

DOROTHEA: A physical activity promotion programme for adults with type 2 diabetes

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Article points

1. Exercise referral schemes have high drop out rates: 80% of participants will fail to complete the programmes.
2. Previous research has found that exercise consultation using motivational interviewing techniques can be successfully employed among adults with type 2 diabetes.
3. Motivational interviewing techniques can be successfully integrated into existing local health service provision.
4. High retention rates in programmes can be achieved with appropriate and modest levels of support.

Key words

- Physical activity promotion
- Motivational interviewing

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This study evaluated the effects of a 12 month physical activity promotion programme Diabetes On Referral Option To Healthy Exercise for Adults (DOROTHEA) that used motivational-based exercise consultations in a population of adults with type 2 diabetes. A total of 225 adults, from two inner London PCTs, with type 2 diabetes took part. The intervention involved hour-long face-to-face consultations with an exercise specialist at 0, 3 and 12 months, and telephone support at 1, 4 and 9 months. The intervention focused on facilitating the participants to build more physical activity into their daily routines. Community-based exercise options were also offered locally at little or no charge. The evaluation measured changes in the participants' physical activity levels as well as other health-related outcome measures.

Type 2 diabetes has become an increasingly serious health problem in the UK and the general population's physical inactivity seems to be a major contributing factor to this rise (McGavock et al, 2004).

Along with diet and medication, increasing physical activity levels in people with type 2 diabetes is now seen as one of the most important aspects of therapy (Miller and Dunstan, 2004; Di Loreto et al, 2005). One session of moderate physical activity can increase glucose uptake by 40% (Perseghin et al, 1996) and if physical activity can be sustained it can have a dramatic effect on glycaemic control as measured by HbA_{1c} (Boule et al, 2001).

Current guidelines suggest that everyone should accumulate a minimum of 30 minutes moderate physical activity on 5 days a week (Pate et al, 1995). It is estimated that 60–80%

of people with type 2 diabetes fail to achieve this (Krug et al, 1991) and up to a third are completely sedentary (Nelson et al, 2002). Yet it is rare that health provision for people with type 2 diabetes prioritises encouraging them to exercise (Wilson et al, 1986; Kirk et al, 2004).

While much research has shown that physical activity interventions can help increase physical activity levels in the short-to medium-term, changes over longer periods seem unsustainable (Miller and Dunstan, 2004; Morgan, 2005).

Research into the reasons why adults with diabetes do not exercise has found that lack of time, lack of local facilities, tiredness, distractions (such as television) and perceived difficulty of taking part in exercise all contribute (Thomas et al, 2004). Among different ethnic groups these barriers to exercise are intensified by cultural norms and social expectations (Lawton et al, 2006).

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1. The DOROTHEA (Diabetes On Referral Option To Healthy Exercise for Adults) programme aimed to assess a technique of exercise consultations based on the trans-theoretical model of behaviour change.
2. The hypothesis was to discover whether or not participants could be empowered regarding their choices for physical activity, and benefit from both physiological and psychological improvements.
3. The programme recruited 225 participants with type 2 diabetes from two London PCTs.
4. The primary outcome measure used was 7-day physical activity recall (PAR).

However, a recent randomised, controlled trial specifically targeted at people with type 2 diabetes has provided positive outcomes. Over the course of a year, the programme used exercise consultations based on the trans-theoretical model of behaviour change (Kirk et al, 2004). This method offers different strategies to the users based on their current stage of readiness to change and encourages them to make their own choices and decisions regarding physical activity. The goal of DOROTHEA (Diabetes On Referral Option To Healthy Exercise for Adults) was to pilot this technique in a local healthcare setting and evaluate whether or not it could be integrated into the diabetes care currently on offer.

Methods**Setting**

The DOROTHEA programme was established in conjunction with local GP practices. The programme recruited people with type 2 diabetes living within two inner London PCTs. Participants were recruited between April 2004 and February 2005 and were part of the programme for 12 months.

