Management of Type 2 diabetes mellitus in primary care

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Declaration

This thesis consists of five peer-reviewed publications in international journals and one peer-reviewed report.

The papers arise from a track record in original academic grant funded research both as Principal and Co-Investigator while working within a multidisciplinary health care team.

I was the Principal Investigator on a funded study for one of the papers. I led the writing of the research proposal, research governance and ethics application and conducted the majority of the data collection, analysis and writing the paper.

For the remaining four papers and report, I was a Co-Investigator on a funded study. I was involved in writing the research proposal for the bid and the day to day project management of the study. I employed two research assistants and engaged the skills of a statistician. I was involved in the analysis of the data and the completion of the report.

For all papers for which I am first author, I wrote the text, including the literature reviews. For the remaining paper, I contributed to the writing of the text and the analysis of the data. I led on the writing of the report with contributions from the co-authors.

Signature Date

Acknowledgements

There are many people whom I wish to acknowledge for their support and guidance in preparing this thesis.

First I wish to acknowledge Dr Grace Lindsay, Reader in Clinical Research, Glasgow Caledonian University for her mentorship, supervision and friendship over many years. Her patience and guidance have been greatly appreciated.

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Abstract

Management of Type 2 diabetes mellitus in primary care

Background

The incidence and prevalence of diabetes mellitus (diabetes) is increasing globally. The majority of people have type 2 diabetes, initially managed by lifestyle changes and the gradual introduction of oral, followed by subcutaneous, medications.

Due to the increasing numbers of people with type 2 diabetes, different models of care management have been utilised within the United Kingdom. One Health Board within Scotland received funding to undertake a service redesign whereby the responsibility of care for people with type 2 diabetes was transferred from secondary care to primary care, with referral to specialist services based on clinical need.

Aim

The aim of this thesis is to present the body of published work on an evaluation research study on the change in service delivery for people with type 2 diabetes. The published works have arisen from two funded research studies resulting in one peer reviewed report and five peer-reviewed papers published in international journals.

First funded study

From knowledge, clinical experience and reading, a need was identified to develop a questionnaire on professionals' perceptions of diabetes. The implementation and impact of the service redesign within the Health Board was also an influencing factor. In 2003, funding and ethical approval was acquired to develop such a questionnaire that was used within the second funded study. One paper arose from this process.

Paper 1: Development of a questionnaire to determine professionals' attitudes to type 2 diabetes

This methodological paper (from first funded study) describes the processes employed to develop a questionnaire to assess professionals' perceptions of diabetes. Four stages were utilised: an in-depth literature review; consultation with panel of experts using the nominal group technique; individual interviews using the talk through technique; piloting with primary care professionals. The outcome was a questionnaire with face and content validity.

Second funded study

In 2001, the then Greater Glasgow Health Board acquired funding from the Scottish Executive to prepare for, and implement, a service redesign. New infrastructure was required prior to the implementation of the changes in a rolled in, phased process.

General Practitioners agreed to provide Level 3 care, which was defined as maintaining a register of people with diabetes and offering care in line with guidelines. Guidelines recommended annual review assessment of people with type 2 diabetes, regular monitoring of diabetes parameters, recall and review of diabetes management and taking appropriate action to improve diabetes control. GPs also agreed to undertake risk factor management, predominantly cardiovascular risk. Additional staff was employed for the new multidisciplinary team. All Practices were asked to provide an annual report of people with diabetes on their register for the Scottish Diabetes Survey using pre-determined criteria.

In 2003, funding was acquired from one of the Local Health-care Co-operatives comprising 14 Practices to undertake an evaluation study of the impact of the service redesign on the management of people with type 2 diabetes; their health status; their satisfaction with care; and professionals' health-care working practices. This is the first evaluation study of its kind within Scotland conducted between 2003 and 2005.

Report: The Glasgow Diabetes Project

This peer review report (from second funded study) was submitted to the funders of the study in 2006 as well as disseminated among key policy holders and clinical colleagues.

An evaluation, before and after, design was utilised using a mixed methods approach. Both quantitative and qualitative tools were used for data collection. Analysis methods congruent with the tools employed are explained. The report presents a synopsis of the work undertaken with preliminary analysis of the data and findings. Further in-depth analysis of data and findings resulted in a further four papers.

Paper 2: Professionals' perceptions of type 2 diabetes

This paper presents the results of a cross sectional survey of professionals' (n=38) perceptions of diabetes utilising the questionnaire developed in Paper 1. Key areas identified in the service redesign were surveyed: diabetes management, attitudes towards type 2 diabetes; use of clinical guidelines and practice organisation. Perceptions towards these aspects are presented and discussed. Overall, with additional education in diabetes, professionals were satisfied with the new model of care and their workload.

Paper 3: Perceptions of a service redesign by adults living with type 2 diabetes

This paper presents the perceptions of the service users to the change in how their care was delivered. A qualitative approach was used and eight focus groups conducted with 35 participants. Thematic analysis was undertaken and five main themes emerged. Overall, people with type 2 diabetes appreciated their care being delivered within the primary care setting where there was the necessary infrastructure to support management of diabetes.

Paper 4: Quality of life in people with type 2 diabetes

This paper discusses changes in quality of life before and after (2003-2004) the service redesign. Two internationally recognised questionnaires were used: the SF 36 and the PAID and paired results compared and contrasted for 88 participants. Health related quality of life remained stable throughout this time period except for the deterioration in the bodily pain domain in the SF 36 ($p=0.02$) and deteriorating scores for older patients in the PAID questionnaire.($p=0.045$ ages 66-74 years; $p=0.02$ ages >74 years).

Paper 5: An evaluation study using a mixed methods approach

This methodological paper discusses the advantages of utilising a mixed methods approach within an evaluation study. The mixed methods research approach is considered appropriate and has added value as opposed to one method of research alone.

The statistically significant results from key clinical parameters of blood pressure ($p<0.001$), prescribing of statin therapy ($p<0.001$), random blood glucose ($p=0.0043$) and non-smoking status ($p=0.007$) are presented and discussed.

Conclusions

The papers demonstrate that the service redesign was effective and well received by patients and health-care professionals. There were some improvements in clinical parameters with no deteriorations.

This was the first evaluation study of its kind in Scotland. Utilising a mixed methods approach compensated for any weakness inherent in using quantitative and qualitative research alone and provided a rich understanding of the impact of the service change.

The collective body of work is presented in fulfilment of a higher degree by published works.

Contents **Page Number**

The report and papers on which the thesis is based are presented first. My own contribution to these publications is identified in Appendix 1.

The published works are presented in the following order.

The main report (of the second funded study) is presented first as this gives the total evaluation of the service change and provides the background for the subsequent papers (Lindsay, McDowell, McPhail 2006).

Thereafter the methodological paper (from the first funded study) on the development of the questionnaire is presented (McDowell, Lindsay, McPhail 2007, Paper 1)

The use of the questionnaire in the second funded study is presented next (McDowell, Inverarity, Gilmour, Lindsay 2012a, Paper 2).

Following these, the remaining three papers focus on the impact on people with type 2 diabetes of:

- The service change (McDowell, McPhail, Halyburton, Brown, Lindsay 2009, Paper 3)
- Their quality of life (Lindsay, Inverarity, McDowell 2011, Paper 4)
- Their clinical parameters (McDowell, Inverarity, O'Dwyer, Lindsay 2012b, Paper 5).

The last paper (McDowell et al 2012b, Paper 5) is also a methodological paper discussing the methods for the entire evaluation study.

The thesis is presented at the end of the publications (page 17) as a discussion chapter.

Lindsay G, **McDowell J**, McPhail K (2006) An evaluation of the impact of the Glasgow Diabetes project for healthcare for patients with type 2 diabetes. University of Glasgow, Glasgow
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An evaluation of the impact of the Glasgow Diabetes Project on healthcare of people with type 2 diabetes

Grace Lindsay, Joan McDowell, Kathryn McPhail,

University of Glasgow, Faculty of Medicine, School of Nursing & Health Care
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PROJECT SUMMARY

Title of research project: An evaluation of the impact of the Glasgow Diabetes Project on healthcare for people with type 2 diabetes.

Research question: In what way does the introduction of a new model of care for people with type 2 diabetes improve care management, patient's health status, healthcare working practices, and patients' satisfaction?

Objectives:
Primary objectives -

1 To assess the extent to which the population of diabetic patients within an LHCC are identified and appropriately managed in terms of regular review
2 To assess changes in clinical indices of diabetic care (retinal screening, foot care, glucose, HbA1c, CHD risk factors, CHD events, other co-morbidity)
3 To evaluate accessibility and uptake of the service at the defined points of contact

Secondary objectives-

1 To assess general health status, health beliefs and health related behaviours across different diabetic client groups
2 To examine patients perceptions of their care and their motivation to participate in their care
3 Comparison with the ideal service and traditional care setting
4 To enumerate contacts with health care professionals and other health-related activities such as exercise referral schemes
5 To assess patients' awareness of the impact of organisational change

Design: Quasi-experimental, using a range of quantitative and qualitative tools at baseline and at 12-18 months following implementation of the new service.

Setting: Greater Shawlands LHCC

Subjects: At the time of the study the population of people with diabetes in Greater Shawlands LHCC was approximately 1450 people. Recruitment to the study of a representative sample was achieved by inviting every third person on each GP practice type 2 diabetes register to participate in the main study. Recruitment for a focus group sub study was performed through purposeful sampling.

Methods: Patient questionnaires were used to evaluate subjective accounts of general health status and individuals' attitudes to their diabetes management before and after implementation of the new service (Appendix A). SPSS software was used for statistical analysis of responses.
Clinical indicators of diabetes management were collected before and after by using the diabetes clinical information system, SCI-DC e.g. HbA1c, RBG, BP, HDL, total cholesterol, retinal screening, feet screening, smoking and exercise. While the diabetes clinical information system identified all electronically recorded information, this still

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necessitated a manual trawl of patients' notes to collect incomplete data.

Patients' perceptions of the change in service delivery were explored through 8 focus group interviews; 5 at baseline, and 3 at18 months thereafter.

Primary healthcare professionals' perceptions of diabetes care were measured after the new service was established through a specially designed and validated questionnaire (Appendix B).

Results: Patient questionnaires showed some worsening in general health (due mainly to conditions other than diabetes, especially musculoskeletal conditions), and stasis in attitudes of individuals coping with diabetes over the time period.

Clinical data showed statistically significant improvements in numerous indices of diabetes management including smoking, exercise, blood pressure and cholesterol levels.

Analysis of qualitative data of patients' perceptions showed appreciation of the new service for its convenience and user friendliness. Patients highlighted areas of service provision that are valued such as readiness of information and expertise and time to talk in depth with health care professionals.

Professionals' perceptions questionnaire showed a high level of satisfaction with the new service.

Conclusions: The new model of care is as good as the old model in terms of clinical outcomes. It has had a positive impact upon patients' health status. Furthermore it has been well received by patients and professionals and the study has also captured patients' interests and suggestions regarding service improvement which have been fed back to service providers for the enhancement of future service development. It is acknowledged that the service was still in a transition phase and that there was some overlap of service provision during this time.

PROJECT

Introduction

The organisation and management of diabetes care is a priority issue. In Scotland about 1:40 people have diabetes and this is expected to rise to 1:25 by 2010. Nine percent of annual NHS expenditure is on diabetes, of which 4.7% is on Type 2 diabetes. Guidelines for the development of diabetes services have directed recent innovations, most notably the NHS Health Services Guidelines' Key Features of a Good Diabetes Service, and the Scottish Diabetes Framework which lays out developmental stages for the coordination of all agencies involved in providing care for this client group. The Glasgow Diabetes Project was designed to meet the requirements of these documents and provide a service that is more accessible and which will reduce morbidity and mortality associated with diabetes.

The purpose of this research project has been to assess the extent to which the population of diabetic patients within an LHCC are identified and appropriately managed in terms of guidelines for best practice. An assessment was undertaken across the Type 2 diabetic client group of general health status, clinical markers of diabetic care management, and patients' health beliefs and health related behaviours before and after implementation of the new model of diabetes care. An outline of the key aspects of the patient journey including location of care; accessibility; uptake and systems for ongoing management was drawn. This included patients' perceptions of their care and their participation in self care. Healthcare professionals' perceptions of diabetes care were also measured across different professional groups using a specifically designed questionnaire.

Methodology

Research Governance

Ethical approval for the study was granted by the Greater Glasgow Primary Care NHS Trust Research Ethics Committee (Community and Mental Health) at the end of June 2003. The same Trust also granted Research and Development Management Approval for the study at this time.

Study Design

The study is based on a quasi-experimental design using a range of quantitative and qualitative tools at baseline and 12-18 months following implementation of the new diabetes service. The study comprised three distinct aspects to address the research question and objectives. Patients were invited to complete questionnaires as well as agreeing to the collection of various clinical parameters. A subgroup was invited to take part in a Focus Group Study. Thirdly, professionals involved in the care of diabetes were invited to complete a questionnaire to elicit their views and perceptions of diabetes care.

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Participants

Participants comprised adults, elderly and people from ethnic minorities with diabetes mellitus within Greater Shawlands LHCC. At commencement of study 63028 patients were registered with practices within this LHCC, of which 1402 had type 2 diabetes. Healthcare professional participants were Practice Managers, Practice Nurses, District Nurses, Podiatrists, Dietitians and GP's within Greater Shawlands LHCC.

Data Collection

To allow evaluation of the new diabetes model of care, data was collected using a range of quantitative and qualitative tools at baseline and at 12-18 months after implementation of the new service.

Patients' clinical data was obtained through liaison with staff at the Primary Care Trust Headquarters and following discussion with their Data Protection Officer. Data which is centrally located in the new clinical information system was downloaded using patients' CHI numbers for confidentiality. This process proved both useful and also very time consuming - it provided access to data in line with data protection requirements but also delivered many repetitious and incomplete entries, requiring sifting, and identification of 'missing data'. Missing data was obtained as far as possible through liaison with practice staff that has access to patients' clinical records.

Liaison with Practice Managers and staff at the Trust HQ information was obtained on practice sizes, numbers of patients with type 2 diabetes, and healthcare systems in place for diabetes management. Through liaison with Practice Managers, Practice Nurses and reception staff demographic information was obtained for all patients on practices' type 2 diabetes registers. (For details of sampling strategy see below).

Patient questionnaires were used to measure general health and well being (SF-36), subjective accounts of living with diabetes (PAID questionnaire) and social support networks (RAND Social Activities Questionnaire). The SF-36 and PAID questionnaires were used at baseline and 12 months, but the Social Activities questionnaire was only used at baseline in response to patients comments regarding the usefulness and relevance of this questionnaire.

Healthcare professionals' perceptions of diabetes care were measured using the Perceptions Of Diabetes Questionnaire at one time point in July 2004. The questionnaire was sent to all GP's, Practice Nurses, District Nurses, Podiatrists, Dietitians and Practice Managers within Greater Shawlands LHCC – 112 people.

Qualitative data was collected to explore patients' perspectives of living with diabetes, their needs, and of healthcare provision, through use of focus group interviews (See Focus Group section of report for full details).

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Sampling

In order to recruit patients to the study every third patient on each practices Type 2 diabetes register was selected. Some stratified sampling was also undertaken in order to ensure representation of ethnic minority groups. Five hundred and seventy six individuals were thus sent a letter with information about the study which also included a consent form for patients to sign and return if they were willing to participate i.e. to completing questionnaires and permit access to clinical records pertaining to their diabetes care. Following a reminder letter to all individuals who had not responded within 4 weeks the number of patients who consented to participate was 140. Of these a small number passed away within the first few months of the study, leaving a sample group of 136 individuals for this section of the study. (Please see the Focus Group Study for information regarding sampling for this qualitative aspect).

Results of Clinical data

The results are presented in three stages. Firstly patients' clinical data is presented. Secondly professionals' views of diabetes care are described. Thereafter, the findings of the Focus Group study are presented.

The clinical data was analysed between before and after, time frames for comparison. They were further analysed by gender, age group and deprivation category. Power calculations have been utilized where appropriate.

Healthcare systems and processes of care

Numbers of patients and prevalence of diabetes within Greater Shawlands LHCC can be seen at Table 1.1.

Table 1.1: Greater Shawlands LHCC - summary figures

	Registered patients	**Registered patients with type 2 diabetes**	**Prevalence of type 2 diabetes**
Baseline*	63028	1402	2.2%
Follow up**	62635	1522	2.4%

*As in summer 2003
** As in autumn 2004

The majority of practices were providing level 3 care before the end of 2002, with one pilot practice providing this service from 2001. At the time of commencing this study one practice was not providing level 3 care. Level 3 care is where the General Practitioner has a register of diabetic patients and offers care in line with agreed local treatment guidelines. This includes regular call and review and action to improve control of diabetes. In addition to regular monitoring and treatment of diabetes, the practice will

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undertake risk factor management as necessary. The General Practice also provide an annual report (based on SIGN dataset) for each diabetic patient in their care. Information from the practice is fed into the shared diabetes Clinical Information System.

By the end of the study period all practices within this LHCC were providing level 3 care for patients. Each practice has a named lead GP for diabetes care, who along with a Practice Nurse from each practice had undertaken the necessary accredited diabetic training course. All community Dietitians and Podiatrists linked to the Diabetes project were also required to complete a credited diabetes course.

All practices maintain a computerised register of diabetic patients, eighty five percent of which (n=12) are on the GPASS system and 15% of which (n=2) are not. Similarly, annual recall for review of diabetic patients is implemented by all practices, the majority through the GPASS system, the remainder through other methods including box file and reference to previous clinic sheets.

Patient demographics

Patient demographics for the population, sample and LHCC are shown in Table 2.1.

Table 2.1: Patient demographic details

	Population	**Sample**	**[LHCC exc sample]**	**p-value**
Total Number	1402	136	1266	---
Gender				0.10
Female	662 (47%)	55 (40%)	607 (48%)	
Male	740 (53%)	81 (60%)	659 (52%)	
Mean Age (st dev) in years	63.76 (13.59)	65.38 (11.96)	63.57 (13.75)	0.08
Age Category				**0.003**
<55 yrs	346 (25%)	28 (21%)	318 (25%)	
55-64 yrs	324 (23%)	23 (17%)	303 (24%)	
65-74 yrs	415 (30%)	56 (41%)	357 (28%)	
>74 yrs	317 (23%)	29 (21%)	288 (23%)	
Deprivation Category				**0.007**
1	38 (3%)	3 (2%)	35 (3%)	
2	260 (19%)	27 (20%)	233 (18%)	
3	160 (11%)	26 (19%)	134 (11%)	
4	252 (18%)	32 (24%)	220 (17%)	
5	85 (6%)	8 (6%)	77 (6%)	
6	187 (13%)	11 (8%)	176 (14%)	
7	420 (30%)	29 (21%)	391 (31%)	
Grouped Deprivation				**0.001**
Categories	268 (21%)	30 (22%)	268 (21%)	
1 & 2	431 (34%)	66 (49%)	431 (34%)	
3, 4 & 5	567 (45%)	40 (29%)	567 (45%)	
6 & 7				
Ethnic Origin				**<0.001**
Asian	254 (18%)	8 (6%)	246 (19%)	
Other	1148 (82%)	128 (94%)	1020 (81%)	
Mean RAND score (st dev)	---	28.43 (7.28)	---	**---**
Missing N		11		

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Proportions (and mean/standard deviation for age) given for LHCC type 2 Diabetic population and for Sample of 136. P-value is for chi-squared test of equal proportions comparing our sample against the remaining LHCC patients (as if we compared the full LHCC, the groups would not be independent). Significant differences shown in bold. There is evidence of a difference in the distributions of age category, deprivation category and ethnic origin between our sample and the rest of the LHCC. Unfortunately this means we cannot say our sample is representative of the full LHCC patient group at the time.

Patient Questionnaires - General Health and Wellbeing (SF36) and Diabetes-specific (PAID)

The SF-36 questionnaire is a widely used and well known tool which has been found to be reliable and valid in the measurement of general health and well being. It consists of 36 items and generates scores for eight domains of health: General Health, Physical Function, Social Function, Mental Health, Bodily Pain, Role Limitation – Physical, Role Limitation – Mental, and Energy / Vitality. The scores range from 0-100, with 0 indicative of poor health and well being and 100 indicative of excellent health and well being (Table 3.1).

The PAID (problem areas in diabetes questionnaire) is a reliable and valid tool used to measure diabetes-specific emotional distress**.** It was developed by the Joslin Diabetes Centre, Boston. The PAID total score ranges from 0-100, with 0 being indicative of the least emotion distress relating to diabetes and 100 being indicative of the greatest emotion distress relating to diabetes (Table 3.1).

Table 3.1: Overall patient questionnaire paired results

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	88	75 (50 - 89)	70 (33 - 85)	-3.69	0.10	-8.05 to 0.67
Role Limitation Physical	88	75 (0 - 100)	50 (0 - 100)	-7.95	0.08	-16.88 to 0.97
Role Limitation Mental	88	88 (33 - 100)	100 (0 – 100)	-0.76	0.86	-9.37 to 7.85
Social Function	88	89 (56 - 100)	78 (47 – 100)	-4.68	0.07	-9.82 to 0.46
Mental Health	88	71.59 (21.50)	69.73 (21.17)	-1.86	0.18	-4.57 to 0.85
Energy / Vitality	88	51.42 (24.27)	48.86 (22.82)	-2.56	0.21	-6.55 to 1.43
Bodily Pain	88	70.39 (27.27)	63.94 (29.39)	**-6.44**	**0.02**	**-11.71 to -1.18**
General Health	88	54.80 (24.17)	51.70 (23.00)	-3.09	0.13	-7.15 to 0.96
PAID	94	13 (5 – 25)	13 (6 - 27)	1.64	0.14	-0.57 to 3.84

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].
‡ Figures are mean for all [as distributions of differences are not skewed].

These results were further analysed to demonstrate changes in the different parameters and these are presented in Table 3.2.

Table 3.2: Overall questionnaire results that have increased, decreased or stayed the same

	No Pairs	Decreased		Same	Increased	
		N (%)	Mean Diff	N (%)	N (%)	Mean Diff
Physical Function	88	43 (49%)	-17.09	18 (21%)	27 (31%)	15.19
Role Limitation Physical	88	29 (33%)	-53.45	44 (50%)	15 (17%)	56.67
Role Limitation Mental	88	21 (24%)	-53.95	47 (53%)	20 (23%)	53.30
Social Function	88	34 (39%)	-27.44	33 (38%)	21 (24%)	24.81
Mental Health	88	41 (47%)	-11.61	22 (25%)	25 (28%)	12.48
Energy / Vitality	88	46 (52%)	-14.57	12 (14%)	30 (34%)	14.83
Bodily Pain	88	37 (42%)	-28.24	28 (32%)	23 (26%)	20.78
General Health	88	51 (58%)	-14.88	9 (10%)	28 (32%)	17.39
PAID	94	36 (38%)	-7.04	8 (9%)	50 (53%)	8.15

Test used is students paired sample t-test. Taking the example of bodily pain (the only significant change here) we can say that there is evidence that the score decreased on average during the 1 year follow up period. It is highly likely that this change is between -11.71 and -1.18, with a best estimate of -6.44. There is no evidence of any of the other domains changing, on average, over the period, however for the sample each one decreased with all the mean differences negative.

These terms apply to all tests of this sort for patient questionnaire data and clinical data. For the full data set above results have also been broken down into the numbers that decreased, increased and stayed the same over the period although no frequency measures have been conducted.

Following this the data set has been broken down into groups and this analysis repeated in order to find any changes within the different groups (Appendices 1; 2; 3; 4;.5; 6; 7;.8; 9). Analyses was conducted by gender, by age group and by deprivation category.

From these, it can be seen that there were statistically significant deterioration in the mental health function for men but not for women (Appendix 1 and 2). Those aged less than 55 years of age showed a significant deterioration in role limitation regarding physical, mental and general health aspects (Appendix 3). This was not replicated across the other age bands of between 55 and 74 years. The over 74 year old age group described a significant reduction in physical function and role, energy and bodily pain (Appendix 4, 5, 6). The 65 -74 year age group and 74 plus age group experienced deterioration in their PAID score (Appendices 5, 6).

Only deprivation categories 1 and 2 showed a significant reduction in physical function and role and general bodily pain (appendix 7).

Patient Clinical Data

The clinical data in relation to the patients' main diabetes and cardiac parameters are presented in Tables 4.1 and 4.2.

