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Diabetes-related distress is reduced in people with type 1, but not type 2 diabetes after participating in a diabetes treatment and teaching programme

Abbreviations

DM1	diabetes mellitus type 1
DM2	diabetes mellitus type 2
DTTP	diabetes treatment and teaching programme
HbA1c	glycated haemoglobin
PAID	Problem Area in Diabetes Scale

Introduction

The importance of participating in a structured diabetes treatment and teaching programme (DTTP) on metabolic control and quality of life in patients with diabetes was raised as early as 1985 by Assal et al. [1]. In addition, the German guidelines for psychosocial well being in diabetes recommend offering all patients with diabetes and a heavy diabetes-related psychological burden the opportunity to participate in a specific DTTP to reduce distress [2]. In particular, a DTTP should be provided if there are worries about the development of complications (such as blindness, amputation) and the patient feels overwhelmed.

The aim of this prospective, longitudinal study was to assess diabetes-related distress in patients with diabetes mellitus type 1 (DM1) or type 2 (DM2) at baseline and to evaluate whether their burden and distress were reduced after participation in a DTTP. Furthermore, metabolic control as a secondary outcome was compared before and after the DTTP.

Research design and methods

All individuals who participated in a DTTP at a university department of endocrinology and metabolic diseases outpatients' clinic during the investigation period (1 January to 31 December 2014) were interviewed before (T0), immediately after (T1) and 6 months after (T2) participation in the DTTP. Inclusion criteria were age $\geq$ 18 years and a diagnosis of either DM1 or DM2. Those with intermediate hyperglycaemia, pregnant women and people who did not understand the German language were excluded. All included patients gave their informed consent to participate.

All participants attended a structured, problem-orientated DTTP (devised by Grüßer and Jörgens). The DTTPs were conceived as group sessions and aimed to support the self-management skills of diabetes patients in everyday life, but also included lessons concerning self-measurement of urine/blood glucose, nutrition, physical activity and diabetes complications. Insulin injection and dose adjustment were further elements for those on insulin therapy.

Diabetes-related burden was assessed with the Problem Area in Diabetes (PAID) scale, a 20-item questionnaire wherein each question is scored from 0 to 4, with 0 = no problem and 4 = a serious problem, and a possible range of 0–100 points. Higher scores indicate more diabetes-related distress, and a PAID score $\geq$ 40 is considered to reflect high diabetes-related distress.

Diabetes-related quality of life was assessed using the evaluated Audit of Diabetes-Dependent Quality of Life (ADDQoL) questionnaire, with scores ranging from −9 to +3. Lower scores are associated with poorer diabetes-related quality of life.

The World Health Organization (Five) Well-Being Index (WHO-5) consists of five questions and assesses current well-being as well as mental health. Each item can be scored from 0 to 5 points, resulting in a total score of 0 to 25. Higher scores are associated with greater well-being.

Satisfaction with diabetes treatment was evaluated by the Diabetes Treatment Satisfaction Questionnaire (DTSQ) for status (score range: 0–36), with higher scores indicating greater treatment satisfaction. In addition, changes in diabetes treatment satisfaction (DTSQc) were assessed immediately after participating in the DTTP at visit T1 (range: −18 to +18), with higher scores indicating greater treatment satisfaction after the intervention.

Clinical and laboratory data were collected from the patients' electronic records on the day of each visit (T0, T1 and T2) by each individual patient. Three to six months prior to the study, participants were instructed to document all episodes of hypoglycaemia. Non-severe hypoglycaemia was defined as the presence of typical symptoms (sweating, poor concentration, feeling shaky) that disappeared quickly after carbohydrate intake, or a plasma glucose $\leq$ 3.9 mmol/L with no symptoms. Severe hypoglycaemia was defined as a need for glucagon or intravenous glucose injection. HbA1c was adjusted to the mean normal value of healthy people (5.05%, 32 mmol/mol) from the Diabetes Control and Complications Trial.