Recruitment

Prior to the launch of the project, all the GP practices in the two selected London PCTs were contacted (n=112) with information about DOROTHEA. Those GP practices that chose to participate then referred people (n=272) based on the participant's interest upon hearing about the programme and lack of contraindications to exercise. Of the 272 people referred, before the end of the recruitment period (April 2004 until February 2005), 225 attended the first consultation (82.7%).

Intervention

Over the course of the year, participants attended three in-depth consultations at 0, 3 and 12 months. These one-to-one, semi-structured meetings were conducted with an exercise specialist. The individuals' current physical activity and motivation levels were

established and formed the basis upon which any advice or encouragement was given. The exercise specialist took a role in the following: encouraging the participants to assess the benefits as well as the costs of increasing activity; agreeing possible strategies to help overcome barriers; explaining the effects of exercise on diabetes; and negotiating achievable goals with the participant. General activities such as walking and housework were promoted, with the focus of the consultation being based around the kinds of activity most suited to the individual. This was achieved by looking at any physical activity already part of the individual's daily life and building on it by adding time, frequency and intensity.

For those participants who wanted a more formal format, the programme offered locally provided exercise options including group walks and exercise classes held at community venues. These activities were designed to be as accessible and enjoyable as possible. Follow up telephone calls at 1, 4 and 9 months offered support and considered any relapse prevention.

Design and outcome measures

The evaluation was carried out using an uncontrolled before and after design. The primary outcome measure used was the 7-day physical activity recall (PAR; Sallis et al, 1985) – this was obtained as part of the consultation with the exercise specialist. The exercise specialist also collected Stage of Change information (*Table 1*; Prochaska, 1979), SF-36 (Medical Outcome Short Form [36] Health Survey; Ware and Sherbourne, 1992), waist-hip ratio and resting heart rate data. Other data collected from the participant's GP practice over the course of the year were: HbA_{1c}, levels of cholesterol and triglycerides, weight and blood pressure.

A small amount of qualitative research was undertaken, seeking the views and experiences of those who had been referred to DOROTHEA and the health professionals who had referred them. The details and results of this research have been submitted for future publication.

Statistical methods

All statistical tests were carried out as two-sided tests at the 5% level. The analysis used t-tests, chi-squared tests, sign tests and McNemar tests; and 95% confidence intervals (CIs) are also reported.

Results

Of the 225 participants recruited there was a larger proportion of women than men (53.3%). Demographically, a significant difference was found between the ethnic distribution of the participants and the estimated prevalence of type 2 diabetes in the area ($P<0.001$). A larger number of Black participants than might have been expected took part, while Caucasian participants were under-represented. However, since none of the results showed any association with ethnicity, the results should be representative of the whole population being studied.

Results at 3 months

Of the 225 participants who attended the baseline consultation, 171 (76%) attended their 3 month follow-up. A comparison of those who attended the 3 month consultation and those who did not found a significant difference between the ethnicity and attendance: Black participants were more likely to continue to attend than those who were of Caucasian or Asian origin. However, no other significant differences were found with regard to age, baseline measure of BMI, HbA_{1c} levels, cholesterol, blood pressure, SF-36 or physical activity level.

Of the participants who attended the 3-month consultation, a significant increase was found in the mean calorific expenditure (as measured by PAR). At baseline, the mean energy expenditure was 817.95 kcal/week (SD 951.44 kcal/week). At 3 months this increased to a mean expenditure of 1325.16 kcal/week (SD 1249.81 kcal/week). This is a significant increase of 507.21 kcal/week ($P<0.001$, 95% CI 333.14 to 681.27 kcal/week) and represents a 62% increase in mean energy expenditure over 3 months.

Assessment by Prochaska's Stage of Change

model found 58% of participants made a positive change and this improvement was found to be significant ($P<0.001$). Statistically significant differences were also found in the direction of improved health for three of the nine SF-36 dimensions of health scores as shown in *Table 2*. Although there were reductions in resting heart rate, waist-hip ratio, blood pressure, cholesterol and triglycerides, these were not statistically significant. There was a small but non-significant increase in BMI.