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Table 4.1: Overall clinical paired results

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	113	8.06 (1.92)	7.81 (1.51)	-0.25	0.18	-0.62 to 0.12
RBG	56	11.62 (3.93)	8.91 (3.11)	**-2.71**	**<0.001**	**-3.80 to -1.61**
Creatinine	109	94.15 (42.02)	97.25 (71.34)	3.10	0.43	-4.60 to 10.80
Cholesterol	102	5.13 (1.07)	4.50 (0.93)	**-0.64**	**<0.001**	**-0.87 to -0.41**
HDL	71	1.20 (0.34)	1.43 (0.66)	**0.22**	**0.001**	**0.09 to 0.36**
Systolic BP	130	145.22 (17.49)	140.15 (18.35)	**-5.08**	**0.01**	**-9.00 to -1.15**
Diastolic BP	130	79.96 (10.50)	75.13 (10.99)	**-4.83**	**<0.001**	**-6.88 to -2.78**
Weight	121	84.87 (17.06)	84.39 (17.01)	-0.48	0.31	-1.43 to 0.46
BMI	120	30.05 (5.49)	30.10 (5.37)	0.05	0.80	-0.35 to 0.45

† Figures are mean (st dev).

There was a significant improvement in random blood glucose, cholesterol levels, HDL and both systolic and diastolic blood pressures. These were further analysed to compare increase, decrease or no change in result and are presented in Appendix 10.

Table 4.2: Clinical results continued

	Baseline	1 yr follow up	p-value †
Smoking Status			**0.007**
Current smoker	21 (18%)	12 (10%)	
Ex smoker	37 (32%)	46 (40%)	
Non smoker	58 (50%)	58 (50%)	
Physical Activity			**0.002**
Physically impossible	2 (4%)	3 (6%)	
Avoids even trivial	12 (25%)	7 (15%)	
Light	25 (52%)	19 (40%)	
Moderate	9 (19%)	18 (38%)	
Heavy	0 (0%)	1 (2%)	
Pulse Left			0.25
Present	90 (99%)	87 (96%)	
Absent	1 (1%)	4 (4%)	
Pulse Right			**0.03**
Present	86 (99%)	80 (92%)	
Absent	1 (1%)	7 (8%)	
Sense Left			0.73
Normal	78 (90%)	80 (92%)	
Impaired	9 (10%)	7 (8%)	
Sense Right			0.45
Normal	72 (89%)	75 (93%)	
Impaired	9 (11%)	6 (7%)	
Retina Left			0.68
Normal	50 (98%)	49 (96%)	
Mild Background	0 (0%)	1 (2%)	
Established	1 (2%)	1 (2%)	
Retina Right			0.68
Normal	48 (98%)	47 (96%)	
Mild Background	0 (0%)	1 (2%)	
Established	1 (2%)	1 (2%)	

† McNemars test used so only paired data is analysed.

Taking smoking status as an example, we can say that there is evidence that the distributions of proportions changed significantly over the 1 year follow up period. Here the percentage of ex smokers increased significantly. Alternatively, there is no evidence of a change in the distribution of proportions of patients with their left pulse present, for example. These terms can be applied to all tests of this sort in the clinical data section.

Following this the data set has been broken down into groups and analysis repeated in order to find any changes within the different groups according to gender, age and deprivation category (Appendices 11, 12, 13, 14, 15, 16, 17, 18, 19). This further analysis presented a similar trend to the overall database.

Where there are national standards set for clinical parameters, results were compared to these. There was significant improvement in hyperlipidaemia and hypertension (Table 4.3).

Table 4.3: Clinical guidelines paired results

	No pairs	Baseline	1yr follow up	p-value
HbA1c	113			0.83
Poor control		41 (36%)	39 (35%)	
Borderline Control		42 (37%)	39 (35%)	
Good Control		30 (27%)	35 (31%)	
Creatinine	109			0.06
Normal		102 (94%)	97 (89%)	
Elevated		7 (6%)	12 (11%)	
Hyperlipidaemia	102			**<0.001**
Normal		50 (49%)	77 (76%)	
Elevated		52 (51%)	26 (25%)	
HDL	71			0.29
Normal		58 (82%)	62 (87%)	
Low		13 (18%)	9 (13%)	
Hypertension	130			**0.001**
Normal		45 (35%)	71 (55%)	
Elevated		85 (65%)	59 (45%)	
BMI	120			0.77
Normal		19 (16%)	21 (18%)	
Overweight		101 (84%)	99 (82%)	

McNemars test used so only paired data analysed.

Results were compared between the clinical parameters measured and patients' self reporting of areas from the SF36, the RAND and the PAID questionnaires. These are presented in Table 4.4 and 4.5.

Table 4.4: Patient questionnaire / Clinical data relationships

1 yr follow up	HbA1c	RBG	Creatinine	Chol.	HDL	Systolic	Diastolic	Weight	BMI	RAND
Physical Function‡	0.018	-0.097	0.152	0.080	-0.016	-0.078	0.049	-0.111	**-0.252**	0.120
p-value	0.82	0.35	0.07	0.33	0.87	0.303	0.52	0.15	**0.001**	0.115
Role Limitation Physical‡	0.067	0.042	**0.214**	0.024	-0.137	-0.033	0.105	0.012	-0.127	0.034
p-value	0.45	0.72	**0.02**	0.79	0.20	0.69	0.21	0.89	0.14	0.68
Role Limitation Mental‡	0.005	-0.102	**0.309**	0.010	-0.102	0.072	0.038	0.034	-0.114	0.078
p-value	0.96	0.38	**0.001**	0.91	0.36	0.40	0.66	0.70	0.20	0.37
Social Function‡	0.097	-0.028	0.130	-0.019	-0.054	0.008	-0.012	-0.136	**-0.237**	**0.189**
p-value	0.24	0.79	0.13	0.82	0.60	0.92	0.88	0.09	**0.004**	**0.02**
Mental Health†	0.007	-0.222	**0.284**	-0.020	-0.031	0.063	0.021	-0.105	**-0.274**	**0.303**
p-value	0.95	0.13	**0.015**	0.87	0.82	0.44	0.84	0.35	**0.01**	**0.004**
Energy/ Vitality†	0.006	-0.175	0.175	0.014	-0.036	0.058	0.057	-0.187	**-0.290**	**0.215**
p-value	0.96	0.24	0.14	0.91	0.79	0.59	0.60	0.09	**0.006**	**0.046**
Bodily Pain†	-0.023	-0.152	0.101	0.093	-0.079	0.007	0.009	-0.186	**-0.344**	0.100
p-value	0.84	0.31	0.40	0.43	0.56	0.95	0.93	0.092	**0.001**	0.36
General Health†	-0.86	**-0.294**	0.177	-0.041	0.136	-0.019	-0.100	-0.190	**-0.237**	**0.213**
p-value	0.46	**0.045**	0.14	0.73	0.32	0.86	0.35	0.09	**0.03**	**0.048**
PAID‡	0.080	0.174	**-0.276**	0.068	0.007	-0.069	-0.053	**0.151**	**0.178**	-0.136
p-value	0.30	0.08	**<0.001**	0.39	0.94	0.34	0.47	**0.04**	**0.019**	0.06

† Figures are r values (Pearson).
‡ Figures are z values (Kendall).

Table 4.5: Patient questionnaire / Clinical data relationships cont.

1 yr follow up	Current Smoker	Ex Smoker	Non Smoker	p-value
Physical Function‡	70 (65 – 85)	60 (45 – 85)	75 (30 – 90)	0.76
Role Limitation Physical‡	75 (25 – 100)	75 (0 – 100)	25 (0 – 100)	0.35
Role Limitation Mental‡	33 (0 – 100)	100 (33 – 100)	100 (0 – 100)	0.27
Social Function‡	100 (22 – 100)	78 (33 – 100)	78 (56 – 100)	0.98
Mental Health†	69.00 (21.31)	70.29 (20.75)	68.57 (23.13)	0.95
Energy/ Vitality†	50.42 (29.73)	46.25 (20.35)	50.48 (23.24)	0.74
Bodily Pain†	74.17 (27.82)	62.75 (26.18)	60.62 (30.77)	0.36
General Health†	49.92 (26.03)	55.36 (23.35)	51.98 (22.27)	0.75
PAID‡	13 (6 – 51)	10 (8 – 20)	16 (5 – 28)	0.87

† Figures are mean (st dev) test is students' two independent samples t-test.
‡ Figures are median (interquartile range), test is Kruskal Wallis test.

Table 4.6: Patient questionnaire / Clinical predictors

Outcome (at follow up)	Adjusted R^2	Sample size	Predictors (at baseline)	P-value	Coefficient estimate & 95% CI
Mental Health	67%	88	SF36 Mental Health	<0.001	0.81 (0.69 to 0.93)
Energy/ Vitality	46%	88	SF36 Energy/ Vitality	<0.001	0.64 (0.49 to 0.79)
Bodily Pain	38%	88	SF36 Bodily Pain	<0.001	0.67 (0.48 to 0.85)
General Health	45%	88	SF36 General Health	<0.001	0.64 (0.49 to 0.79)
HbA1c	11%	113	HbA1c	<0.001	0.27 (0.13 to 0.41)
Systolic BP	34%	130	Systolic BP	0.02	0.22 (0.04 to 0.40)
Diastolic	15%	130	Diastolic BP	<0.001	0.41 (0.25 to 0.58)
BMI	84%	120	BMI	<0.001	0.89 (0.83 to 0.97)

Backward stepwise selection (involving first order terms for baseline value of response variable and baseline values for HbA1c, BP's, BMI, age, sex, deprivation category,

RAND, ethnic origin, practice and smoking status) was carried out to come up with the final models displayed in Tables 4.4; 4.5; 4.6. In all cases only the baseline value of the variable in question was found to be significant in contributing to follow up value. Therefore there is no evidence that the aforementioned variables (in the list in brackets) predict the outcome value in each case. This cannot be done for remaining SF36 scores and PAID as they are not distributed normally and so cannot be entered into a linear regression model.

The management of diabetes can be monitored through assessment of clinical measures of optimal care as outlined within the new GMS contract of 2003 (Investing in General Practice 2003 www.bma.org.uk). Key clinical indices for diabetes management were analysed for patients achieving or exceeding targets as can be seen from Table 4.7. Targets used were those defined in SIGN guidelines. There was an improvement in the majority of measures after the introduction of the new service.

Table 4.7: Key clinical variables baseline and one year following implementation of the new Community-based diabetic service

	Baseline % (n)	One year after introduction of new service % (n)	Change from baseline P-value *p*
Systolic BP <130mmHg	14.6% (n=130)	26.5% (n=136)	0.0362*
Diastolic BP <85mmHg	69.2% (n=130)	85.3% (n=136)	0.0020*
Total cholesterol < 5 mmol/L	47.1% (n=104))	68.5% (n=130)	0.0005*
BMI <25kg/m^2	11.3% (n=134)	9.2% (n=130)	0.3743
BMI <30kg/m^2	54.0% (n=134)	56.2% (n=130)	0.8203
HBA1c <7.5	45.7% (n=116)	49.2% (n=132)	0.4736
Random blood sugar <8	17.9% (n=67)	45.2% (n=73)	0.0043*

* Statistically significant at p< 0.05 level

Medication prescriptions

Data was captured on prescribing practices at two time points. The first was at the beginning of the service redesign and the second was at 2 years after initiation of the change in service. Data was collected on the 138 patients who had consented.

Table 5.1: Changes in prescription of sulphonylureas

Sulphonylureas		**Follow up**		
		Not on drug	**On drug**	**Total**
Baseline	**Not on drug**	72(56%)	18 (14%)	90
	On drug	9 (7%)	29(23%)	38 (30%)
	Total	81	47 (37%)	128

Missing N: 8 (6%); P value 0.12

The percentage of patients in the sample on a sulphonylurea increased from 30% to 37% at follow up. This was not found to be statistically significant (using a 0.05 significance level) so there is not enough evidence to say that this increase was not a random occurrence.

There were 26 patients on gliclazide at both time points. The median dose at baseline was 100mg and this was found to increase to 160mg at follow up. The Wilcoxon Signed rank test produced a p-value of 0.009. On average, there was a significant increase in the prescribing dose of Gliclazide to patients that were on the drug at both baseline and follow up.

There were insufficient numbers of patients on other sulphonylureas for statistical analysis. Categorical change in dose for all sulphonlyurea drugs was undertaken. From this, 66% of patients remained on the same dose, 35% experienced an increase in dose and no-one had their dose decreased.

Table 5.2: Change in prescription of metformin

Metformin		**Follow up**		
		Not on drug	**On drug**	**Total**
Baseline	**Not on drug**	62(49%)	22(17)	84
	On drug	3 (2%)	40(32%)	43 (34%)
	Total	65	62 (49%)	127

Missing N: 9 (7%); P-value <0.001

There was a statistically significant increase in the prescribing of Metformin. This was true for the increase in dose and the frequency of prescription.

While there was an increase in the number of patients who required insulin from baseline to follow up, this was not statistically significant.

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Table 5.3: Change in prescription of all diabetes medications

Sulphonylureas, Metformin, Insulin, Triglitazones		Follow up		
		Not on drug	**On drug**	**Total**
Baseline	**Not on drug**	34 (27%)	18 (14%)	52
	On drug	0 (0%)	76 (59%)	76 (59%)
	Total	34	94 (73%)	128

Missing N: 8 (6%); P-value<0.001

The percentage of patients on any diabetic drugs increased from 59% to 73% between baseline and follow up. This change occurred through 14% of patients commencing a drug during this period, while no-one who was on a drug at baseline was taken off it. There was a significant increase in the proportion of patients that were prescribed some form of diabetes medication and could suggest that this was due to improved management from the new service.

Table 5.4: Change in number of diabetes medications

No. pairs	Decreased No drugs	Same No. drugs	Increased No. drugs	P-value
126	5 (4%)	82(65%)	39 (31%)	**0.001**

There was a statistically significant difference between baseline and follow up that the number of diabetes drugs prescribed to patients increased (Table 5.4).

Table 5.5: Change in prescription of ace inhibitors

Ace inhibitors		Follow up		
		Not on drug	**On drug**	**Total**
Baseline	**Not on drug**	69 (54%)	20 (16%)	89
	On drug	2 (2%)	37 (29%)	39 (31%)
	Total	71	57 (45%)	128

Missing N: 8 (6%); P-value<0.001

Table 5.6: Change in prescription of angiotensin receptor antagonists (ARA)

ARA		Follow up		
		Not on drug	**On drug**	**Total**
Baseline	**Not on drug**	114 (90%)	6 (5%)	120
	On drug	0 (0%)	7 (6%)	7 (6%)
	Total	114 (90%)	13 (10%)	127

Missing N: 9 (7%); P-value<0.031

Table 5.7: Change in prescription of all hypertensive drugs

All hypertensive drugs		Follow up		
		Not on drug	On drug	Total
Baseline	Not on drug	34 (27%)	18 (14%)	52
	On drug	0 (0%)	76 (59%)	76 (59%)
	Total	34	94 (73%)	128

Missing N: 8 (6%); P-value<0.001

Table 5.8: Change over time in prescription of statins

All hypertensive drugs		Follow up		
		Not on drug	On drug	Total
Baseline	Not on drug	36 (28%)	32 (25%)	68
	On drug	1 (1%)	59 (46%)	60 (47%)
	Total	37	91 (71%)	128

Missing N: 8 (6%); P-value<0.001

Table 5.9: Change in prescription of aspirin

Aspirin		Follow up		
		Not on drug	On drug	Total
Baseline	Not on drug	60 (47%)	24 (19%)	84
	On drug	2 (2%)	41 (32%)	43 (34%)
	Total	62	65(51%)	127

Missing N: 8 (6%); P-value<0.001

There was statistical significance in the prescribing of all ace inhibitors, angiotensin receptor antagonists, hypertensive drugs, statins and aspirin (Table 5.5; 5.6; 5.7; 5.8; 5.9)

There were no statistically significant results around the prescribing of the triglitazones; diuretics, beta blockers.

Data were analysed to determine if there was a link between the changes in diabetes drug usage to changes in diabetes clinical measurements. Those patients who had experienced an improvement in their HbA1c between baseline and follow up were examined for prescription aspects. There were 61 people in total. There was no significant difference in prescriptions of any drug in relation to improvement of diabetes clinical parameters. Those patients who showed an improvement in clinical measurements also had their dose increased on average and suggests that this led to the improvement.

Data were analysed to determine if there was a link between the changes in hypertension drug usage to changes in hypertension clinical measurements. Changes in prescription of

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all hypertensive drugs had a statistically significant result for both systolic and diastolic blood pressure.

Data were analysed to determine if there was a link between the changes in cholesterol drug use to changes in cholesterol clinical measurements. The change in prescription of statins was statistically significant ($p<0.001$).

Of 127 patients records reviewed, only 5 were referred to an exercise programme as part of their diabetes management.

There was a median of 15.5 visits per patient for GP attendances for non diabetes reasons in the 2 year period (range 10-26.75); median 2 visits per patient for GP diabetes attendances; only one GP emergency diabetes attendance.

Data was collected to determine hospital admissions and clinic attendances (Table 5.10; 5.11). GP attendances were separated between routine GP care and attendances specifically for diabetes care. Hospital attendances were separated between clinic appointments for diabetes and for other clinical situations e.g. cancer.

Table 5.10: GP attendances

	Missing Data	**Frequency of Zero**	**Median**	**IQ Range ***
GP attendances	8 (6%)	0 (0%)	15.5	10-26.75
GP diabetes attendances	10 (7%)	9 (7%)	2	1-4
Emergency GP Diabetes	10 (7%)	122 (97%)	1	1-1
GP: defaulters	9 (6%)	106 (84%)	1	1-1

* for patients with more than one attendance/default

Table 5.11: Hospital attendances

	Missing Data	**Frequency of Zero**	**Median**	**IQ Range ***
Hospital appointments	19 (14%)	82 (70%)	1	1-2
Hospital diabetes clinics	19 (14%)	20 (17%)	3	2-6
Hospital clinic defaulters	17 (13%)	33 (28%)	2	1-2

* for patients with more than one appointment/diabetes clinic default

During the data collecting period, there was one person who had a myocardial infarction; four who had an angina attack and four who had a cerebrovascular accident.

Professionals' Perceptions of Diabetes

There were 112 numbers of professionals within the population. All were sent the PODQ and asked to complete and return it. The response rate was 34% (n=38) and their demographic details are below.

Gender:	Males	9 (24%)
	Females	29 (76%)
Qualification year:	Before 1991	28 (78%)
	1991 – 1995	4 (11%)
	1996 – 2000	4 (11%)
	Unknown	2 (5%)
Profession:	Dietitian	1 (3%)
	District Nurse	4 (11%)
	General Practitioner	14 (37%)
	Podiatrist	5 (13%)
	Practice Manager	2 (5%)
	Practice Nurse	12 (32%)
Diabetic Training:	Bradford Diploma	15 (39%)
	Warwick course	4 (11%)
	Other	5 (13%)

Practice Organisation

When asked who runs the diabetic clinic in your practice the responses were:

GP only	4 (11%)
PN only	5 (13%)
GP and PN	20 (53%)
GP, PN, Podiatrist and Dietitian	8 (23%)

When asked how much time was spent with each client the responses were:

10 mins	2 (6%)
15 mins	1 (3%)
20 mins	7 (21%)
30 mins	24 (71%)

All were asked about their satisfaction with care delivery, their workloads and how these were linked to resources (Tables 6.1 - 6.4).

Table 6.1: Satisfaction with the care delivery system

1 (not at all satisfied)	2	3	4	5 (very satisfied)	p-value
0 (0%)	2 (5%)	3 (8%)	17 (45%)	16 (42%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the proportions are not equal and it appears that in general HCP's are satisfied with the new system of care.

Table 6.2: Workload attributed to diabetic care

1 (too much)	2	3	4	5 (not enough)	p-value
2 (5%)	12 (32%)	20 (54%)	2 (5%)	1 (3%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the proportions are not equal and it appears that in general HCP's do not feel strongly towards either case.

Table 6.3: Workload attributed linked to adequate time and resources

	1 (adequate)	2	3	4	5 (inadequate)
1 (too much)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)
2	0 (0%)	4 (44%)	1 (11%)	3 (33%)	1 (11%)
3	5 (25%)	2 (10%)	5 (25%)	5 (25%)	3 (15%)
4	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
5 (not enough)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)

The horizontal access addresses time and resource issues. The vertical access addresses perceived workload issues. Chi-squared test for linear trend p-value = 0.04 so there is evidence of an association between the HCP's views on the workload attributed to diabetes care and the adequacy of time and resources to treat type 2 diabetes effectively. It appears that two health care professionals' (HCPs) think there is inadequate time and resources to effectively treat patients with type 2 diabetes who also think that too much workload is attributed to diabetes care. No-one indicated that they felt they had adequate time and resources and an adequate workload. The majority (44%) appeared to indicate sufficient time, resources and workload associated with the management of people with diabetes.

Table 6.4: Types of care provided by each practice before and after service redesign

	Practice										
Before	**A**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**
Child	S	S	N	S	S	S	S	S	N	N	S
Teen	S	S	N	S	S	S	S	S	N	S	S
Adult	S	S	N	S	S	S	S	S	S	S	S
Elderly	S	S	N	S	S	S	S	S	S	S	S
After											
Child	S	S	U	S	S	U	S	U	S	N	U
Teen	S	S	U	S	S	S	S	U	S	S	U
Adult	A	S	A	S	A	A	A	S	A	A	A
Elderly	A	A	A	S	A	A	A	S	A	A	A

A = All care, N = No care, S = Shared care, U = Unknown

Clinical Issues

Professionals were asked several questions in relation to a variety of clinical issues. They were first asked to rate the importance of methods of screening for diabetes and results are shown in Table 7.1.

Table 7.1: Importance of methods of screening

			Profession						
	All	**p-value†**	**PM's+**	**GP's+**	**PN's+**	**Pods+**	**Dietitians**	**DN's+**	**p-value‡**
Urine testing		0.54							0.34
1 (not important)	4 (11%)		0 (0%)	1 (7%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)	
2	6 (16%)		0 (0%)	2 (14%)	3 (25%)	1 (20%)	0 (0%)	0 (0%)	
3	10 (27%)		0 (0%)	6 (43%)	1 (8%)	2 (40%)	1 (100%)	0 (0%)	
4	9 (24%)		0 (0%)	3 (21%)	3 (25%)	0 (0%)	0 (0%)	3 (75%)	
5 (very important)	8 (22%)		1 (100%)	2 (14%)	2 (17%)	2 (40%)	0 (0%)	1 (25%)	
Fasting Blood Glucose		**<0.001**							0.55
1 (not important)	2 (5%)		0 (0%)	1 (7%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	1 (3%)		0 (0%)	1 (7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	4 (11%)		1 (50%)	3 (21%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
5 (very important)	30 (81%)		1 (50%)	9 (64%)	12 (100%)	4 (100%)	1 (100%)	3 (75%)	
Random Blood Glucose		**<0.001**							0.65
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	3 (8%)		0 (0%)	3 (21%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	5 (13%)		1 (50%)	2 (14%)	1 (8%)	1 (20%)	0 (0%)	0 (0%)	
4	20 (53%)		1 (50%)	7 (50%)	6 (50%)	3 (60%)	1 (100%)	2 (50%)	
5 (very important)	10 (26%)		0 (0%)	2 (14%)	5 (42%)	1 (20%)	0 (0%)	2 (50%)	
Oral Glucose Tolerance Tests		0.25							0.12
1 (not important)	8 (21%)		0 (0%)	5 (36%)	1 (8%)	0 (0%)	1 (100%)	1 (25%)	
2	3 (8%)		0 (0%)	1 (7%)	0 (0%)	1 (20%)	0 (0%)	1 (25%)	
3	12 (32%)		0 (0%)	6 (43%)	4 (33%)	1 (20%)	0 (0%)	1 (25%)	
4	7 (18%)		2 (100%)	0 (0%)	2 (17%)	2 (40%)	0 (0%)	1 (25%)	
5 (very important)	8 (21%)		0 (0%)	2 (14%)	5 (42%)	1 (20%)	0 (0%)	0 (0%)	
Glucose 2hrs after a Meal		**0.01**							0.60
1 (not important)	6 (17%)		0 (0%)	3 (21%)	2 (18%)	0 (0%)	1 (100%)	0 (0%)	
2	6 (17%)		0 (0%)	4 (29%)	0 (0%)	1 (20%)	0 (0%)	1 (25%)	
3	14 (39%)		0 (0%)	5 (36%)	5 (45%)	3 (60%)	0 (0%)	1 (25%)	
4	9 (25%)		1 (100%)	2 (14%)	3 (27%)	1 (20%)	0 (0%)	2 (50%)	
5 (very important)	1 (3%)		0 (0%)	0 (0%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.
+ PM=Practice Manager; GP= General Practitioner; PN=Practice Nurse; Pods=Podiatrists; DN=District Nurse

There is evidence that the proportions are not equal regarding Fasting Blood Glucose and Random Blood Glucose and it appears that in general the HCP's think these 2 are important. There is also evidence of differences with Glucose 2hrs after a meal but in general the HCP's do not feel strongly either way. There is no evidence of any differences in the distributions of proportions between the profession groups.

