Chapter 7

Is there a window of opportunity for behaviour change? A comparison of behaviour and cognitions between patients with screen-detected and clinically diagnosed type 2 diabetes

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Abstract

Aims

To investigate whether patients with type 2 diabetes detected by screening and patients clinically diagnosed differ in health behaviours and cognitions.

Methods

The study population consisted of 239 screen-detected patients and 239 patients clinically diagnosed within the past three years. In a cross-sectional study, questionnaires were used to assess physical activity and dietary intake. Cognitions were assessed by a Theory of Planned Behaviour questionnaire, the Illness Perception Questionnaire-Revised (IPQ-R), and the Short Form Spielberger State Anxiety Inventory (SF-STAI). The impact of time since diagnosis on behaviour and cognitions was investigated in clinically diagnosed patients.

Results

There were no between-group differences in physical activity. Clinically diagnosed patients reported a healthier dietary intake. Screen-detected patients had a stronger intention to change physical activity than clinically diagnosed patients (3.9 ± 0.8 vs. 3.6 ± 0.8, respectively) and also a stronger intention to change dietary intake (3.9 ± 0.8 vs. 3.6 ± 0.7 respectively). Illness perceptions did not differ between groups. Screen-detected patients had a lower median anxiety score (SF-STAI: 30.0, interquartile range 23.3 – 40.0) than clinically diagnosed patients (SF-STAI: 33.3, interquartile range 26.7 – 43.3) ($p<0.001$). There was no association between time since diagnosis and behaviour or cognitions.

Conclusions

Patients detected by screening had stronger intentions to change their physical activity and dietary intake. Clinically diagnosed patients reported higher levels of anxiety. No impact of time since diagnosis was found, suggesting that between-group differences may have been due to screening. Diagnosis by screening may represent a window of opportunity for behavioural interventions.

Introduction

There is increasing interest in screening for type 2 diabetes. It is believed by some that earlier diagnosis and treatment will help to prevent or delay the onset of diabetes-related complications (1,2). In addition, evidence that screening induces psychological problems has not been forthcoming (3-6).

The management of diabetes is complex as it involves change in several behaviours: adopting a healthy diet, increasing physical activity, stopping smoking and taking medication as prescribed (7). Nevertheless, behavioural interventions among people with type 2 diabetes have been successful, resulting in lifestyle change (8,9).

Screening identifies people when asymptomatic and does not appear to be associated with psychological problems. Patients detected by screening may be more motivated to reduce the risk of developing complications (10,11). Screening may therefore represent a potential window of opportunity for behaviour change. Investigation of cognitions underlying intention to change behaviour might provide insight into the possible existence of such a window of opportunity (12,13).

A few studies have found differences in cognitions in subgroups of patients with diabetes. Adriaanse et al. found that newly diagnosed patients in general practice reported more symptom distress and a worse overall mental health status than patients detected by screening (14). In a qualitative study by Peel et al. screen-detected patients reported a range of emotional reactions. Most patients were relieved to hear their diagnosis at an early stage so that they had an opportunity to manage their disease before complications developed (10). Thoolen et al. found that perceived vulnerability for diabetes among screen-detected patients increased significantly with time since diagnosis (6).

The majority of the afore mentioned studies did not use behavioural theories as a framework to study differences in cognitions which may influence behavioural choices (15). In this study, two theories were used. Firstly, the Theory of Planned Behaviour (TPB) (16), which assumes that there are three determinants of intention to change a specific behaviour: attitude towards the behaviour, subjective norm which represents perceived social pressure by significant others to perform the behaviour, and perceived behavioural control, which refers to perceived ease or difficulty of performing the behaviour (16,17). Secondly, Leventhal's self-regulation model, which links people's cognitions about diabetes with self-management behaviours (18). This model differs from other theories in its emphasis on the role of emotion in coping with illness (19).

The first aim of this study was to compare behaviour and cognitions in screen-detected patients with patients clinically diagnosed in the last three

years. We hypothesized that clinically diagnosed patients would report more physical activity and a healthier dietary intake because they received advice on diabetes management. We also hypothesized that screen-detected patients would have stronger intentions to change behaviour, because of the perceived opportunity to reduce risks of developing complications as they may have been diagnosed in an early stage, and would be less anxious than clinically diagnosed patients, based on previous evidence that screening did not raise anxiety levels (3,5,6).