In data collected from the GP practices, HbA_{1c} levels were available for 97 of the participants who returned for their 3 month consultation. For these participants there was an absolute decrease in the mean HbA_{1c} level of 0.53% (95% CI 0.90% to 0.017%). This indicates that the mean HbA_{1c} values have significantly decreased ($P=0.005$) with a 6.5% relative reduction in the mean HbA_{1c} levels over 3 months. Each 1% absolute reduction in HbA_{1c} over ten years is associated with a decrease in frequency of some clinical complications of type 2 diabetes (UK Prospective Study Group, 1998) and Farmer et al (2005) have identified an absolute reduction in HbA_{1c} of 0.5% as clinically important.

Results at 12 months

At 12 months 167 participants (74.2%) attended a consultation. A comparison of the demographic and baseline characteristics

Page points

1. Seventy-six per cent of the people with diabetes who attended an initial consultation returned for their 3 month consultation.
2. Calorific expenditure, as measured by PAR (physical activity recall), significantly improved by the 3 month consultation.
3. HbA_{1c} levels significantly improved compared to baseline.

Table 1. Stage of Change categories.

Precontemplation	I am not currently very physically active and I don't intend to become more active in the next 6 months OR I am too busy right now.
Contemplation	I am not currently very physically active, but I am thinking about increasing the amount of activity I take in the next 6 months.
Preparation	The amount of activity I take varies: sometimes I am physically active, other times not.
Action	I am currently physically active on most days, but have only just begun to be so within the last 6 months.
Maintenance	I am currently physically active on most days, and have been so for longer than 6 months.
Termination	A year ago I was physically active on most days, but in the last few months I have been less active.

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1. At 3 months participants were shown to significantly improve their Stage of Change.
2. There were non-significant reductions in resting heart rate, waist-hip ratio, blood pressure, cholesterol and triglycerides.
3. Of the people with diabetes who attended an initial consultation, 74.2% returned for their 12 month consultation.
4. Participants made the most changes to their physical activity during the first 3 months, but were able to sustain these changes for 12 months.

found no statistically significant differences between those who attended and those that did not.

Of the 167 participants who did attend the 12 month consultation, there was a significant increase in their calorific expenditure (as measured by the PAR). At baseline, the mean energy expenditure was 824.04 kcal/week (SD 943.62 kcal/week). At 12 months this increased to a mean expenditure of 1543.24 kcal/week (SD 1461.84 kcal/week). This is a significant increase of 719.21 kcal/week ($P < 0.001$, 95% CI 511.59 to 926.83 kcal/week) and represents an 87.26% increase in mean energy expenditure over 12 months. An analysis of change in the calorific expenditure for the participants who attended all three consultations is shown in *Figure 1*. This shows that the participants made the most changes to their physical activity in the first 3 months and that the participants managed to sustain these changes over the final 9 months of the programme. For the purposes of illustration, the highest and lowest scores

were removed from the box plot (9274.5 and -5703.5 kcal/week for 3 month change, 5422.50 and -5271.00 kcal/week for 12 month change).

At 12 months, a statistically significant difference ($P < 0.001$) was found in which Stage of Change the person with diabetes was currently occupying, with 60% of participants having made a positive change.

Statistically significant differences were found in the direction of improved health for five of the nine SF-36 dimension of health scores (*Table 2*). The results show that the participants have felt improvements in their physical function, mental health, energy/vitality, and overall in the perception of their health and change in health.

In the data collected from the GP practices at 12 months a statistically significant reduction in systolic blood pressure was found ($P = 0.04$). No other significant differences were found (although this could be due the lack of data).

