

Short Report: Epidemiology

Progress of the Healthier You: NHS Diabetes Prevention Programme: referrals, uptake and participant characteristics

E. Barron¹ , R. Clark¹, R. Hewings², J. Smith¹ and J. Valabhji³

¹Public Health England, ²Diabetes UK and ³NHS England, UK

Accepted 7 December 2017

Abstract

Aims To describe early progress of the Healthier You: NHS Diabetes Prevention Programme, a behavioural intervention designed to prevent or delay onset of Type 2 diabetes in people in England already identified to be at high risk, to assess numbers of referrals received by Programme providers and the proportion that attended the initial assessment, and to identify the factors associated with attendance rates.

Methods These analyses examine the data for referrals received between June 2016 and March 2017.

Results There were 43 603 referrals received, 16% higher than expected. Of those referred, 49% attended the initial assessment, higher than the 40% modelled uptake. Of those referred, there was no significant difference in uptake by sex ($P=0.061$); however, attendance per 100 000 population varied significantly by sex, age group, ethnicity and deprivation; it was significantly lower for men ($P<0.001$), higher as age increased ($P<0.001$) and higher for individuals from Asian, Afro-Caribbean, mixed and other ethnic groups compared with individuals from white European groups ($P<0.001$). There was significant interaction between attendance rates by ethnicity and deprivation ($P<0.001$) such that attendance rates were significantly higher in the most deprived quintile vs the least deprived quintile for Asian, Afro-Caribbean, mixed and other ethnic groups but not significantly different for white European ethnic groups.

Conclusion The analyses show that referral numbers and percentage uptake are in excess of prior modelled values. Characteristics of attendees suggest that the programme is reaching those who are both at greater risk of developing Type 2 diabetes and who typically access healthcare less effectively.

Diabet. Med. 35, 513–518 (2018)

Introduction

The prevalence of diabetes in England has increased from 2.3 million in 2009/2010 [1] to 3.0 million in 2015/2016 [2]. Over 90% of people with diabetes have Type 2 diabetes [3]. The associated complication and premature mortality burden is borne by individuals, their families and carers [4], and by the National Health Service (NHS) [5]. Randomized controlled trials in those with impaired glucose tolerance have shown that onset of Type 2 diabetes can be prevented or delayed through behavioural interventions [6,7].

A strategy for future healthcare in England, published in 2014, suggested a focus on prevention to manage demand, and proposed a national Type 2 diabetes prevention programme [8]. The Healthier You: NHS Diabetes Prevention Programme was therefore developed to prevent or delay onset of Type 2 diabetes in adults already identified to be at high risk, defined as having non-diabetic hyperglycaemia [HbA_{1c} 42–47 mmol/mol (6.0–6.4%) or fasting plasma glucose 5.5–6.9 mmol/l]. Individuals identified after an NHS Health Check [9], through retrospective searches of general practice records for qualifying blood tests, or through routine clinical practice, are offered a place on a behavioural intervention. This approach is outlined in the National Institute for Health and Care Excellence (NICE) Public Health Guideline PH38 [10], and will be complemented by the population-level interventions to tackle obesity, the major modifiable risk factor for Type 2

Correspondence to: E. Barron. E-mail: Emma.Barron@phe.gov.uk
This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.
This article is published with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

What's new?

- The Healthier You: NHS Diabetes Prevention Programme received 43 603 referrals between June 2016 and March 2017.
- 49% of individuals who were referred attended the first session.
- Attendance rates for men, for individuals from Asian, Afro-Caribbean, mixed and other ethnic groups, and for individuals from areas in the most deprived quintile, suggest that the programme is reaching both those who are at greater risk of developing Type 2 diabetes and those who typically access healthcare less effectively.

diabetes, outlined in the UK Government's Childhood Obesity Plan [11].

Following a commissioned evidence review [12], an expert reference group [13] developed a service specification for behavioural interventions and their delivery, which informed a national procurement for intervention providers. Four service providers were appointed, each with the ability to provide the behavioural interventions in localities across England. The behavioural interventions enable weight loss, increased physical activity and improved nutrition through a minimum of 13 face-to-face group-based sessions, over at least 9 months, constituting at least 16 h of contact time. Local health economies, partnerships of Clinical Commissioning Groups and Local Authorities who have responsibility for commissioning healthcare and public health services, choose from the available national service providers. They undertake to identify and refer a target number of eligible individuals into the programme, based on local expected prevalence of those at risk as well as on enabling infrastructure.