A second aim of the study was to explore if any observed differences were likely to be due to screening or simply disease duration. We therefore investigated the association between time since diagnosis and cognitions and behaviour among the subsample of clinically diagnosed patients. We hypothesized that patients would be more motivated to change behaviour soon after diagnosis than after a few years of treatment.

Patients and methods

Study design

This study was conducted using baseline data from a randomised controlled trial (ADDITION *Plus* Study, MRC Epidemiology Unit/University of Cambridge, ISRCTN99175498). The trial is assessing the additional benefits of a behavioural intervention delivered by trained facilitators over and above intensive general practice care for people with type 2 diabetes detected by screening and clinically diagnosed. All patients gave their written informed consent. The study was approved by the Eastern multi-centre research ethics committee (reference number 02/5/24).

Procedure

Twenty-six out of 27 general practices approached in the East of England agreed to take part in the study.

Screen-detected patients were identified by means of a stepwise program which has been described in detail elsewhere (1). Briefly, a simple risk score, based on data routinely collected in general practice, was calculated for people aged 40-69 years without known diabetes (20). Those with a score in the top 25% of the risk distribution were invited into a stepwise screening procedure which included a random and a fasting capillary blood glucose and HbA1c test in general practice, followed by a confirmatory standard 75g oral glucose tolerance test (OGTT) in a clinical research facility. 73% of those invited attended the initial random capillary glucose test. Self-reported questionnaires to assess

physical activity and dietary intake were administrated at the OGTT and clinical measurements were performed. The 1998 WHO diagnostic criteria were used (21). Participants were informed of the diagnosis by their general practitioner two weeks after the OGTT. Patients diagnosed with diabetes were invited to participate in ADDITION *Plus*, the behavioural intervention study. They received an invitation letter and information sheet, and were asked to reply by a freepost card. 239 screen-detected patients agreed to participate and returned a postal questionnaire including questions on cognitions within an average of 5 weeks (SD 6.5) post-diagnosis. There were no significant differences in age, gender, body mass index and glycosylated haemoglobin between those screen-detected patients who agreed and those who declined to participate in the study. Response rate for questionnaires was 99,4%.

Patients clinically diagnosed within the previous three years (n=684) were invited by letter from 19 of the above practices and 8 newly recruited practices. These patients were diagnosed by their GP because they presented with symptoms suggested undiagnosed diabetes or because of opportunistic testing. Interested patients received a recruitment phone call from the research team to book a baseline visit at a clinical research facility. 239 out of 283 interested patients were recruited to the study and were sent a postal questionnaire including questions on cognitions, with the request to return these at the baseline visit. The physical activity and dietary intake questionnaires were administrated at the baseline visit. 99.7 % of questionnaires of patients in this group were completed.

Measurements

Anthropometric measurements were undertaken by trained staff according to standard operating procedures.

Weight and height were measured in bare feet wearing only light clothes. Weight and body fat were measured on electronic scales (Tanita TBF 531). Height was measured using a fixed stadiometer (Chasmos). Weight (kg) was divided by height squared (m) to calculate body mass index (BMI). Waist circumference (cm) was measured at the level midway between the lowest rib margin and the iliac crest. Systolic and diastolic blood pressure (mmHg) was measured after 5 minutes of rest in a seated position using an automatic sphygmomanometer (Omron M4I) and was calculated as the mean of three readings.

Ethnicity, self-reported smoking and alcohol status, work status, marital or cohabiting status, ownership of cars and property, and educational level were assessed by questionnaire. Self-reported history of hyperlipidaemia, hypertension, and cardiovascular disease and the use of medication were also

assessed by questionnaire. In clinically diagnosed patients, self-reported diabetes duration was also assessed.

Self-reported behavioural measures

Physical activity
We used the self-administered Epic-Norfolk Physical Activity Questionnaire (EPAQ2) to estimate: TV viewing, activity at home, activity at work, recreational activity, vigorous activity (recreational activities with a MET (metabolic equivalent) score > 5) and self-reported total physical activity (work and recreational activity) (22,23).