When asked regarding the importance of ongoing education and advice, Chi-squared tests for equal proportions show all distributions contain significant differences except for Urinary Glucose Monitoring (Appendix 20). It appears that the HCP's view the ongoing

education and advice of all issues accept this one as important.

Asked about how important they rate the annual undertaking of parameters produced similar results (Appendix 21). Chi-squared tests for equal proportions show all distributions contain significant differences except for Testing Urine for Glucose. It appears that the HCP's view the annual recording of all parameters except this and height as important. However, a significantly greater proportion views height as unimportant.

Similar to this, in general all HCPs viewed all management issues as important (Appendix 22). There is evidence that the distributions for each issue do not contain equal proportions. There is no evidence of any differences in the distributions of proportions between the profession groups.

In considering the importance of referrals to other HCPs, there is evidence that the distributions for each issue do not contain equal proportions and it appears that in general the HCP's view all as important. There is no evidence of any differences in the distributions of proportions between the profession groups (Appendices 23).

When considering the importance of recording findings and results, there is evidence that the distributions for each issue do not contain equal proportions and it appears that in general the HCP's view medical notes and practice diabetes register as important but generally do not hold strong views either way on patient held records. There is no evidence of any differences in the distributions of proportions between the profession groups.

Attitudes to diabetes

Professionals were asked about their attitudes to diabetes in relation to other chronic diseases, their own confidence and linked to training. The results are presented in Tables 8.1 – 8.11 inclusive.

Table 8.1: Treatment of type 2 diabetes compared to other chronic diseases

			Profession						
	All	**p-value†**	**PM's+**	**GP's+**	**PN's+**	**Pod's+**	**Dietitians**	**DN's+**	**p-value‡**
Hypertension		**<0.001**							0.95
1 (type 2 is easier to treat)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
3	6 (17%)		0 (0%)	3 (23%)	2 (17%)	0 (0%)	0 (0%)	1 (25%)	
4	16 (46%)		1 (50%)	6 (46%)	4 (33%)	3 (75%)	0 (0%)	2 (50%)	
5 (type 2 is harder to treat)	12 (34%)		1 (50%)	4 (31%)	5 (42%)	1 (25%)	0 (0%)	1 (25%)	
Hyperlipidaemia		**0.001**							0.74
1 (type 2 is easier to treat)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	2 (6%)		0 (0%)	1 (8%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
3	8 (23%)		0 (0%)	1 (8%)	5 (42%)	1 (25%)	0 (0%)	1 (25%)	
4	12 (34%)		1 (50%)	6 (46%)	1 (8%)	2 (50%)	0 (0%)	2 (50%)	
5 (type 2 is harder to treat)	13 (37%)		1 (50%)	5 (39%)	5 (42%)	1 (25%)	0 (0%)	1 (25%)	
Angina		**0.001**							0.74
1 (type 2 is easier to treat)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	3 (9%)		0 (0%)	2 (15%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
3	15 (44%)		0 (0%)	6 (46%)	5 (42%)	3 (75%)	0 (0%)	1 (33%)	
4	7 (21%)		1 (50%)	3 (23%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)	
5 (type 2 is harder to treat)	9 (27%)		1 (50%)	2 (15%)	3 (25%)	1 (25%)	0 (0%)	2 (67%)	
Heart Failure		0.14							0.55
1 (type 2 is easier to treat)	3 (9%)		0 (0%)	3 (23%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	6 (18%)		0 (0%)	3 (23%)	2 (17%)	1 (25%)	0 (0%)	0 (0%)	
3	12 (35%)		0 (0%)	3 (23%)	6 (50%)	2 (50%)	0 (0%)	1 (33%)	
4	5 (15%)		1 (50%)	2 (15%)	2 (17%)	0 (0%)	0 (0%)	0 (0%)	
5 (type 2 is harder to treat)	8 (24%)		1 (50%)	2 (15%)	2 (17%)	1 (25%)	0 (0%)	2 (67%)	
Arthritis		**0.001**							0.12
1 (type 2 is easier to treat)	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	4 (12%)		0 (0%)	3 (23%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
3	16 (47%)		0 (0%)	6 (46%)	8 (67%)	1 (25%)	0 (0%)	1 (33%)	
4	6 (18%)		1 (50%)	2 (15%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)	
5 (type 2 is harder to treat)	7 (21%)		1 (50%)	1 (8%)	0 (0%)	3 (75%)	0 (0%)	2 (67%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.
+ PM=Practice Manager; GP= General Practitioner; PN=Practice Nurse; Pods=Podiatrists; DN=District Nurse

There is evidence that the distributions for each disease except heart failure do not contain equal proportions and it appears that in general the HCP's view type 2 diabetes as harder to treat. There is no evidence of any differences in the distributions of proportions between the profession groups.

Table 8.2: Severity of type 2 diabetes by treatment

			Profession						
	All	**p-value†**	**PM's +**	**GP's+**	**PN's+**	**Pod's+**	**Dietitians**	**DN's+**	**p-value‡**
Diet Alone		**<0.001**							0.86
1 (not at all serious)	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	2 (6%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	
3	9 (26%)		0 (0%)	4 (31%)	4 (33%)	1 (25%)	0 (0%)	0 (0%)	
4	10 (29%)		0 (0%)	4 (31%)	2 (17%)	2 (50%)	0 (0%)	2 (50%)	
5 (very serious)	13 (37%)		1 (100%)	3 (23%)	6 (50%)	1 (25%)	1 (100%)	1 (25%)	
Tablets		**<0.001**							0.68
1 (not at all serious)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	5 (14%)		0 (0%)	3 (23%)	1 (8%)	0 (0%)	0 (0%)	1 (25%)	
4	15 (43%)		0 (0%)	7 (54%)	4 (33%)	2 (50%)	0 (0%)	2 (50%)	
5 (very serious)	15 (43%)		1 (100%)	3 (23%)	7 (58%)	2 (50%)	1 (100%)	1 (25%)	
Insulin		**<0.001**							0.53
1 (not at all serious)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	8 (23%)		0 (0%)	2 (15%)	2 (17%)	1 (25%)	0 (0%)	3 (75%)	
5 (very serious)	26 (74%)		1 (100%)	10 (77%)	10 (83%)	3 (75%)	1 (100%)	1 (25%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.
+ PM=Practice Manager; GP= General Practitioner; PN=Practice Nurse; Pods=Podiatrists; DN=District Nurse

There is evidence that the distributions for each treatment method do not contain equal proportions and it appears that in general the HCP's view all treatment methods as serious. There is no evidence of any differences in the distributions of proportions between the profession groups.

Table 8.3: Confidence in management of type 2 diabetes

1 (very confident)	**2**	**3**	**4**	**5 (not confident)**	**p-value**
8 (24%)	10 (29%)	8 (24%)	7 (21%)	1 (3%)	0.14

Chi-squared test for equal proportions used. There is no evidence that the proportions are not equal. HCP's appear not to feel strongly in either direction.

Table 8.4: Confidence in management of type 2 diabetes linked to training

	1 (enough training)	**2**	**3**	**4**	**5 (not enough training)**
1 (very confident)	4 (50%)	3 (38%)	1 (13%)	0 (0%)	0 (0%)
2	0 (0%)	4 (40%)	3 (30%)	3 (30%)	0 (0%)
3	0 (0%)	3 (38%)	2 (25%)	3 (38%)	0 (0%)
4	1 (14%)	2 (29%)	0 (0%)	4 (57%)	0 (0%)
5 (not confident)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)

Chi-squared test for linear trend p-value = 0.004 so there is evidence of an association between the HCP's views on their training and their confidence in management of type 2 diabetes. It appears that HCP's that feel they have enough training also feel confident in management of the disease.

Table 8.5: Confidence that own therapeutic actions/ advice result in improved outcomes

1 (strongly agree)	2	3	4	5 (strongly disagree)	p-value
8 (24%)	11 (32%)	8 (24%)	6 (18%)	1 (3%)	0.09

Chi-squared test for equal proportions used. There is no evidence that the proportions are not equal. HCP's appear not to feel very strongly about this although they tend to agree more than disagree.

Table 8.6: Confidence in therapeutic actions/ advice linked to training

	1 (enough training)	2	3	4	5 (not enough training)
1 (very confident)	3 (38%)	3 (38%)	2 (25%)	0 (0%)	0 (0%)
2	1 (9%)	6 (55%)	1 (9%)	3 (27%)	0 (0%)
3	0 (0%)	3 (38%)	2 (25%)	2 (25%)	1 (13%)
4	1 (17%)	0 (0%)	1 (17%)	4 (67%)	0 (0%)
5 (not confident)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)

Chi-squared test for linear trend p-value = 0.004 so there is evidence of an association between the HCP's views on their training and their confidence that their actions/advice result in improved outcomes. It appears that HCP's that feel they have enough training also feel confident in their actions/ advice.

Table 8.7: Training capacity

			Profession						
	All	p-value†	PM's+	GP's+	PN's+	Pod's+	Dietitians	DN's+	p-value‡
1 (enough training)	5 (15%)	**0.03**	1 (100%)	2 (18%)	1 (8%)	1 (20%)	0 (0%)	0 (0%)	0.65
2	12 (35%)		0 (0%)	5 (46%)	5 (42%)	0 (0%)	1 (100%)	1 (25%)	
3	6 (18%)		0 (0%)	2 (18%)	2 (17%)	1 (20%)	0 (0%)	1 (25%)	
4	10 (29%)		0 (0%)	1 (9%)	4 (33%)	3 (60%)	0 (0%)	2 (50%)	
5 (not enough training)	1 (3%)		0 (0%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.
+ PM=Practice Manager; GP= General Practitioner; PN=Practice Nurse; Pods=Podiatrists; DN=District Nurse

There is evidence that the proportions are not equal and that in general HCP's do not feel strongly either way regarding their training. There is no evidence of any differences in the distributions of proportions between the profession groups.

Table 8.8: Adequacy of time and resources to effectively treat people with type 2 diabetes

1 (adequate)	2	3	4	5 (inadequate)	p-value
6 (18%)	7 (21%)	6 (18%)	8 (24%)	7 (21%)	0.98

Chi-squared test for equal proportions used. There is no evidence that the proportions are not equal. HCP's appear not to feel strongly in either direction.

Table 8.9: Diabetic care requires a team approach

1 (strongly agree)	2	3	4	5 (strongly disagree)	p-value
23 (68%)	4 (12%)	1 (3%)	1 (3%)	5 (15%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the proportions are not equal. HCP's appear to feel strongly that a team approach is required but 5 HCP's have strongly disagreed with the idea.

Table 8.10: Patient centred care can improve adherence to recommended healthcare of type 2 diabetic patients

1 (strongly agree)	2	3	4	5 (strongly disagree)	p-value
16 (46%)	7 (20%)	6 (17%)	3 (9%)	3 (9%)	**0.003**

Chi-squared test for equal proportions used. There is evidence that the proportions are not equal. HCP's appear to feel strongly that patient centred care can improve adherence.

Table 8.11: Patient centred care views linked to importance of recording results from patient held records

	1 (does improve)	2	3	4	5 (does not improve)
1 (not important)	1 (7%)	1 (7%)	7 (47%)	3 (20%)	3 (20%)
2	0 (0%)	0 (0%)	4 (57%)	0 (0%)	3 (43%)
3	0 (0%)	2 (33%)	2 (33%)	1 (17%)	1 (17%)
4	0 (0%)	1 (33%)	1 (33%)	1 (33%)	0 (0%)
5 (very important)	0 (0%)	0 (0%)	0 (0%)	2 (67%)	1 (33%)

Chi-squared test for linear trend p-value = 0.63 so there is no evidence of an association between the HCP's views on the importance of patient held records and on the usefulness of patient centred care.

Use of clinical guidelines

As clinical guidelines in diabetes were among the first to be developed, professionals were asked about their use. Results are presented in Tables 9.1- 9.4 inclusive.

Table 9.1: Level of organisational support from practice towards use of guidelines

1 (very little)	2	3	4	5 (very high support)	p-value
1 (3%)	1 (3%)	8 (23%)	4 (43%)	10 (29%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the proportions are not equal and it appears that in general HCP's rate the level of support as high.

Table 9.2: Clinical guidelines affect the degree to which consultations are patient centred

			Profession						
	All	**p-value†**	**PM's+**	**GP's+**	**PN's+**	**Pod's+**	**Dietitians**	**DN's+**	**p-value‡**
1 (strongly agree)	3 (9%)	**0.002**	1 (50%)	0 (0%)	1 (8%)	0 (0%)	0 (0%)	1 (33%)	0.14
2	7 (21%)		0 (0%)	3 (25%)	3 (25%)	1 (20%)	0 (0%)	0 (0%)	
3	14 (44%)		1 (50%)	9 (75%)	3 (25%)	2 (40%)	0 (0%)	0 (0%)	
4	8 (24%)		0 (0%)	0 (0%)	4 (33%)	2 (40%)	0 (0%)	2 (67%)	
5 (strongly disagree)	1 (3%)		0 (0%)	0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.
+ PM=Practice Manager; GP= General Practitioner; PN=Practice Nurse; Pods=Podiatrists; DN=District Nurse

There is evidence that the distribution does not contain equal proportions and it appears that in general the HCP's generally do not agree or disagree strongly with the statement. There is no evidence of any differences in the distributions of proportions between the profession groups.

Table 9.3: Benefits of clinical guidelines

	1 (not a benefit)	**2**	**3**	**4**	**5 (very much a benefit)**	**p-value**
Keeps you up to date with research findings	0 (0%)	0 (0%)	4 (12%)	17 (50%)	13 (38%)	**<0.001**
Access to research findings	0 (0%)	1 (3%)	10 (29%)	14 (40%)	10 (29%)	**<0.001**
Saves time reading research papers	1 (3%)	4 (11%)	7 (20%)	16 (46%)	7 (20%)	**0.001**
Shows how to apply research in practice	1 (3%)	0 (0%)	11 (31%)	15 (43%)	8 (23%)	**<0.001**
Aid to clinical decision making	0 (0%)	0 (0%)	6 (17%)	18 (51%)	11 (31%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the distributions for each benefit do not contain equal proportions and it appears that in general HCP's rate all issues as beneficial.

Table 9.4: Barriers to clinical guidelines

	1 (not a barrier)	2	3	4	5 (very much a barrier)	p-value
No time to read	7 (20%)	1 (3%)	3 (9%)	16 (46%)	8 (23%)	**0.001**
Relevant literature not accessible	6 (17%)	5 (14%)	17 (49%)	6 (17%)	1 (3%)	**<0.001**
Lack of time to implement new ideas on the job	3 (9%)	0 (0%)	16 (46%)	10 (29%)	6 (17%)	**<0.001**
Facilities are inadequate for implementation	3 (9%)	8 (23%)	14 (40%)	8 (23%)	2 (6%)	**0.01**
Organisation will not cooperate with implementation	7 (20%)	10 (29%)	9 (26%)	6 (17%)	3 (9%)	0.37
Ability to evaluate quality of research	5 (14%)	3 (9%)	13 (37%)	7 (20%)	7 (20%)	0.09
Little understanding of statistics	4 (11%)	4 (11%)	14 (40%)	6 (17%)	7 (20%)	**0.046**
Adverse effect on relationship with patient	5 (14%)	8 (23%)	19 (54%)	2 (6%)	1 (3%)	**<0.001**

Chi-squared test for equal proportions used. There is evidence that the distributions for all barriers except two do not contain equal proportions. It appears that in general HCP's feel that a lack of reading time is the greatest barrier to using clinical guidelines.

Discussion

Health care systems and processes of care

Within this LHCC the population of people with diabetes is fully identified through use of computerised record systems, predominantly the GPASS system, through which annual recall for patient review is achieved. For the small number of practices without the GPASS system, annual review is achieved through use of VISION, previous clinic sheets, and box file records.

The number of patients registered with type 2 diabetes in this LHCC increased by 120 people within the study period, from 1402 at baseline, to 1522 by the end of the study. This equates to an increase in identified prevalence of the condition of 0.2%: 2.2% at baseline and 2.4% in the follow up (Table 1.1).

At the start of the study the majority of practices had begun to implement level 3 care, and by the end all practices were delivering this level of service. Patients' experiences of this change in service were explored through focus group discussions and their perceptions are presented in the focus group section of this report. One of the requirements of level 3 care is staff attendance at accredited diabetic training which has

been met by all practices. Hence each practice has a named lead GP and Practice Nurse for diabetes care.

Study Sample

Forty one percent (n=576) of the population of people with type 2 diabetes were invited to participate in the study through the sampling strategy described in the methodology section, of which 140 agreed to participate (10% of the population). In hindsight had a larger number been invited then a larger and more representative study sample may have been obtained. However due to time constraints and the necessity to get the study underway reminder letters were sent to all non respondents but further recruiting was not undertaken.

Although there is no significant difference in the mean age of the sample group and the population (65.4yrs and 63.8yrs respectively), there are significant differences in the breakdown of age categories with a higher representation of 65-74 year olds in the sample group and a smaller representation of under 64 year olds and over 75 year olds. This may be due in part to work commitments of under 64 year olds and age restrictions of over 75 year olds restricting ability or willingness to participate in the study.

Again, a significant difference is noted in the deprivation categories of the sample and population groups with a higher percentage of deprivation categories 1 to 5 represented in the sample, and a smaller representation of deprivation categories 6 and 7 (Table 2.1).

The percentage of patients from an Asian ethnic background in the population is 18% whereas that in the sample is 6%. This is in spite of stratified sampling to ensure representation of this client group, and may be partially due to language barriers especially in the older age group.
Due to the differences in age category, deprivation category and ethnic origin the sample is not fully representative of the population.

Patient questionnaires

Results from the SF-36 questionnaire which measures general health and well being, and the PAID questionnaire which is a diabetes-specific measurement of distress show no difference in these measures for the whole sample group between baseline and follow up (Table 3.1). The only exception to this is in the score for bodily pain where a mean difference of –6.44 is noted (in the scale of 0-100). Respondents were encouraged to add any of their own comments to these questionnaires which many did, and frequent reference was made to musculoskeletal conditions such as arthritis and joint replacements as the cause of bodily pain.

The median PAID score at baseline and follow up remained stable at 13 (Table 3.2). The score generated by PAID is on a scale from 0-100, with 100 representing a high level of distress and 0 representing a low level of distress caused by living with diabetes. Therefore it would appear that within the sample there is a good level of coping with the

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condition.

Appendices 1 and 2 break down questionnaire responses for females and males. The only statistically significant difference is a slight worsening in the measurement of mental health for males (mean difference in score = -4.23)

Appendices 3-6 break down responses as per age categories of respondents. Statistically significant differences are highlighted in bold. For the under 55 year old age group significant worsening is seen in Role limitation physical, Social function and General Health.

No significant difference in scores was found in the 55-64 year old age group, while the only significant difference in the 65-74 yr olds was in the measurement of the PAID score with a mean increase in score of 2.56 points.

PAID scores from patients in the less than 74 year age group show significant worsening in Physical function; Role limitation physical; Energy/Vitality and Bodily pain. Again this may be due in part to co-morbidity factors such as musculoskeletal conditions. The PAID score for this group also shows a mean increase of 4.51 points.

Appendices 7-9 break down questionnaire results for deprivation categories 1&2, 3-5 and 6&7. No statistically significant differences are noted for respondents from deprivation categories 3 to 7. For respondents from deprivation categories 1&2 significant worsening is noted in Physical function; Role limitation physical; Energy/Vitality and Bodily pain.

Patients' clinical data

This section refers to Tables 4.1-4.3 and Appendices 10- 19. Baseline and follow up clinical data was obtained retrospectively from computer and manual records. Baseline data was taken from the nearest record to January 2002, and follow up data from the nearest record to December 2003.

Statistically significant improvements for the entire sample were found in levels of random blood glucose, cholesterol, HDL, systolic blood pressure and diastolic blood pressure.

Table 4.2 outlines other clinical results. As can be seen in the table there is a significant improvement in smoking status and levels of physical activity for the sample group as a whole. There is also a significant worsening in the presence of the right pedal pulse. There were no statistically significant findings in referral to smoking cessation clinics or exercise classes. There were no prescriptions given for nicotine replacement therapy (NRT). It is acknowledged however that concomitantly with this study, there was a local initiative through pharmacies to provide NRT free for 3 months. This did not result in any ongoing prescriptions beyond that time.

In the breakdown of results for females it can be seen that although random blood

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glucose, cholesterol, HDL, and diastolic blood pressure significantly improved, there is no significant change in systolic blood pressure or quality of life issues (Appendix 11). Systolic blood pressure remains borderline at both time points: 141.92mmHg at baseline and 139.02mmHg at follow up.

Statistically significant paired clinical results for males does not include absence of right pedal pulse (Appendix 12) although 10% of pairs show absence of same at follow up.

For those in the <55 yr age group the statistically significant improvements were seen in random blood glucose levels, total cholesterol and smoking status (Appendix 13). Appendix 14 shows results for the 55-64 yr age group – statistically significant improvement is seen in HDL levels, and Body mass Index sees a statistically significant worsening from a mean of 30.5 to a mean of 31.6.

In the 65-74 age group the statistically significant improvements were seen in random blood glucose, total cholesterol, HDL and diastolic blood pressure (Appendix 15) whereas in the >75 age group the only statistically significant differences were improvements in total cholesterol and in systolic blood pressure (Appendix 16).

Appendix 17 shows that the only statistically significant differences for those in deprivation categories 1 & 2 are improvements in random blood glucose, total cholesterol and HDL. This is also true for those in deprivation categories 3 to 5 (Appendix 18). However results for deprivation categories 6&7 also show a statistically significant improvement in HbA1c levels (mean of 8.58 at baseline and 7.74 at follow up), and also in random blood glucose, total cholesterol and smoking status (Appendix 19).

Table 4.3 shows the percentages of results which were within the range of recommended guidelines at baseline and at follow up. It can be seen that there is a statistically significant improvement in the results for total cholesterol and blood pressure in line with recommended guidelines.

Medication prescriptions

While certain clinical parameters had improved, others showed statistical significance. On interrogating the data to determine if there had been increased prescriptions of new drugs or increased prescription of current dosages, several area were identified (Tables 5.1-5.9).

There was a significant increase in the prescribing dose of Gliclazide to patients that were on the drug at both baseline and follow up. There was a statistically significant increase in the prescribing of Metformin. This was true for the increase in dose and the frequency of prescription.

While there was an increase in the number of patients who required insulin from baseline to follow up, this was not statistically significant.

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There was a significant increase in the proportion of patients that were prescribed some form of diabetes medication and could suggest that this was due to improved management from the new service. There was a statistically significant difference between baseline and follow up of the number of diabetes drugs prescribed to patients.

There was statistical significance in the prescribing of all ace inhibitors, angiotensin receptor antagonists, hypertensive drugs, statins and aspirin. When linked to clinical parameters, prescriptions to address hypertension and cholesterol were the only statistically significant results. Hence, the prescription of drugs is improving clinical parameters around hypertension and the treatment of cholesterol. While diabetes related drugs have shown increased usage, there is no causal link between this and the improved HbA1c results noted.

It must be noted however that although there was an improvement of HbA1c, there was no increase of BMI. Normally, when a person improves their glycaemic control, this is at the expense of their weight gaining. While not statistically significant, there may be benefit in a less aggressive approach to improvement of glycaemic control if it maintains body weight.

Health care professionals perceptions

Statistical analysis of the healthcare professionals' questionnaire highlighted a number of strong perceptions (Table 7.1, Appendices 20-24). Overall the responses show a high level of satisfaction with the new system of care delivery for patients with Type 2 diabetes. A patient centred, and team approach is perceived as very important, as well as tight management in terms of annual monitoring and advice. The management of diabetes is perceived as harder than some other chronic conditions, and diabetes-specific training is valued for increasing confidence in the management of it. Referral to other professionals is valued as important also.

Conclusions

The introduction of community based care for people with type 2 diabetes within this LHCC is not compromising individuals' health status or care management. Indeed significant improvements are noted in key clinical indices including blood pressure and cholesterol levels. Patients' general health status and coping with diabetes remain largely unchanged.

Medications were prescribed to address clinical issues of diabetes, hypertension, and cholesterol. Links were demonstrated between improvements in blood pressure and cholesterol levels and increased prescribing of appropriate medications.

Health care professionals perceive type 2 diabetes to be a serious condition and value the importance of tight clinical management. Diabetes-specific training was valued, and there is overall a high level of satisfaction among health care professionals with the new system of care. Patients' perspectives of the new service are discussed below.

Focus group Study: Perceptions of service users

Aim

To explore the perceptions and experiences of adults with type 2 diabetes of a restructuring of their diabetes service from secondary to primary care and of living with diabetes.