Formative evaluation has already been conducted [14], and a clinical and cost-effectiveness evaluation of the Programme has been commissioned by the National Institute for Health Research that will report in 2021 [15]. There are few reports describing the implementation of large-scale diabetes prevention programmes: the US Diabetes Prevention Programme has reported on 14 747 participants [16], the Australian lifestyle intervention programme 'Life!' on 8412 participants [17], and the Finnish National Diabetes Prevention Programme on 2798 participants [18].

The purpose of this paper is to describe early progress of the Healthier You programme. Using referrals from receipt of the first referral in June 2016 to the end of the first financial year of implementation (March 2017), this paper addresses the following questions:

1. Are the numbers of referrals received by programme providers in line with expectations?
2. What proportion of those referred, attend the initial assessment?

3. Do the characteristics of those attending the initial assessment suggest equality of access according to age, sex, ethnicity and deprivation?

Due to the minimum 9-month intervention duration and time delay from referral to commencing the programme, no one had completed the programme by April 2017, so programme retention and completion rates, and changes in weight and glucose values were not available for this study.

Methods

Providers are contractually required to collect a minimum dataset comprising participant demographic and clinical information, and information about implementation. This study used data submitted by providers in June 2017, covering referrals from the first referral received in June 2016 to referrals made by the end of March 2017, with records of attendance at initial assessment extending to April 2017. Age, sex and general practice of individuals are recorded in the referral. First attendance is for an initial assessment, at which additional data, including ethnicity and postcode, are recorded. Because of the time delay between referral and initial assessment, uptake into the programme was calculated using the number of referrals received by the Providers up to January 2017 as the denominator, with numbers of corresponding attendees at initial assessment by April 2017 as the numerator. A pilot study involving 19 general practices capturing data up to March 2017 suggests that presently, coding at general practices of diagnoses of non-diabetic hyperglycaemia and of referrals into the Programme was insufficient to use *referrals recorded* on general practice systems, hence only *referrals received* by Providers are used in the present study [19].

Recorded ages were grouped into 5-year age bands and self-reported ethnicity was grouped as either 'white European', or as 'Asian, Afro-Caribbean, mixed and other'. Deprivation was derived using Lower Super Output Area (derived from participant postcode), linked to the deprivation quintile from the Index of Multiple Deprivation [20].

The local health economy of each participant is recorded in the minimum dataset. General practice codes were used to assign a Clinical Commissioning Group to each record. The adult population (aged ≥ 18 years) of each local health economy was calculated using the 2015 mid-year population estimates produced by the Office for National Statistics of each Clinical Commissioning Group within the local health economy [21]. Ethnicity population estimates for each Clinical Commissioning Group were calculated by applying ethnicity proportions from the 2011 census to the adult population [22], and population estimates by deprivation quintile were calculated by applying proportions by deprivation quintile from the Index of Multiple Deprivation to the adult population [20].

Referral and attendance (at initial assessment) rates were calculated using Office for National Statistics adult population estimates as the denominator. Attendance rates for a given subgroup were calculated with respect to the estimated adult population for that subgroup. Uptake was calculated as the proportion of referrals attending initial assessment. All associations were tested using a two-way chi-squared test. A logistic regression model was used to investigate the association between the individual ethnicity and deprivation quintile of the participant (independent variables) and attendance (dependant variable). A Wald test was used to test the significance of the interaction between ethnicity and deprivation. Statistical significance was defined as $P < 0.05$. CIs were set at 95%.

Results

There were 43 603 referrals made into the programme during this first financial year, corresponding to a rate of 198 per 100 000 of the adult population. The sum of the referral targets set by local health economies was 37 584, so that referral numbers exceeded targets by 16%. The local health

economies included in this first wave of national roll-out equated to a geographical coverage of 51% of England. By local health economy, the rate of referrals ranged from 70 to 692 per 100 000 (Table 1).

Of the individuals referred between June 2016 and January 2017, 49% attended the first session by April 2017. This ranged from 16% to 86% by local health economy (Table 1). There was no significant difference in uptake by sex (48% men, 49% women; $P=0.061$). Uptake was significantly different by age group ($P<0.001$) and increased as the age range of participants increased: from 34% for individuals aged <40 years to 36% for ages 40–44 years, 39% for ages 45–49 years, 42% for ages 50–54 years, 49% for ages 55–59 years, 51% for ages 60–64 years, 56% for ages 65–69 years and then decreasing to 55% for ages 70–74 and 51% for ages ≥ 75 years. Ethnicity and deprivation are only recorded at initial assessment; therefore uptake could not be calculated according to these characteristics.