Dietary intake
The self-administered EPIC-Food Frequency Questionnaire was used to assess dietary intake (24). The dietary intake per day was calculated and converted to nutrient intake (fat, fibre, vitamin C and total amount of intake of energy (in kcal)) by using food table codes (25). The ratio of polyunsaturated fat (P) and saturated fat (S) was calculated (PS ratio). Percentage energy from fat was calculated by dividing the amount of fat (1 gram fat = 9 kcal) by total energy intake.

Cognition measures

Determinants of behaviour
Determinants of physical activity and eating a lower fat diet were assessed by a questionnaire informed by the Theory of Planned Behaviour (TPB) (16). The questionnaire was developed according to the TPB guidelines (16,17). To reduce measurement burden, only the proximal determinants of behaviour (intention, perceived behavioural control (PBC) and behavioural beliefs (BB)) were assessed. Each construct was assessed with two items, measured on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Higher scores indicate a stronger intention, perceived behavioural control or belief to change the specific behaviour. Examples of PBC items are: 'I am confident that I could be more physically active/eat a lower fat diet in the next 12 months, if I wanted to'. For BB: 'If I was more physically active/did eat a lower fat diet in the next 12 months, it is likely that my health will improve'. For intention to change behaviour: 'I intend to be more physically active/eat a lower fat diet in the next 12 months'. Items were summed to calculate total scores, divided by the number

of items. Cronbach's α was > 0.70 for all variables, indicating good internal consistency of the constructs.

Illness perceptions

We used the consequences and treatment control subscales of the Illness Perception Questionnaire-Revised (IPQ-R) (18,26). The consequences scale assessed the seriousness of diabetes and the impact of diabetes on various aspects of life. An example is: 'My diabetes is a serious condition'. The treatment control scale assessed the beliefs and feelings associated with the management of diabetes (19). An example is: 'My treatment can control my diabetes'. Both scales were measured on 5-point Likert scales (ranging from 'strongly disagree' to 'strongly agree'). High scores on the consequences scale represent strongly held beliefs about the negative consequences of the illness. High scores on the treatment control represent positive beliefs about the controllability of the illness.

Items were summed to calculate total scores, divided by the number of items. Cronbach's α was 0.74 for consequences, and 0.55 for treatment control.

Anxiety

The Short Form Spielberger State Anxiety Inventory (SF-STAI) (27) consists of six items assessing the extent to which patients feel 'calm', 'tense', 'upset', 'relaxed', 'content', and 'worried' on a 4-point scale ranging from 'not at all' to 'very much'. Sum scores range between 20 and 80 with higher scores indicating higher levels of anxiety (27). Cronbach's α was 0.87.

Statistical analyses

Descriptive statistics for the screen-detected and clinically diagnosed patients are presented as percentages, means $\pm$ SD, or median (interquartile range, IQR) in the case of a skewed distribution. Between-group differences were tested using Independent samples t-test for normally distributed continuous variables, Mann-Whitney U test for continuous variables with a skewed distribution, and chi-square test or Fisher's exact test for categorical variables. Linear regression analysis was used to adjust the above analyses for age, gender, marital/cohabiting and work status and to test the impact of time since diagnosis on behaviour and cognitions in clinically diagnosed patients. Assumptions for linear regression analysis were met.

The amount of missing data was very limited (less than 1% in both groups) and therefore we did not replace them. All statistical analyses were performed using SPSS for Windows (version 12.0.1, SPSS Inc., Chicago, IL).

Results

Patient characteristics

Characteristics of participants are presented in table 1. Screen-detected patients were older, less likely to be prescribed medication and had higher levels of cardiovascular risk factors than the clinically diagnosed patients.

The median self-reported duration of diabetes in the clinically diagnosed patients was 24 months (IQR 12-33). When attending their baseline visit, 34 recruited patients reported having been diagnosed more than three years earlier. All analyses were repeated excluding these patients but this did not influence the results and we report results including these patients.