Statistical analyses

All analyses were performed using IBM SPSS Statistics 21.0 software (IBM Corp., Armonk, NY, USA). All continuous data

are presented as means ± standard deviation (SD), while categorical data are expressed as absolute and relative frequencies. A linear mixed-effects model was used to assess the influence of covariates on changes in PAID scores (between T0 and T2). Statistical significance was defined as a P value < 0.05.

Results

In total, 63 people were invited to participate in the study and all accepted: 26 had DM1 (age: 45.6 years, 50.0% women, diabetes duration 16.6 years, HbA1c 7.6%); and 37 had DM2 (age: 64.3 years, 32.4% women, diabetes duration 9.3 years, HbA1c 7.0%). All (100%) were followed for 6 months. However, for eight people with DM2 (six not taking insulin, two using insulin), only questionnaires were available (no clinical or laboratory data).

DM1 patients

In the participants with DM1, PAID scores were significantly reduced by −7.1 points between T0 and T1 (21.8 ± 13.8 vs 14.7 ± 11.4; $P < 0.001$; Table 1). However, after 6 months (T2), PAID scores increased from T1 to T2 (19.2 ± 12.6; $P = 0.003$), resulting in a non-significant difference between T0 and T2 ($P = 0.128$). The highest scores for the three visits (T0, T1, T2) were for items on'worries about the future and the possibility of serious complications' (mean PAID scores: 2.2 ± 1.2, 1.7 ± 1.0, 2.1 ± 1.1, respectively), 'feelings of guilt or anxiety for neglecting therapy' (mean PAID scores: 1.7 ± 1.3, 1.2 ± 1.0, 1.5 ± 1.1, respectively) and 'worries about hypoglycaemia' (mean PAID scores: 1.5 ± 1.0, 1.2 ± 0.9, 1.5 ± 1.0, respectively). The biggest reduction between T0 and T2 was for 'feeling overwhelmed by diabetes' (−0.31; $P = 0.029$).

There were no significant changes in quality of life, wellbeing or treatment satisfaction between T0 and T2 (Table 1), except for greater satisfaction with diabetes treatment at T1 (DTSQc score: +10.5 ± 5.6). In general, HbA1c in people with DM1 did not change between T0 and T2 (Table 1). In participants with a baseline HbA1c > 7.5%, HbA1c was reduced by 0.6% (8.5 ± 0.5% vs 7.9 ± 1.2%; $P = 0.052$) whereas, in those with a baseline HbA1c ≤ 7.5%, HbA1c remained stable (6.8 ± 0.5 vs 7.0 ± 0.8; $P = 0.274$). In addition, there was a non-significant decrease in frequency of non-severe hypoglycaemia between T0 and T2 (−4.1 episodes per month, or −1.1 events per week).

DM2 patients

In these DM2 participants, the mean PAID score as well as the number of subjects with a PAID score ≥ 40 did not differ significantly between T0, T1 and T2 (Table 1). Also, there were no significant differences in scores between patients not using insulin ($n = 28$; T0: 12.7 ± 13.7, T1: 11.5 ± 11.2, T2: 9.4 ± 10.1, respectively) compared with insulin users ($n = 9$; T0: 7.0 ± 6.3, T1: 11.1 ± 7.9, T2: 10.3 ± 6.3, respectively). In patients with DM2 not using insulin, the item 'worries about hypoglycaemia' diminished significantly between T0 and T2 (0.7 ± 0.3 vs 0.3 ± 0.3, difference: −0.39; $P = 0.025$).