Participant characteristics and subgroup attendance rates are described in Table 2. Attendance rates were significantly lower for men than women [74 (95% CI 72–75) vs 87 (95% CI 86–89) per 100 000; $P<0.001$] and increased as age group

Table 1 Referral numbers and rates per 100 000 during June 2016 to March 2017 and percentage uptake, using referrals received between June 2016 and January 2017 by local health economy

Local health economy	Number of referrals	Target	Population of each local health economy	Referral rate per 100 000 adult population	95% CIs		Uptake*, %	95% CIs for uptake	
					Lower	Upper		Lower	Upper
Berkshire	1386	1500	688 825	201	191	212	35	32	38
Birmingham	977	2092	1 233 026	79	74	84	52	47	56
Bury	232	190	145 231	160	140	182	86	79	91
Cambridgeshire & Peterborough	762	1333	687 857	111	103	119	42	37	47
Camden, Islington & Haringey	1354	1238	594 685	228	216	240	62	59	66
Cheshire	710	797	821 475	86	80	93	46	42	51
Cumbria	1190	1274	410 169	290	274	307	32	29	35
CWHHE*	6524	1560	942 193	692	676	709	50	49	52
Derbyshire	1613	587	798 109	202	192	212	44	41	47
Dudley	196	350	248 478	79	68	91	63	52	72
Durham	489	376	419 453	117	106	127	55	48	61
East Midlands CN	4431	5032	2 182 542	203	197	209	45	43	47
Essex	749	1169	1 064 113	70	65	76	31	26	37
Greater Lincolnshire	3442	2454	854 372	403	390	417	54	52	56
Hertfordshire	2136	1002	887 082	241	231	251	51	48	53
Inner North East London	1817	2205	900 722	202	193	211	16	14	19
Leeds	1531	1943	611 462	250	238	263	57	54	60
NHS Herefordshire	1038	1350	152 032	683	642	726	59	55	63
Norfolk	1591	1000	497 066	320	305	336	56	53	60
Oldham	258	976	172 518	150	132	169	72	65	78
Rochdale	601	485	163 340	368	339	399	56	50	62
Sefton	507	372	220 506	230	210	251	86	75	93
Sheffield	649	850	453 896	143	132	154	55	50	60
South East CN	3455	2078	3 776 821	91	88	95	49	47	52
South London	4707	4070	2 522 861	187	181	192	43	42	45
St. Helens	339	286	141 333	240	215	267	72	66	78
Worcestershire	919	1015	463 334	198	186	212	70	67	74
Total	43 603	37 584	22 053 501	198	196	200	49	48	49

CN, clinical network; CWHHE, Central London, West London, Hammersmith & Fulham, Hounslow and Ealing.

*Uptake calculated using referrals received between June 2016 and January 2017

Table 2 Participant characteristics and attendance rates by subgroup for individuals who attended initial assessment during June 2016 to April 2017

	Number attended initial assessment	Percentage of attendees	Population of each subgroup	Rate per 100 000 population subgroup	95% CIs		Chi-squared <i>P</i>
					Lower	Upper	
Total	17 892		22 053 501	81	80	82	
Sex							
Men	7929	44	10 763 217	74	72	75	<0.001
Women	9866	55	11 290 284	87	86	89	
unknown	97	1	n/a	n/a	n/a	n/a	
Age group							
<40 years	626	3	8 403 055	7	7	8	<0.001
40–44 years	624	3	1 905 971	33	30	35	
45–49 years	1019	6	2 000 593	51	48	54	
50–54 years	1520	8	1 927 497	79	75	83	
55–59 years	2020	11	1 631 036	124	119	129	
60–64 years	2,329	13	1 433 023	163	156	169	
65–69 years	3,168	18	1 475 649	215	207	222	
70–74 years	2,903	16	1 105 270	263	253	272	
≥75 years	3,667	20	2 171 407	169	163	174	
Unknown	16	0	n/a	n/a	n/a	n/a	
Ethnic group							
Asian, Afro-Caribbean, mixed, other	4,515	25	3 792 288	119	116	123	<0.001
White European	12,397	69	18 261 213	68	67	69	
Unknown	980	5	n/a	n/a	n/a	n/a	
Deprivation quintile							
IMD 1 (most deprived)	3,073	17	4 296 577	72	69	74	<0.001
IMD 2	2,972	17	4 602 993	65	62	67	
IMD 3	3,492	20	4 418 163	79	76	82	
IMD 4	2,854	16	4 294 546	66	64	69	
IMD 5 (least deprived)	2,651	15	4 441 222	60	57	62	
Unknown	2,850	16	n/a	n/a	n/a	n/a	