Discussion**Table 2. Impact of intervention on primary outcome measures at 3 months and 12 months.**

		Baseline		Change at 3 month intervention				Change at 12 month intervention			
		n	Mean	n	Mean change	95% CI	P-value	n	Mean change	95% CI	P-value
PAR	kcal/week	225	815.41	171	507.21	333.14, 681.27	0.001	167	719.21	511.59, 926.83	0.001
SF-36	Physical function	220	67.71	165	2.59	0.10, 5.08	0.041	165	4.67	1.51, 7.83	0.004
	Role limitation due to physical problems	220	67.04	165	2.86	-3.61, 9.33		165	4.81	-1.71, 11.35	0.147
	Role limitation due to emotional problems	219	69.84	165	1.00	-6.14, 8.15	0.782	165	1.41	-5.63, 8.44	0.694
	Social functioning	218	78.13	166	-0.73	-4.82, 3.36	0.724	164	-0.47	-4.52, 3.58	0.818
	Mental health	219	72.79	166	0.65	-2.12, 3.42	0.645	161	2.79	0.21, 5.37	0.034
	Energy/vitality	220	56.71	166	1.62	-1.39, 4.62	0.290	163	3.81	0.94, 6.68	0.010
	Bodily pain	219	67.32	166	-1.26	-5.34, 2.81	0.541	165	-3.94	-8.33, 0.43	0.077
	General health	222	55.83	166	3.76	1.15, 6.37	0.005	164	6.78	4.03, 9.53	0.001
	Perceptions of change in health	220	57.43	166	8.53	3.33, 13.73	0.001	165	15.78	10.36, 21.27	0.001
HbA _{1c}		160	7.91	97	-0.53	-0.90, -0.017	0.005				

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1. The DOROTHEA programme increased physical activity levels in 56.9% of participants.
2. Despite drop-out rates of 80% in other exercise referral schemes, DOROTHEA retained 74.2% of participants 12 months after initial consultation.
3. The programme's supportive approach seems to enable participants to become more physically active while significantly increasing expected retention levels.

The randomised, controlled trial piloted by Kirk et al (2004) has important implications for healthcare providers in the design and management of exercise interventions for adults with type 2 diabetes. It demonstrated how much more effective exercise consultations can be in increasing people's activity levels than the standard practice of telling them to do more exercise or handing over a leaflet to read.

In taking up the proposition by Kirk et al (2004) that physical activity counselling should become a part of standard diabetes care, DOROTHEA piloted the approach in local primary health care practices. The main purpose was to see whether the beneficial effects demonstrated in Kirk et al's studies (2001, 2003, 2004) could be achieved as part the current diabetes care services for adults with type 2 diabetes delivered by PCTs.

DOROTHEA achieved a comparable success rate, increasing physical activity levels in 56.9% of the participants compared to a 57% in Kirk et al (2004) and significant reductions in HbA_{1c}, systolic blood pressure

and positive changes in the SF-36 scores, similar to Kirk et al (2001, 2003). But, perhaps most surprisingly of all, DOROTHEA managed to retain 74.2% of its participants at 12 months. A recent review of exercise referral schemes in primary care found that average drop-out rates were around 80% (Gidlow et al, 2005). DOROTHEA's much lower attrition rate of approximately 26% seems especially noteworthy considering that people with type 2 diabetes are often less active to begin with (Thomas et al, 2004), and that the accompanying health problems experienced by many of the DOROTHEA participants such as high blood pressure, high BMI and heart problems, would exclude them from the more generic exercise referral programmes normally available.

Research investigating the causes behind high attrition rates of other exercise referral programmes has found that reasons included: inconvenience of timing of the programmes; lack of transport; and a general dislike of the gym environment (Gidlow et al, 2005). Facilitators of these programmes were also found to be a significant reason for attrition, in particular the problems with the staff and the level and type of programme they set for the participants (Lippke et al, 2003).

In assessing why DOROTHEA seems to be so much more successful than other exercise referral programmes, the evidence gathered from the qualitative part of the study suggests that DOROTHEA was able to avoid many of the problems listed above. Detailed outcomes have been submitted for print, but in summary: the programme was able to offer individually tailored advice in a supportive and practical manner; there was a variety of exercise options on offer in both formal and informal environments; the participants were able to form a relationship with the exercise specialists throughout the course of the year; and many of the participants interviewed, who had increased their activity levels, noted seeing improvements in their health that motivated them to sustain the changes they had made.

