4	-	-	2	2	1	1	1	1	1
15	295	17.4	9	1	1	3	1	1	1	-	-	-	1
16	345	12.8	3	1	-	-	2	-	-	-	-	-	-
17	420	16	9	2	1	3	-	1	1	-	-	1	-
Total	10 616	15.2	175	32	7	34	29	19	8	6	9	9	15

*Each practice was given a sequential number 1–17.

†DM number means number of people with diabetes on each general practice QOF register.

‡In the NHS in England community physicians (general practitioners) report annual reviews of patients with long-term conditions including diabetes. Patients may be excluded from this QOF for a variety of reasons.

GLP1, glucagon-like peptide-1; GP, general practitioner; NHS, National Health Service; QOF, quality outcomes framework; SGLT2, sodium-glucose cotransporter-2 inhibitor.

- ▶ One hundred and forty-one staff attended practice reviews in 2018 and 2019, and 175 cases were reviewed.
 - Only 24 (17%) reviews resulted in referral to hospital specialists, 9 to psychiatry and 15 to non-diabetes specialists.

Tabulation of HbA1c levels in bands was stratified by therapy. The numbers of cases with low HbA1c (<48 mmol/mol), sub-optimal control of HbA1c (>53< 75 mmol/mol) and poor control (>75 mmol/mol) were highlighted. Fifty-one selected cases in total were investigated to evaluate overtreatment of 36 frail persons and options for intensification of therapy in 15.

Interventions 2: improved access and timely referral to community podiatry services

Podiatry links with general practice were working well in 15 of 17 practices. In two practices, joint care had remained disjointed leading to delayed referrals of two severe diabetic foot problems. This was reviewed at the practice visit and addressed.

- ▶ Minor amputation incidence decreased from 26/10 000 before the integrated care program (greater than the upper CI for NHS England) to 18/10 000 for 3 years following it (less than the lower CI for NHS England). See online supplemental document 3.
- ▶ There is insufficient data to confirm that foot problems were referred more promptly to community podiatry.

Intervention 3: provision of a weekly virtual MDFT clinic led by the vascular surgeon

The virtual MDFT was undertaken by the whole MDFT team led by the vascular surgeon and lead podiatrist for 90 min before the face-to-face clinic. An e-referral form was developed with facility to attach a dedicated mobile phone photograph of the foot ulcer. See online supplemental table 2. Community podiatrists, practice and community nurses could access the service. Service users were also enabled to send in foot ulcer photographs following intervention and discharge home.

In the first 2 years of the service, 416 virtual consultations of 220 individuals with foot ulcers were processed. Sixty eight per cent were male, mean HbA1c was 63±22.4 mmol/mol, and mean age was 74.6±13.3 years.

- ▶ Fifty per cent did not require face-to-face MDFT review.
- ▶ Fourteen per cent were admitted directly to the arterial center.
- ▶ Thirty six per cent were referred to the face-to-face 'one stop' MDFT clinic with preliminary blood tests, wound swabs, X-rays and in 14% duplex scans on the day of appointment.
- ▶ Major amputation incidence declined from a range of 13–15/10 000 annually for the 9 years before the integrated care program (greater than the upper CI for NHS England) to 3/10 000 afterwards from 2017

to 2020 (less than the lower CI for NHS England). See online supplemental document 3.

Intervention 4: improved access to healthy lifestyle support

Twelve practices invited registered diabetic persons to eight separate locality-based well-being events. Each practice sent invitations to all persons identified with diabetes on the practice register. Seven hundred persons living with diabetes attended during 2018 and 2019.

- ▶ Lifestyle advice, cognitive-behavioral therapy appointments, foot examination and discussion of therapy were available at these events for persons living with diabetes.
- ▶ Service user feedback after these events is shown in online supplemental figure 4).
- ▶ Forty-four of 700 attending well-being events had not engaged in diabetic care for two or more years.

Intervention 5: understanding patient needs through the 'What Matters to You' program

A dietetic helpline and Facebook page were established to facilitate non-face-to-face in depth lifestyle discussions (What Matters to You),²² without the need for hospital referral.

- ▶ In the first 2 years, 3334 visits have been made to the Facebook page,²⁴ which has included an 'eat well Wednesday' blog.
- ▶ Practice nurses have accessed this during diabetic consultations.
- ▶ The North Devon Health Diabetes website has been accessed more than 1000 times per month.²⁵

The reasons for self-referral to the dietetic helpline are shown in figure 3.

Intervention 6: same standard of diabetes care for hard-to-reach patients

Community nurses were invited to attend training courses in diabetes care run by a diabetic specialist nurse, podiatrist and dietitian with particular focus on insulin

Primary recorded reason for patients contacting the helpline

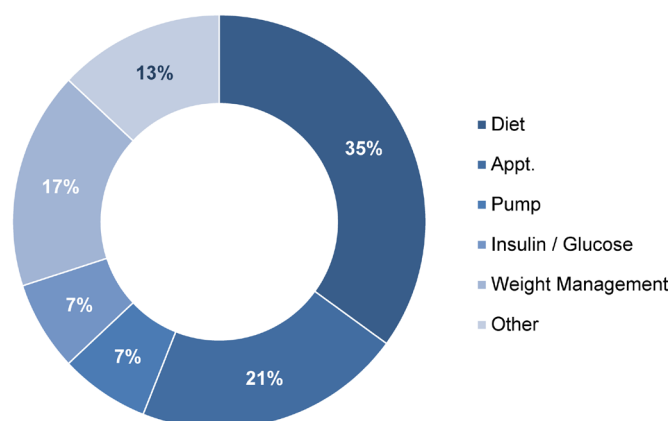


Figure 3 Reasons for accessing diet help line referral.

adjustment, prevention of hypoglycemia, foot examination and collection of QOF data.

- ▶ Twenty-nine link community nurses have been trained to coordinate diabetes care for housebound and residential home persons with diabetes.
- ▶ Review of all long-term conditions and collection of QOF data was performed at home review for 41 service users in the first year: 2019.

Intervention 7: easier access to patient education resources

An NHS-approved telephone and text-based personalized education support for those recently diagnosed with diabetes has been in place for 2 years. The system Oviva²⁶ is offered up to 2 years after diagnosis of type 2 diabetes and can be modified to include face-to-face, individual or group sessions at the service user's request. A full description of the program is shown in online supplemental document 4.

- ▶ Referral for DSE has increased from 5% to 71% (age range 40–84 years), and 90% of those referred who engaged with the course completed the first year.
- ▶ Basic diabetes education, retinal screening and foot care were all included.
- ▶ Analysis of weight and HbA1c levels in the first 47 participants with new onset type 2 diabetes (18 female, age 61.3±13.7 years) at baseline and 6 months were 99.4±25 and 95.5±24.2 kg and 59.3±16 and 54.8±12.9 mmol/mol, respectively, p values 0.00003 and 0.003.
- ▶ Improvement in HbA1c was significantly associated with weight loss: $R^2=0.414$, $p=0.001$.
- ▶ Eight of the cohort (two female, mean age 58.8±13.3) presented with HbA1c levels >70 mmol/mol. Weight loss and improvement in glycemia were satisfactory 3 months after starting the program: 102.4±27.4 to 94.3±24.8 kg, and 86.5±20.4 to 69.0±17.4 mmol/mol, p values 0.03 and 0.009, respectively. These results have been sustained at 6 months.

Single practice intervention

In one general practice, low carbohydrate dietary advice based on the Unwin diet was offered to all those with new type 2 diabetes.^{27 28} This approach has been reported with similar results in another center.²⁹

- ▶ Eight who engaged with the Unwin diet experienced a reduction in weight from 110.2±19 to 101.5±20 kg and of HbA1c from 52.8±7 to 45.2±3.4 mmol/mol, at 1 year, $p=0.00003$ for both weight loss and reduction in HbA1c.

Effect on bed occupancy for persons with diabetes

Percentage of bed day occupancy by persons with diabetes through time shows a significant decrease between 2016 and 2020, regression p value of 0.03 see online supplemental figures 1–3.