IMD, Index of Multiple Deprivation.

increased up to age 74 years and then decreased for ages ≥75 years ($P<0.001$). There was a significantly higher attendance rate for Asian, Afro-Caribbean, mixed and other ethnic group participants compared with white European participants [119 (95% CI 116–123) vs 68 (95% CI 67–69) per 100 000; $P<0.001$]. Attendance rates varied significantly by deprivation with higher rates in the most deprived quintile vs the least deprived quintile [72 (95% CI 69–74) vs 60 (95% CI 57–62) per 100 000; $P<0.001$]; however, there was a significant interaction between ethnicity and deprivation (Wald=33.3, df=4; $P<0.001$), so that, while attendance rates were significantly higher in the most deprived quintile vs the least deprived quintile for Asian, Afro-Caribbean, mixed and other ethnic groups, they were not significantly different for white European groups (Fig. 1).

Discussion

The results of these early analyses show that the Healthier You Programme has achieved higher than anticipated numbers of referrals, 49% uptake and equality of access, reflected by the proportions of men, participants of Asian, Afro-Caribbean, mixed and other ethnic groups, and participants from the most deprived areas.

There were 43 603 referrals received, exceeding the target by 16%. There was a tenfold variation in referral

rates across local health economies. Much of this can be attributed to differences in initial targets set; local health economies that generated higher rates of referrals had typically set a higher target. However, targets were not solely reflective of prevalence of non-diabetic hyperglycaemia, but also of local health economy infrastructure, and as the Programme progresses, and local infrastructure is developed, it is expected that future referral numbers will better reflect local need.

Uptake into the programme was 49%; the prior modelled estimate was 40%, based on expert knowledge [13]. There was also significant variation in uptake across local health economies from 16% to 86%, attributable to factors including staggered roll-out of programme provision, time lag between referral and initial assessment and differing mechanisms of engagement by referrer of those referred. Indeed, early qualitative evaluation will assess methods of engagement by referrer that are associated with higher uptake [15]. There were no significant differences in uptake by sex, and whilst attendance rates for men were lower than for women, attendance for men was higher than observed in implementation of weight management programmes both in England [23,24] and diabetes prevention programmes internationally [16–18].

Attendance rates for men, Asian, Afro-Caribbean, mixed and other ethnic groups and participants from areas in the

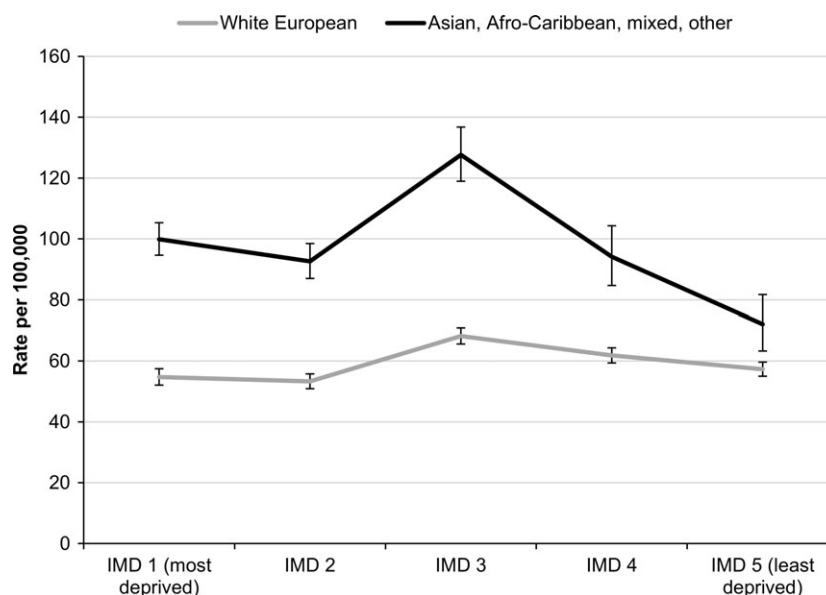


FIGURE 1 Attendance rates per 100 000 population by ethnic group and deprivation quintile during June 2016 to April 2017.

most deprived quintile further suggest that, in its early stages, the programme is reaching both those who are at greater risk of developing Type 2 diabetes and those who typically access healthcare less effectively, although efforts at engaging those most deprived have not been as successful for white European groups as for Asian, Afro-Caribbean, mixed and other ethnic groups, something that the Programme will focus on moving forward.