Methodology

Patients were selected from GP practices and focus groups were held per practice. The focus group discussions were conducted in two phases – five in the autumn of 2003 with participants (n= 23) from five GP practices who were in the early stages of implementing the new diabetes service, and a further three in the autumn of 2004 with participants (n=12) from three GP practices who had been providing the new service for the longest time (approximately two years). The sample was sent an invitation letter and this was followed up a week later with a telephone call from one of the researchers to acquire consent and answer any questions.

Concurrent data collection and thematic analysis was conducted by 3 researchers for credibility and reliability. The study used a phenomenological approach, and interpretivism was used to analyse the qualitative data generated by the focus groups. Each discussion lasted for between 60 and 90 minutes and was moderated by a lead researcher. A topic guide was used as a prompt to encourage discussion and flexibility was also employed to let participants direct the conversation to matters that interested and concerned them. Further areas for exploration were thereby identified for subsequent groups. A research assistant was present along with the lead researcher to help with logistical matters and take field notes.

Sample

The sample was acquired from the Greater Shawlands LHCC which consisted of 14 GP practices. It is recommended that a sample for qualitative research is not pre-specified in strict terms lest important data sources be overlooked and so purposive sampling is often used. The aim of this study was to explore service users' perceptions and experiences so a range of participants was sought to represent different ages, genders and ethnic backgrounds in order to explore a range of perspectives. With this in mind people were selected to meet identified criteria from GP's diabetes registers. Inclusion criteria were adults with type 2 diabetes for at least 2 years. Exclusion criteria were people who had type 1 diabetes or who were younger than 18 years. Fourteen people were selected from each register and in total, 35 people consented to take part in the focus group study.

Analysis

Tape recordings of each focus group were transcribed verbatim, and the transcripts, along with the tapes and field notes, formed the findings.

The data was analysed both during and after collection. The topic guide served as an aid to analysis. Thematic analysis was used whereby sections of transcripts which related to the areas of topic under study were pulled together, and thereafter separated into sections and categories. Analysis of the content of the first three focus groups indicated that saturation, which is the point at which further observations yield no new information, had not been reached. Therefore a further 2 groups were planned and conducted in this initial phase and saturation reached. In the second phase of the study saturation was achieved early after 2 focus groups but a 3rd was conducted for confirmation.

The 5 earlier focus groups were analysed in depth together and thereafter the 3 latter groups. It became clear that there was no new material in the latter groups and hence the findings are presented together.

Investigator triangulation was used to validate findings. Member checking was also employed to validate findings and to improve the rigour of the research. All participants were given a written summary of the findings and were invited to attend a feedback session where findings were presented. Participants were encouraged to make comments and were provided with a response sheet to make anonymous written comments if they so wished. This process proved useful in clarifying and confirming the findings.

Results

Six major themes emerged from the analysis: Impact of organisational change, Location and process of care, Perceptions of care, Living with diabetes, Motivation to participate in care and Education and information.

Impact of organisational change

Various attitudes towards the change in service became evident, such as acceptance, cautious expectation, and also a positive outlook:

> *"As long as you are still getting the same service, I don't see why it should bother anybody."*

> *" …it is important to know that you have other options if you are not happy. But I've always found the practice to be very good so I would certainly come along and see what happens."*

The view was expressed that the driver for change was service improvement, and familiarity with healthcare staff was appreciated:

> *"I was told it was to provide a better service."*

> *"…you know your own nurse and you know the doctor, and they give you a better chance…"*

It was also perceived by some that the reasons for the change in service may be financial:

> *"… is this part of the larger Glasgow plan to reduce the number of hospitals and so on?"*

Location and Process of Care

For both models of care participants discussed factors that contributed to levels of convenience and comfort such as location, numbers of other people at clinics, and waiting times involved at appointments.

The new service was welcomed for its convenience, with smaller numbers of other people present at the clinics and with more time available to spend in consultation.

> *"..it's obviously far more convenient…you don't have the numbers that you have at the hospital. Here…it just runs through."*
> *"When you went to the hospital…you sat in a waiting room. And you went back and forward and back and forward. You're talking a full morning or afternoon."*

Perceptions of care

Within the new model participants felt more relaxed with healthcare staff. They felt able to ask questions and discuss concerns, and were confident of referral to specialists if it is necessary:

> *"..it's faces that you know and I feel quite relaxed and I feel I can ask her things and she's very nice."*

> *"They know me. It's on a more personal basis."*

> *"I know they can refer me to the hospital if they're not sure about something."*

In contrast some found the hospital setting intimidating, and felt rushed and unable to ask questions:

> *"I think when you go to the hospital, it's just a face, with a name. … they are only interested in one thing, and that's what you've got, whether it's diabetes or it's something else, then that's what they stick to. …a lot of people are frightened to go to the hospital, and would rather go to their own GP."*

However, the hospital service was perceived as specialised, up to date and reassuring:

> *'I found the hospital very good…because they gave me a great deal of information and a lot of support to begin with at the annual checks… they are pretty up to date."*

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"I felt I was being very carefully looked after."

Concerns were raised by some participants about the accessibility of expertise and information in the general setting:

" Just one concern I have was that…you feel that the hospital is a centre of expertise and you kind of worry a wee bit…"

These concerns were balanced with the view that primary healthcare professionals had undergone further educational diabetes training in order to provide the new service:

"..they are pretty well informed…out in the community."

"I would ask the nurse, cause I know now she's up in it, very well qualified to talk about it."

Concerns also touched upon specific aspects of service provision that people valued in the old model and did not wish to lose such as annual check, and provision of a feedback letter with test results:

" … if you're moving it from a centre and you're offering what is perceived to be a better service, in your own practice, then you'll be looking for something more … more frequently rather than annually."

"… you got a letter back from the hospital telling all of your results. You don't get that from the (GP)."

Living with Diabetes

Participants expressed awareness of the seriousness of diabetes and discussed the impact of being diagnosed with the condition:

"...my initial reaction was 'why me'."

"You automatically get a shock, and you immediately think about needles and insulin.."

The impact of diabetes on their lifestyle was discussed:

"We have to face it...we have no other option. ...It's a big thing."
"It dawns on you after quite a short time that you've got this for the rest of your life. ... You've got to do something about it."

When asked what they perceived to be the worst part of living with diabetes some participants answered:

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"The initial realisation, getting hit with it, and taking it all in and having to change your lifestyle and the eating habits and all the rest of it."

Motivation to Participate in Care

Participants emphasised the central role of "self" in managing the condition:

"...yourself is the person that should be controlling it...it lies with you, how you're diabetes goes."

"You have to be proactive."

"I think the bottom line must be as an individual, you must look after yourself."

They also discussed the need for support from others in the form of understanding and information:

"..with advice, help and support you adjust to it."

"If you are wanting to work in partnership with your doctor and control your own condition…then you want more up to date information."

Education and Information

Formal education sessions which were provided under the hospital model of care were valued highly although due to the timing of meetings were not accessible to people working office hours. Education sessions in the new service had not been fully established but were considered to be desirable, especially for people newly diagnosed, and with a peer support slant:

"I think you've got to have something. I think newly diagnosed people obviously do require a fair degree of material upfront."

"..we gain a lot from each other when we talk to each other." A clear point of contact in the new service for information and expertise was also desired.

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Discussion of completed project

The whole project aimed to evaluate the impact of the Glasgow Diabetes Project on healthcare for people with type 2 diabetes. There were 3 primary objectives and 5 secondary objectives that will be addressed in the discussion. These are presented on page 5.

Each of the practices (n=14) had an electronic system for identifying people with diabetes. Most practice sued GPASS although a few used VISION. These IT systems identify when period reviews are required and maintain a record of medications prescribed and clinical management.

People still had contact with health care professionals in both primary and secondary care (Tables 5.10; 5.11). The goal of the project was that people with stable type 2 diabetes would be managed solely within primary care and only referred to secondary care for specialist input. There was evidence that the change process was still ongoing. This may not be unexpected in a transition period. This appeared to look, from the case notes, to be ongoing care that was already established as opposed to new referrals to secondary care.

HbA1c improved but not statistically significant however the random blood glucose improved statistically significantly (Table 4.1). The overall improvement in diabetes control, while not statistically significant was not at the expense of weight gain which is the normal expected result. Hence, the improvement is clinically beneficial for patient care.

There was a significant increase in the prescribing of Gliclazide and Metformin. While there are newer hyperglyaecemic agents it is interesting to note that the well established medications were the drugs of choice. The history of metformin has changed over the years and it is good to see its increased usefulness. Current guidelines indicate that it should be the first point of management in people with type 2 diabetes. However its benefits are greater than for the newly diagnosed and this is evidenced here. We cannot make an inference between this prescribing and improvement in HbA1c.

There was a statistically significant improvement in the blood pressure and cholesterol levels with a number achieving target levels (Table 4.3, 4.7). The related factor may be the statistically significant increase in the prescribing of all ace inhibitors, angiotensin receptor antagonists, hypertensive drugs, statins and aspirin (Tables 5.5; 5.6;5.7; 5.8; 5.9).

There was a statistically significant improvement in the number of people who stopped smoking during this time (Table 4.2). This significance was seen in the male population under the age of 55 years. It was discovered towards the end of the project that during this data collection period The Starting Fresh Pharmacy Project took over the prescribing of Nicotine Replacement Therapy free with the maximum duration of the course being 12 weeks. During this time, the LHCC employed a smoking cessation co-ordinator who ran clinics in several locations. It is unknown if people took up this offer. However, it could

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be assumed that if someone commenced nicotine replacement therapy and found it beneficial, they would ask their GP for a prescription for continuation. It is noted that there were no prescriptions for nicotine replacement therapy for any patients in this study or any record of health care interventions/advice to promote smoking cessation.

There was a statistically significant improvement in the number of people who improved their exercise levels during this time. Only a few people were referred to an exercise referral scheme (page 18) and hence there is no cause and effect evident. The few referrals made for exercise were from the one practice.

Patients' appreciated the new service because of its convenience and patient centered focus. They had confidence in the health care team for referral to specialist services if needed. There were very few default rates from both primary and secondary care although rates were higher at the hospital clinic (Tables 5.10; 5.11).

Patients' general health did deteriorate but due to other conditions, not diabetes. In the whole study population, although there was a trend for general lower health status this was only significant in relation to bodily pain (Table 3.1) People indicated that this was due to other concomitant chronic illnesses. Men had a significant deterioration in their mental health score. Women, across all ages, remained the same in all the domains of health (Appendices 1, 2). There was no statistically significant reduction in reported deterioration in health status for patients in the highest area of economic deprivation (Appendix 9). There were statistically significant deteriorations in those people from the most affluent areas (Appendix 7). It is noted that those in deprivation category areas 6 and 7 had lower baseline health scores compared to those in deprivation categories 1 and 2 however, those in deprivation categories areas 6 and 7 did not deteriorate.

On subgroup analysis there was statistically significant deterioration in several health domains for the under 55 year olds and the over 74 year olds regardless of gender. This may reflect the challenges facing the normally economically active population and the health issues associated with ageing.

Patients' attitudes to coping with diabetes stayed the same no matter where their care was delivered. They expressed concern that their annual review would be extended beyond a year due to increasing number of people with diabetes. Patients stated that they would like more education about self management of diabetes. Some patients had experience of a 6 week programme offered from secondary care for people newly diagnosed and referred to secondary care. The need for education and information to be available was seen as being particularly strong at diagnosis, but also ongoing, and a clear point of contact for such was sought. They highly valued access to up to date information and expertise to enable them to manage their own condition. Patients also requested that they be given a written record of their results so that they could compare these with previous years.

Overall the participants who took part in this focus group study appreciated the change in

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service delivery. Their local GP surgery was more geographically convenient and they felt that they were 'known' by the staff in the GP surgery where they also received holistic care. This was in contrast to the hospital where they felt that they were seen only for their diabetes and that time constraints worked against building up relationships with the healthcare professionals. Some concerns were aired around the generalist versus specialist debate. In discussion, it was acknowledged that the primary care professionals had undergone additional educational preparation and hence they had confidence in the referral system should individual people require this.

As people volunteered to take part in focus groups, it is not surprising that they all had a very strong internal locus of control about their diabetes. All stated that they personally were primarily responsible for their diabetes management and that it was not health care professionals who were responsible.

Interestingly no new findings were found between patients perceptions in the early stages of the new service and also 2 years on. This may indicate that patients are satisfied with the new delivery of service, albeit they may have had minimal contact due to the annual nature of the clinics. Alternatively, from above, it appears to be that the service is still undergoing change in practice and people, in addition to being seen in secondary care, are also being seen in primary care and so could be seeing health care professionals more frequently.

The professionals' perceptions questionnaire showed a high level of satisfaction with the new service. In general, professionals view type 2 diabetes harder to treat when compared with people who have hypertension, hyperlipidaemia, angina, or arthritis.

Conclusion

In conclusion this study demonstrates that for these people, the change in service delivery is welcomed provided patient requests for education and a record of their results are put in place and an annual review maintained. In addition it is evident that the new model of care is beneficial with significant improvements in a range of clinical indices of good diabetes management. However, because patients were still being seen by both systems of care it is difficult to differentiate the impact of each separate service.

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Recommendations for practice

1. Patient education programmes are initiated for the newly diagnosed in the first instance in primary care.

2. Ongoing patient education in primary care is made available.

3. Patients are given a record of their key clinical parameters at each visit and encouraged to meet targets

4. An annual review of clinical parameters is maintained.

5. That there is a more proactive approach to discharging patients from secondary care.

6. Advice about smoking cessation or referral to specialist services should be recorded in clinical notes.

7. Good management was observed within GP practices and efforts to sustain and develop this activity should be supported.

8. The project should be re-evaluated in 5 years time to ensure that the transition period has been completed and that there is no duplication of service delivery.

Dissemination

Findings have been disseminated through various means throughout the course of the study including poster presentations and concurrent sessions at conferences. The focus group findings were presented at a concurrent session at the Caring for Glasgow Nursing Conference in May 2004. Findings of the clinical data study were also presented at a concurrent session at the Annual International Nursing Research conference in Belfast in March 2005. At this same conference a poster presentation was made of the focus group study also. In April 2005, a presentation of the clinical data was made in the Division of Nursing and Midwifery, University of Glasgow, and in May 2005 to the Greater Shawlands LHCC. Articles are in the process of being written for publication that are at various stages of acceptance by journals.

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Paired results for females: Appendix 1

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	36	73 (46 - 80)	63 (46 - 80)	-4.72	0.25	-12.83 to 3.39
Role Limitation Physical	36	50 (0 - 100)	25 (0 - 100)	-9.03	0.24	-24.31 to 6.26
Role Limitation Mental	36	67 (25 - 100)	100 (0 - 100)	-3.69	0.60	17.80 to 10.41
Social Function	36	78 (56 - 100)	78 (56 - 100)	-3.08	0.48	-11.87 to 5.71
Mental Health	36	66.11 (22.54)	67.67 (21.69)	1.56	0.46	-2.65 to 5.77
Energy / Vitality	36	47.50 (24.86)	47.36 (21.76)	-0.14	0.97	-7.10 to 6.83
Bodily Pain	36	67.33 (25.71)	59.00 (29.01)	-8.33	0.08	-17.60 to 0.94
General Health	36	53.36 (26.44)	52.58 (22.43)	-0.78	0.80	-7.05 to 5.50
PAID	38	13 (5 – 27)	13 (6 - 27)	1.05	0.55	-2.44 to 4.55

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for males: Appendix 2

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	52	75 (50 - 95)	78 (41 - 90)	-2.98	0.24	-8.01 to 2.05
Role Limitation Physical	52	100 (0 - 100)	75 (0 - 100)	-7.21	0.20	-18.43 to 4.01
Role Limitation Mental	52	100 (33 - 100)	100 (33 - 100)	1.27	0.82	-9.92 to 12.46
Social Function	52	89 (59 - 100)	78 (44 - 100)	-5.79	0.08	-12.47 to 0.67
Mental Health	52	75.38 (20.20)	71.15 (20.90)	**-4.23**	**0.02**	**-7.74 to -0.72**
Energy / Vitality	52	54.13 (23.72)	49.90 (23.67)	-4.23	0.09	-9.11 to 0.65
Bodily Pain	52	72.50 (28.36)	67.37 (29.40)	-5.13	0.12	-11.56 to 1.29
General Health	52	55.79 (22.67)	51.10 (23.58)	-4.69	0.09	-10.14 to 0.75
PAID	56	12 (6 – 23)	13 (6 - 27)	2.03	0.17	-0.90 to 4.96

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for <55yrs: Appendix 3

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	15	75 (55 - 100)	80 (20 - 95)	-9.33	0.06	-19.09 to 0.42
Role Limitation Physical	15	100 (0 - 100)	50 (0 - 100)	**-16.67**	**0.045**	**-32.94 to -0.40**
Role Limitation Mental	15	100 (0 - 100)	33 (0 - 100)	-6.67	0.57	-31.03 to 17.69
Social Function	15	89 (33 - 100)	67 (11 - 100)	**-15.53**	**0.006**	**-25.90 to -5.17**
Mental Health	15	59.47 (28.72)	56.27 (26.98)	-3.20	0.41	-11.37 to 4.93
Energy / Vitality	15	41.67 (27.50)	41.33 (26.69)	-0.33	0.92	-6.99 to 6.34
Bodily Pain	15	68.27 (25.20)	57.87 (37.22)	-10.40	0.19	-26.54 to 5.74
General Health	15	50.27 (26.45)	41.40 (6.66)	**-8.67**	**<0.001**	**-12.96 to -4.77**
PAID	18	25 (11 - 46)	23 (13 - 43)	0.69	0.86	-7.60 to 8.99

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for 55-64 yrs: Appendix 4

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	17	75 (43 - 90)	80 (63 - 93)	8.52	0.19	-4.57 to 21.63
Role Limitation Physical	17	100 (13 - 100)	100 (50 - 100)	11.77	0.29	-11.01 to 34.54
Role Limitation Mental	17	100 (46 - 100)	100 (67 - 100)	6.35	0.46	-11.56 to 24.27
Social Function	17	89 (56 - 100)	78 (67 - 100)	3.88	0.54	-9.22 to 16.99
Mental Health	17	66.82 (22.13)	67.53 (20.09)	0.71	0.79	-4.84 to 6.26
Energy / Vitality	17	52.35 (27.96)	52.35 (26.52)	0.00	1.00	-13.51 to 13.51
Bodily Pain	17	66.06 (30.15)	68.06 (25.83)	2.00	0.74	-10.55 to 14.55
General Health	17	52.29 (24.84)	55.82 (29.43)	3.53	0.48	-6.76 to 13.81
PAID	18	16 (8 – 37)	13 (9 - 36)	-2.36	0.39	-8.04 to 3.32

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for 65-74 yrs: Appendix 5

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	39	75 (50 - 90)	70 (30 - 90)	-2.69	0.40	-9.13 to 3.75
Role Limitation Physical	39	50 (0 - 100)	50 (0 - 100)	-4.49	0.51	-18.26 to 9.29
Role Limitation Mental	39	67 (33 - 100)	100 (0 - 100)	1.49	0.81	-10.94 to 13.91
Social Function	39	89 (67 - 100)	89 (0 - 100)	-1.44	0.71	-9.08 to 6.21
Mental Health	39	75.28 (18.14)	73.64 (19.13)	-1.64	0.47	-6.24 to 2.96
Energy / Vitality	39	52.05 (23.22)	51.15 (20.82)	-0.90	0.73	-6.17 to 4.37
Bodily Pain	39	70.41 (29.39)	65.33 (28.26)	-5.08	0.18	-12.51 to 2.36
General Health	39	56.74 (24.60)	53.97 (20.81)	-2.77	0.46	-10.25 to 4.71
PAID	40	10 (5 – 17)	11 (5 - 22)	**2.56**	**0.045**	**0.07 to 5.06**

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for >74 yrs: Appendix 6

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	17	65 (45 - 78)	45 (23 - 75)	**-13.24**	**<0.001**	**-19.66 to -6.81**
Role Limitation Physical	17	50 (13 - 100)	0 (0 - 63)	**-27.94**	**0.013**	**-49.20 to -6.68**
Role Limitation Mental	17	100 (17 - 100)	67 (0 - 100)	-7.82	0.52	-33.20 to 17.55
Social Function	17	78 (62 - 95)	67 (56 - 95)	-11.12	0.10	-24.40 to 2.16
Mental Health	17	78.59 (16.55)	74.82 (16.96)	-3.74	0.13	-8.77 to 1.25)
Energy / Vitality	17	57.65 (18.63)	46.76 (19.76)	**-10.88**	**0.04**	**-21.05 to -0.71**
Bodily Pain	17	76.53 (21.54)	62.00 (29.30)	**-14.53**	**0.03**	**-27.13 to -1.93**
General Health	17	56.82 (21.68)	51.47 (15.18)	-5.35	0.13	-12.53 to 1.82
PAID	18	6 (3 - 13)	9 (3 - 22)	**4.51**	**0.02**	**0.76 to 8.27**

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for deprivation categories 1&2: Appendix 7

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	24	75 (55 - 89)	75 (51 - 84)	**-5.21**	**0.04**	**-10.09 to -0.33**
Role Limitation Physical	24	100 (50 - 100)	50 (6 - 100)	**-26.04**	**0.01**	**-46.09 to -5.99**
Role Limitation Mental	24	100 (33 - 100)	100 (42 - 100)	-2.38	0.80	-21.63 to16.88
Social Function	24	100 (78 - 100)	89 (59 - 100)	-8.79	0.06	-17.96 to 0.38
Mental Health	24	81.00 (12.27)	77.50 (12.25)	-3.50	0.06	-7.20 to 0.20
Energy / Vitality	24	62.71 (16.22)	54.38 (20.97)	**-8.33**	**0.02**	**-15.26 to -1.41**
Bodily Pain	24	79.29 (19.99)	67.63 (23.71)	**-11.67**	**0.03**	**-21.70 to -1.63**
General Health	24	64.13 (20.61)	55.08 (18.68)	-9.04	0.02	-16.47 to -1.62
PAID	24	9 (4 - 13)	9 (4 - 18)	2.29	0.11	-0.54 to 5.13

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for deprivation categories 3-5: Appendix 8

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	41	75 (55 - 88)	75 (48 - 88)	-3.05	0.23	-8.15 to 2.05
Role Limitation Physical	41	100 (75 - 100)	100 (75 - 100)	0.61	0.92	-11.93 to 13.15
Role Limitation Mental	41	75 (29 - 100)	100 (17 - 100)	6.29	0.25	-4.59 to 17.17
Social Function	41	89 (56 - 100)	89 (56 - 100)	0.51	0.88	-6.80 to 7.82
Mental Health	41	70.73 (22.99)	70.63 (22.17)	-0.10	0.96	-4.05 to 3.85
Energy / Vitality	41	51.10 (24.81)	50.24 (23.23)	-0.85	0.74	-5.94 to 4.24
Bodily Pain	41	70.51 (27.81)	67.27 (28.32)	-3.24	0.35	-10.21 to 3.72
General Health	41	55.63 (21.85)	53.63 (23.91)	-2.00	0.40	-6.79 to 2.79
PAID	42	13 (5 – 27)	14 (6 - 34)	1.28	0.44	-2.05 to 4.61

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Paired results for deprivation categories 6&7: Appendix 9

	No Pairs	Baseline†	1 yr follow up†	Mean difference‡	p-value	95% CI for diff
Physical Function	23	50 (15 - 90)	45 (10 - 85)	-3.26	0.64	-17.31 to 10.79
Role Limitation Physical	23	25 (0 - 100)	0 (0 - 100)	-4.35	0.57	-19.86 to 11.17
Role Limitation Mental	23	67 (0 - 100)	33 (0 - 100)	-11.65	0.22	-30.89 to 7.59
Social Function	23	67 (33 - 89)	56 (22 - 78)	-9.65	0.11	21.62 to 2.31
Mental Health	23	63.30 (23.25)	60.00 (23.57)	-3.30	0.35	-10.43 to 3.82
Energy / Vitality	23	40.22 (25.78)	40.65 (22.58)	0.44	0.93	-10.14 to 11.01
Bodily Pain	23	60.87 (30.60)	54.17 (35.12)	-6.70	0.30	-19.78 to 6.39
General Health	23	43.57 (27.75)	44.74 (24.85)	1.17	0.83	-9.83 to 12.18
PAID	28	14 (8 – 35)	13 (9 - 33)	1.61	0.54	-3.69 to 6.90

† Figures are mean (st dev) for mental health to general health and median (interquartile range) for physical function to social function and PAID [due to skewed distributions].

‡ Figures are mean for all [as distributions of differences are not skewed].