DISCUSSION

The Northern Devon Healthcare Trust (NDHT) integrated diabetes care project was developed from 2017

after detailed discussions with service users in the area. Multidisciplinary virtual practice visits rationalized the diagnostic process for newly diagnosed diabetes, inaugurated audit of general practice diabetes lists (based on banding of HbA1c and therapy) and explored options for patients with significant diagnostic or management challenges. Link podiatrists and the virtual MDFT have been associated with sustained fall in major and minor diabetes related lower extremity amputations. North Devon health district had sustained very high diabetes-related lower extremity amputation incidence for the previous 9 years despite peer reviews and an improvement in most of the rest of the southwest region.³⁰ The decrease from 2017 to 2020 occurred after a peer review in 2015 followed by introduction of the integrated care service in 2017. STP funding enabled rapid introduction of significant improvements in diabetic foot care at all stages of the process: primary care, community podiatry, the face-to-face MDFT and a new virtual MDFT. Well-being events and diabetes training of a core team of community nurses have begun the process of engaging hard-to-reach persons living with diabetes. The community-facing website has sustained popularity. The Facebook page has facilitated direct contact between dietitians and persons living with diabetes and allowed healthcare professionals to access advice during consultations. A new telephone and text messaging-based approach to education of newly diagnosed persons with type 2 diabetes has increased engagement from 5% to 71%. Improvement in weight and glycemic control was achieved, most markedly in those with highest weight and HbA1c at diagnosis. Persons living with diabetes in one very remote general practice area have enjoyed successful local intervention with a low carbohydrate diet. This affords another choice for those with newly diagnosed and established type 2 diabetes with minimum face-to-face contact. The decrease in bed occupancy by persons with diabetes in the district general hospital cannot be attributed with certainty to any one of the specific interventions introduced in the integrated care service. However, it is reassuring that a partially virtual service has been delivered in association with a reduction in percentage hospital bed occupancy for diabetes and improved outcomes for service users.

Approaches to diabetes care delivery in the community have been successful in several areas of the UK. Sustained success has been widely reported.^{10 11 31 32} The rural nature of North Devon is most similar to West Hampshire where community-based diabetes integrated care has most effectively evolved over 5 years.¹⁸ This study is the first to achieve such a dramatic reduction in diabetes-related lower extremity amputation incidence with integrated and partly virtual services.

The strength of this initiative derives from the keen participation of a selected group of persons living with diabetes in an entire health district (service users) and their acceptance of virtual clinics and mobile phone and text message-based learning. Engagement of those with diabetes through well-being events enabled 700 to meet

the multidisciplinary care team in their own locality. This enabled 44 lost to follow-up to re-engage with diabetes care. With the advent of the COVID-19 pandemic, there is a need to explore virtual presentations to smaller groups of service users while maintaining social distancing.^{33 34}

There are several limitations to this study. Primary care professionals, especially pharmacists and practice nurses, agreed with the need to have 'what matters to you' conversations. However, no extra time was allotted to have those conversations; therefore, follow-up of issues raised by service users was limited. In addition, the lack of electronic patient records for community nurses and podiatry made it difficult to make a detailed analysis of numbers and profiles of service users whose care was managed by the community link nurses in care homes and their own homes. Proof of reduction in late diabetic foot ulcer referral will require more detailed analysis over a longer time. More than 95% of the population served by North Devon District NHS Trust are white British living in semirural communities. However, there is every reason for city dwellers and all ethnic groups to be offered integrated diabetes care. NDHT is a geographically large health district, with a relatively small stable population (166 000) served by 17 general practices. Detailed liaison with general practice and community nurses was accomplished by a small team from secondary care. Several teams may be required in health districts with much larger populations. Multidisciplinary secondary diabetes care team visits to individual practices could be undertaken with web-based discussions at least until the COVID-19 epidemic has subsided. Areas where entirely virtual consultation will not be appropriate for diabetes care include annual review, retinal screening, antenatal diabetes care, initiation of insulin pumps, severe diabetic foot disease and end-stage renal failure therapy. Provision of diabetes care partly through virtual or non-face-to-face clinics demanded by the COVID-19 virus pandemic requires careful audit. This report is encouraging in that it describes the success of a partly virtual diabetes service developed during the 3 years before the pandemic. The improvements in outcomes and service user access support current initiatives to develop virtual diabetes clinical services more widely both during and after the COVID-19 pandemic.

Author affiliations

¹Integrated Diabetes Care, Northern Devon Healthcare NHS Trust, Barnstaple, UK

²Department of Integrated Care, Northern Devon Healthcare NHS Trust, Barnstaple, UK

³Integrated Diabetes Care, Bideford Medical Centre, North Devon, Barnstaple, UK

Acknowledgements We wish to pay tribute to AIW who planned and initiated the integrated diabetes care program in North Devon and was actively involved until his untimely death.

Contributors JW, RB, LW and KD developed and delivered the virtual multidisciplinary foot (MDFT). EW, AmW and LP-M developed and delivered the website, Facebook page and dietetic non-face-to-face service. EB, GR, PB, RP and AB developed and delivered the general practice care plan discussions and virtual general practice clinics. All living authors gave final approval and agreed to be accountable for all aspects of work ensuring integrity and accuracy. AIW designed

and initiated the project development. General practice staff have engaged enthusiastically in all aspects of the integrated diabetes care program. Glen Allway, Karen Acott (practice leads), Matt Robert (DUK South West), Mel Hucker (tissue viability service), Pat Doran (service user), Sharon Bates (practice manager and CCG adviser), John Wilkins and Hannah Keighley (project support managers) contributed to monitoring of the integrated diabetes care development program. Toni Pascoe-Knight provided diabetes specialist nurse support to the MDFT. The Barnstaple branch of Diabetes UK contributed to wellbeing events, service user recruitment for focus groups and participation in questionnaires. Thanks to Melvin Cowie for graphic design and Rosamund Paisey for formatting the manuscript. Nicolas Harrison, principal analyst, North Devon Healthcare, provided data analysis of bed occupancy and education program follow up. Ruth Tapsell initiated and followed up low carbohydrate diet therapy at Hartland general practice, Devon, UK. Statistical advice was provided by Dr Paul Hewson and Dr Christopher Paisey.

Funding Funding was received from the Sustainability and Transformation Programme in 2017.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplemental information.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Richard Paisey <http://orcid.org/0000-0002-7790-2569>

REFERENCES

- Hex N, Bartlett C, Wright D, *et al*. Estimating the current and future costs of type 1 and type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. *Diabet Med* 2012;29:855–62.
- Public health profiles, 2019. Available: <https://fingertips.phe.org.uk/profile/diabetes-ft> [Accessed 9 Sep 2019].
- NHS Digital. National diabetes audit programme. Available: <https://digital.nhs.uk/data-and-information/clinical-audits-and-registries/national-diabetes-audit> [Accessed 25 Nov 2019].
- NHS Digital. National diabetes foot care audit, 2014–2018. NHS digital, 2019. Available: <https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-footcare-audit/2014-2018> [Accessed 18 Jun 2019].
- NICE. Foot care for people with diabetes overview - NICE Pathways, 2019. Available: <https://pathways.nice.org.uk/pathways/foot> [Accessed 18 Jun 2019].
- Jeffcoate WJ, Vig S, Swage T. NHS Diabetes commissioning documents & guidance - Diabetes UK, 2011. Available: http://www.diabetes.nhs.uk/commissioning_resource/ [Accessed 29 Nov 2016].
- Stratton IM, Adler AI, Neil HA, *et al*. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *BMJ* 2000;321:405–12.
- Colhoun HM, Betteridge DJ, Durrington PN, *et al*. Primary prevention of cardiovascular disease with atorvastatin in type 2 diabetes in the Collaborative atorvastatin diabetes study (cards): multicentre randomised placebo-controlled trial. *Lancet* 2004;364:685–96.
- NHS Digital. Quality and Outcomes Framework, Achievement, prevalence and exceptions data - 2017–18 [PAS], 2018. Available: <https://digital.nhs.uk/data-and-information/publications/statistical/>