Table 1. Comparison of characteristics of screen-detected patients and clinically diagnosed patients with type 2 diabetes

	Screen-detected patients (n=239)	Clinically diagnosed patients (n=239)	P-value
Age (years) #	61.0 ± 7.1	58.3 ± 7.8	< 0.001 ***
Gender (% male) $	62.6	62.0	0.896
Ethnicity (% white) $	97.0	96.6	0.787
Smoking (% smokers) $			
Current smoker	13.8	16.7	0.673
Former smoker	49.0	47.3	
Never smoker	37.2	36.0	
Alcohol status (units/week) †	4.0 (0.0 – 10.0)	3.0 (0.0 – 12.0)	0.771
Medication (% on medication) $	87.3	95.8	0.001 ***
Diabetes duration (months)	NA	24 (12 – 33)	NA
Self-reported history (%) of: $			
High blood cholesterol	26.2	68.2	< 0.001 ***
High blood pressure	59.1	59.7	0.895
Cardiovascular disease	21.8	25.5	0.333
Body mass index (kg/m^2) #	33.1 ± 5.2	32.4 ± 6.0	0.181
Waist circumference (cm) #	111.6 ± 12.9	109.9 ± 14.7	0.172
Systolic blood pressure (mmHg) #	140.4 ± 21.0	131.8 ± 16.2	< 0.001 ***
Diastolic blood pressure (mmHg) #	81.8 ± 10.6	78.7 ± 10.0	0.001 ***
Educational level $			
up to 14 years	3.4	2.5	0.131
15-18 years	82.6	76.7	
19-25 years	11.5	19.1	
over 25 years	2.6	1.7	
Cars ownership (% own car) $	94.1	93.3	0.706
Property ownership (% own house) ‡	97.6	98.0	0.788
Married/cohabiting (% yes) $	84.0	79.4	0.192
Work status (%) $			
Employed	47.7	55.4	0.050 *
Unemployed	9.4	12.4	
Retired	43.0	32.2	

Data are means ± SD, n (%), or median (interquartile range) in case of a skewed distribution.

Independent t-test, $ Chi-square test, † Mann-Whitney U test, ‡ Fisher's exact test

* p < 0.05, *** p < 0.001

Differences in behaviour and cognitions between screen-detected and clinically diagnosed patients

Behaviour

There were no between-group differences on any physical activity variables (Table 2). Screen-detected patients reported higher intake of fat and total energy intake than clinically diagnosed patients. The PS ratio was significantly higher in clinically diagnosed patients indicating that they consumed less saturated fat than screen-detected patients. However, both groups reported eating more saturated than polyunsaturated fat.

Behavioural determinants

Mean scores of patients in both groups on behavioural beliefs, perceived behavioural control and intentions to change physical activity and to eat a lower fat diet were positive (Table 3).

Screen-detected patients had stronger intentions to increase physical activity (3.9 ± 0.8) than clinically diagnosed patients (3.6 ± 0.8) ($p=0.002$). Also, intention to eat a lower-fat diet was stronger in the screen-detected (3.9 ± 0.8) than in the clinically-diagnosed group (3.6 ± 0.7; $p<0.001$). Perceived behavioural control towards eating a lower fat diet was higher ($p=0.006$) in the screen-detected than in the clinically diagnosed patients (3.8 ± 0.9 vs. 3.6 ± 0.9, respectively).

After adjustment for possible confounders we found that age was associated with all outcomes: younger patients had a stronger intention and perceived behavioural control than older patients. However, significant differences between the two groups remained after adjustment for age. Adjustment for gender, marital/cohabiting and work status did not influence differences between screen-detected and clinically diagnosed patients.

Table 2. Differences in behavior between screen-detected and clinically diagnosed patients