Overall clinical results that have increased, decreased or stayed the same: Appendix 10

	No Pairs	Decreased		Same	Increased	
		N (%)	Mean Diff	N (%)	N (%)	Mean Diff
HbA1c	113	61 (54%)	-1.52	3 (3%)	49 (43%)	1.32
RBG	56	44 (79%)	-4.14	0 (0%)	12 (21%)	2.55
Creatinine	109	63 (58%)	-14.48	3 (3%)	43 (39%)	29.07
Cholesterol	102	72 (71%)	-1.11	5 (5%)	25 (25%)	0.58
HDL	71	12 (17%)	-0.19	11 (16%)	48 (68%)	0.38
Systolic BP	130	75 (58%)	-19.87	7 (5%)	48 (37%)	17.29
Diastolic BP	130	81 (62%)	-12.10	9 (7%)	40 (31%)	8.80
Weight	121	64 (53%)	-4.19	16 (13%)	41 (34%)	5.11
BMI	120	46 (38%)	-2.04	27 (23%)	47 (39%)	2.13

Clinical paired results for females: Appendix 11

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	45	8.02 (1.89)	7.76 (1.46)	-0.25	0.37	-0.81 to 0.31
RBG	20	12.83 (4.82)	8.49 (3.61	**-4.34**	**<0.001**	**-5.99 to -2.69**
Creatinine	45	82.76 (18.60)	79.80 (20.37)	-2.96	0.31	-8.73 to 2.81
Cholesterol	39	5.09 (1.08)	4.53 (0.98)	**-0.56**	**0.001**	**-0.88 to -0.23**
HDL	28	1.31 (0.40)	1.59 (0.80)	**0.27**	**0.04**	**0.02 to 0.52**
Systolic BP	51	141.92 (15.12)	139.02 (16.99)	-2.90	0.35	-9.13 to 3.33
Diastolic BP	51	76.71 (10.48)	71.98 (10.32)	**-4.73**	**0.01**	**-8.37 to -1.07**
Weight	49	77.33 (18.30)	76.24 (17.30)	-1.08	0.13	-2.48 to 0.31
BMI	48	30.77 (6.60)	30.40 (6.18)	-0.38	0.22	-0.99 to 0.24

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			0.56
Current smoker	6 (13%)	5 (11%)	
Ex smoker	12 (26%)	13 (28%)	
Non smoker	29 (62%)	29 (62%)	
Physical Activity			0.22
Physically impossible	2 (11%)	2 (11%)	
Avoids even trivial	1 (5%)	2 (11%)	
Light	12 (63%)	9 (47%)	
Moderate	4 (21%)	6 (32%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			1.00
Present	37 (97%)	37 (97%)	
Absent	1 (3%)	1 (3%)	
Pulse Right			0.99
Present	36 (97%)	35 (95%)	
Absent	1 (3%)	2 (5%)	
Sense Left			1.00
Normal	35 (97%)	35 (97%)	
Impaired	1 (3%)	1 (3%)	
Sense Right			0.99
Normal	34 (100%)	33 (97%)	
Impaired	0 (0%)	1 (3%)	
Retina Left			---
Normal	18 (100%)	18 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	
Retina Right			---
Normal	18 (100%)	18 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for males: Appendix 12

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	68	8.09 (1.96)	7.84 (1.55)	-0.25	0.32	-0.76 to 0.25
RBG	36	10.95 (3.21)	9.15 (2.83)	**-1.80**	**0.01**	**-3.24 to -0.40**
Creatinine	64	102.16 (51.26)	109.52 (89.80)	7.36	0.25	-5.18 to 19.89
Cholesterol	63	5.19 (1.06)	4.47 (0.91)	**-0.69**	**<0.001**	**-1.01 to -0.37**
HDL	43	1.13 (0.27)	1.32 (0.55)	**0.19**	**0.02**	**0.04 to 0.35**
Systolic BP	79	147.35 (18.61)	140.87 (19.25)	**-6.48**	**0.01**	**-11.61 to -1.35**
Diastolic BP	79	82.06 (10.03)	77.16 (10.99)	**-4.90**	**<0.001**	**-7.39 to -2.41**
Weight	72	90.00 (14.12)	89.93 (14.49)	-0.08	0.91	-1.36 to 1.21
BMI	72	29.57 (4.60)	29.90 (4.79)	0.33	0.20	-0.19 to 0.85

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			**0.005**
Current smoker	15 (22%)	7 (10%)	
Ex smoker	25 (36%)	33 (48%)	
Non smoker	29 (42%)	29 (42%)	
Physical Activity			**0.04**
Physically impossible	0 (0%)	1 (3%)	
Avoids even trivial	11 (38%)	5 (17%)	
Light	13 (45%)	10 (35%)	
Moderate	5 (17%)	12 (41%)	
Heavy	0 (0%)	1 (3%)	
Pulse Left			0.81
Present	53 (100%)	50 (94%)	
Absent	0 (0%)	3 (6%)	
Pulse Right			0.25
Present	50 (100%)	45 (90%)	
Absent	0 (0%)	5 (10%)	
Sense Left			0.69
Normal	43 (84%)	45 (88%)	
Impaired	8 (16%)	6 (12%)	
Sense Right			0.22
Normal	38 (81%)	42 (89%)	
Impaired	9 (19%)	5 (11%)	
Retina Left			0.99
Normal	32 (97%)	31 (94%)	
Mild Background	0 (0%)	1 (3%)	
Established	1 (3%)	1 (3%)	
Retina Right			0.99
Normal	30 (97%)	29 (94%)	
Mild Background	0 (0%)	1 (3%)	
Established	1 (3%)	1 (3%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for <55 yrs: Appendix 13

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	21	8.47 (2.64)	8.10 (1.76)	-0.37	0.55	-1.63 to 0.90
RBG	12	13.53 (3.52)	9.27 (2.89)	**-4.27**	**0.006**	**-7.02 to -1.51**
Creatinine	21	87.48 (56.55)	92.00 (80.70)	4.52	0.56	-11.34 to 20.39
Cholesterol	22	5.50 (1.06)	4.69 (0.87)	**-0.81**	**0.01**	**-1.42 to -0.20**
HDL	17	1.33 (0.55)	1.47 (0.68)	0.14	0.07	-0.01 to 0.30
Systolic BP	24	138.92 (14.26)	137.92 (16.35)	-1.00	0.74	-7.18 to 5.18
Diastolic BP	24	83.25 (11.26)	84.79 (11.14)	1.54	0.38	-2.03 to 5.11
Weight	22	92.51 (21.55)	91.80 (18.14)	-0.91	0.51	-3.71 to 1.89
BMI	22	32.18 (8.05)	32.14 (6.95)	-0.05	0.93	-1.14 to 1.04

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			**0.03**
Current smoker	8 (29%)	3 (11%)	
Ex smoker	3 (11%)	8 (29%)	
Non smoker	17 (61%)	17 (61%)	
Physical Activity			0.09
Physically impossible	1 (10%)	1 (10%)	
Avoids even trivial	3 (30%)	2 (20%)	
Light	6 (60%)	2 (20%)	
Moderate	0 (0%)	4 (40%)	
Heavy	0 (0%)	1 (10%)	
Pulse Left			0.99
Present	23 (100%)	22 (96%)	
Absent	0 (0%)	1 (4%)	
Pulse Right			0.82
Present	21 (100%)	19 (91%)	
Absent	0 (0%)	2 (10%)	
Sense Left			---
Normal	21 (100%)	21 (100%)	
Impaired	0 (0%)	0 (0%)	
Sense Right			---
Normal	21 (100%)	21 (100%)	
Impaired	0 (0%)	0 (0%)	
Retina Left			---
Normal	16 (100%)	16 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	
Retina Right			---
Normal	15 (100%)	15 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for 55-64 yrs: Appendix 14

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	18	7.83 (1.51)	7.66 (0.99)	-0.17	0.66	-0.99 to 0.65
RBG	9	10.33 (2.27)	8.77 (2.37)	-1.57	0.29	-4.72 to 1.58
Creatinine	18	111.33 (71.52)	121.50 (140.84)	10.17	0.56	-25.88 to 46.21
Cholesterol	18	5.01 (0.98)	4.66 (1.09)	-0.36	0.31	-1.08 to 0.37
HDL	10	1.10 (0.20)	1.25 (0.23)	**0.16**	**0.01**	**0.05 to 0.26**
Systolic BP	22	138.91 (14.32)	136.23 (13.56)	-2.68	0.54	-11.62 to 6.26
Diastolic BP	22	79.72 (8.48)	77.59 (8.21)	-2.14	0.42	-7.54 to 3.28
Weight	20	90.43 (15.95)	92.82 (16.08)	2.19	0.12	-0.61 to 4.96
BMI	20	30.50 (5.10)	31.60 (5.01)	**1.10**	**0.02**	**0.19 to 2.01**

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			0.32
Current smoker	5 (25%)	4 (20%)	
Ex smoker	9 (45%)	10 (50%)	
Non smoker	6 (30%)	6 (30%)	
Physical Activity			0.26
Physically impossible	0 (0%)	0 (0%)	
Avoids even trivial	3 (27%)	1 (9%)	
Light	3 (27%)	2 (18%)	
Moderate	5 (46%)	8 (73%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			---
Present	17 (100%)	17 (100%)	
Absent	0 (0%)	0 (0%)	
Pulse Right			---
Present	17 (100%)	17 (100%)	
Absent	0 (0%)	0 (0%)	
Sense Left			1.00
Normal	16 (89%)	17 (94%)	
Impaired	2 (11%)	1 (6%)	
Sense Right			1.00
Normal	13 (87%)	14 (93%)	
Impaired	2 (13%)	1 (7%)	
Retina Left			0.99
Normal	9 (100%)	8 (89%)	
Mild Background	0 (0%)	1 (11%)	
Established	0 (0%)	0 (0%)	
Retina Right			0.99
Normal	9 (100%)	8 (89%)	
Mild Background	0 (0%)	1 (11%)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for 65-74 yrs: Appendix 15

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	50	8.25 (1.77)	7.98 (1.70)	-0.27	0.29	-0.77 to 0.24
RBG	22	10.97 (4.08)	8.87 (3.33)	**-2.10**	**0.005**	**-3.49 to -0.70**
Creatinine	45	87.80 (16.91)	86.38 (28.91)	-1.42	0.77	-11.34 to 8.50
Cholesterol	44	4.92 (0.89)	4.36 (0.92)	**-0.56**	**<0.001**	**-0.82 to -0.31**
HDL	32	1.19 (0.21)	1.52 (0.82)	**0.34**	**0.02**	**0.05 to 0.62**
Systolic BP	55	148.09 (18.13)	143.67 (19.84)	-4.41	0.19	-11.01 to 2.18
Diastolic BP	55	79.51 (10.56)	72.31 (11.06)	**-7.20**	**<0.001**	**-10.48 to -3.92**
Weight	52	82.61 (13.68)	81.67 (14.34)	-0.94	0.14	-2.21 to 0.33
BMI	52	29.46 (4.44)	29.25 (4.41)	-0.21	0.46	-0.78 to 0.35

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			0.56
Current smoker	6 (13%)	5 (11%)	
Ex smoker	17 (38%)	18 (40%)	
Non smoker	22 (49%)	22 (49%)	
Physical Activity			0.22
Physically impossible	1 (6%)	1 (6%)	
Avoids even trivial	4 (22%)	3 (17%)	
Light	11 (61%)	10 (56%)	
Moderate	2 (11%)	4 (22%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			0.50
Present	33 (97%)	31 (91%)	
Absent	1 (3%)	3 (9%)	
Pulse Right			0.25
Present	32 (97%)	29 (88%)	
Absent	1 (3%)	4 (12%)	
Sense Left			0.63
Normal	28 (88%)	30 (94%)	
Impaired	4 (13%)	2 (6%)	
Sense Right			0.38
Normal	25 (83%)	28 (93%)	
Impaired	5 (17%)	2 (7%)	
Retina Left			1.00
Normal	17 (94%)	17 (94%)	
Mild Background	0 (0%)	0 (0%)	
Established	1 (6%)	1 (6%)	
Retina Right			1.00
Normal	17 (94%)	17 (94%)	
Mild Background	0 (0%)	0 (0%)	
Established	1 (6%)	1 (6%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for >74 yrs: Appendix 16

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	24	7.48 (1.70)	7.31 (1.06)	-0.18	0.67	-1.00 to 0.65
RBG	13	11.84 (4.59)	8.75 (3.66)	-3.10	0.05	-6.22 to 0.02
Creatinine	25	98.80 (27.84)	103.76 (34.06)	4.96	0.32	-5.05 to 14.97
Cholesterol	18	5.34 (1.42)	4.4 (0.86)	**-0.90**	**0.008**	**-1.54 to -0.26**
HDL	12	1.17 (0.28)	1.26 (0.30)	0.09	0.11	-0.02 to 0.21
Systolic BP	29	149.79 (18.63)	138.28 (19.77)	**-11.52**	**0.02**	**-21.30 to -1.73**
Diastolic BP	29	78.28 (11.06)	70.62 (6.81)	-7.66	0.001	-11.99 to -3.32
Weight	27	78.87 (17.15)	77.63 (17.86)	-1.23	0.17	-3.02 to 0.55
BMI	26	29.08 (4.82)	28.92 (5.45)	-0.15	0.74	-1.08 to 0.77

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			0.12
Current smoker	2 (9%)	0 (0%)	
Ex smoker	8 (35)%	10 (44%)	
Non smoker	13 (57%)	13 (57%)	
Physical Activity			0.25
Physically impossible	0 (0%)	1 (11%)	
Avoids even trivial	2 (22%)	1 (11%)	
Light	5 (56%)	5 (56%)	
Moderate	2 (22%)	2 (22%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			---
Present	17 (100%)	17 (100%)	
Absent	0 (0%)	0 (0%)	
Pulse Right			0.99
Present	16 (100%)	15 (94%)	
Absent	0 (0%)	1 (6%)	
Sense Left			0.99
Normal	13 (81%)	12 (75%)	
Impaired	3 (19%)	4 (25%)	
Sense Right			1.00
Normal	13 (87%)	12 (80%)	
Impaired	2 (13%)	3 (20%)	
Retina Left			---
Normal	8 (100%)	8 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	
Retina Right			---
Normal	8 (100%)	8 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for deprivation categories 1&2: Appendix 17

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	23	7.39 (1.47)	7.22 (1.10)	-0.17	0.61	-0.84 to 0.51
RBG	13	11.48 (3.73)	7.19 (3.39)	**-4.27**	**0.003**	**-6.82 to -1.71**
Creatinine	20	97.95 (18.63)	91.20 (26.58)	-6.75	0.08	-14.27 to 0.77
Cholesterol	19	5.41 (1.35)	4.13 (0.82)	**-1.26**	**0.001**	**-1.99 to -0.57**
HDL	16	1.26 (0.30)	1.41 (0.28)	**0.18**	**0.003**	**0.07 to 0.26**
Systolic BP	29	148.21 (16.92)	138.07 (20.42)	-10.13	0.04	-19.57 to -0.71
Diastolic BP	29	79.24 (11.18)	72.24 (11.15)	-7.00	<0.001	-10.50 to -3.50
Weight	25	78.52 (15.39)	77.74 (14.06)	-0.78	0.42	-2.73 to 1.17
BMI	24	27.33 (3.87)	27.63 (3.55)	-0.21	0.61	-1.03 to 0.62

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			---
Current smoker	3 (14%)	3 (14%)	
Ex smoker	8 (36%)	8 (36%)	
Non smoker	11 (50%)	11 (50%)	
Physical Activity			0.12
Physically impossible	1 (9%)	2 (18%)	
Avoids even trivial	2 (18%)	0 (0%)	
Light	7 (64%)	5 (46%)	
Moderate	1 (9%)	4 (36%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			---
Present	18 (100%)	18 (100%)	
Absent	0 (0%)	0 (0%)	
Pulse Right			---
Present	17 (100%)	17 (100%)	
Absent	0 (0%)	0 (0%)	
Sense Left			1.00
Normal	15 (94%)	14 (88%)	
Impaired	1 (6%)	2 (13%)	
Sense Right			---
Normal	14 (93%)	14 (93%)	
Impaired	1 (7%)	1 (7%)	
Retina Left			---
Normal	10 (100%)	10 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	
Retina Right			---
Normal	9 (100%)	9 (100%)	
Mild Background	0 (0%)	0 (0%)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for deprivation categories 3, 4 & 5: Appendix 18

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	57	8.03 (1.98)	8.09 (1.58)	0.05	0.83	-0.46 to 0.57
RBG	27	10.91 (3.37)	8.79 (2.68)	**-2.12**	**0.01**	**-3.73 to -0.51**
Creatinine	57	97.00 (53.27)	102.38 (93.71)	5.39	0.41	-7.60 to 18.37
Cholesterol	54	5.06 (1.02)	4.76 (0.98)	**-0.30**	**0.03**	**-0.57 to -0.04**
HDL	39	1.23 (0.37)	1.53 (0.82)	**0.29**	**0.02**	**0.06 to 0.52**
Systolic BP	65	143.77 (17.51)	140.28 (16.33)	-3.49	0.20	-8.83 to 1.85
Diastolic BP	65	80.53 (10.12)	75.84 (11.57)	-4.69	0.003	-7.71 to -1.67
Weight	62	84.95 (16.65)	85.46 (17.15)	0.51	0.42	-0.74 to 1.78
BMI	62	29.60 (4.79)	29.95 (4.93)	0.35	0.18	-0.02 to 0.87

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			0.06
Current smoker	13 (22%)	8 (14%)	
Ex smoker	14 (24%)	19 (33%)	
Non smoker	31 (53%)	31 (53%)	
Physical Activity			0.12
Physically impossible	0 (0%)	0 (0%)	
Avoids even trivial	8 (29%)	7 (25%)	
Light	12 (43%)	9 (32%)	
Moderate	8 (29%)	12 (43%)	
Heavy	0 (0%)	0 (0%)	
Pulse Left			0.84
Present	48 (100%)	46 (96%)	
Absent	0 (0%)	2 (4%)	
Pulse Right			0.59
Present	49 (100%)	46 (94%)	
Absent	0 (0%)	3 (6%)	
Sense Left			0.22
Normal	39 (85%)	43 (94%)	
Impaired	7 (15%)	3 (7%)	
Sense Right			0.38
Normal	37 (86%)	40 (93%)	
Impaired	6 (14%)	3 (7%)	
Retina Left			0.99
Normal	28 (100%)	27 (96%)	
Mild Background	0 (0%)	1 (4%)	
Established	0 (0%)	0 (0%)	
Retina Right			0.99
Normal	27 (100%)	26 (96%)	
Mild Background	0 (0%)	1 (4 %)	
Established	0 (0%)	0 (0%)	

† McNemars test used so only paired data is analysed.

Clinical paired results for deprivation categories 6 & 7: Appendix 19

	No Pairs	Baseline†	1 yr follow up†	Mean difference	p-value	95% CI for diff
HbA1c	33	8.58 (2.00)	7.74 (1.58)	**-0.84**	**0.04**	**-1.65 to -0.03**
RBG	16	12.96 (4.78)	10.52 (3.88)	**-2.43**	**0.03**	**-4.52 to -0.33**
Creatinine	32	86.69 (27.03)	91.88 (36.49)	5.19	0.40	-7.14 to 17.52
Cholesterol	29	5.10 (0.95)	4.26 (0.76)	**-0.84**	**<0.001**	**-1.26 to -0.43**
HDL	16	1.08 (0.25)	1.19 (0.41)	0.11	0.11	-0.02 to 0.25
Systolic BP	36	145.44 (17.89)	141.58 (20.35)	-3.86	0.31	-11.52 to 3.80
Diastolic BP	36	79.50 (10.87)	76.17 (9.56)	-3.33	0.13	-7.74 to 1.07
Weight	34	89.40 (17.92)	87.30 (17.89)	-2.10	0.04	-4.10 to -0.10
BMI	34	32.44 (6.79)	32.12 (6.46)	-0.32	0.47	-1.21 to 0.57

† Figures are mean (st dev).

	Baseline	1 yr follow up	p-value †
Smoking Status			**0.046**
Current smoker	5 (14%)	1 (3%)	
Ex smoker	15 (42%)	19 (53%)	
Non smoker	16 (44%)	16 (44%)	
Physical Activity			0.07
Physically impossible	1 (11%)	1 (11%)	
Avoids even trivial	2 (22%)	0 (0%)	
Light	6 (67%)	5 (56%)	
Moderate	0 (0%)	2 (22%)	
Heavy	0 (0%)	1 (11%)	
Pulse Left			0.99
Present	24 (96%)	23 (92%)	
Absent	1 (4%)	2 (8%)	
Pulse Right			0.25
Present	20 (95%)	17 (81%)	
Absent	1 (5%)	4 (19%)	
Sense Left			0.99
Normal	24 (96%)	23 (92%)	
Impaired	1 (4%)	2 (8%)	
Sense Right			---
Normal	21 (91%)	21 (91%)	
Impaired	2 (9%)	2 (9%)	
Retina Left			---
Normal	12 (92%)	12 (92%)	
Mild Background	0 (0%)	0 (0%)	
Established	1 (8%)	1 (8%)	
Retina Right			---
Normal	12 (92%)	12 (92%)	
Mild Background	0 (0%)	0 (0%)	
Established	1 (8%)	1 (8%)	

† McNemars test used so only paired data is analysed.