- quality-and-outcomes-framework-achievement-prevalence-and-exceptions-data/2017-18 [Accessed 28 Jun 2019].
- 10 Rea RD, Gregory S, Browne M, *et al*. Integrated diabetes care in Derby: new NHS organisations for new NHS challenges. *Practical Diabetes* 2011;28:312-3.
 - 11 Diabetes UK. Improving the delivery of adult diabetes care through integration, 2014. Available: <https://www.diabetes.org.uk/resources-s3/2017-11/integrated%20diabetes%20care%20%28pdf%2C%20648kb%29.pdf> [Accessed 3 Dec 2020].
 - 12 Integrated GP led diabetes care in Bexley. The role of 'an active integrator' in developing integration in NHS services, 2012. Available: www.bexley.diabetesukgroup.org
 - 13 Schwingshackl L, Dias S, Hoffmann G. Impact of long-term lifestyle programmes on weight loss and cardiovascular risk factors in overweight/obese participants: a systematic review and network meta-analysis. *Syst Rev* 2014;3:130.
 - 14 Alharbi M, Gallagher R, Kirkness A, *et al*. Long-Term outcomes from healthy eating and exercise lifestyle program for overweight people with heart disease and diabetes. *Eur J Cardiovasc Nurs* 2016;15:91-9.
 - 15 Hayes TM, Harries J. Randomised controlled trial of routine hospital clinic care versus routine general practice care for type II diabetics. *Br Med J* 1984;289:728-30.
 - 16 Kar P. The 'super six' for the acute trust; all else under primary care? *Practical Diabetes* 2011;28:308-9.
 - 17 Introducing personalised care planning into Newham: outcomes of a pilot project.
 - 18 Successful recommissioning of community diabetes services in West Hampshire.
 - 19 Gottlieb K. The Nuka system of care: improving health through ownership and relationships. *Int J Circumpolar Health* 2013;72:72.
 - 20 Public health profiles. Available: <https://fingertips.phe.org.uk/profile/tobacco-control/data#page/1/gid/1938132885/pat/6/par/E12000009/ati/102/are/E06000027> [Accessed 2 Mar 2019].
 - 21 NHS England. Diabetes transformation fund. Available: <https://www.england.nhs.uk/diabetes/diabetes-prevention/diabetes-transformation-fund/> [Accessed 6 Jun 2020].
 - 22 NHS England. What matters to you. Available: <https://www.england.nhs.uk/what-matters-to-you/> [Accessed 3 Jun 2020].
 - 23 Diabetes Footcare - PHE. Available: <https://fingertips.phe.org.uk/profile/diabetes-footcare> [Accessed 6 Nov 2020].
 - 24 North Devon integrated diabetes service. Available: <https://www.facebook.com/NorthDevonIntegratedDiabetesService/> [Accessed 3 Jun 2020].
 - 25 North Devon Health care Trust. North Devon diabetes website. Available: <https://www.northdevonhealth.nhs.uk/services/diabetes/diabetes-healthcare-professional/dietitians/>
 - 26 Diabetes support. Oviva. Available: <https://oviva.com/uk/en/diabetes-support/> [Accessed 7 Jun 2020].
 - 27 Unwin D, Unwin J. Low carbohydrate diet to achieve weight loss and improve HbA_{1c} in type 2 diabetes and pre-diabetes: experience from one general practice: Low carbohydrate diet to achieve weight loss and improvements in HbA_{1c}. *Practical Diabetes* 2014;31:76-9.
 - 28 Feinmann J. Hope for diabetes: five minutes with David Unwin. *BMJ* 2020;368:m404.
 - 29 Ahmed SR, Bellamkonda S, Zilbermint M, *et al*. Effects of the low carbohydrate, high fat diet on glycemic control and body weight in patients with type 2 diabetes: experience from a community-based cohort. *BMJ Open Diabetes Res Care* 2020;8:e000980.
 - 30 Paisey RB, Abbott A, Levenson R, *et al*. Diabetes-related major lower limb amputation incidence is strongly related to diabetic foot service provision and improves with enhancement of services: peer review of the South-West of England. *Diabet Med* 2018;35:53-62.
 - 31 Pal K, Eastwood SV, Michie S, *et al*. Computer-based diabetes self-management interventions for adults with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 2013;CD008776.
 - 32 Coulter A, Entwistle VA, Eccles A, *et al*. Personalised care planning for adults with chronic or long-term health conditions. *Cochrane Database Syst Rev* 2015;CD010523.
 - 33 Gov.UK. Staying alert and safe (social distancing). GOV.UK coronavirus (COVID-19) guidance and support. Available: <https://www.gov.uk/government/publications/staying-alert-and-safe-social-distancing/staying-alert-and-safe-social-distancing> [Accessed 2 Jun 2020].
 - 34 NHS.UK. Social distancing and changes to everyday life - Coronavirus (COVID-19) - NHS. NHS Coronavirus (COVID-19). Available: <https://www.nhs.uk/conditions/coronavirus-covid-19/social-distancing/> [Accessed 2 Jun 2020].
 - 35 Ardens The Complete Toolkit For SystmOne & EMIS Web Users. Available: <https://www.ardens.org.uk/> [Accessed 10 Nov 2020].
 - 36 Frame | diabetes foot screening home. Available: <http://www.diabetesframe.org/> [Accessed 20 Feb 2017].

Supplementary document 1 Presentation of progression of diabetes integrated care to CCG 2018



EARLY RESULTS IN NORTH DEVON DEMONSTRATE EFFECTIVENESS OF DIABETES TRANSFORMATION FUNDING

Summary

North Devon has seen a significant reduction in diabetes related harm after using Diabetes Transformation Funding to test the effectiveness of a new integrated care model that was co-designed with people who have diabetes.

After listening to what matters to people with diabetes, the team from across the diabetes pathway worked in partnership to deliver what was needed.

Personalised care-planning, underpinned by motivational interviewing has been built into diabetes reviews and a link nurse programme delivers improved quality of care for housebound patients.

Transformation funding enabled specialists in diabetes and footcare to spend time out of hospital providing education and support in GP practices and community wellbeing events. Funding for extra podiatrists to carry out this educational role was intended to ensure people whose feet were at risk were referred earlier into the foot protection service. This is exactly what happened – there has been an over 50% increase in referrals into podiatry and due to the increased staffing capability waiting times have actually gone down. The foot amputation rate is also now the lowest in the county having consistently been the highest.

North Devon has been a pioneer in building community systems infrastructure with statutory and voluntary partners addressing wider determinants of health and wellbeing. Transformation funds were also used to build sustainable links with community wellbeing services and the voluntary sector where health inequalities can be best addressed. Recognising the growing gap in health inequalities, the team is next hoping to test out more flexible approaches to working with individuals who are less engaged with diabetes care as these are the ones that are likely to have the worst health outcomes.

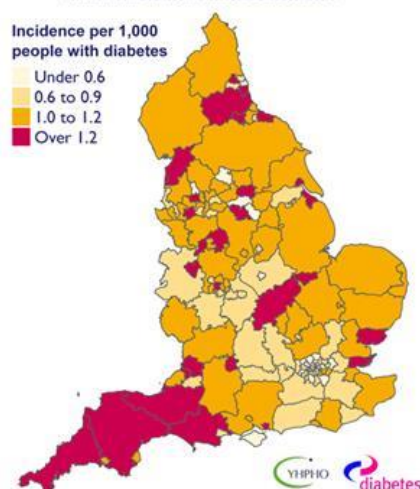
Background

North Devon has a population of around 162,000 people and a slightly higher than average incidence of diabetes at 7.5%. However, variation exists with areas of affluence alongside pockets of high deprivation and there are some stark health inequalities with a life expectancy gap of 14.6 years¹.

The South West has a higher than national rate of diabetes-related limb amputations, an indicator of poorly controlled diabetes. For the past decade, North Devon consistently had the highest rate in Devon.

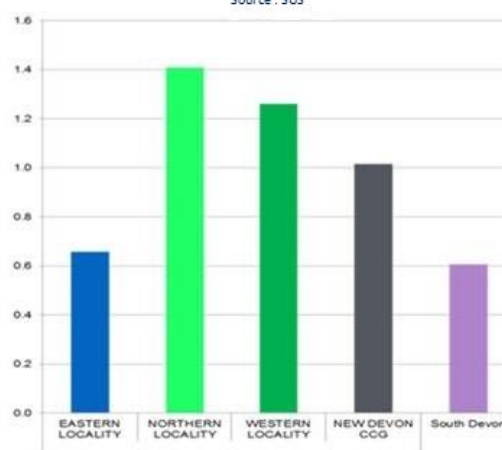
Major amputation rates in people with diabetes

Sources: The Quality and Outcomes Framework (QOF) 2007/08 to 2009/10, Hospital Episode Statistics (HES) 2007/08 to 2009/10, The NHS Information Centre for health and social care



One year Incidence rate of Major Amputations (2014/15 – 2016/17) per 1000 Diabetic Patients (as per QOF Register 2015)

— same methodology as used by YHPO in Diabetic Footcare Profiles
Source: SUS



There was recognition from clinicians that local pathways contained inefficiencies, duplications and missed opportunities for learning and effective communication between primary and secondary care.

STOP, LISTEN and LOOK

A small team took the lead in tackling these issues together. The group included representatives from primary care, diabetes specialists, podiatrists, dietitians, psychologists, commissioners and patients. The first step was to understand what works well, what doesn't and whether we were doing what matters. No suggestions at this stage were made about solutions.

We engaged people with diabetes, holding two patient focus meetings, 22 individual patient interviews, 163 patient questionnaires and attending 3 local diabetes UK meetings. We

¹ <http://www.devonhealthandwellbeing.org.uk/jsna/overview/archive/starting-well/life-expectancy-at-birth/> Table 8.2, Shortest and longest average life expectancy in years (LE) at birth by ward, Devon local authority districts, 2009 - 2013.

engaged with clinicians through eight GP questionnaires, three GP forums and four primary care workshops with 72 attending from 13 practices.