	Screen-detected patients (n=239)	Clincally diagnosed patients (n=239)	P-value
Physical activity			
TV time (h/wk) #	25.3 ± 11.9	24.0 ± 12.1	0.224
Activity at home (MET.h/wk) †	35.8 (19.3 – 58.7)	34.2 (20.2 – 51.7)	0.658
Activity at work (MET.h/wk) †	14.1 (0.0 – 72.9)	37.6 (0.0 – 82.5)	0.080
Recreational activity (MET.h/wk) †	19.0 (7.3 – 46.5)	20.2 (5.7 – 47.4)	0.694
Vigorous activity (h/wk) †	0.0 (0.0 – 0.2)	0.0 (0.0 – 0.24)	0.484
Self-reported physical activity index (total score (MET.h/wk) †	61.8 (21.2 – 101.8)	70.1 (24.8 – 120.4)	0.340
Dietary intake			
Fiber (g/day) #	18.1 ± 7.1	18.9 ± 7.4	0.237
Fat (g/day) #	73.2 ± 31.7	65.9 ± 32.5	0.013 *
PS ratio #	0.55 ± 0.2	0.64 ± 0.3	<0.001 ***
Energy (kcal/day) #	2016.6 ± 675.5	1852.0 ± 699.2	0.009 **
Energy from fat (%) #	32.1 ± 5.5	31.4 ± 6.5	0.220
Vitamin C (mg/day) #	144.7 ± 69.9	143.3 ± 72.7	0.824

Data are means ± SD, or median (interquartile range) in case of a skewed distribution.
MET = metabolic equivalent: the ratio of a given activity to resting metabolic rate.
# Independent t-test, † Mann-Whitney U test
* p < 0.05, ** p < 0.01, *** p < 0.001

Illness perceptions

There were no differences in scores between the groups (Table 3). The mean score of all patients was the response of 'neither agree nor disagree' for the consequences of diabetes scale. The scores on the treatment control scale assessing beliefs and feelings about diabetes management of diabetes were around the 'agree' score.

Anxiety

Patients diagnosed by screening were less anxious than patients who were clinically diagnosed (30.0 and 33.3 respectively) (Table 3). Age and gender were associated with anxiety: younger patients and women were more anxious. The between-group difference still existed after adjusting for age and gender.

Table 3: Differences in cognitions between screen-detected patients and clinically diagnosed patients

	Screen-detected patients (n=239)	Clinically diagnosed patients (n=239)	P-value
Determinants of behavior (Theory of Planned Behavior)			
Physical activity #			
Perceived behavioral control	3.8 ± 0.8	3.7 ± 0.9	0.190
Behavioral beliefs	4.0 ± 0.6	4.0 ± 0.7	0.595
Intention	3.9 ± 0.8	3.6 ± 0.8	0.002 **
Dietary intake #			
Perceived behavioral control	3.8 ± 0.9	3.6 ± 0.9	0.006 **
Behavioral beliefs	3.9 ± 0.7	3.8 ± 0.7	0.472
Intention	3.9 ± 0.8	3.6 ± 0.7	<0.001 ***
Illness Perception Questionnaire – Revised #			
Consequences	2.9 ± 0.6	2.9 ± 0.7	0.858
Treatment control	3.8 ± 0.5	3.7 ± 0.5	0.074
Spielberger State Anxiety Inventory – Short form †	30.0 (23.3 – 40.0)	33.3 (26.7 – 43.3)	<0.001 ***

Data are means ± SD, or median (interquartile range) in case of a skewed distribution.
Independent t-test, † Mann-Whitney U test
** p < 0.01, *** p < 0.001

The impact of time since diagnosis

We did not find any association between time since diagnosis and any of the cognitions and behaviours among clinically diagnosed patients. We found the following standardized beta's (95% confidence intervals): Total self-reported physical activity = -0.055 (-0.549 ; 0.232) and total energy intake = 0.013 (-2.993 ; 3.868). Determinants to change physical activity: Intention = 0.011 (-0.003 ; 0.004), PBC = 0.025 (-0.003 ; 0.005), BB = 0.012 (-0.003 ; 0.004). Determinants to change dietary intake: Intention = 0.065 (-0.002 ; 0.005), PBC = 0.030 (-0.003 ; 0.005), BB = 0.091 (-0.001 ; 0.006). Illness perception questionnaire: treatment control = -0.008 (-0.004 ; 0.001), consequences = 0.124 (0.000 ; 0.006). Anxiety = 0.030 (-0.052 ; 0.084).