Importance of ongoing education and advice: Appendix 20

	1 (not important)	2	3	4	5 (very important)	p-value
Diet	0 (0%)	0 (0%)	1 (3%)	8 (21%)	31 (82%)	**<0.001**
Oral Hypoglycaemic Agents	0 (0%)	0 (0%)	2 (5%)	12 (32%)	24 (63%)	**<0.001**
Insulin Administration	0 (0%)	0 (0%)	3 (8%)	8 (21%)	27 (71%)	**<0.001**
Insulin Dose Adjustment	0 (0%)	0 (0%)	3 (8%)	8 (21%)	27 (71%)	**<0.001**
Hypoglycaemia	0 (0%)	1 (3%)	2 (5%)	8 (21%)	26 (70%)	**<0.001**
Hyperglycaemia	0 (0%)	1 (3%)	4 (11%)	6 (17%)	25 (69%)	**<0.001**
Blood Glucose Monitoring	0 (0%)	2 (5%)	7 (18%)	10 (26%)	19 (50%)	**<0.001**
Urinary Glucose Monitoring	5 (14%)	10 (27%)	9 (24%)	7 (19%)	6 (16%)	0.67
What to do when sick	0 (0%)	1 (3%)	1 (3%)	11 (29%)	25 (66%)	**<0.001**
Social Eating	0 (0%)	1 (3%)	9 (24%)	17 (45%)	11 (29%)	**<0.001**
Alcohol	0 (0%)	0 (0%)	5 (13%)	20 (53%)	13 (34%)	**<0.001**
Exercise	0 (0%)	0 (0%)	2 (5%)	11 (29%)	25 (66%)	**<0.001**
Foot care	0 (0%)	0 (0%)	2 (5%)	3 (8%)	33 (87%)	**<0.001**
Smoking	0 (0%)	0 (0%)	0 (0%)	5 (13%)	33 (87%)	**<0.001**
Psychological Aspects	0 (0%)	1 (3%)	7 (18%)	11 (29%)	19 (50%)	**<0.001**
Employment	0 (0%)	2 (5%)	8 (21%)	16 (42%)	12 (32%)	**<0.001**
Sexual Function	0 (0%)	0 (0%)	8 (22%)	15 (41%)	14 (38%)	**<0.001**
Contraception/ Pregnancy	0 (0%)	0 (0%)	7 (19%)	10 (27%)	20 (54%)	**<0.001**
Driving & the DVLA	0 (0%)	0 (0%)	9 (24%)	12 (32%)	16 (43%)	**<0.001**

Importance of the annual undertaking of parameters: Appendix 21

	1 (not important)	2	3	4	5 (very important)	p-value
Weight	0 (0%)	0 (0%)	6 (16%)	13 (35%)	18 (49%)	**<0.001**
BMI	0 (0%)	0 (0%)	4 (11%)	10 (27%)	23 (61%)	**<0.001**
Height	34 (90%)	0 (0%)	2 (5%)	0 (0%)	1 (3%)	**<0.001**
Dietary Assessment	0 (0%)	0 (0%)	5 (14%)	12 (32%)	20 (54%)	**<0.001**
Blood Pressure	0 (0%)	0 (0%)	1 (3%)	7 (19%)	29 (78%)	**<0.001**
Blood Samples Taken	0 (0%)	0 (0%)	0 (0%)	6 (16%)	31 (84%)	**<0.001**
Testing Urine for Glucose	6 (17%)	4 (11%)	9 (25%)	7 (19%)	10 (28%)	0.53
Testing Urine for Ketones	2 (6%)	7 (19%)	8 (22%)	4 (11%)	15 (42%)	**0.008**
Testing Urine for Protein	1 (3%)	0 (0%)	3 (8%)	7 (19%)	25 (69%)	**<0.001**
Testing Visual Acuity	1 (3%)	1 (3%)	0 (0%)	8 (22%)	27 (73%)	**<0.001**
Retinal Screening	0 (0%)	0 (0%)	1 (3%)	5 (14%)	31 (84%)	**<0.001**
Testing for Neuropathy	0 (0%)	0 (0%)	3 (8%)	6 (16%)	28 (76%)	**<0.001**
Inspection of Feet/ Footwear	0 (0%)	1 (3%)	3 (8%)	5 (14%)	26 (76%)	**<0.001**
Inspection of Injection Sites	0 (0%)	2 (5%)	5 (14%)	7 (19%)	23 (62%)	**<0.001**
Impotence/ Sexual Function	0 (0%)	2 (5%)	6 (16%)	13 (35%)	16 (43%)	**<0.001**

Importance of management issues: Appendix 22

	Profession								
	All	**p-value†**	**PM's**	**GP's**	**PN's**	**Pod's**	**Dietitians**	**DN's**	**p-value‡**
Optimise HbA1c Levels		**<0.001**							0.40
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	8 (22%)		0 (0%)	4 (33%)	2 (17%)	0 (0%)	0 (0%)	2 (50%)	
5 (very important)	28 (78%)		2 (100%)	8 (67%)	10 (83%)	5 (100%)	1 (100%)	2 (50%)	
Optimise Blood pressure		**<0.001**							0.30
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	5 (14%)		0 (0%)	2 (15%)	1 (8%)	0 (0%)	0 (0%)	2 (50%)	
5 (very important)	32 (86%)		2 (100%)	11 (85%)	11 (92%)	5 (100%)	1 (100%)	2 (50%)	
Treat Abnormal Lipid Profile		**<0.001**							0.27
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	1 (3%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	
4	8 (22%)		0 (0%)	3 (23%)	2 (17%)	1 (20%)	0 (0%)	2 (50%)	
5 (very important)	28 (76%)		2 (100%)	10 (77%)	10 (83%)	4 (80%)	1 (100%)	1 (25%)	
Return Appointment		**<0.001**							0.26
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	4 (11%)		0 (0%)	3 (23%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
4	9 (24%)		0 (0%)	3 (23%)	1 (8%)	3 (60%)	1 (100%)	1 (25%)	
5 (very important)	24 (65%)		2 (100%)	7 (54%)	10 (83%)	2 (40%)	0 (0%)	3 (75%)	
Discuss Individual Targets		**<0.001**							0.63
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	4 (11%)		0 (0%)	2 (15%)	1 (8%)	0 (0%)	0 (0%)	1 (25%)	
4	14 (38%)		0 (0%)	6 (46%)	2 (17%)	3 (60%)	1 (100%)	2 (50%)	
5 (very important)	18 (49%)		2 (100%)	4 (31%)	9 (75%)	2 (40%)	0 (0%)	1 (25%)	
Sources of Help		**<0.001**							0.64
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	4 (11%)		0 (0%)	3 (23%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
4	20 (54%)		1 (50%)	8 (62%)	4 (33%)	3 (60%)	1 (100%)	3 (75%)	
5 (very important)	12 (32%)		1 (50%)	1 (8%)	7 (58%)	2 (40%)	0 (0%)	1 (25%)	
Diabetes UK		**<0.001**							0.98
1 (not important)	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	7 (19%)		0 (0%)	2 (15%)	3 (25%)	1 (20%)	0 (0%)	1 (25%)	
4	19 (51%)		1 (50%)	8 (62%)	5 (42%)	2 (40%)	1 (100%)	2 (50%)	
5 (very important)	9 (24%)		1 (50%)	1 (8%)	4 (33%)	2 (40%)	0 (0%)	1 (25%)	

† Chi-squared test for equal proportions used on proportions of each rating answer
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.

Importance of referrals to other HCP's: Appendix 23

			Profession						
	All	**p-value†**	**PM's**	**GP's**	**PN's**	**Pod's**	**Dietitians**	**DN's**	**p-value‡**
Dietitian		**<0.001**							0.87
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	4 (11%)		0 (0%)	2 (15%)	1 (8%)	0 (0%)	0 (0%)	1 (25%)	
4	7 (19%)		1 (100%)	2 (15%)	3 (25%)	1 (20%)	0 (0%)	0 (0%)	
5 (very important)	25 (68%)		0 (0%)	8 (62%)	8 (67%)	4 (80%)	1 (100%)	3 (75%)	
Specialist Diabetic Team		**<0.001**							0.76
1 (not important)	2 (5%)		0 (0%)	1 (8%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
2	2 (5%)		0 (0%)	2 (15%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	7 (19%)		0 (0%)	3 (23%)	4 (33%)	0 (0%)	0 (0%)	0 (0%)	
4	8 (22%)		1 (100%)	3 (23%)	1 (8%)	2 (40%)	0 (0%)	1 (25%)	
5 (very important)	18 (49%)		0 (0%)	4 (31%)	6 (50%)	3 (60%)	1 (100%)	3 (75%)	
Retinal Screening Test		**<0.001**							0.82
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	8 (22%)		1 (100%)	3 (23%)	2 (17%)	1 (20%)	0 (0%)	1 (25%)	
5 (very important)	28 (76%)		0 (0%)	9 (69%)	10 (83%)	4 (80%)	1 (100%)	3 (75%)	
Exercise Referral		**<0.001**							0.76
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	1 (3%)		0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	6 (16%)		0 (0%)	4 (31%)	1 (8%)	0 (0%)	0 (0%)	1 (25%)	
4	18 (49%)		1 (100%)	5 (39%)	7 (58%)	4 (80%)	0 (0%)	1 (25%)	
5 (very important)	12 (32%)		0 (0%)	3 (23%)	4 (33%)	1 (20%)	1 (100%)	2 (50%)	
Nephrologist		**0.001**							0.12
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	3 (8%)		0 (0%)	3 (23%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	12 (33%)		0 (0%)	6 (46%)	4 (36%)	1 (20%)	0 (0%)	1 (25%)	
4	7 (19%)		1 (100%)	2 (15%)	1 (9%)	3 (60%)	0 (0%)	0 (0%)	
5 (very important)	14 (39%)		0 (0%)	2 (15%)	6 (55%)	1 (20%)	1 (100%)	3 (75%)	
Other		**<0.001**							0.96
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	2 (22%)		0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	
5 (very important)	7 (78%)		0 (0%)	1 (100%)	3 (100%)	0 (0%)	1 (100%)	1 (100%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.

NB other is made up of Podiatrist (67%), Vascular Clinic (11%), Chiropody (11%), Psychologist (11%).

Importance of recording findings and results: Appendix 24

			Profession						
	All	**p-value†**	**PM's**	**GP's**	**PN's**	**Pod's**	**Dietitians**	**DN's**	**p-value‡**
Medical Notes		**<0.001**							0.58
1 (not important)	1 (3%)		0 (0%)	0 (0%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	1 (3%)		0 (0%)	0 (0%)	0 (0%)	1 (20%)	0 (0%)	0 (0%)	
4	5 (14%)		1 (50%)	2 (15%)	0 (0%)	1 (20%)	0 (0%)	1 (25%)	
5 (very important)	30 (81%)		1 (50%)	11 (85%)	11 (92%)	3 (60%)	1 (100%)	3 (75%)	
Practice Diabetes Register		**<0.001**							0.07
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	5 (14%)		1 (50%)	2 (15%)	0 (0%)	1 (20%)	1 (100%)	0 (0%)	
4	6 (16%)		0 (0%)	4 (31%)	0 (0%)	1 (20%)	0 (0%)	1 (25%)	
5 (very important)	26 (70%)		1 (50%)	7 (54%)	12 (100%)	3 (60%)	0 (0%)	3 (75%)	
Patient Held Records		**0.008**							0.86
1 (not important)	1 (3%)		0 (0%)	0 (0%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	
2	4 (11%)		0 (0%)	3 (23%)	0 (0%)	1 (20%)	0 (0%)	0 (0%)	
3	14 (39%)		0 (0%)	6 (46%)	5 (46%)	1 (20%)	1 (100%)	1 (25%)	
4	8 (22%)		1 (50%)	2 (15%)	2 (18%)	2 (40%)	0 (0%)	1 (25%)	
5 (very important)	9 (25%)		1 (50%)	2 (15%)	3 (27%)	1 (20%)	0 (0%)	2 (50%)	
Other		---							---
1 (not important)	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
3	0 (0%)		0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
4	1 (17%)		0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	
5 (very important)	5 (83%)		0 (0%)	1 (100%)	3 (100%)	0 (0%)	0 (0%)	1 (100%)	

† Chi-squared test for equal proportions used on proportions of each rating answer.
‡ Chi-squared test for equal proportions used on distributions of proportions for each profession.

NB other is made up of IT database (17%), CDSS (34%), Unspecified (49%).

Paper 1

McDowell JRS, Lindsay G, McPhail K (2007) Development of a questionnaire to determine professionals' attitudes to type 2 diabetes. *Journal of Research in Nursing* 12:4:365-370

Journal of Research in Nursing 2007 12: 365
Joan McDowell, Grace Lindsay and Kathryn McPhail

Development of a questionnaire to determine professionals' attitudes to type 2 Diabetes

Paper 2

McDowell JRS Inverarity K, Gilmour H, Lindsay G (2012a) Professionals' perceptions of type 2 diabetes in primary care during a service redesign. *European Diabetes Nursing* 9:1:6-11

European Diabetes Nursing

McDowell, J.R.S., Inverarity, K., Gilmour, H., and Lindsay, G. (2012) *Professionals' perceptions of type 2 diabetes in primary care during a service redesign.* European Diabetes Nursing, 9 (1). 6-11f.

DOI: 10.1002/edn.196

Paper 3

McDowell JRS, McPhail K, Halyburton G, Brown M, Lindsay G (2009) Perceptions of a service redesign by adults living with type 2 diabetes. *Journal of Advanced Nursing* 65:7:1432-1441

Journal of Advanced Nursing

McDowell, J.R.S., McPhail, K., Halyburton, G., Brown, M., and Lindsay, G. (2009) *Perceptions of a service redesign by adults living with type 2 diabetes.*

Journal of Advanced Nursing, 65 (7). pp. 1432-1441

doi:10.1111/j.1365-2648.2009.05003.x

Paper 4

Lindsay G, Inverarity K, **McDowell JRS** (2011) Quality of Life in People with Type 2 Diabetes in Relation to Deprivation, Gender, and Age in a New Community-Based Model of Care *Nursing Research in Practice* Article ID 613589, 8 pages doi:10.1155/2011/613589

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Research Article

Quality of Life in People with Type 2 Diabetes in Relation to Deprivation, Gender, and Age in a New Community-Based Model of Care

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Objectives. To evaluate changes in health related quality of life (HRQL) for individuals with Type 2 diabetes following the introduction of a new community-based model of care. *Methods*. A survey method was used in which HRQL, Problems Areas In Diabetes (PAID) and demographics were assessed before and 18 months after introducing the new service. *Results*. Overall HRQL and PAID scores were lower than published levels in individuals with diabetes but remained stable during the transition to the new model of care except for the bodily pain domain and deteriorating PAID scores for older patients. Four domains of SF36 health showed deterioration in the highest socio-economic groups. Deterioration was also observed in males, most notably mental health, in patients aged 54 years or less, 75 years or more and patients from socio-economic groups 1 and 2. HRQL was lowest at baseline and follow-up in socio-economic groups 6 & 7. Low levels of distress in patients across all deprivation categories was observed but remained stable over the transition. *Conclusions*. HRQL and distress associated with diabetes remained stable following the introduction of the new community-based model of care except for deterioration in the bodily pain domain and deteriorating PAID scores for older patients. *Relevance for Practice*. (i) Health related quality of life assessment is practical and acceptable to patients. (ii) In clinical governance terms it is good practice to monitor the impact of change in service delivery on the health of the patients in your care. (iii) Screening with health related quality of life tools such as generic and disease specific tools could help identify health problems otherwise undetected within current clinical care. Systematic identification of the most vulnerable groups with Type 2 diabetes should allow care to be better targeted.

1. Introduction

The increasing incidence of Type 2 diabetes globally is challenging to health care systems. Within the United Kingdom (UK), different models of care are proposed to cope with this challenge.

In 2003, the Scottish Executive Health Department awarded £2.3 million to Greater Glasgow Health Board (GGHB), now defunct but at the time the largest Health Board in Scotland, to undertake a service redesign [1] aimed at meeting the requirements of policy documents, providing a service that is more accessible to people with Type 2 diabetes and consequently reducing morbidity and mortality associated with diabetes. An integrated model of care was proposed with general practitioners (GPs) based in primary care taking the lead role rather than hospital-based consultants in secondary care. Patients would be referred to secondary care based on clinical need.

All members of the multiprofessional primary health care team were required to undergo accredited diabetes education. General Practices provided information technology (IT) and data management systems to support an annual review of clinical parameters and management of diabetes and risk factors. Additional new posts were created

Table 1: Comparisons of key differences in approaches between the secondary care focussed model of care to a community model of care for patients with Type 2 diabetes.

Parameter	Previous	New model
Setting of diabetes care	Hospital based (secondary care)	General practitioner surgery (Primary care)
Access to care	Mixed community/secondary care	Community
Structure	IT systems	IT systems to support annual review, recall, and management systems introduced
Care provided	Annual Screening and review of clinical parameters	Annual screening and review of clinical parameters Followup appointments for management of clinical parameters; greater empowerment of self-care
	Laboratory results sent onto GP with recommendations for action	GP receives laboratory results directly and acts accordingly
	Recommendations to GP for change in prescriptions	GP alters prescriptions and initiates necessary therapies
	Review by dietitian, podiatrist, and diabetes specialist nurse at annual review that may require considerable waiting times	Review by dietitian, podiatrist, and practice nurse at annual review as part of a one stop shop so no waiting between professionals
	Management of diabetes and related risk factors	Management of diabetes, related risk factors within a holistic context
	Referral to specialist services as required for example, renal physicians	Referral to specialist services as required for example, renal physicians
Educational preparation	Staff have significant clinical expertise in diabetes with or without recognised qualifications	Staff all required to undertake a credit-rated qualification in diabetes
Retinal screening	Secondary care	National level directed

in community nursing, dietetics and podiatry to support the service redesign.

The new model of care was based on the chronic care model [2]. This model focuses on six evidence-based areas of practice associated with improved outcomes in the management of patients with a chronic disease, namely, the community, the health care system, the design of the delivery system, the decision support system, the clinical information systems, and self-management support. The chronic care model [2] also suggests that informed and motivated patients in conjunction with prepared proactive teams can produce better care and improved outcomes [3]. This was a central tenet of the move to the new model of care. Key differences between the new and previous model are presented in Table 1.

Diabetes and its management can have a considerable impact on people's lives [4, 5], for example, feelings of isolation, codependency, experience of loss, overuse of defence mechanisms, and loss of freedom, all of which could have consequences for the optimal management of the condition.

The literature on the impact of a range of interventions to improve care for people with diabetes has produced conflicting findings. Some features of diabetes care and its management regimen have been shown to reduce HRQL [6]. On the other hand, specific improvements in quality of life have been reported when care was associated with regular clinical review (at least twice a year), continuity of care, education by the Diabetes Nurse and satisfaction with education [5]. Davies et al. [7] also found positive changes on depression scores, greater understanding of diabetes, perceived personal responsibility and weight loss following a structured education programme with 12-month followup. However, other authors who have evaluated specific educational interventions found that blood glucose monitoring or educational courses [8] had no impact on HRQL.

HRQL is increasingly taken into account within health care provision as a measure of the effectiveness of care [9]. As part of a larger study, it was considered important to include not only clinical markers of effective service which are reported elsewhere [10], but also any potential impact on HRQL.

This study was conducted to evaluate a new model of care for people with Type 2 diabetes and reports on the general health status and disease-specific health of individuals before and after the change in service delivery.

1.1. Aims of This Study. The aim of the study is to assess HRQL for people within a defined geographical area who are experiencing a change in service delivery for their diabetes care management. Patterns of changes in HRQL were examined in relation to different age groups, gender, and socioeconomic deprivation categories.

2. Materials and Methods

2.1. Study Design. The before and after design of the study used validated and reliable questionnaires at baseline and followup 18 months after the implementation of the new service [10–13]. Two questionnaires were used as recommended

in the literature [14]. Ethics permission was acquired from GGHB Primary Care Research Ethics Committee.

2.1.1. Questionnaires

(a) *Demographic Information.* Demographic details (age, sex, and postcode) were collected from the health care IT system and used to estimate socioeconomic status using an updated version of the Carstairs deprivation scores [15]. The deprivation score is based on vital statistics collected by UK Government surveys and is a number from 1 to 7 calculated from indicators such as lack of car ownership, male unemployment, postcode, and overcrowding, with 1 denoting the most affluent and 7 the most socioeconomically deprived.

(b) *General Health Status.* The health experiences of participants in the four weeks prior to assessment was measured using the SF-36 questionnaire [11]. The questionnaire itself consists of thirty-six questions measuring eight domains of health, namely, "physical functioning," "role limitation due to physical" health problems, "bodily pain," "general health," "energy and vitality," "social functioning," "mental health," and "role limitations due to mental" health problems. Each domain provides a score from 0 to 100 with zero indicating the worst health status and 100 the best. The questionnaire is based on a WHO definition of health, which states that health is not only defined by the absence of disease and infirmity, but also by the presence of physical, mental, and social well-being [16]. The domains themselves were developed in consultation with health professionals rather than patients. The scales were scored using a Likert's method of summated ratings. Each item was assumed to have a linear relationship with the score for its domain. The eight scales of the SF-36 questionnaire have been shown to have high internal consistency (Cronbach Alpha 0.76–0.86). Content validity (the extent to which SF-36 comprehensively measured health status) and criterion validity (the extent to which SF-36 correlated with existing measures of health) were established during this developmental stage. The SF-36 health assessment questionnaire has been reported as valid and reliable in normal populations as well as diabetes patient groups [14, 17, 18].

(c) *Diabetes Specific Emotional Distress.* The problem areas in diabetes (PAID) questionnaire is a reliable and valid tool to determine diabetes specific emotional distress [12, 13, 18]. It consists of 20 items measuring emotional adjustment to living with diabetes. These items are further constructed around the goals of treatment, family support, worry about complications, and eating and drinking. Each item is scored on a 5-point Likert scale according to the degree to which the individual perceives that it as a problem. Total scores vary between 0 and 100 with a higher score indicating greater emotional distress associated with diabetes.

2.2. Participants. At the time of the study, the primary care structure within GGHB was based on 14 local health care cooperatives (LHCCs), each of which was a functional unit for the delivery of care in a defined geographical area. The study was conducted within one LHCC with 14 GP practices and a registered patient population of 63,028 patients of whom 1,402 people were diagnosed with Type 2 diabetes.

Every third person on each general practitioner's (GP) register with Type 2 diabetes was invited to take part in the study ($n = 576$). These individuals were sent a letter via their GP to inform them of the study, the nature of any participation and a written informed consent sheet granting permission to access their clinical records pertaining to diabetes care.

Consenting individuals were sent the SF-36 and the PAID questionnaires with instructions for their completion together with stamped addressed envelopes for their return at two time points. The questionnaires were completed in the first instance at the commencement of the new community-based model of care (2004) and again 18 months later (2006).

2.2.1. Data Presentation and Analysis. Data are presented as mean ± standard deviation and median (interquartile range) for nonparametric distributions. Differences in the outcome variables were tested by comparison of baseline and follow-up data using χ^2 tests for categorical variables and Students' t-tests or Mann-Whitney tests for continuous variables (dependent upon data distribution) using Arcus Quickstat Biomedical software (Addison Wesley Longman trading as Research Solutions). The sample size allowed sufficient statistical power to detect a 10% change in the SF-36 scores with a confidence level of 90% and a P value of .05.

3. Results

A total of 136 people were recruited to the study. Paired data for the questionnaire responses at baseline, and followup was available on 65% ($n = 88$) of the participants.

Demographic details (age, gender, deprivation category, and ethnic origin) of the participants and the population group from which they were selected are presented in Table 2. Proportions (and mean/standard deviation for age) are calculated for the LHCC Type 2 diabetes population and for the sample of 136 participants. A Chi-squared test of equal proportions was used to compare our sample against the remaining LHCC patients. Significant differences are shown in bold. There is evidence of a difference in the distributions of age category, deprivation category, and ethnic origin between our sample and the rest of the LHCC. Unfortunately this means that it is not possible to state that the sample is representative of the full LHCC patient group at the time.

Scores from the SF-36 and the PAID questionnaires are presented in Tables 3, 4, and 5. Comparisons are made for the whole group between the SF-36 as applied to other diabetic patient groups and this sample (Table 3). Thereafter, SF-36 and PAID results are presented by gender, age categories and by deprivation category (Tables 4 and 5).

3.1. SF-36 General Trends. Overall, the general health of the study group was similar to that of other published results on

Table 2: Comparison of patient demographic details between the research sample and the local health cooperative (LHCC) population of patients with Type 2 diabetes*.

Patient numbers with Type 2 diabetes in the LHCC and the research sample	Total patient population in the LHCC with Type 2 diabetes	Research sample	LHCC patient population with Type 2 diabetes (excluding research sample)	*P*-value
Total Number	1402	136	1266	—
Gender				.10
Female	662 (47%)	55 (40%)	607 (48%)	
Male	740 (53%)	81 (60%)	659 (52%)	
Mean age (SD dev) in years	63.76 (13.59)	65.38 (11.96)	63.57 (13.75)	.08
Age Category				**.003**
<55 yrs	346 (25%)	28 (21%)	318 (25%)	
55–64 yrs	324 (23%)	23 (17%)	303 (24%)	
65–74 yrs	415 (30%)	56 (41%)	357 (28%)	
>74 yrs	317 (23%)	29 (21%)	288 (23%)	
Deprivation category				**.007**
1	38 (3%)	3 (2%)	35 (3%)	
2	260 (19%)	27 (20%)	233 (18%)	
3	160 (11%)	26 (19%)	134 (11%)	
4	252 (18%)	32 (24%)	220 (17%)	
5	85 (6%)	8 (6%)	77 (6%)	
6	187 (13%)	11 (8%)	176 (14%)	
7	420 (30%)	29 (21%)	391 (31%)	
Grouped dep cat				**.001**
1 and 2	268 (21%)	30 (22%)	268 (21%)	
3, 4 & 5	431 (34%)	66 (49%)	431 (34%)	
6 & 7	567 (45%)	40 (29%)	567 (45%)	
Ethnic origin				**<.001**
Asian	254 (18%)	8 (6%)	246 (19%)	
Other	1148 (82%)	128 (94%)	1020 (81%)	

* Chi Squared statistics were used to compare differenced in frequencies.

larger samples but tended towards reduced levels at followup. There was no evidence of "floor" or "ceiling" effects; that is, the scaling was sensitive at the extremes of the scales and could detect changes in states of very poor health and very good health. The "physical function," "bodily pain," "role limitation physical," "role limitation mental," and "social function" scores were all better than other published results for people with diabetes at the beginning of the change in service delivery, but there was a lowering of these scores over the course of the study. Scores in "general health," "energy/vitality," and "mental health" commenced at a lower level and remained lower (Table 3). However, scores for the whole group showed no statistically significant change at the $P < .05$ level after implementation of the new model of care, except in the "bodily pain" domain ($P = .02$).

There were no differences between genders with the exception of a deteriorating mental health score for males. The oldest group showed more deterioration in SF-36 scores across "physical function," "role limitation due to physical function," "energy and vitality," and "bodily pain" (4 domains), whereas the youngest group showed more deterioration in "role limitation due to physical function," "social function," and "general health" (3 domains). There was also a statistically significant deterioration in "physical function," "role limitation due to physical function," "energy and vitality," "bodily pain," and "general health" (5 domains) for people in the highest socioeconomic groups (dep cat 1 & 2) with the scores for those in the other socioeconomic groups remaining stable (Table 4). HRQL was lower for all groups at baseline in socioeconomic groups 6 & 7 and remained so at follow-up assessment.

The middle years of 55–74 appear to be the most settled with no extremes in results. There was no evidence of improvement in SF-36 health domains. Any statistically significant changes across the whole group or within the patient subgroups examined were deterioration in health status.

3.2. PAID Scores. The results from this questionnaire were similar both before and after the implementation of the new community-based model of care (Figure 1). Scores indicated that there was sensitivity to different levels of

Table 3: Health-related quality of life scores: SF-36 by whole group and by gender before and 18 months after introduction of the new community model of care for people with Type 2 diabetes compared with other diabetic population groups (12).