What people with diabetes said

People with diabetes told us that family support was one of the most important factors in managing their health; that one of the biggest struggles was maintaining a healthy lifestyle yet there seemed to be little out there to help them with the motivation and tools to do that; some felt judged by doctors and nurses because they hadn't improved their weight or targets; there was not enough recognition and support for the psychological impact of diabetes and they felt particularly overwhelmed when diabetes was only one of the long term conditions they were trying to manage. There was also a worrying variation in their experience of diabetes diagnosis and care depending on where they lived and which practice they attended.

Nearly all valued their relationship and review with their practice nurse but that this wasn't frequent enough to help them with day to day questions and those who attended peer support groups found it to be a lifeline.

What clinicians said

The diabetes specialist team recognised that they only saw a very small proportion of people with diabetes so their impact was limited with the majority of diabetes care and oversight being in the community. They were frustrated at having limited opportunities to offer advice or input into the wider services or prevention strategy.

GPs said they felt de-skilled as the practice nurses managed most of their diabetes care and they were less confident about prescribing now that there were such a wide variety of treatment alternatives. GPs and practice nurses said they would welcome increased opportunities to consult members of the specialist team about individual patients and also raised concerns about house-bound patients who they felt weren't receiving the same standard of care due to split responsibilities. There was general consensus that they needed better tools to help patients make needed lifestyle changes.

Podiatrists and vascular surgeons were concerned that people whose feet were at risk of ulceration were not being referred soon enough and that people were not as aware of the risks as they should be. All clinicians recognised the service would work better if it was joined up across the providers with more emphasis on supporting 'people' with diabetes rather than concentrating on their feet, eyes or HbA1c results. This was echoed by people with diabetes.

TEST AND RESPOND

Diabetes Transformation Funding² enabled the team to begin to test whether employing more staff would help in addressing some of the issues identified as well as enabling some dedicated project support.

Foot care

We wanted to test the hypothesis that if practice linked podiatrists were employed to work more closely with practices more people would be referred at the right time to the foot protection service. It was a two-fold approach of increasing understanding of patients and healthcare providers in the importance of foot checks, how to correctly assess risk and refer accordingly, followed by increasing the capacity of community podiatry to respond to the increase in referrals.

These podiatrists have been working with their practice cluster, providing education, shadowing and joint visits. By testing new ways of working together we get a better understanding of the detail of what can go wrong. In one practice, open discussion revealed that foot checks were not being carried out consistently. The podiatrist trained the HCAs to carry out this role meaning more time was now allocated to this important check. Another discovery was that practice nurses weren't always sure if the referrals they made to podiatry were appropriate, making them hesitate to refer. A letter is now sent after each referral comparing the level of risk found by the podiatrist to that found by the practice. This acts as an educational tool and reduces delayed referrals.

The multi-disciplinary footcare team (MDFT) tested whether having a weekly forum to discuss patients of concern without bringing them into hospital would mean those at higher risk of amputation could be triaged sooner. North Devon is a predominantly rural geography and practice nurses explained that many in the farming community would not make appointments to have sores on their feet checked until problems were advanced. This 'virtual' forum is an opportunity to discuss and monitor patients and arrange appropriate investigations prior to face to face contact in the clinic. Using Transformation Funds, podiatrists were given iPads to share photographs of feet which could be triaged without patients having to travel long distances.

Specialist support to primary care

The team wanted to understand the best way to provide the specialist diabetes support that GPs and practice nurses had said would help, within the workforce constraints that funding would not resolve. A programme of support that would be beneficial but practical and

² Bringing together the plans of its four localities, Devon STP was awarded Diabetes Transformation Funding in June 2017. The Northern Locality was allocated c. £700k for two years to improve treatment targets and reduce amputations.

achievable with the existing workforce was co-designed and tested with the diabetes consultant, diabetes specialist nurse and podiatrist in four GP practices across the locality. Practices are now scheduled to receive an annual support visit which brings together the practice team with the community and specialist team. During the visit they review practice processes and discuss up to ten patients that the practice has identified and a plan of action is jointly agreed. GPs felt that their knowledge and tools to provide dietary advice was lacking³ so transformation funds have enabled these visits to now include a dietitian to help inform and equip practice staff to have discussions about diet and nutrition with their patients.

The discussion around practice processes has proven to be as valuable as the patient discussions as it has highlighted variation in delivery both between practices and within them. It is only variation in *quality* of practice that the team has been interested in, rather than the actual process which can vary according to patient list size or workforce as long as those carrying out the processes have the right clinical competencies. The team has been able to collect best practice examples from these visits and share them resulting in a body of learning that increases with each visit.

A template has been co-produced that can be added to all practice IT systems to deliver a consistent *and* personalised approach to agreeing a plan of action. After their diabetes review, people are able to take away these care plans that include graphs of their test results and the actions they've agreed to take.

In addition to the practice visits, the specialist team have tailored their communication channels to be available to discuss individual patients, introducing hotlines and email advice lines.

Personalised, place-based support

An issue that concerned both people with diabetes and their primary care team was how to make the lifestyle changes they understood to be necessary. It disheartened people that they didn't have the tools they needed to sustain changes to their diet and activity levels and it frustrated healthcare providers that they weren't in a position to provide the necessary support.

There was a strong view from the clinical workshops that funding should not be used to put a new lifestyle support service in place that may not be sustainable, therefore tools would be provided to existing clinicians to work in partnership with individuals to make lifestyle changes. This begins with conversations with individuals to understand 'what matters' to them, their motivation level and preferences as well as the circumstances they live in that either help or hinder them. The hypothesis was that if diabetes reviews had three broad

³ NHS Long Term Plan, Chapter 2, 2.19

themes: Me, My Circumstances and My Diabetes, then a more personalised plan could be agreed together that would be more likely to succeed⁴.

To embed this into working practice, the template for diabetes appointments includes this feature which promotes shared responsibility for health, a feature of the NHS Long Term Plan.⁵

An annual programme of training is now available to all practices to have motivational interviewing and lifestyle coaching by psychology and health coach professionals.

The next stage is to have options available to suit individual needs and preferences, such as education resources tailored to learning styles and introductions to local activities that interest the person and fit with their schedules.

Even before engagement took place, it was clear that people in North Devon prefer to stay local. There is a successful Diabetes UK group that runs in the largest town and those who attend it are effusive about how much it helps them manage their diabetes. However, very few people attend who do not live local to the group therefore 'place-based' opportunities needed to be encouraged. A variety of community activities have been tested such as exercise groups; practice support; peer support groups and 'Diabetes Wellbeing' events. These events bring together diabetes specialists, practice nurses, podiatrists, dietitians, psychologists, health, pharmacists and other wellbeing services and the local Diabetes UK group. Detailed local knowledge and links were important and transformation funds allowed the team to test working with a community partnership organisation to bring the local elements together. Feedback from the 600 + people who attended was that they valued the opportunity to ask questions of clinicians they would not normally have access to and find out what's available in their community. The events have generated new referrals and resulted in a further peer support group. There has been positive feedback from clinical staff and four wellbeing events are now scheduled to rotate across communities annually.

Not all the place-based tests have proven successful – part of the cycle of learning process is to understand whether the whole intervention was not wanted or whether certain aspects that could be tweaked and re-tested.

Equality of care at home

Having listened to concerns that housebound patients were not receiving the same quality of care as those who could attend appointments, the team tried to find out more. It transpired that there was no consistent approach across the locality. Not everyone in the process had the correct competencies and communication between providers was not

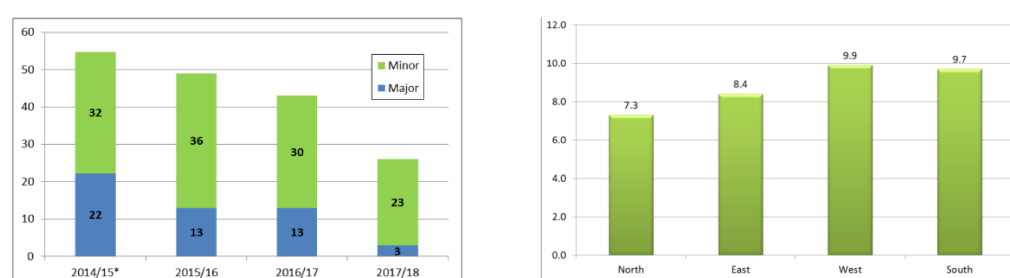
⁴ Developed with EasierInc

⁵ NHS Long Term Plan, Chapter 1, 1.38.

working well. In response, the diabetes specialist nurses have invited all nurses who care for people at home to become diabetes link nurses, with enhanced training in diabetes. 25 nurses from primary care, community nursing and care homes have been trained to undertake this role. Communication links are strengthened between primary and community nurses and their GPs during annual support visits.