There were no significant changes in quality of life, wellbeing or treatment satisfaction between T0 and T2 in this group of participants (Table 1) nor between those using insulin or not. However, satisfaction with treatment at T1, as measured by the DTSQc, increased by +11.9 ± 4.9 in this patient group (no insulin: +12.0 ± 4.6, on insulin: +11.4 ± 5.8). HbA1c decreased significantly by −0.7% (7.8 mmol/mol) from 7.2% (54.8 mmol/mol) at T0 to 6.5% (47.0 mmol/mol) at T2 ($P = 0.002$) in all participants with DM2. In those not on insulin therapy, there was a significant reduction in HbA1c of −0.9% [from 7.3 ± 1.7% (56.4 ± 18.3 mmol/L) to 6.4 ± 0.9% (46.4 ± 10.3 mmol/L); $P = 0.002$].

Discussion

Our present study has demonstrated a reduction in diabetes-related distress after participation in a DTTP in DM1, but not DM2, patients. However, the improvement did not last and faded over time, although the score after 6 months was still lower than the baseline score. The overall low PAID score (21.8) at baseline in patients with DM1 and the very low score (11.3) in those with DM2 are comparable to the PAID scores (DM1: 17.8, DM2: 16.8) reported in a cross-sectional study of people with diabetes [3]. Thus, it can be concluded that, in general, the diabetes-specific burden in patients with DM2, regardless of the use of insulin, is relatively low.

The Dose Adjustment for Normal Eating (DAFNE) education programme, set up for patients with DM1 in the UK, is based on principles developed and evaluated by Michael Berger and his group in Düsseldorf. Several reports of DAFNE participants have shown that diabetes-related distress was reduced after participation in the DAFNE programme [4–7]. Also, the study by Speight

Table 1
Metabolic and psychological parameters in participants with type 1 (DM1) and type 2 (DM2) diabetes mellitus before and after participation in a diabetes treatment and teaching programme (DTTP).

Parameters	DM1 ($n = 26$)			P	DM2 ($n = 37$)			P
	T0	T1	T2		T0	T1	T2	
PAID score (0–100)	**21.8 ± 13.8**	**14.7 ± 11.4**	**19.2 ± 12.6**	**0.001**[a] **0.003**[c] n.s.[b]	11.3 ± 12.5	11.4 ± 10.4	9.7 ± 9.3	n.s.
PAID score ≥ 40 [n (%)]	3 (11.5)	1 (3.8)	2 (7.7)	n.s.	2 (5.4)	0 (0)	1 (2.7)	n.s.
ADDQoL (−9 to +9)	−1.7 ± 1.1	–	−1.6 ± 1.3	n.s.	−0.7 ± 0.8	–	−0.6 ± 0.6	n.s.
WHO-5 (0–25)	13.5 ± 4.4	–	13.8 ± 5.3	n.s.	16.1 ± 5.8	–	17.2 ± 5.1	n.s.
DTSQs (0–36)	26.2 ± 6.0	–	28.0 ± 4.9	n.s.	28.0 ± 5.9	–	28.8 ± 7.4	n.s.
HbA1c (%)	7.6 ± 1.2	–	7.4 ± 1.1	n.s.	**7.2 ± 1.5**	**–**	**6.5 ± 0.9**	**0.002**[b]
HbA1c (mmol/mol)	59.4 ± 13.0	–	57.7 ± 12.2	n.s.	**54.8 ± 16.5**	**–**	**47.0 ± 9.6**	**0.002**[b]
Non-severe hypoglycaemia (frequency/week)	3.2 ± 3.0	–	2.1 ± 1.4	n.s.	0.1 ± 0.2	–	0.1 ± 0.3	n.s.
Insulin dosage (IU/day)	48.4 ± 23.7	43.5 ± 26.7	48.0 ± 28.3	n.s.	53.0 ± 26.7	57.0 ± 23.2	56.5 ± 33.5	n.s.
Insulin injections (n/day)	4.1 ± 1.9	3.8 ± 2.1	3.9 ± 2.2	n.s.	2.7 ± 0.8	2.6 ± 0.8	2.7 ± 0.8	n.s.
Body weight (kg)	75.9 ± 13.8	–	76.2 ± 13.8	n.s.	90.7 ± 21.7	–	90.3 ± 22.2	n.s.