In the US Programme report, 80% of attendees were women and those of non-Hispanic white ethnicity constituted only 45% of participants [16]. In the Australian report, 66% were women, and more participants were not working than were employed [17]. In the Finnish report 67% were women, and lower socio-economic status was associated with higher participation in men [18,25]. The latter two reports did not describe ethnicity.

It is acknowledged that equality extends beyond the four participant characteristics presented here, although those presented are associated with Type 2 diabetes risk. Future analyses will consider equality at a broader level, including geography of implementation and additional individual-level protected characteristics.

There are some limitations to the analyses. Because of the risk of introducing additional uncertainties through the use of modelled estimates of non-diabetic hyperglycaemia and the current lack of observational data for non-diabetic hyperglycaemia prevalence, rates in this study were defined with respect to total populations rather than populations with non-diabetic hyperglycaemia. Asian, Afro-Caribbean, mixed and other ethnic groups can be estimated to have 1.2 times greater prevalence of non-diabetic hyperglycaemia (Barron E, 2017, unpublished data relating to Public Health England [26]) so the observed 1.8 times increase in

attendance rates of Asian, Afro-Caribbean, mixed and other ethnic groups compared with white European groups cannot simply be attributed to increased prevalence of non-diabetic hyperglycaemia.

Some fields in the minimum dataset are better recorded than others. While age and sex have less than or equal to 1% missing values, 5% of ethnicity records and 16% of postcodes (needed to derive deprivation status) are missing, which could affect the deprivation picture presented here. This will be addressed in future through provider contract management and associated data quality assurance. The analysis is further limited by the timing of the data collected; while age and sex of the participant are recorded in the referral received by Providers, ethnicity and deprivation are not recorded until attendance at the initial assessment.

In conclusion, this report contains early analyses of referral and uptake data, focusing on equality of access, and provides a platform for ongoing learning and improvements. As further data become available, it will be possible to examine rates of retention and completion, as well as changes in weight and HbA_{1c} by programme completion. In addition, in 2018/2019 the National Diabetes Audit will extract data from general practices on non-diabetic hyperglycaemia, allowing the long-term impact of the programme beyond 2021 to be assessed, although improvements in non-diabetic hyperglycaemia Read coding, as well as data linkage between Providers and general practices, need to be explored to facilitate this [19].

Funding sources

None.

Competing interests

All authors are members of the NHS England Diabetes Programme Directors Group. R.H. is Head of Policy, Knowledge and Insight at Diabetes UK; J.S. is the Public Health England Programme Director for the Healthier You programme; J.V. is the Clinical lead for the Healthier You Programme and National Clinical Director for Diabetes and Obesity at NHS England.

Acknowledgements

We thank members of the NHS England Diabetes Programme Directors Group for reviewing the manuscript.