PROGRAMME OUTCOMES

To understand whether these interventions are succeeding, the team is monitoring whether fewer people need treatment for diabetes related complications. Early results are encouraging.



Diabetes Lower limb amputation rates in North Devon **Avg. length of stay for people admitted with active foot disease (days) 2018**

There are many factors that will have contributed to this improvement from all parts of the pathway from patient education to improving communication between primary care, podiatry and MDFT as well improvements to the vascular pathway and network arrangement. It is difficult to identify direct cause-effect but since the start of the programme there has been:

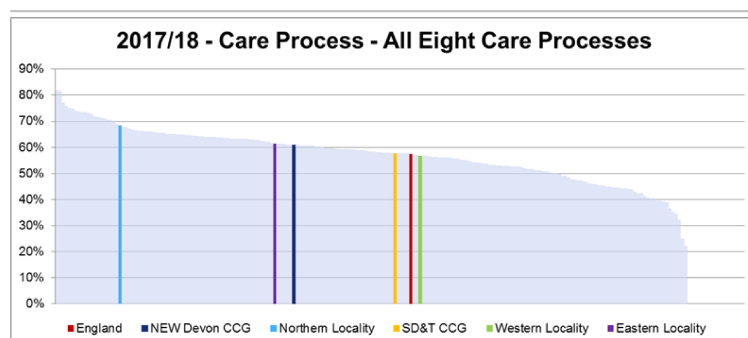
- Over 50% increase in referrals to podiatry for people with diabetes
- Despite this increase, average waits have reduced by 10%

Prevalence of diabetes in North Devon has increased from 7.1% to 7.5% yet

- emergency admission into hospital for people with diabetes has reduced from 16% to 13%
- major amputations have dropped to 0.6 per 1000, a reduction of 77%, compared to 0.8 per 1000 in England⁶

Recent figures from the National Diabetes Audit show that there has been an improvement in all 8 care processes completed in primary care from 51.2% to 68.3% in North Devon compared to the England average of 57.6%. In particular there has been a 15% increase in foot surveillance which brings us slightly above the England average.

⁶ Public Health England, Diabetes Footcare Profile – 2011/12 – 2016/17 May 2018



Although we have seen a small improvement in HbA1c and cholesterol levels, we recognise a lot more work needs to be done to improve treatment targets which still sit below national average.

Conclusion

Diabetes Transformation Funding allowed for new working practices to be tested and evaluated. Because they were co-designed with those who will be delivering them based on the feedback of those who use them, the team is confident that they are moving in the right direction. The co-design framework also builds trust across the system. In the words of one of our GPs *"This project has done more for the relationship between primary care and secondary care in North Devon than any other project in the last 10 years"*.

For more information contact:

Andrea Beacham
Partnerships & GP Liaison Lead
Northern Devon Healthcare NHS Trust
Trinity Suite, Level 5
North Devon District Hospital
Raleigh Park, Barnstaple, EX31 4JB
Phone: 01271 313971 (ext 4271)
Mobile: 07527 329 414
Email: andrea.beacham@nhs.net
Web: www.northdevonhealth.nhs.uk
Facebook: [facebook.com/northdevonintegrateddiabetesservice](https://www.facebook.com/northdevonintegrateddiabetesservice)

Supplementary document 2 The North Devon District integrated diabetes service patient engagement report to CCG 2018

The North Devon Integrated Diabetes project team is engaging with patients throughout the development of the new service.

Patients have been engaged in four ways, being involved in:

1. Project Team meetings
2. Patient Focus group meetings
3. Individual patient engagement through:
 - Detailed patient interviews
 - Patient questionnaires
4. Project assurance by means of the local Diabetes UK group booked in January 2018

This report outlines the result of that engagement that has taken place from January to August 2017.

We carried out a survey with the North Devon Diabetes Group on 5th & 19th December with 28 people with diabetes. Whilst some people described excellent care and clear points of contact, when we asked 'What 3 aspects of your current diabetes care would you change to improve it?' the most popular responses were:

- More frequent appointments with more time to ask questions and checks such as footcare (9 responses)
- Better information and education, sometimes given varying advice (7 responses)
- Easier access and knowing who to approach to help with specific advice such as diet, feet (7 responses)

When asked what 3 aspects of your current diabetes care would you keep because it works well?

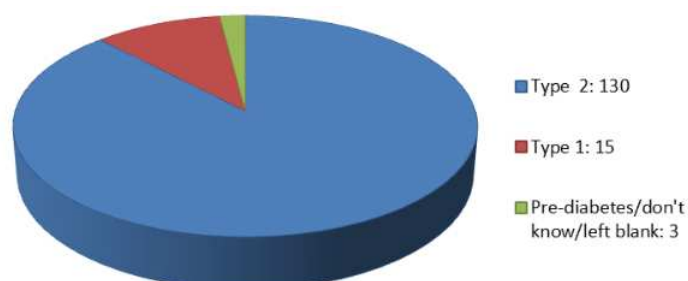
- Six monthly review (14 responses)
- Retinal screening and eye check (4 responses)
- Annual appt with consultant at NDDH
- GP contact (2 responses)
- A good practice nurse (2 responses)
- Diabetes group

Patient questionnaires

Questionnaires, based on the responses from the 22 patient interviews, were given to patients by practice nurses and diabetes specialist nurses during July and August 2017.

Type of diabetes

148 questionnaires were returned, the vast majority by people with Type 2 diabetes (see figure 1)



There were no discernible differences between the responses for Type 1 & Type 2 differences except in the answers to the following questions:

- In the last 3 months, has anything worried you about your diabetes:

8 out of 15 people with Type 1 diabetes said yes (53% had worries about diabetes in last 3 months)

89 out of 130 people with Type 2 diabetes said no (32% had worries about diabetes in last 3 months)

- In the last 3 months, have you ever been unsure about what to do with regard to your diabetes?

2 out of 15 people with Type 1 diabetes said yes (13% were unsure what to do in last 3 months)

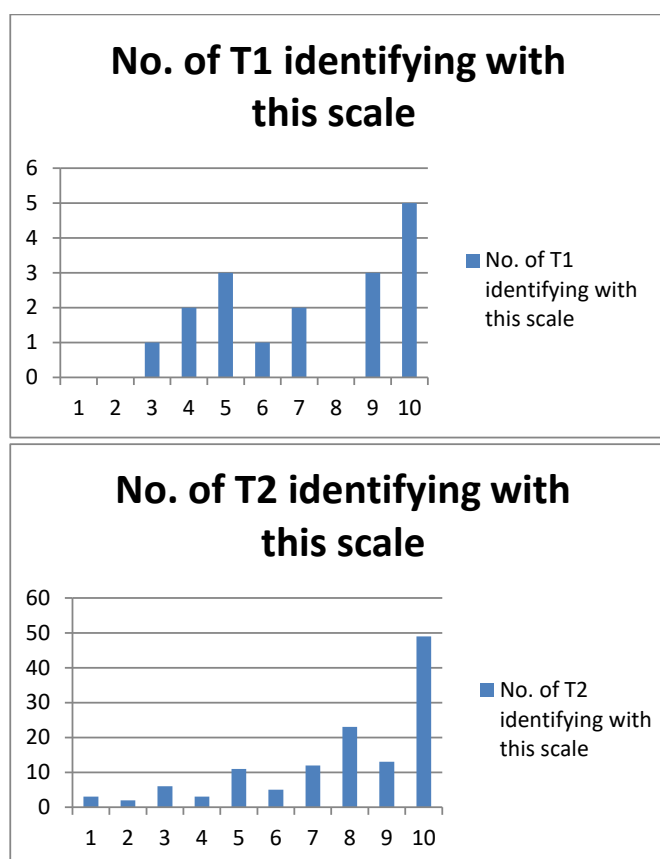
95 out of 130 people with Type 2 diabetes said no (27% were unsure what to do in the last 3 months)

The responses to the questions below have therefore not been split by the type of diabetes the person has.

Questions & Responses

Question 1

How easy is it for you to manage your health (score 1-10)?



Reasons given for score for Type 1 & Type 2 combined (as no discernible difference between the qualitative responses given):

Complications x 1

Information x 2

“More help and details from diabetic nursing team – information”

“Because I understand what being diabetic means keep my levels low for long term better health”

Family x 2

“Problems with my partner who has been in hospital”

Self-management/lifestyle x 2

Specialists

- Continued access to specialist Doctor, Nurse and Dietician, I consistently fail to meet NICE guidelines H6A/c 48MMol/L BG levl 5-7. Access to best technology.