SF-36 domains	SF 36 scores (9)	Whole group	Males	Females
n	541	88	52	36
Baseline/followup		B F	B F	B F
Physical function	67.7	75 versus 70 $P = .10$	75 versus 78 $P = .24$	73 versus 63 $P = .25$
Role limitation physical	56.8	75 versus 50 $P = .08$	100 versus 75 $P = .20$	50 versus 25 $P = .24$
Role limitation mental	75.6	88 versus 100 $P = .86$	100 versus 100 $P = .82$	67 versus 100 $P = .60$
Social function	82.0	89 versus 78 $P = .07$	89 versus 78 $P = .08$	78 versus 78 $P = .48$
Mental health	76.8	72 versus 70 $P = .18$	75.4 versus 71.2 $P = \mathbf{.02}$	66.1 versus 67.7 $P = .46$
Energy/vitality	55.7	51 versus 49 $P = .21$	54.1 versus 49.9 $P = .09$	47.5 versus 47.4 $P = .97$
Bodily pain	68.5	70 versus 63.9 $P = \mathbf{.02}$	72.5 versus 67.4 $P = .12$	67.3 versus 59.0 $P = .08$
General health	56.1	54.8 versus 51.7 $P = 0.13$	55.8 versus 51.1 $P = .09$	53.4 versus 52.6 $P = .80$

Table 4: Health-related quality of life scores: SF-36 before and 18 months after introduction of the new community model of care for people with Type 2 diabetes by age groupings and deprivation category. Statistical comparisons of baseline and follow-up data, when these data are not normally distributed, are based on the Mann-Whitney-Wilcoxon rank test.

SF-36 domains	Age <55 years	Age 55–64 years	Age 65–74 years	Age >74 years	Dep cat 1&2	Dep cat 3, 4 & 5	Dep cat 6 & 7
n	15	17	39	17	24	41	23
Baseline/followup	B F	B F	B F	B F	B F	B F	B F
Physical function	75 versus 80 (55–100) $P = .06$	75 versus 80 (43–90) $P = .19$	75 versus 70 (50–90) $P = .40$	65 versus 45 (45–78) $P < \mathbf{.001}$	75 versus 75 $P = \mathbf{.04}$	75 versus 75 $P = .23$	50 versus 45 $P = .64$
Role limitation physical	100 versus 50 (0–100) $P = \mathbf{.045}$	100 versus 100 (13–100) $P = .29$	50 versus 50 (0–100) $P = .51$	50 versus 0 (13–100) $P = \mathbf{.013}$	100 versus 50 $P = \mathbf{.01}$	100 versus 100 $P = .92$	25 versus 0 $P = .57$
Role limitation mental	100 versus 33 (0– 100) $P = .57$	100 versus 100 (46–100) $P = .46$	67 versus 100 (33–100) $P = .81$	100 versus 67 (17–100) $P = .52$	100 versus 100 $P = .80$	75 versus 100 $P = .25$	57 versus 33 $P = .22$
Social function	89 versus 67 (33–100) $P = \mathbf{.006}$	89 versus 78 (56–100) $P = .54$	89 versus 89 (67–100) $P = .71$	78 versus 67 (62–95) $P = .10$	100 versus 89 $P = .06$	89 versus 89 $P = .88$	67 versus 56 $P = .11$
Mental health	59.5 versus 56.3 $P = .41$	66.8 versus 67.5 $P = .71$	75.3 versus 73.6 $P = .47$	78.6 versus 74.8 $P = .13$	81.0 versus 77.5 $P = .06$	70.7 versus 70.6 $P = .96$	63.3 versus 60.0 $P = .35$
Energy/vitality	41.7 versus 41.3 $P = .92$	52.4 versus 52.4 $P = 1.00$	52.1 versus 51.2 $P = .73$	57.7 versus 46.8 $P = \mathbf{.04}$	62.7 versus 54.4 $P = \mathbf{.02}$	51.1 versus 50.2 $P = .74$	40.2 versus 40.7 $P = .93$
Bodily pain	68.3 versus 57.9 $P = .19$	66.1 versus 68.1 $P = .74$	70.4 versus 65.3 $P = .18$	76.5 versus 62 $P = \mathbf{.03}$	79.3 versus 67.6 $P = \mathbf{.03}$	70.5 versus 67.3 $P = .35$	60.9 versus 54.2 $P = .30$
General health	50.3 versus 41.4 $P < \mathbf{.001}$	52.3 versus 55.8 $P = .48$	56.7 versus 54.0 $P = .46$	56.8 versus 51.5 $P = .13$	64.1 versus 55.1 $P = \mathbf{.02}$	55.6 versus 53.6 $P = .40$	43.6 versus 44.7 $P = .83$

Table 5: Health-related quality of life scores: PAID questionnaires before and 18 months after introduction of community model of care for people with Type 2 diabetes.

Domain	Whole group		Males		Females		Age <55 years		Age 55–64 years		Age 65–74 years		Age >74 years		Dep cat 1 & 2		Dep cat 3, 4 & 5		Dep cat 6 & 7	
n	88		52		36		15		17		39		17		24		41		23	
Baseline/ followup	B	F	B	F	B	F	B	F	B	F	B	F	B	F	B	F	B	F	B	F
PAID	13 versus 13		12 versus 13		13 versus 13		25 versus 23		16 versus 13		10 versus 11		6 versus 9		9 versus 9		13 versus 14		14 versus 13	
	$P = .14$		$P = .17$		$P = .55$		$P = .86$		$P = .39$		$P = \mathbf{.045}$		$P = \mathbf{.02}$		$P = .11$		$P = .44$		$P = .54$	

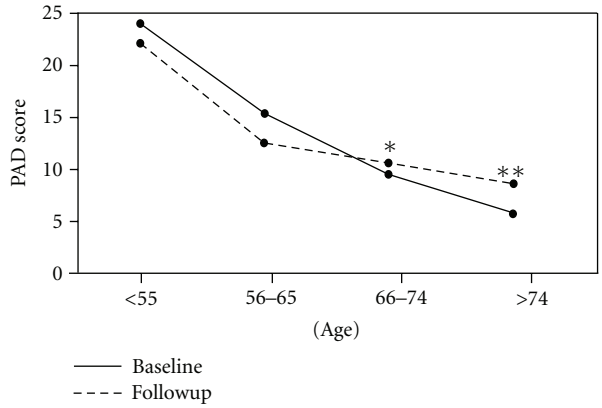

Figure 1: Baseline PAID score and follow-up PAID score versus age. *statistically significant difference with $P = .045$. **statistically significant difference with $P = .020$.

distress associated with diabetes and were slightly lower than other published data for people with diabetes [13, 18] in respect of lower and unchanged levels of distress following the introduction of the new community-based service. However, scores were generally low (less distress), but were relatively higher in younger participants (Table 5) and exhibited statistically significant deterioration in patients aged 65 years or more (Figure 1).

4. Discussion

In the study group, no major differences were observed in the pattern of HRQL and PAID scores both by comparison with other published assessment [11] or over the timeframe of the introduction of the new service except in respect of a deterioration in the "bodily pain" domain of SF-36 which was due to other conditions unrelated to diabetes. However, a tendency towards lowering of health status over the period of the study (see results section) emerged. Data on the presence of other medical conditions was noted in participants' accounts of their health, for example, presence of arthritis, but this was not confirmed by checking medical records.

An earlier study [19] showed no gender differences with the PAID questionnaire. This is further supported in the present study using the PAID and SF-36 questionnaires with the only exception being in respect of mental health for males. However, mental health scores were higher at baseline for male participants and higher than women overall. Nevertheless, the statistically significant result is that the mental health of males deteriorated during the period of the study, whereas that of females was stable.

This result contrasts with other work examining depression and diabetes which found no differences in levels of depression between men and women living with the condition [20]. This effect was observed only with the total group and was not obvious in analyses by age group or deprivation category. This was a surprise finding. Men are known to be less proactive than women in accessing health care facilities; nevertheless, there is no obvious reason why there should be such a deterioration in their mental health over this 18-month period.

A meta-analyses of studies examining links between depression in diabetes demonstrated a relationship with hyperglycaemia [21] and with an increased risk for complications [22]. People at elevated risk for depression can be identified through the medical history and clinical presentation and by asking depression-specific questions or through the use of depression screening tools. People with a history of depression, anxiety disorder, mental health treatment, substance abuse, or smoking are at heightened risk for depression, as are women and those with a family history of depression or mental health treatment. People who have multiple complications are more likely to be depressed, especially when those complications include neuropathy, impotence, or cardiovascular disease [22].

The older age group (>74years) experienced a greater deterioration in health scores than younger groups. This may reflect a group of people who are living with increased frailty generally but appear to have less psychosocial related health issues. By contrast, the youngest age group (<55years) had various deteriorations in health scores and, moreover, had the lowest, energy, and vitality scores for all age groups. A potential explanation for this observation is that people at this stage of life have many competing demands on time, for example, employment, commitments to children, and ageing parents although the study provides no supporting evidence.

Interestingly, the deterioration in health status as measured by the SF 36 questionnaire was statistically significant in deprivation categories 1 & 2 for various domains (Table 4). It is not clear why scores in this group decreased but the

outcome are scores that are similar to participants from deprivation categories 3, 4, and 5. By implication this places this group of people at higher risk of increased mortality and morbidity associated with increased levels of socioeconomic deprivation. It would appear that those in deprivation categories 1 & 2 are experiencing HRQL issues as if they lived in a lower deprivation category. This was a surprise finding, implying that the more articulate, educated people are just as much in need of support as those from a more deprived background.

It has been reported in the literature that diabetes disproportionately affects socially and materially disadvantaged individuals [23]. Higher levels of retinopathy, heart disease, and HbA1c and less health checks for the quality indicators of diabetes care have been reported leading to increased mortality and morbidity [24]. Our findings are similar in that we found the lowest levels of health scores in participants from the areas of highest socioeconomic deprivation. For participants from deprivation categories 3, 4, 5, and 6 & 7 there was a general deterioration in scores, but the trend was not statistically significant. This pattern of HRQL change differs from reports examining the impact of a range of interventions including diabetes education and behavioural modification (15 studies), pharmacotherapy (11 studies), and surgery (7 studies) in that these interventions generally demonstrated improvement in HRQL although the magnitude of effect varied [25]. Our evaluation is different in the respect that it assesses differences in two models of routine clinical care and as such the fundamental principles of care may not be radically changed compared with the testing of an additional focussed intervention. Recommendations have been made to develop further focussed strategies aimed at reducing inequalities of health outcomes for people with diabetes from areas of socioeconomic disadvantage [24].

It is interesting to note that PAID scores were at the lower level of distress severity compared with the generic SF-36 health domains where some domains were less than 50% of the possible optimal score. The statistically significant deterioration in scores in the older-age groups (Figure 1) could be related to the fact that these people had lived with the condition for a longer period of time and may be experiencing some of the wider pathological effects of diabetes. Alternatively, people newly diagnosed with diabetes in that age group may find the impact of diabetes greater than younger people. This conclusion, however, must be treated with caution, as it is based on the difference between just one individual.

A review of assessment and measurement of quality of life in people with Type 2 diabetes [26] acknowledged that there are many other variables that impact on quality of life, for example, demographics, comorbidities and psychosocial factors. The effect of daily ongoing monitoring of diet, exercise, medication management, and glucose monitoring to achieve as closely as possible a nondiabetic metabolic state was recognized as having a major impact on peoples' lives. New models of service delivery, such as that described here, can best support care management and are likely to improve HRQL.

Using both the SF-36 and PAID questionnaires allows insight into the impact of diabetes to health alone and a holistic assessment of overall health status. These questionnaires provide appropriate tools to evaluate a service that is moving from a specialist model to enhanced generalist community-based model of care, the latter being noted by participants to be important to them [27]. Because the general health scores were disproportionately lower than the disease-specific scores, it could be argued that a general, holistic health care context is more fitting for these patient's health care needs.

5. Conclusions

In the group studied, HRQL and distress associated with diabetes remained stable following the introduction of a change in the delivery of care from a hospital-based setting to a community model of care. The only statistically significant deterioration in HRQL was in bodily pain and was identified as due to other health conditions and unrelated to diabetes.

Although it is recognised that many factors impact on HRQL it is noteworthy that for particular age groups, people from socioeconomic groups 1 & 2 and males had significant deterioration in certain domains of their HRQL. The reasons for these findings are beyond the scope of this study but will form the basis for further investigation. In agreement with the literature, it was noted that HRQL was lowest at baseline in socioeconomic groups 6 & 7 and remained so at follow-up assessment.

The study confirms the value of measuring HRQL for people with diabetes, living with a chronic long-term condition, to identify changes in status as a mechanism for understanding wider health issues and developing individualised strategies to improve care. The HRQL measures have been shown to identify subgroups of people whose health may be particularly affected by the impact of diabetes mellitus. Assessment of HRQL could be integrated into annual review assessments.

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Paper 5

McDowell JRS, Inverarity K, O'Dwyer L, Lindsay G (2012b) An evaluation study using a mixed methods approach: Diabetes service redesign. *International Journal of Multiple Research Approaches* 6:1:10-22

International Journal of Multiple Research Approaches

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Introduction

The health-care context

There is an increasing prevalence of diabetes mellitus (diabetes) globally that is a major cause of morbidity and mortality. It is estimated that there are 346 million people with diabetes in the world of whom 90% will have type 2 diabetes and this is increasing annually (World Health Organization 2012).

Within the United Kingdom, 10% of the National Health Service (NHS) budget is spent on diabetes, approximately £10 billion, (The Global Diabetes Community 2012, Hex et al 2012) of which 80% was spent on managing potentially preventable complications in England (Diabetes UK 2012). In Scotland, 247,278 people (4.7%) have diabetes and it is estimated that 20,000 people are as yet undiagnosed (NHS Scotland 2011, The Scottish Public Health Observatory 2012). Inpatient costs for diabetes in Scotland (2005-2007) were 12% of total inpatient expenditure (Govan et al 2011).

To address the increasing prevalence of diabetes and limited health-care resources, new models of care have (Lindsay et al 2006) and are being adopted (Forbes et al 2010). Type 2 diabetes is initially managed by adjustments to lifestyle (SIGN 2010) and can be managed effectively within a primary care setting (Renders et al 2009).

Health is a devolved issue to the Scottish Parliament, formed in 2001, and the structure of diabetes in Scotland has developed in many ways. The Scottish Diabetes Group is served by sub-groups addressing all elements of care for people with diabetes (Diabetes in Scotland 2012) with the Diabetes Action Plan (The Scottish Government 2010) setting strategic direction. Specific aspects of care have been prioritised nationally through the appointment of short term

posts in professional and patient education, podiatry and paediatric care (2009-2014).

The papers critiqued in this thesis derived from an evaluation study undertaken as part of a service redesign to manage people with type 2 diabetes in Greater Glasgow Health Board (GGHB) in Scotland, which was the first of its kind. Interventions identified (Renders et al 2009) were applied in clinical practice to substantiate their effectiveness outwith a research setting.

The Project Report (Lindsay et al 2006)

The project report (Lindsay et al 2006) is based on a funded evaluation study that provides a significant contribution to diabetes service redesign. The overall study aim was: In what way does the introduction of a new model of care for people with type 2 diabetes impact on care management, health-care working practices, patient's health status and patients' satisfaction with care? Secondary objectives are identified (Lindsay et al 2006 page 5).

The research aim was answered using an evaluation before-and-after design with mixed methods (McDowell et al 2012b Paper 5) and secondary objectives addressed to varying degrees. Using a before-and-after design allows for comparisons within groups however the lack of an external control group reduces the rigour of the study. The Year of Care (2011) also used an evaluation design although it states flexible approaches for evaluation research are challenging.

The service redesign was being implemented through a phased, roll in programme. This meant that some people were still receiving care management from both primary and secondary care. While clinical standards and guidelines indicate that people need an annual assessment of their clinical parameters, it is also clear that to support self management, people want frequent contact with professionals (Forbes et al 2010, Shaban et al 2012, The Year of Care 2011) although the actual components of good clinical care are still not totally determined (Farooqi 2012, The Health Foundation 2011).

Our study showed statistically significant improvements in random blood glucose ($p<0.001$); cholesterol ($p<0.001$); systolic blood pressure ($p<0.001$) and smoking cessation status ($p=0.007$). A systematic review, using a meta-anlaysis and meta-regression synthesis of data, of the chronic care model used in our study, showed statistically significant improvements in HbA1c (mean reduction of 0.46%); blood pressure (mean reduction by 1.3mmHg) total cholesterol (mean reduction by 0.24mmol/l) (Si et al 2008) that supports our study. Differences in results may be due to the size of populations.

Secondary questions were addressed to varying degrees. General health status was assessed through questionnaires but health beliefs and related behaviours were not captured in any robust manner. Some aspects were addressed through focus groups but these were not substantiated by quantitative measures. Likewise comparisons between service provisions were limited from a patient perspective as not everyone who participated in focus groups had experience of the traditional care setting.

Forbes et als' scoping exercise (2010) identified that patients wanted education and to be cared for by professionals who were up to date. This confirms findings in the report (Lindsay et al 2006) whereby patients stated that they wanted more diabetes education. They were confident in their health-care professionals (HCP) who had undertaken an accredited diabetes course as part of the service redesign.

The service redesign model is similar to The Year of Care programme in England (2011) that identified that both organisational culture and systems must change to support new ways of working. Our study did not have any specific intervention to address the culture that, on reflection, may be a weakness.

Paper 1: Development of a questionnaire to assess professionals' perceptions of diabetes (McDowell et al 2007)

As primary HCPs were assuming the clinical management of people with type 2 diabetes, previously managed in secondary care, it was important to assess

their perceptions of the condition, its management and their attitudes towards it.

The infrastructure for the new model of care involved re-organising patient appointments, the clinic IT system and how care was organised. HCPs also had to undergo further education prior to implementation of the new service. As professionals' perceptions affect the care received, it was deemed important to assess their perceptions as these were core to addressing the research question.

No suitable questionnaire was found that would address all the necessary topics although other questionnaires appraised are discussed (McDowell et al 2007, page 366). The Perceptions of Diabetes Questionnaire (PODQ, Appendix 2) was designed to measure HCPs' perceptions of:

- the clinical management of type 2 diabetes;
- their attitude towards type 2 diabetes;
- their use of clinical guidelines;
- their practice organisation.

The novel approach to the development of the PODQ is described (McDowell et al 2007) and the outcome was a unique questionnaire developed to address specific research questions (Lindsay et al 2006, page 5). There is no right method to develop a questionnaire (McColl et al 2001, Oppenheim 2001, Polit, Hungler 1995) just as there is no unique method of assessing attitudes, behaviours and values. Observation research may measure behaviours but will not measure the person's attitude affecting these behaviours (Bowling 1997). Therefore the use of questionnaires with graded responses is considered to be an acceptable method of acquiring attitudinal data. Self administered questionnaires provide information that may be difficult to acquire by any other means (Moule, Goodman 2009) although weaknesses are that it is hard to determine the veracity of the answers nor is it possible to explore how a person's response actually relates to their behaviours.

The literature review identified relevant criteria that could be rated by professionals. A purposive sample of experts completed the questionnaire, returned it and attended a meeting six weeks later where the consensus group technique was used. The consensus group technique was important to add rigour to the final criteria so that the criteria were not determined on a 'tick box' mentality but that there was thought, discussion and debate around every item. There was the potential for group interactions to influence people's participation and responses and for bias, as they were intimately aware of the changes to the service delivery due to working, or being patients, within GGHB.

As all participants agreed with their earlier scoring, this ensured internal consistency of the questionnaire. The consensus technique was a test-retest for reliability (Polit, Hungler 1997). The only changes made were in relation to reducing the number of response options on the Likert scales from 1-10 to 1-5.

Thereafter, other professionals participated in the PODQ development through using the 'talk through' technique (Denig, Haaijer-Ruskamp 1994). This technique gives insights into such things as the wording of questions that would assist others in their understanding. Another group of HCPs piloted it. While different techniques were employed to develop the questionnaire they ensured that the final questionnaire had face, content and criterion validity and was acceptable and relevant for participants that should increase response rates.

The reliability of an instrument is the degree of consistency in repeat measure using the same tool (Polit, Hungler 1997). While the PODQ's reliability was established with the panel of experts, it was not established with the pilot group. On reflection, it would have further established the PODQ's reliability if it had been sent to the pilot group twice and both sets of results analysed. The practicalities of real life research was that the questionnaire development was just completed when the new service commenced and there was a degree of urgency to implement the questionnaire before there were too many changes in practice.

The outcome of this study is an original, validated questionnaire to explore professionals' perceptions of the management of people with type 2 diabetes and organisational structures within primary care that is unique.

The PODQ (McDowell et al 2007) has been used in further research (Lindsay et al 2006) in a cross sectional survey (McDowell et al 2012a). Moreover, it has been requested by international researchers from America, Portugal, Iran, Japan and India and used in Masters and Doctoral studies.

Further research would aim to determine the internal consistency of the instrument through establishing the Cronbach Alpha whereby higher values (between 0.0 and 1.00) reflect a higher degree of internal consistency.

Paper 2: Professionals' perceptions of type 2 diabetes (McDowell et al 2012a)

The aims of McDowell et als study (2012a) were to examine: HCPs' perspectives of type 2 diabetes; the management of type 2 diabetes; the value of clinical guidelines and the impact of practice organisation in the light of the service redesign.

A cross-sectional postal survey design was used as it provides information at that particular time point (Robson 2002). The findings would have been enhanced if a before-and-after design had been utilised and the same people re-surveyed about 18 months after the change in service. It was considered that the HCPs, some of whom had been involved in the development of the questionnaire (McDowell et al 2007), were fatigued with change and research and so a reminder and repeat postal survey was not undertaken. Results identified any problematic issues at the commencement of the change in service and provided a baseline for any future studies.

One finding was that HCPs attached great importance to patient education although there was no structured patient education available at this stage in the study. Patients also identified this as a need in the focus group study (McDowell et al 2009). These findings are supported by Forbes et al (2010) where participants

also wanted a national educational model with different types of education. Scotland has now implemented a structure for different levels of patient education (NHS Education for Scotland 2012a, 2012b).

HCPs undertook further education in diabetes (McDowell et al 2012a). Participants in Forbes et al's study (2010) requested that professionals were further educated in diabetes. Forbes et al (2010) found that professionals rated more positive views, than patients, of the quality of patient education provided. Hawthorne et al (2009) found that doctors reported giving lifestyle behaviour advice more than patients reported receiving it. Both quality of patient education and patients' perception of education received were not assessed in this study (Lindsay et al 2006). It would appear that professionals have a will and desire to support patient education but the delivery of education needs to be made more explicit and targeted to clinical need before patients recognise it as such.

While HCPs rated patient notes as very important they did not hold strong views about patient held records that contradict the ethos of the chronic care model (Wagner 1998). The Year of Care (2011) utilised joint care planning to support decision making and Forbes et al (2010) found that people with diabetes wanted transferable care plans between care settings. Patient held records and their use would be worthy of further research.

Professionals find that the management of type 2 diabetes in primary care is more difficult to treat than other chronic conditions. Type 2 diabetes is not perceived as a 'mild' condition that may reflect the benefits of new knowledge from the compulsory education that all professionals had to complete prior to the service redesign. Holman et als longitudinal study (2008) highlights the serious impact of a diagnosis of type 2 diabetes. A more recent study has shown that other GPs within the UK still adhere to the perception that type 2 diabetes is 'mild' when considering treatment options (Zhang et al 2011).

A previous study which identified that nurses and dietitians had more positive attitudes towards people with diabetes than doctors (Anderson et al 1992) was not supported in our study. There was almost no variation in responses according to professional grouping (McDowell et al 2012a), although small numbers per

profession prohibited any meaningful statistical analysis. A larger response rate would have given more meaningful results.

With further education in diabetes and appropriate changes in structures, professionals were satisfied with the new model of care and their workload. This has implications for chronic disease management within primary care.

Professionals' beliefs and behaviours have a significant impact on the care of people with diabetes that could still be improved by targeting activities addressing theoretical constructs e.g. social learning theory, aimed at changing clinicians' behaviours in a more positive manner (Presseau et al 2013). There are therefore more strategies being recognised as relevant in professionals' behaviour in diabetes care.

Paper 3: Perceptions of a service redesign by adults living with type 2 diabetes (McDowell et al 2006)

This qualitative focus group study provides the perspective of people with type 2 diabetes towards the change in service delivery (McDowell et al 2006). The preliminary analysis for the project report identified six themes that, on further in-depth analysis, were reduced to five as themes were condensed and re-titled to more accurately reflect content.

Living with diabetes remained a theme as this was a key component of the focus groups. Participants discussed the following aspects of care as making a large impact on their lives:

- the shock of diagnosis;
- making adjustments to food intake;
- the need to stop smoking;
- the need to increase exercise;
- the issue around meeting clinical targets;
- the psychological strain of diabetes.