References

- NHS Digital. Quality and Outcomes Framework (QOF) 2009/10. Available at <http://content.digital.nhs.uk/catalogue/PUB04431>. Last accessed 10 June 2017.
- NHS Digital. Quality and Outcomes Framework (QOF) 2015/16. Available at <http://content.digital.nhs.uk/qof>. Last accessed 10 June 2017.
- National Diabetes Audit, Report 1 Care processes and Treatment Targets 2016-17. Available at <https://digital.nhs.uk/catalogue/PUB30142>. Last accessed 18 November 2017.
- National Diabetes Audit, 2015-16 Report 2a: Complications and Mortality. Available at <https://digital.nhs.uk/catalogue/PUB30030>. Last accessed 3 September 2017.
- Hex N, Bartlett C, Wright D, Taylor M, Varley D. 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: 855–862.
- Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P *et al.* Prevention of Type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *NEJM* 2001; 344: 1343–1350.
- Diabetes Prevention Program Research Group. Reduction in the incidence of Type 2 diabetes with lifestyle intervention or metformin. *NEJM* 2002; 346: 393–403.
- NHS England. Five Year Forward View. 2014. Available at www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf. Last accessed 18 November 2017.
- Public Health England. NHS Health Check Best Practice Guidance. 2017. Available at www.healthcheck.nhs.uk/document.php?o=1308. Last accessed 3 September 2017.
- National Institute for Health and Clinical Excellence. Type 2 diabetes: prevention in people at high risk. 2012. Available at www.nice.org.uk/guidance/ph38/resources/type-2-diabetes-prevention-in-people-at-high-risk-pdf-1996304192197. Last accessed 3 September 2017.
- UK Government. Childhood Obesity: a plan for action. 2016. Available at www.gov.uk/government/publications/childhood-obesity-a-plan-for-action. Last accessed 3 September 2017.
- Public Health England. A systematic review of the effectiveness of lifestyle interventions for the prevention of type 2 diabetes mellitus (T2DM) in routine practice. 2015. Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/456147/PHE_Evidence_Review_of_diabetes_prevention_programmes_FINAL.pdf. Last accessed 18 November 2017.
- NHS England. NHS DPP Expert reference group. Available at www.england.nhs.uk/diabetes/diabetes-prevention/exp-ref-grp/. Last accessed 3 September 2017.
- Penn L, Rodrigues A, Haste A, Marques MM, Budig K, Sainsbury K *et al.* The NHS Diabetes Prevention Programme in England: formative evaluation of the programme in early phase implementation. *BMJ Open* 2017; in press.
- NHS National Institute for Health Research. Collaboration for Leadership in Applied Health Research and Care Greater Manchester. DIPLOMA – Evaluation of the national NHS Diabetes Prevention Programme. Available at <http://clahrc-gm.nihr.ac.uk/our-work/exploiting-technologies/diploma-evaluation-nation-nhs-dpp/> Last accessed 7 September 2017.
- Ely EK, Gruss SM, Luman ET, Gregg EW, Ali MK, Nhim K *et al.* A national effort to prevent type 2 diabetes: participant-level evaluation of CDC's national diabetes prevention program. *Diabetes Care* 2017; 40: 1331–1341.
- Dunbar J, Jayawardena A, Johnson G, Roger K, Timoshanko A, Versace VL *et al.* Scaling up diabetes prevention in Victoria, Australia: Policy development, implementation and evaluation. *Diabetes Care* 2014; 37: 934–942.
- Saaristo T, Moilanen L, Korpi-Hyövälti E, Vanhala M, Saltevo J, Niskanen L *et al.* Lifestyle intervention for prevention of type 2 diabetes in primary health care: one-year follow-up of the Finnish National Diabetes Prevention Program (FIN-D2D). *Diabetes Care* 2010; 33: 2146–2151.
- NHS Digital. National Diabetes Prevention Programme: Pilot study for the collection of data from GP practices in England. Available at www.digital.nhs.uk/catalogue/PUB30119. Last accessed 19 November 2017.
- Department for Communities and Local Government. The English indices of deprivation 2015. Available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/465791/English_Indices_of_Deprivation_2015_-_Statistical_Release.pdf Last accessed 23 July 2017.
- Office for National Statistics. Dataset: Clinical commissioning group mid-year population estimates. Available at www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/clinicalcommissioninggroupmidyearpopulationestimates. Last accessed 23 July 2017.
- NOMIS Official labour market statistics. Ethnic group by sex and age. Available at www.nomisweb.co.uk/census/2011/lc2101ew. Last accessed 3 September 2017.
- Dixon KJ, Shcherba S, Kipping RR. Weight loss from three commercial providers of NHS primary care slimming on referral in North Somerset: service evaluation. *J Public Health* 2012; 34: 555–561.
- Ahern AL, Aveyard P, Boyland EJ, Halford JCG, Jebb S. Inequalities in the uptake of weight management interventions in a pragmatic trial: an observational study in primary care. *British Journal of General Practice*. 2016; 66: e258–e263.
- Rautio N, Jokelainen J, Oksa H, Saaristo T, Peltonen M, Niskanen L *et al.* Participation, socioeconomic status and group or individual counselling intervention in individuals at high risk for type 2 diabetes: One-year follow-up study of the FIN-D2D-project. *Primary Care Diabetes* 2012; 6: 277–283.
- Public Health England. Research and analysis: Analysis of non-diabetic hyperglycaemia prevalence in England. Available at www.gov.uk/government/publications/nhs-diabetes-prevention-programme-non-diabetic-hyperglycaemia Last accessed 15 September 2017.