Uncertainty

- Guesswork in how much insulin to take; Carb training (Dafne Course).

Diet/weight/exercise x 6

- **poor diabetic control, very over weight**

Struggle to understand food labelling

- **I have food issues ie comfort eat**

Illness

- I am able to manage my diabetes well but sometimes my condition can be a little bit unstable if I feel poorly etc but this doesn't happen often, and I know how to deal with these situation; I feel I am in good health I eat well and exercise

Diabetes nurses

- Listening to diabetic nurses and do as they say eating sensibly.

Memory x 2

- To get a 10 it would take ... a good memory.

Other health conditions x 2

- Vascular Dementia and Alzheimer's

- PMR & fibromyalgia, depression

- - Tired, depressed, change in diet

Struggle with levels x 2

- Unable to keep glucose levels low

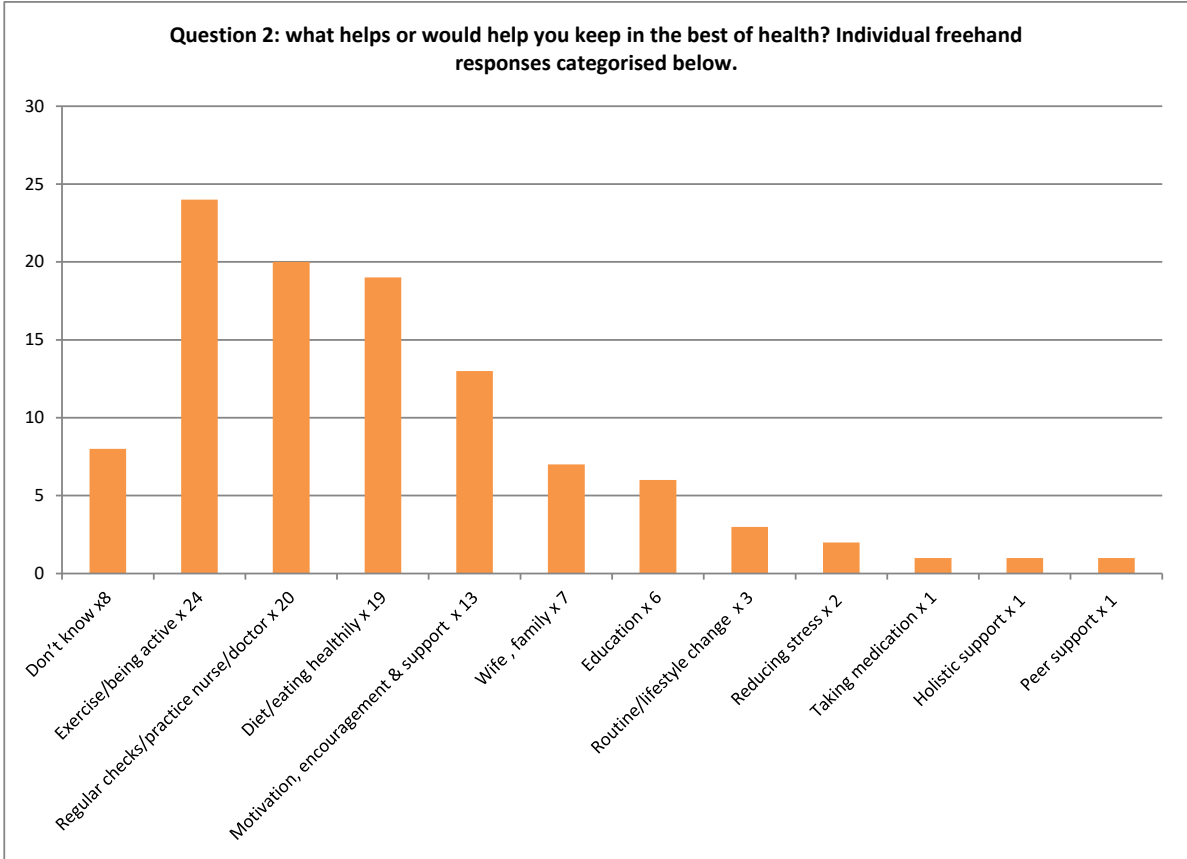
keeping sugar levels down despite reducing carbs

Lack of support x 1

"Lack of support"

Question 2

What helps or would help you keep in the best of health?



These are some of the comments that were provided in answer to Question 2:

Diet/eating healthily x 19

Lose weight (not easy)

Diet would make me feel better no picking in-between meals

Advice about diet

List of foods should and shouldn't eat

Not to feel hungry all the time

Still waiting for hospital to contact me regarding appointment to go through diets etc. and info about Diabetes (over a year waiting)

A good cook

Feet hard skin suffer a lot from weight. Losing fat around stomach area finding it very hard and upsetting.

Regular meals not too much sweet stuff.

Exercise/being active (x 24)

As long as I am fit enough to get exercise should do the trick.

More exercise once knee better.

Need to walk more.

Stay as active and 'normal' as possible

Giving myself more time to exercise more

More movement, but difficult due to pain

Motivation, encouragement & support x 13

Perhaps a fitness type coach

Need plenty of support and bullying

Having more will power than a goldfish.

I think more threats, pictures of bits being removed due to the illness would help, a bit more shock and awe!

Support and help to meet the NICE target.

Practice checks x 20

I appreciate the twice-a-year check-up.

Have several appointments at clinic monitoring all health issues.

An annual review in my birthday month.

I am reviewed every 6 months by (practice nurse) If I have any queries, I feel I can discuss them with her.

I am quite competitive and need to 'beat' my previous readings.

More foot checks

Having more people like (practice nurse). Best care I have ever received.

Help with stress x 2

To be able to be stress free so I can concentrate on my health

Relaxation techniques

Routine/lifestyle change x 3

Less busy life.

Routine that fits with lifestyle. Plus lifestyle changes.

Holistic support x 1

Having support from knowledgeable staff who understand the whole 'me' and my health issues.
Not just pat answers.

Education/information x 6

Visits from diabetic teams in schools and colleges i.e. knowledge in early life.

Being able to access information quickly, either through a book or being able someone to speak to

Daphne course.

Peer support x 1

Share experience with other similar people. Not get too hung up on where I am. To know where I am on the scale.

Wife , family x 7

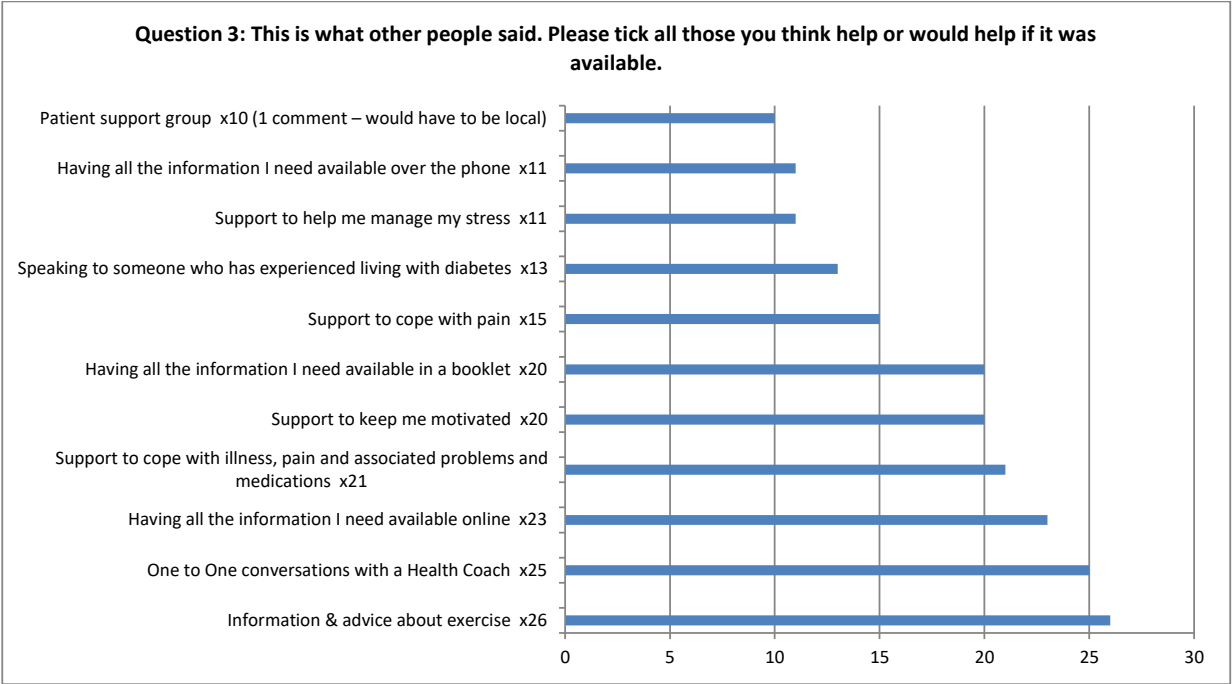
My wife and with her pushing me more.