These findings are similar to a more recent study (Donaghy 2009).

People living with type 2 diabetes greatly appreciated the change in service delivery as it was convenient, user friendly, delivered by professionals they could relate to and there was time to talk through issues in depth with the health-care professionals. All these aspects were also identified by Forbes et al (2010). Many indicated that they took responsibility for their own health, requested further patient education and a move to patient-held records. Again these findings are similar to those of Forbes et al (2010).

Limitations with this study are that volunteers may have been the more motivated people and are not necessarily representative of the population. As the focus groups were conducted during the day, this restricted attendance to those who were available at this time or could balance commitments with focus group attendance.

Participants highlighted the need to receive information and education for self-management that, at that time, was not fully implemented within primary care. Since the study ended, most GPs have a system whereby people are given details of their own clinical information. Coupled with this, participants can now register to access their own clinical data on a website dedicated for education (My Diabetes My Way). Structured patient education has also been initiated in primary care (Greater Glasgow and Clyde Health Board 2010).

In a recent study, most people reported low rates of receiving advice, self management and education (Hawthorne et al 2012) showing that lack of information and education are ongoing issues although there is variability between what professionals think they have given relating to education and what people perceive they have received.

Paper 4: Quality of life in people with type 2 diabetes (Lindsay et al 2011)

Patients' quality of life was assessed by a before-and-after cross-sectional survey using two international questionnaires: the SF36 for general quality of life and the PAID for disease specific aspects (Lindsay et al 2011). The combination of questionnaires was used to provide a broader approach that

could help identify health issues that one questionnaire alone may not identify (Rubin, Peyrot 1999).

This paper demonstrated no relevant change in quality of life during a change in service delivery (except for bodily pain, p=0.02, not related to diabetes) as the SF36 and the PAID scores were otherwise stable at both time surveys. Self-reported scores were stable in the SF36 with a trend towards deterioration following the change in service design in keeping with previous research (Jacobson et al 1994). Those from the lowest socioeconomic categories had the lowest scores at both the commencement of the new service and the follow up period.

There were some interesting results in the SF 36 that has not been previously reported. There appears to be a higher risk of increased morbidity and mortality evident in those from socioeconomic deprivation categories 1 and 2. There appears to be deterioration in mental health of men from deprivation categories 1 and 2 aged 54 years or less or 75 years or more. These both have implications for service delivery. The mental health of women remained stable.

Other studies indicate that quality of life is better among men than women (Jelsness-Jorgensen et al 2011, Goz et al 2007, Rubin, Peyrot 1999) although the presence of depression has a negative effect on quality of life independent of diabetes (Eren et al 2008). The incidence of both types of diabetes is greater in men in Scotland than in women (NHS Scotland 2011) and men are more likely to die younger in Scotland than in England (McCartney et al 2012) but this does not account for this result. Social support is acknowledged as a key factor in health (Osborne et al 2012, Goz et al 2007) and it could be that men in the above categories are limited in their social networks due to work commitments and, in later life, retirement and the loss of a spouse that adversely affects their mental health.

There is a significant increase in the likelihood of mental health symptoms when a person has two or more diabetes related complications (Jelsness-Jorgensen et al 2011, Rubin, Peyrot 1999) but such correlations were not conducted in this study. It has been identified that most quality of life tools do

not measure peoples' active involvement in their own lives (Osborne et al 2012) although we explored this through the focus group study (McDowell et al 2006, Paper 3)

PAID scores were lower than normally expected with people with diabetes. Scores were relatively stable throughout the study period except in older people who recorded deterioration in living with diabetes that may demonstrate there are other contributing factors influencing older people other than the change in service delivery (Osborne et al 2012).

The Scottish Executive Health Department (2002) demonstrated that the health of the people in Scotland and all cause mortality was the worst in Western Europe. While the divide between the more affluent and deprived areas widened life expectancy, there was a corresponding increase in long term conditions among those living in the more deprived areas. The lower PAID scores may therefore reflect a degree of pragmatism towards ill health as long term conditions may be considered as inevitable.

Paper 5: An evaluation study using a mixed methods approach: Diabetes redesign (McDowell et al 2012b)

This paper discusses the mixed methods research approach that is the theoretical and methodological basis for the evaluation study. The paper also presents key clinical outcomes during the change in service with some interesting results.

Research normally assumes either a positivist or naturalistic paradigm. A positivist paradigm assumes that reality exists and objectivity is sought. The researcher employs a deductive process to obtain knowledge, being independent from those being researched (Polit, Hungler 1995). The naturalistic paradigm assumes that reality is subjective and values are inevitable and desirable. The researcher interacts with participants and an inductive process is employed to obtain knowledge (Polit, Hungler 1995).

The research question normally indicates the paradigm to be employed (Creswell 2009, Medical Research Council 2008, Brink, Wood 2001). The overall aim of Lindsay et al's study (2006,) commences with 'In what way does…' (page 5). This implies that there is knowledge (positivist paradigm) that the change in service will have some impact on a variety of parameters. It was known that any change in service delivery impacts on both the recipients of the service and professionals delivering it. In determining the paradigm, there was a need to collect data that is both objective and quantitative e.g. clinical outcomes and also qualitative e.g. perceptions of diabetes, that gives explanatory insights into findings. Hence there is a naturalistic aspect to the research question.

The overall paradigm therefore is primarily quantitative in approach with a qualitative component that ensures there is synergy of effect (Creswell 2009) and adds rigour to the study (Creswell et al 2003). Traditional forms of research, employing only one method of data collection, may not be adequate to answer complex questions (Hesse-Biber, Burke 2013).

The new model of care delivery was a change in service that was not planned as a randomised control trial whereby cause and effect would be examined. Likewise, the evaluation study was not designed as an observational study whereby specific data is recorded and noted as the service redesign was a complex change involving structures, processes and primary HCPs that could not be easily observed. Coupled with this, inferences were to be made from data that could not be easily interpreted using observational research.

The research design should be determined by the philosophical underpinnings of the area of enquiry (Medical Research Council 2008, Brink, Wood, 2001). Evaluation research has a practical orientation with links to care and healthcare practices (Clarke 2001) and addresses current issues and questions about the way a service functions and its impact on care programmes or policies (Moule, Goodman 2009, Clarke 2001) which was appropriate for this complex study.

As a formative tool, evaluation research can be used during the developmental phase of a project to facilitate improvements while the project is active. It also considers the potential interpretive weakness of not considering all extraneous factors that may impact on the findings (Castro et al 2010). As a summative tool, it can be used on the completion of a project to provide guidance as to whether or not the project should be repeated (Moule, Goodman 2009). The study population were the implementers of the new service redesign and hence formative evaluation was the research design as findings from the study would influence any changes or improvements required for full implementation across GGHB.

The mixed method design of evaluation research was therefore ideal for studying the complexities of a project as it enabled the use of a variety of methods to consider the context of the project, changes made within that context and how people respond to these changes (Castro et al 2010, Stetler et al 2007, Burke, Onwuegbuzie 2004). It is also considered an appropriate method for an evaluation study within primary care (Borkan 2004) and has been utilised in subsequent studies (The Year of Care 2011, Forbes et al 2010). Moule and Goodman (2009) suggest that a good understanding of research designs and methods is needed to undertake an evaluation research project.

While there is a wide ranging debate on the philosophical paradigm of mixed methods research one definition is 'the investigator collects and analyzes data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of enquiry' (Tashakkori, Creswell 2007 pg 4). The methods may utilise a sequential or concurrent design (Creswell 2009). The concurrent design is characterised by collecting both quantitative data and qualitative findings during the same stage of the study (Creswell et al 2003) that was employed (Lindsay et al 2006).

There is consensus that the sequence of the phases in the study should be planned and that the data collection tools should be specified (Tashakkori 2009). As different groups of people were affected by the new service, each group required different research questions to be answered utilising different methods and tools (McDowell et al 2012b). This approach ensured that the

research questions were answered while weaknesses in using a single data collection method were overcome.

Other healthcare studies (Greenhalgh et al 2009, Byng et al 2005) have referred to evaluation research as 'realistic evaluation' indicating that, as a methodology, evaluation research is still developing although other authors propose that it is a natural complement to traditional paradigms (Burke, Onwuegbuzie 2004).

Lindsay et als' evaluation study (2006) therefore used a mixed methods approach. McDowell et als' paper (2006) presents the qualitative elements of this approach. Both Lindsay et al (2011) and McDowell et als' (2012b) papers present a before-and-after quantitative survey. McDowell et als' paper (2012a) utilised a cross-sectional survey approach.

Limitations of evaluation research utilising a mixed methods approach include: the lack of robust studies that makes it appear too complex to accomplish (Borkan 2004) although both Greenhalgh et al (2009) and Byng et als' large studies (2005) are addressing this limitation; the evolving theoretical framework of this method (Blamey, Mackenzie 2007, Byng et al 2005); and the complexities within which evaluation is undertaken (Byng et al 2005, Burke, Onwuegbuzie 2004).

In our study, quantitative data looked for measurable changes within health and well being that were analysed statistically. A shortcoming of this is that they cannot determine people's personal views and hence the qualitative aspect of the study was an acceptable method for considering how acceptable the change in service was to users.

There were statistically significant improvements in key clinical parameters and cardiovascular risk factors: improvements in non-smoking status ($p=0.007$) especially in men in the 55 year old age bracket; reduction of blood pressure ($p<0.001$), prescribing of statin therapy ($p<0.001$) and random blood glucose ($p=0.0043$). There was a trend of improvement in HbA1C. A subsequent study reported similar improvements in blood pressure, cholesterol and HbA1c results (Si

et al 2008). These findings suggest that people with type 2 diabetes can be safely and effectively managed in primary care.

Unique contribution to knowledge

This thesis contributes to unique knowledge in that:

- It was the first evaluation study of its kind in Scotland to consider clinical outcomes; patient and professional perceptions of type 2 diabetes and quality of life.
- The study demonstrates that utilising a mixed methods approach in an evaluation study of a complex service redesign can yield important data and findings for practitioners and funders within a relatively short time frame and be cost-efficient.
- The Perceptions of Diabetes Questionnaire is the only one of its kind appropriate for health care practitioners working in primary care.
- Contrary to recent research, the professionals in this study, after further education, did not consider type 2 diabetes as 'mild'.
- People with type 2 diabetes in deprivation categories 1 and 2 have similar health related quality of life as those in categories 3, 4 and 5.
- Men aged 54 years or less and 75 years or more in deprivation categories 1 and 2 showed deterioration in their mental health over an 18 month period.
- The reduction in smoking status in men in the 55 year old age bracket is unique.
- The statistically significant reduction of random blood glucose results has not been previously reported.

Implications for research

Further research could be undertaken in namely:

- Developing the internal consistency of the PODQ through test-retest reliability and establishing Cronbach's alpha.
- Explore professionals' perceptions around patient centred care, shared decision making and joint record keeping.

- Exploring self management for people with type 2 diabetes.
- Explore workforce planning for primary care management of people with type 2 diabetes.
- Further explore sub-groups of people with type 2 diabetes as the disease appears to have greater impact on health and wellbeing in men and some specific age groups.
- Follow up study of the patients in this study to see if improvements in clinical parameters and quality of life have been maintained.

Reflexivity

Through these studies, I have developed skills as a researcher. I have developed an enquiring approach and robust techniques to capture and analyse data. I was challenged in writing a research proposal for funding and navigated my way through the ethics approval and research governance processes.

I refined my skills in managing groups through conducting the focus groups and the consensus group technique, ensuring everyone contributed as well as remaining focused on questions posed.

Using a positivistic approach, I learned how important it is to determine key correlations required of data to inform working with statisticians and determine appropriate statistical tests to address research questions.

I was challenged in writing a final report for funders while also considering publications for the academic community that would include addressing the research questions in depth. These papers contribute new knowledge in specific areas as outlined in the thesis.

A further challenge was undertaking a Doctor of Philosophy degree by publications due to the lack of custom and habit of this route within my discipline. The thesis is compiled after the research is completed and consequently there is limited support for research training and supervision normally available to postgraduate research students (University of Glasgow 2013).

I have learned a lot about undertaking research that I have transferred into my daily working practices in relation to research supervision and leading further funded studies. I have yet more to learn and look forward to post doctoral studies.

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*** Selected publications submitted for the Doctor of Philosophy by published works**

Appendix 1

Perceptions of Diabetes Questionnaire

(PODQ)

PERCEPTIONS OF DIABETES QUESTIONNAIRE (PODQ)

The purpose of this questionnaire is to measure **your own professional views and perceptions of diabetes care** for people with **type 2 diabetes**.

Where any of the questions do not apply to every person with type 2 diabetes please try to rate the importance you would attach to these aspects of care where they do apply. For example, 'inspection of injection sites' is only relevant for those people with type 2 diabetes who have progressed to taking insulin, but how important would you rate this aspect of care for those to whom this does apply?

Thank you for taking the time to complete this questionnaire.

SECTION A Diabetes

1. How important do you **rate** these **methods of screening** to detect diabetes in general practice?

(Please score 1=not at all important, to 5=very important)

Urine Testing		1	2	3	4	5
Fasting Blood Glucose	1	2	3	4	5	
Random Blood Glucose		1	2	3	4	5
Oral Glucose Tolerance Tests		1	2	3	4	5
Glucose 2hrs After a Meal		1	2	3	4	5

2. How important do you **rate ongoing education and advice** of the person with type 2 diabetes with regard to:

(Please score 1=not at all important, to 5=very important)

Diet	1	2	3	4	5
Oral hypoglycaemic agents	1	2	3	4	5
Insulin administration	1	2	3	4	5
Insulin dose adjustment	1	2	3	4	5
Hypoglycaemia	1	2	3	4	5
Hyperglycaemia	1	2	3	4	5
Blood glucose monitoring	1	2	3	4	5
Urinary glucose monitoring	1	2	3	4	5
What to do when sick	1	2	3	4	5
Social eating	1	2	3	4	5
Alcohol	1	2	3	4	5
Exercise	1	2	3	4	5
Foot care	1	2	3	4	5
Smoking	1	2	3	4	5
Psychological aspects	1	2	3	4	5
Employment	1	2	3	4	5
Sexual Function	1	2	3	4	5
Contraception / Pregnancy	1	2	3	4	5

Driving & the DVLA		1	2	3	4	5

3. How important do you **rate** an **annual** undertaking of the following parameters for people with Type 2 diabetes?

(Please score 1=not at all important, to 5=very important)

Weight		1	2	3	4	5
Body Mass Index		1	2	3	4	5
Height		1	2	3	4	5
Dietary assessment		1	2	3	4	5
Blood Pressure	1	2	3	4	5	
Blood Samples taken		1	2	3	4	5
Testing urine for glucose		1	2	3	4	5
Testing urine for ketones		1	2	3	4	5
Testing urine for protein		1	2	3	4	5
Testing Visual Acuity		1	2	3	4	5
Retinal screening		1	2	3	4	5
Testing for neuropathy	1	2	3	4	5	
Inspection of feet / footwear		1	2	3	4	5
Inspection of injection sites		1	2	3	4	5
Impotence / Sexual functioning		1	2	3	4	5

4. How important do you **rate** the following management issues for people with Type 2 diabetes?

(Please score 1=not at all important, to 5=very important)

Optimise HbA1c levels	1	2	3	4	5	
Optimise Blood Pressure		1	2	3	4	5
Treat abnormal lipid profile		1	2	3	4	5
Return appointment		1	2	3	4	5
Discuss individual targets		1	2	3	4	5
Sources of help	1	2	3	4	5	
Diabetes UK		1	2	3	4	5

5. How important do you **rate referring** people with Type 2 diabetes to other professionals?

(Please score 1=not at all important, to 5=very important)

Dietitian	1	2	3	4	5
Specialist Diabetic Team	1	2	3	4	5
Retinal Screening Team	1	2	3	4	5
Exercise referral	1	2	3	4	5
Nephrologist	1	2	3	4	5
Other, please specify: _____	1	2	3	4	5

6. How important do you **rate** recording findings and results in any of the following sources?

(Please score 1=not at all important, to 5=very important)

Medical notes	1	2	3	4	5
Practice diabetes register	1	2	3	4	5
Patient held records	1	2	3	4	5
Other, please specify _____	1	2	3	4	5

SECTION B Attitudes to Type 2 Diabetes

Diabetes mellitus is defined as a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, protein and fat metabolism resulting from deficits in insulin secretion, insulin action or both. (Scottish Diabetes Framework, 2002)

We are interested in **your feelings about Type 2 diabetes and its treatment** in primary care.

1. How do you feel the treatment of Type 2 diabetes compares to other chronic diseases?
(Please score 1=diabetes is easier to treat, to 5=diabetes is harder to treat)

Hypertension	1	2	3	4	5
Hyperlipidaemia	1	2	3	4	5
Angina	1	2	3	4	5
Heart Failure	1	2	3	4	5
Arthritis	1	2	3	4	5

2. How would you rate the severity of Type 2 diabetes treated by:
(Please score1=not at all serious, to 5=very serious)

a) Diet alone	1	2	3	4	5
b) Tablets	1	2	3	4	5
c) Insulin	1	2	3	4	5

3. Type 2 diabetes is difficult to treat because people with diabetes do not adhere to recommended healthcare.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

4. How confident do you feel in your management of Type 2 diabetes?
(Please score 1=very confident, to 5=not confident)

1 2 3 4 5

5. I feel confident that my therapeutic actions / advice result in improved diabetic outcomes.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

6. I have enough training to care for people with Type 2 diabetes.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

7. I have adequate time and resources to effectively treat people with Type 2 diabetes.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

8. Diabetic care requires a team approach.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

'Patient-centred care' has been identified as care which explores patients' concerns, seeks an understanding of the patients' world, finds common ground on what the problem is and mutually agrees on management, enhances prevention and health promotion and enhances the continuing relationship between the patient and health professional (Little et al., 2001).

9. Patient-centred care can improve adherence to recommended healthcare of patients with Type 2 diabetes.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

SECTION C Use of Clinical Guidelines

We have defined clinical guidelines as any of the systematically developed statements to assist practitioner and patient decisions about appropriate health care for people with type 2 diabetes.

We are interested in your level of usage of guidelines for people with Type 2 diabetes.

1. Please rate the level of organisational support you feel your general practice provides for the use of guidelines.
(Please score 1=very little support, to 5=very high support)

1 2 3 4 5

2. Clinical guidelines affect the degree to which your consultations are patient centred.
(Please score 1=strongly agree, to 5=strongly disagree)

1 2 3 4 5

3. Which of the following do you feel are benefits to using clinical guidelines?
(Please score 1=not a benefit, to 5=very much a benefit)

Keeps you up to date with research findings	1	2	3	4	5
Access to research findings	1	2	3	4	5
Saves time reading research papers	1	2	3	4	5
Shows how to apply research in practice	1	2	3	4	5
An aid to clinical decision making	1	2	3	4	5

4. Which of the following do you feel are barriers to using clinical guidelines?
(Please score 1=not a barrier, to 5=very much a barrier)

No time to read	1	2	3	4	5
Relevant literature not accessible	1	2	3	4	5
Lack of time to implement new ideas on the job	1	2	3	4	5
Facilities are inadequate for implementation	1	2	3	4	5
Organisation will not cooperate with implementation	1	2	3	4	5
Ability to evaluate quality of research	1	2	3	4	5
Little understanding of statistics	1	2	3	4	5
Adverse effect on relationship with patient	1	2	3	4	5

SECTION D Practice Organisation

1. Does your practice run a diabetic clinic?
(Please tick the appropriate box)

Yes
No
Don't know

If yes, who runs the clinic?
(Please tick the appropriate box(es))

Practice Nurse
GP
Health Visitor
Don't know
Other, please specify: _____

2. What is the average length of time you as a professional spend with your client during their clinic appointments? (or in their own home, if relevant)
(Please tick the appropriate box)

10 mins ☐
20 mins ☐
30 mins ☐
Other, please specify: _____

3. How satisfied are you with the care delivery system in place for people with Type 2 diabetes in your practice?

(Please score 1=not at all satisfied, to 5=very satisfied)

1 2 3 4 5

4. How do you perceive the workload that is attributed to diabetic care in your own practice?

(Please score 1=too much, to 5=not enough)

1 2 3 4 5

5. What types of care does your practice provide for each of the following client groups? (Please tick the appropriate boxes)

Client groups	**Does not provide care**		**Sole care provider**		**Shared care**	
	Type 1	**Type 2**	**Type 1**	**Type 2**	**Type 1**	**Type 2**
Children	☐	☐	☐	☐	☐	☐
Teenagers	☐	☐	☐	☐	☐	☐
Adults	☐	☐	☐	☐	☐	☐
Elderly	☐	☐	☐	☐	☐	☐

6. Does your practice provide leaflets for people with diabetes?
(Please tick the appropriate box)

Yes ☐
No ☐

SECTION E About You

Finally we would like to ask you some questions about yourself.

1. What gender are you?
(Please tick the appropriate box)

Male ☐
Female ☐

2. In what year did you qualify as a health care professional?

(Please write in the box)

3.Please indicate your position within primary care
(Please tick the appropriate box(es))

General Practitioner
Practice Nurse ☐
District Nurse ☐
Diabetes Nurse Specialist ☐
Dietitian ☐
Podiatrist ☐
Practice Manager ☐
Other, please specify: _____

4. What professional qualification(s) do you hold?

MBChB
MRCGP
FRCGP
DRCOG
Practice Nurse Qualification
Other, please specify: _____

RN ☐
SEN ☐
DN ☐
HV ☐
☐

5. What diabetes-specific education have you undertaken?
(Please tick all that apply)

Bradford course ☐
University of Warwick course ☐
Other(s), please specify: _____

Finally, please note down any other issues which you think this questionnaire may not have fully covered.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Appendix 2

Declarations of authorship

Personal contribution towards thesis of published works

Lindsay G, McDowell J, McPhail K (2006) An evaluation of the impact of the Glasgow Diabetes project for healthcare for patients with type 2 diabetes. University of Glasgow, Glasgow ISBN: 9780852618233
JRSMcD and GL collaborated in the development of a research proposal that was submitted for peer reviewed consideration and was successful in attracting funding. JRSMcD led on the writing of the report with contribution from GL, and significant contribution from KMcP the research assistant.

McDowell JRS, Lindsay G, McPhail K (2007) Development of a questionnaire to determine professionals' attitudes to type 2 diabetes. *Journal of Research in Nursing* 12:4:365-370
JRSMcD had the original idea for developing the proposal and was successful in the application, with GL as Co-Investigator, in acquiring funding. JRSMcD led on the writing of the paper with contributions from GL and KMcP, the research assistant.

McDowell JRS, McPhail K, Halyburton G, Brown M, Lindsay G (2009) Perceptions of a service redesign by adults living with type 2 diabetes. *Journal of Advanced Nursing* 65:7:1432-1441
JRSMcD and GL collaborated in the development of a research proposal that was submitted for peer reviewed consideration and was successful in attracting funding. JRSMcD led on the writing of the paper with contributions from GL and KMcP, the research assistant. This paper could not have arisen without the support and input of clinical leads. GH facilitated access to both patients and professionals. MB was the Local Health Care Co-operative Lead and Trust Collaborator and provided invaluable support and knowledge of the organisational change as well as facilitating access to both patients and professionals.

Lindsay G, Inverarity K, McDowell JRS (2011) Quality of Life in People with Type 2 Diabetes in Relation to Deprivation, Gender, and Age in a New Community-Based Model of Care. *Nursing Research in Practice* Article ID 613589, 8 pages doi:10.1155/2011/613589

JRSMcD and GL collaborated in the development of a research proposal that was submitted for peer reviewed consideration and was successful in attracting funding. GL led on the writing of the paper with significant contribution from JRSMcD and discussion with KI, the research assistant.

McDowell JRS, Inverarity K, O'Dwyer L, Lindsay G (2012) An Evaluation Study using a Mixed Methods approach: Diabetes Service redesign. *International Journal of Multiple Research Approaches 6:1*

http://mra.e-contentmanagement.com/archives/vol/6/issue/1/

ISSN 1834-0806

JRSMcD and GL collaborated in the development of a research proposal that was submitted for peer reviewed consideration and was successful in attracting funding. JRSMcD led on the writing of the paper with contribution from GL, and in discussion with KI and LO'D, research assistants.

McDowell JRS, Inverarity K, Gilmour H, Lindsay G (2012) Professionals' perceptions of type 2 diabetes in primary care during a service redesign. *European Journal of Diabetes Nursing* 9:1:6-11

JRSMcD and GL collaborated in the development of a research proposal that was submitted for peer reviewed consideration and was successful in attracting funding. JRSMcD led on the writing of the paper with contribution from GL, and further statistical analysis of data from HG and in discussion with KI, the research assistant.