n.s.: not significant; PAID: Problem Areas In Diabetes scale; ADDQoL: Audit of Diabetes-Dependent Quality of Life; WHO-5: World Health Organization (Five) Well-Being Index; DTSQs: Diabetes Treatment Satisfaction Questionnaire for status.
[a] T0 vs T1.
[b] T0 vs T2.
[c] T1 vs T2.

et al. (2016) [4] showed reductions in the PAID score (from 30 to 20 points, −10.4) as well as in the number of subjects with a high diabetes-related burden (from 29.3% to 12.6%) between baseline and follow-up (6–18 months), and the items in the PAID questionnaire scoring the highest were 'worrying about the future and the possibility of serious complications', 'feelings of guilt or anxiety for neglecting therapy' and 'worrying about hypoglycaemia' at both baseline and follow-up. This is exactly in line with our present study results and suggests that it is very important to discuss these topics during a DTTP. However, while hypoglycaemia and diabetes complications are discussed in all currently available DTTPs, none of these programmes can provide precise figures on the risk of developing diabetes-related complications and their prevalence. This may be why the current DTTPs are, in fact, not as effective as they could be in reducing the diabetes-related burden.

In a population-based prospective trial, 506 participants with DM2 were assessed three times over 18 months for different psychological outcomes, including diabetes-related distress, which was measured by the Diabetes Distress Scale [8]. This trial found a 29.2% prevalence of diabetes-related distress at any of the three time points (baseline, 9-month follow-up and 18-month follow-up), but a mean of only 6.4% for all time points combined. Thus, diabetes-related distress is clearly highly variable over time and is probably associated with multiple variables, such as patients' feelings of well-being and their living conditions. Indeed, our present trial has confirmed this result, as only one patient showed high diabetes-related distress twice (T0 and T2), whereas all others at only one visit.

For the DM2 cohort as a whole, the improvement in HbA1c was −0.7%; for those not on insulin therapy, the change was −0.9% after 6 months. In patients with DM2 and taking insulin, HbA1c decreased with no changes in insulin dosage and body weight. In contrast, in those with DM1, HbA1c remained stable overall, although those with initially high HbA1c levels improved markedly, eventually achieving the treatment target of $\leq 7.5\%$ recommended by German guidelines for patients with DM1 [9]. In fact, after 6 months, the mean HbA1c of the whole group was on target at 7.4%.

Conclusion

Participation in a DTTP is associated with a reduction of diabetes-related distress in patients with DM1. However, this immediately achieved improvement after DTTP was not fully maintained after 6 months. Also, while all participants had diabetes-specific problems before the intervention, the mean PAID score was nevertheless below the threshold of 40 points, indicating that the overall prevalence of diabetes-related distress was low, especially in those with DM2. Further future research is necessary to either increase the efficacy of DTTPs by adding to our information on the individual risks for diabetes-related morbidity and/or developing more sensitive instruments to detect diabetes-related distress.

Statement of informed consent

Informed consent was obtained from all patients included in the study.

Statement on human rights

All procedures followed were in accordance with the ethical standards of the responsible committees for human experimentation (institutional and national) and with the Helsinki Declaration of 1975 (as revised in 2008).

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Disclosure of interest

The authors declare that they have no competing interest.

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Evacuation is a risk factor for diabetes development among evacuees of the Great East Japan earthquake: A 4-year follow-up of the Fukushima Health Management Survey

Introduction

The Great East Japan earthquake struck on 11 March 2011. After the earthquake, a massive tsunami hit the Tokyo Electric Power company's Fukushima Daiichi nuclear power plant in Fukushima prefecture, causing the release of radiation. The Fukushima Daiichi nuclear disaster forced the evacuation of several towns, which led to lifestyle changes and anxiety over radiation among the evacuees.