Family and friends keeping me in check.

A partner who would exercise or go walking with me

Question 3

This is what other people said. Please tick all those you think help or would help if it was available.



Other conditions x 3 (more what makes it hard)

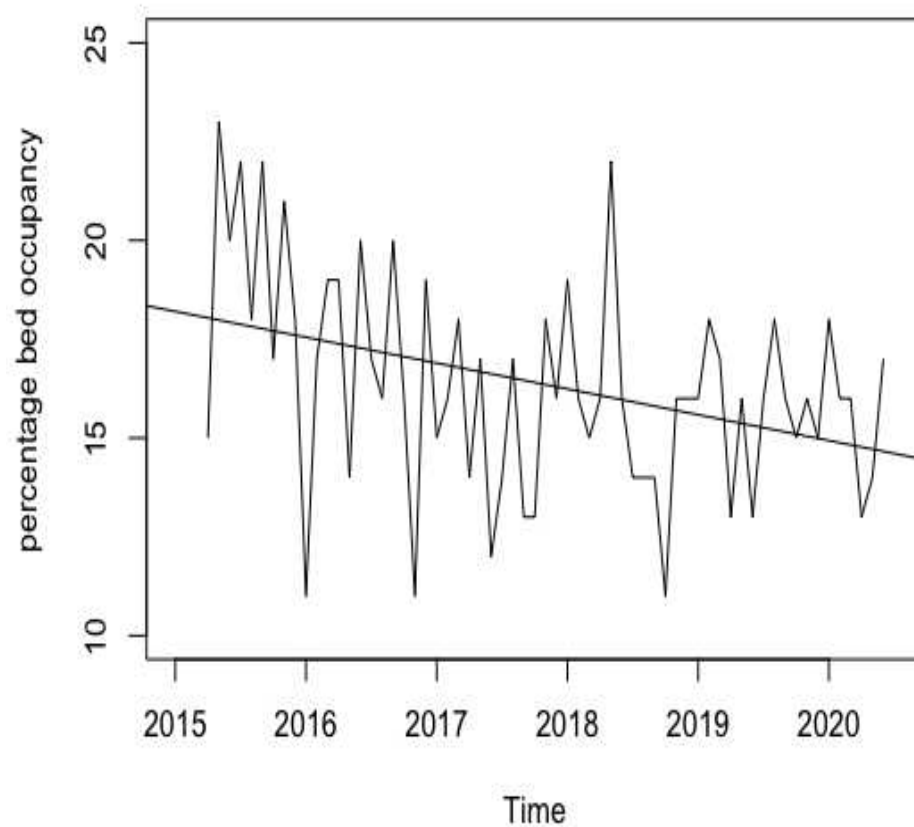
I don't think that I can get any healthier given my underlying condition of auto-immune hepatitis.

To not have the conditions I have to enable me to be more active

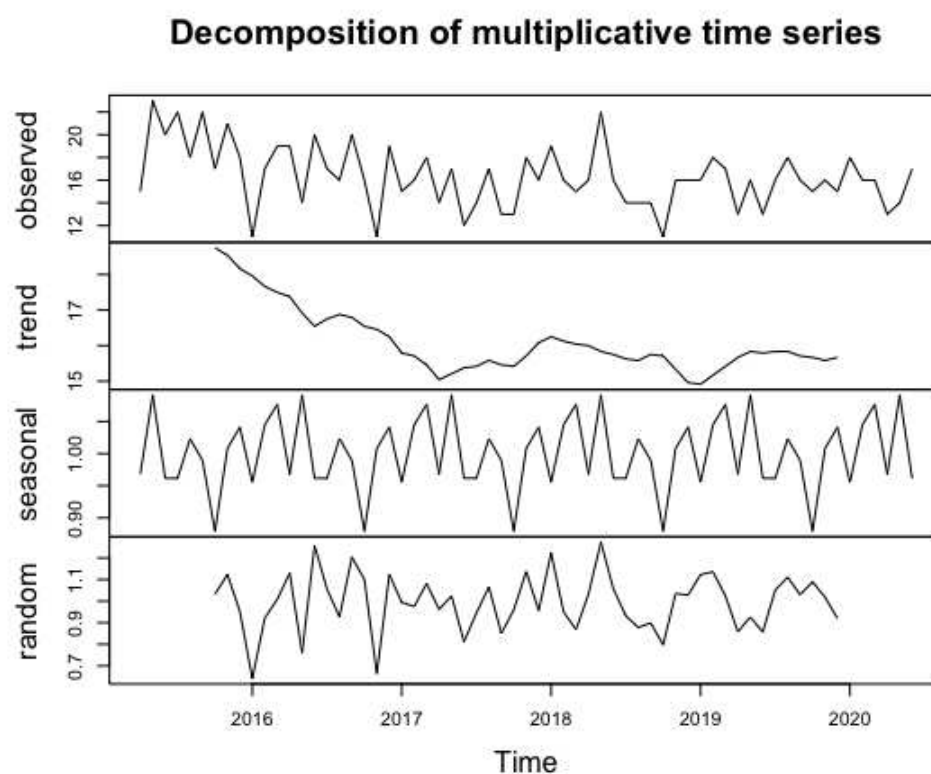
Not a lot more can help with multiple health problems

Supplementary table 1 Comments most commonly expressed by General Practitioners about the diabetes care during development of the integrated care programme

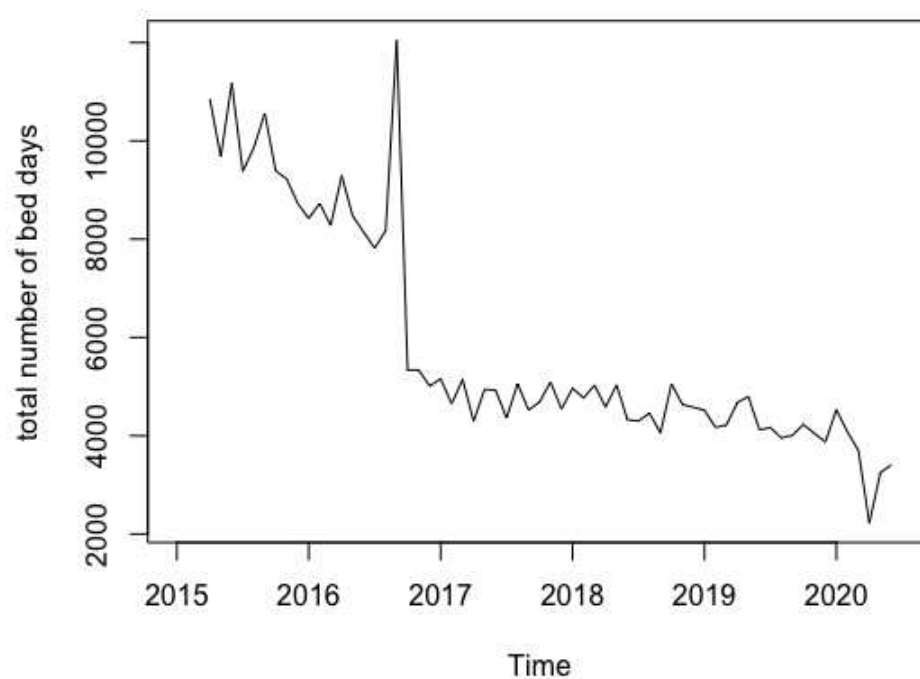
Better deal for patients	Knowledge base & Education	Holistic support	Aspirations
"A better understanding of the DM foot pathway and rapid access into that could also perhaps be a little smoother/clearer"	"We GPs and our patients will need to call more and more on specialist skills as artificial barriers (between primary and secondary care) are removed and more care is delivered in the community"	"The concept of Primary and Secondary care is out dated as we simply serve different parts of the same pathway"	"I see the benefits of IDS as being truly shared care with easy, safe communication between clinicians and patients. I'd like the diabetic service to be a community service using a community shared record, not a hospital based service with communication via letters".
I feel we have quite a disjointed service in Devon (not only in diabetes). Developing some guidelines jointly would be sensible.	"It's a shame that we should need to send patients to (hospital) for insulin initiation injectables type 2 therapy etc as they often have a very good, enduring relationship at the practice and I'm sure we could do it well with more support"	"Type 2 diabetes is a consequence of life style choice. Although prescribing drugs is easy life style change is more appropriate"	"I see diabetes care as part of the challenge to demedicalise people and get them to take responsibility for their own health, they will become well motivated, self-determining individuals rather than passive, ill-informed patients. The need is for lifestyle gurus, educationalists and then an IDS for those people who require medicalization"
"It's ages since I worked in hospital so I wouldn't be so bold (or stupid) to assume I know what a secondary care diabetic service currently does but I've often wondered why outpatient clinics have to be in hospitals, perhaps I'm missing something"	"GPs as a group have probably become quite deskilled as a result of our excellent nurses and would value more education and instruction. Perhaps a helpline or rapid advice service might be helpful"	"The risk is of doing nothing, do nothing and diabetes will consume the NHS and social care budgets. This would be great news for the drug companies"	I think QOF may be scrapped- would be good to have something good, locally worked up and relevant to replace it, rather than something imposed- because I think they will still want us to demonstrate good chronic disease management in some form.