Discussion

This study compared behaviour and cognitions between people with type 2 diabetes detected by screening and clinically diagnosed, and investigated the impact of time since diagnosis on cognitions and behaviour among the latter group. We found no differences between the two groups in self-reported physical activity. Clinically diagnosed patients reported a lower fat intake, lower energy intake and a more favourable PS ratio than screen-detected patients. This is in accordance with our hypothesis that clinically diagnosed patients would report eating a healthier diet. We found that screen-detected patients had a stronger intention to change their behaviour than clinically diagnosed patients, which supported the second hypothesis. However, differences between the two groups were rather small.

Our hypothesis concerning anxiety was also confirmed: clinically diagnosed patients reported higher anxiety than screen-detected patients.

We found no impact of time since diagnosis among the clinically diagnosed patients, contrary to our hypothesis. Thoolen et al. reported an impact of time since diagnosis on psychological outcomes but this was investigated in screen-detected patients only (6).

The between-group differences remained after adjusting for possible confounders, questionnaires were completed in similar circumstances in both groups, and there was no apparent association between duration of diabetes and outcomes among clinically diagnosed patients. This suggests that the differences between the two groups may have been due to detection by screening rather than simply the more recent diagnosis in the screen-detected group. The finding that screen-detected patients reported a stronger intention to change physical activity and dietary intake may be because they were glad to have been identified at an early stage of the disease, thereby having the opportunity to change their behaviour before the onset of complications, as described by Peel et al. (10). This finding might represent a window of opportunity for behaviour change. However, there are alternative explanations for the observed between-group differences in intentions. Firstly, clinically diagnosed patients might have already changed their behaviour, as suggested by the food frequency questionnaire results, and cannot change further. Secondly, clinically diagnosed patients may have tried to change but failed and therefore do not intend to try again. Finally, screen-detected patients might have an unrealistic optimism about their ability to change their behaviour.

Patients in both groups had high scores on the treatment control scale of the IPQ-R, which means that they believe that their disease can be controlled by treatment. This may have a positive impact on their ability to cope with diabetes

(18). However, the patients scored more negative on the consequences scale, indicating that they did not consider diabetes to be a serious disease, which may have the opposite effect.

Both groups reported low levels of anxiety. Our results support those of Adriaanse et al., who described greater symptom distress in patients clinically diagnosed in general practice compared with screen-detected patients, and also other screening studies which found a low impact of the diagnosis on psychological outcomes (3-5,28-30). In a qualitative study, Murphy et al. showed that the majority of asymptomatic patients did not consider their diabetes to be a serious threat to their health (11), which may explain why screen-detected patients, who are less likely to have symptoms of the disease or its complications, were less anxious. The higher anxiety scores in clinically diagnosed patients might also reflect their greater burden of treatment. It has been suggested that anxiety is elevated shortly after the diagnosis and diminishes fast (5). As questionnaires were administered on average five weeks after diagnosis by screening we cannot exclude the possibility of higher levels of anxiety among screen-detected patients immediately after diagnosis. Furthermore, a certain level of anxiety may be a necessary precursor to behaviour change and therefore not necessarily an adverse outcome.

The present study has some limitations. First, it is a cross-sectional study. Longitudinal studies are needed to test whether differences in behaviour and cognitions between screen-detected and clinically diagnosed patients remain over time, and to what extent they influence future behaviour and response to behavioural interventions. Second, we used a non-validated questionnaire to assess determinants of the TPB. However, the internal consistencies of the subscales for the two behavioural domains were adequate. Third, the physical activity and food frequency questionnaires might be susceptible to error or even bias. For instance, clinically diagnosed patients may have reported their dietary intake as more favourable, regardless of their actual dietary behaviour, because they had received advice on healthy eating as part of their diabetes care. And finally, there is a lack of generalisation to the diabetes population because we expect that patients in our study are a highly motivated group concerning the general belief that only motivated patients are willing to participate in a study.

Further research with other subgroups of patients, for example from different age or socio-economic groups, is needed to gain more insight into perceived difficulties with changing behaviour and to establish which subgroups of patients might need additional support.

In conclusion, this study suggests that patients detected by screening have stronger intentions to increase their physical activity and change their

dietary intake and lower levels of anxiety than clinically diagnosed patients. Diagnosis by screening may therefore provide a window of opportunity for behavioural interventions.

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