Further research is required to improve understanding of how to better facilitate

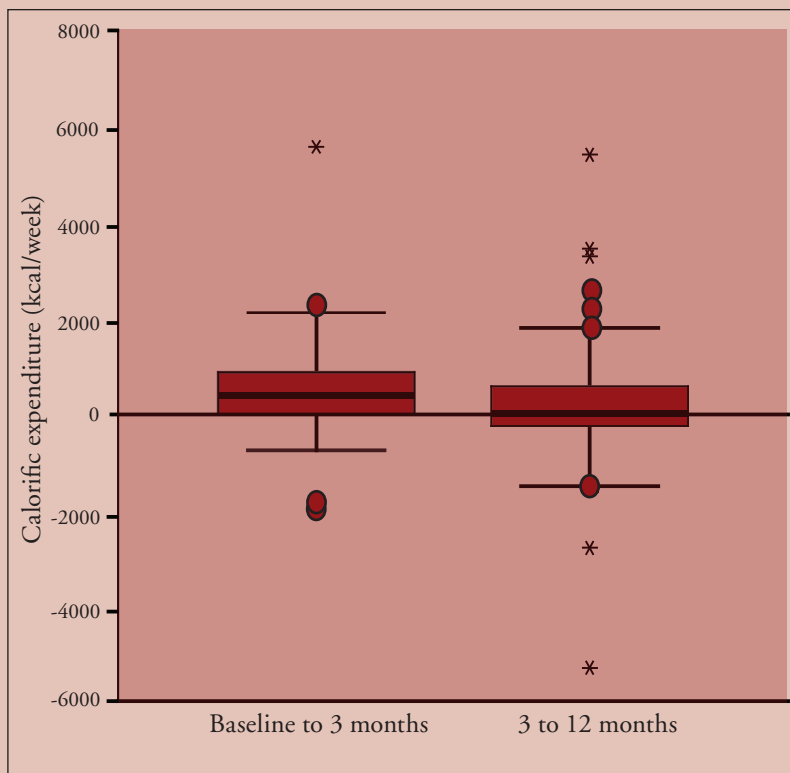


Figure 1. Change in calorific expenditure of participants.

people's initial attendance and adherence to such exercise schemes. The question also remains as to how best to integrate all the elements required for successful management of diabetes in the most cost-effective manner. DOROTHEA provides one potential component of such a service and was exercise focused, with the diabetes management service in the PCT providing other components. Other approaches, for example, that of Logan et al (2006) seek a more fully integrated service.

The service considered by Logan et al (2006) is aimed at people newly diagnosed with type 2 diabetes, while DOROTHEA accepts people newly diagnosed with diabetes and those who have had it for some time. Logan et al's (2006) exercise part of the programme was focused on attending classes and failed to demonstrate any change in exercise level, while DOROTHEA

focused on encouraging people to become more active in their daily lives, with classes available for those that wanted classes, and was more successful at increasing people's level of activity. Perhaps a combination of Logan et al's education package and DOROTHEA's exercise approach would be more successful than either individually.

A limitation of our study is the lack of longer term follow-up post cessation of the programme. It proved very difficult to gather the blood data (HbA_{1c} and cholesterol) from the general practices and frequently these measures were not taken sufficiently close to the study time points. Future studies should, if possible, make their own measurements of these important variables.

Conclusion

The DOROTHEA programme was

'Many of the participants interviewed, who had increased their activity levels, noted improvements in their health that motivated them to sustain the changes they had made.'

successful in achieving a significant increase in physical activity levels and unusually high retention levels. This suggests that the exercise consultation using motivational interviewing techniques can be successfully incorporated within existing diabetes care. The programme's supportive approach seems to enable participants to become more physically active while significantly increasing expected retention levels. And, as Kirk et al (2004) argue, the introduction of such a programme requires minimal expense and can be employed by any member of the diabetes team with appropriate training. ■

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