Supplementary figure 1. Percentage of hospital bed days occupied by persons with diabetes through time with regression line



Supplementary figure 2. Decomposition of time series of hospital bed days occupied by persons with diabetes



Supplementary figure 3. Total number of bed days occupied by persons with diabetes



Supplementary figure 4 Feedback from service users after well-being events in 2018

Patient's Name	Click here to enter text.
NHS Number	Click here to enter text.
Date	
Clinicians Name	Click here to enter text.
Contact Details	Click here to enter text.

Situation	Reason for referral? Click here to enter text.			
Background	<p>Relevant History: Click here to enter text.</p> <p>Where is the wound?</p> <table border="1"> <tr> <td> <p>Left <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p> </td> <td> <p>Right <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: Click.weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p> </td> </tr> </table> <p>HbA1c at presentation: mmol/mol</p> <p>Cellulitis evident? Yes <input type="checkbox"/> No <input type="checkbox"/> Antibiotics? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>If yes, Drug: Click here Dose: Click here Start date: Click here to enter a date.</p> <p>Picture attached to email(several views if possible): Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Current dressing plan:</p> <p>Current offloading plan: Click here to enter text.</p> <p>Is the patient able/willing to travel to attend an appointment? Yes <input type="checkbox"/> No <input type="checkbox"/></p>		<p>Left <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p>	<p>Right <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: Click.weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p>
<p>Left <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p>	<p>Right <input type="checkbox"/></p> <p>Toe <input type="checkbox"/> Dorsum <input type="checkbox"/></p> <p>Plantar Forefoot <input type="checkbox"/> Heel <input type="checkbox"/></p> <p>Midfoot <input type="checkbox"/></p> <p>Other: Click here to enter text.</p> <p>SINBAD score=</p> <p>Duration: Click.weeks</p> <p>New ulcer <input type="checkbox"/></p> <p>Re occurrence (same site) <input type="checkbox"/></p> <p>Size: L Click W Click D Click</p>			
Assessment	<p>Vascular supply:</p> <p>Neurological:</p> <p>Other:</p> <p>Foot deformity:</p> <p>Pain Score:</p>			
Recommendations (what do you want? E.g. plan? Bring appointment forward? DFC appointment?)				

PLEASE EMAIL THIS FORM TO THE MDFT ADMINISTRATOR WITH A PHOTO ATTACHED. Phone
MDT Discussion

Situation	Reason for referral: Click here to enter text.
Background	Assessments already done: Click here to enter text. Renal Status: eGFR: Click here to enter text. Creatinine: Click here to enter text. CKD Stage: Click here to enter text. Current HbA1c: Click.mmol/mol Known to DNS: Yes <input type="checkbox"/> No <input type="checkbox"/> Remark: Click here to enter text.
Assessment	What needs to happen? What else do we need? Click here to enter text.
Recommendations	Plan: Click here to enter text. Outcome: Click here to enter text. Imaging Requested, prior to appointment: X ray <input type="checkbox"/> Duplex <input type="checkbox"/> Other: <u>Click here to enter text.</u> Refer on: <u>Click here to enter text.</u> Epro Letter: Yes <input type="checkbox"/> No <input type="checkbox"/> Advice only <input type="checkbox"/> To book DFC appointment: Yes <input type="checkbox"/> No <input type="checkbox"/> How many weeks/date: <u>Click here to enter text.</u> If yes: book new <input type="checkbox"/> follow up <input type="checkbox"/> routine <input type="checkbox"/> urgent <input type="checkbox"/> Follow up review in Virtual <input type="checkbox"/> When: <u>Click here to enter text.</u> Comments for : Click here to enter text.

Supplementary table 2 Diabetes Foot Proforma for MDFT Referral

Supplementary document 3 Statistical analysis of amputation incidence and outcomes of education programme

North Devon diabetic foot outcomes- major amputations				PHE comparisons - All England*			Interventions
year	Major number	DM population	incidence	incidence	LCI	UCI	
2011	11	9250	11.9	8.3	8.1	8.4	
2012	14	9250	15.1				
2013	12	9250	13.0	8.4	7.9	8.3	
2014	10	9700	10.3				
2015	14	9700	14.4	8.2	8	8.4	Peer review
2016	15	9700	15.5				MDFT vascular hub
2017	3	10616	2.8	8.2	8	8.4	Podiatry links to general practice, virtual MDFT, STP funding
2018	3	10616	2.8	8.2	8.1	8.4	
2019	4	10616	3.8				

*LCI lower confidence interval, UCI upper confidence interval

North Devon diabetic foot outcomes minor amputations				PHE comparisons All England*			Interventions
year	Minor number	DM population	incidence	incidence	LCI	UCI	
2011		9250		20.4	20.1	20.7	
2012		9250	31				
2013		9250	34	21	20.7	21.3	
2014		9700	33				
2015	36	9700	37	21.2	20.9	21.5	Peer review
2016	30	9700	31				MDFT vascular hub
2017	23	10616	22	21.5	21.2	21.8	Podiatry links to general practice, virtual MDFT, STP funding
2018	18	10616	17	22	21.7	22.3	
2019	16	10616	15				

*LCI lower confidence interval, UCI upper confidence interval

Major and minor diabetes related lower extremity amputations aligned with interventions to improve services. North Devon compared to NHS England data from PHE/fingertips/diabetes.

	HbA1c>70 at baseline n=8		P value paired t-test baseline v 6 months	All participants n=47		P value paired t-test baseline v 6 months
Age mean	58.75 (SD13.16)			61.3 (SD 13.7)		
Gender	3/9 female			18/46 female		
	Baseline	6months		Baseline	6months	
Mean Weight Kg	102.4 (SD 27.4)	94.3 (SD 24.8)	0.031	99.4 (SD 25.0)	95.4 (SD 24.2)	0.0000003
HbA1c mmol/l/mol	86.5	69.0	0.008	59.3 (SD16.0)	54.7 (SD 12.6)	0.003

Weight and HbA1c changes after text and phone-based diabetes structured education in North Devon 2018 to 2019

Supplementary document 4 Description of Oviva diabetes education programme

Who are Oviva?

Oviva is a digital behaviour change company. Our team of specialist healthcare professionals combined with our unique digital tools support you to improve your health and better self-manage your condition.

The one-to-one support led by our healthcare professionals is personalised, engaging and tailored to your individual needs. Our programmes are 100% remote, which means you can take part in the programme from the comfort of your own home at a time that suits you.

Oviva programmes are developed by experts using the latest scientific evidence, which means you have access to relevant, safe and up to date information and education. They are free on the NHS and our NHS Digital approved app & learning portal supports you to change your lifestyle to achieve long-term health improvements. The app allows you to track your progress and keep track of your goals!

What is Oviva Diabetes Support?

Oviva Diabetes Support is a free NHS service to help you learn more about your Type 2 diabetes and make lasting changes in your diet and lifestyle to help you stay well, lose weight, and improve your blood glucose and diabetes management.

Our team of healthcare professionals offer fully remote appointments over the phone or via our app, so you can receive expert care from home at a time that suits you. As part of Diabetes Support, you will be able to speak to a specialist diabetes coach on a one-to-one basis, use the app to track your food and activity levels, and continue to work towards your health goals without leaving your home.

People who join our programme gain confidence in managing their diabetes. They are able to lose weight, improve their blood glucose and make lasting sustainable changes to their lifestyle, which will continue even when the programme has ended.

Carine Jelinek / Operations Manager

07748001224 / carine.jelinek@oviva.com

[Oviva UK Ltd](#)

3 Risborough Street, London, SE1 0HF & Office 18.2 The Pinnacle, Leeds, LS1 5AA