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Prevalence of comorbid depression is high in out-patients with Type 1 or Type 2 diabetes mellitus. Results from three out-patient clinics in the Netherlands

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Abstract

Aims Depression is common in diabetes, but the scope of the problem and associated correlates are not well established in specialist diabetes care. We aimed to determine the prevalence of depression among adult outpatients with Type 1 (T1DM) or Type 2 diabetes (T2DM) using both self-report measures and a diagnostic interview, and to establish demographic and clinical characteristics associated with depressive affect.

Methods A random sample of 2055 diabetes out-patients from three diabetes clinics was invited to participate. Depressive affect was assessed using the World Health Organization-5 Well Being Index (WHO-5), the Centre for Epidemiologic Studies-Depression scale (CESD) using predefined cut-off scores, and depressive disorder with the Composite International Diagnostic Interview (CIDI). Associations between depression and patient characteristics were explored using regression analyses.

Results Seven hundred and seventy-two patients completed the depression questionnaires. About one-third of T1DM patients and 37–43% of T2DM patients reported depressive affect (WHO-5). The prevalence of depressive affect (CESD) was 25% and 30% for men and women with T1DM, and 35% and 38% for men and women with T2DM, respectively. Based on the CIDI, 8% of T1DM patients (no gender difference) and 2% of men and 21% of women with T2DM suffered from a depressive disorder. Depressive affect was associated with poor glycaemic control and proliferative retinopathy in T1DM, while non-Dutch descent, obesity and neuropathy were correlates in T2DM.

Conclusions Depressive symptoms and major depressive disorder constitute a common comorbid problem among Dutch out-patients with T1DM or T2DM and appear particularly common in migrants and women with T2DM.

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Keywords ambulatory care, depression, diabetes, prevalence, risk factors

Abbreviations BMI, body mass index; CES-D, Centre for Epidemiologic Studies Depression scale; CI, confidence interval; CIDI, Composite International Diagnostic Interview; EDID, European Depression in Diabetes; MDD, major depressive disorder; OR, odds ratio; RUNMC, Radboud University Nijmegen Medical Centre; T1DM, Type 1 diabetes; T2DM, Type 2 diabetes; VUMC, VU University Medical Centre; WHO-5, World Health Organization-5

Introduction

Individuals with Type 1 (T1DM) or Type 2 diabetes (T2DM) have about a 2-fold increased risk for major depression, affecting one of every 10 diabetic patients [1,2]. Depression not only has a

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serious negative impact on patients' quality of life [3], but is also associated with poorer glycaemic control, worse cardiovascular outcomes and increased healthcare consumption [4–6]. The aetiology of depression in diabetes is not fully understood, with both biological and psychosocial factors likely to play a role [1,2]. Depression is particularly common in diabetic patients with comorbidity [7,8] and high levels of diabetes-related distress [9].

Previous research into the prevalence of depression in diabetes has enhanced our understanding of the magnitude of the problem of depression, its ramifications and potential risk factors. However, further research is warranted using not only self-report measures but also a psychiatric diagnostic interview. Although more time consuming, the interview is considered the gold standard, allowing for an accurate diagnosis of a depressive disorder [1,2].

Self-report depression measures are less precise and generally result in overestimation of the prevalence [1,2]. Another limitation of previous research relates to case mix, with the majority of prevalence studies having been conducted in primary care. Only a few studies have been performed in specialist diabetes care settings. Although case mix may differ across countries, T2DM patients treated in secondary care are likely to be more complex, i.e. have more diabetes-related complications and/or in need of more intensive regimens to help control their blood glucose levels, compared with diabetic patients recruited from primary care settings or population-based studies. As a result, out-patients with T2DM may be expected to have relatively high levels of depression.

In a study from the European Depression in Diabetes (EDID) research consortium, prevalence rates for depressive affect in out-patients with diabetes ranged between 34% and 39% for Croatian out-patients, 19% and 21% for Dutch out-patients and 19% and 39% for English out-patients [9]. Other studies that used self-report measures for depression reported prevalence rates of 8% in a mixed T1DM/T2DM out-patient sample from the UK [10], 32% in a Korean out-patient sample with T2DM [11], 10% in English-speaking and 30% in non-English-speaking hospital out-patients with T2DM [12], and 33% in Greek T2DM out-patients without overt macrovascular disease [13]. Two studies used a psychiatric diagnostic interview in out-patients with diabetes: a Croatian study from EDID (n = 384) reported a prevalence of depressive affect of 33% in out-patients with T2DM; 8% of the participants appeared to suffer from a depressive disorder [14]. A German study (n = 420) showed that 31% of the participants with T1DM/T2DM had an elevated depression score, while 13% were diagnosed with an affective disorder [15].

The present study set out to screen for depression in a representative sample of out-patients with T1DM and T2DM, using both self-report measures of depression and a diagnostic interview, allowing for a reliable estimate of the point prevalence of depressive affect (symptoms) and depressive disorder [major depressive disorder (MDD) or dysthymia]. Secondly, we aimed to determine the demographic and clinical characteristics associated with depression in patients with T1DM or T2DM.

Patients and methods

Setting and procedure

Data were collected within the framework of a multicentre depression screening research project (randomized controlled trial) in the Netherlands, aimed to test the effects of screening for depression with subsequent feedback to the patient and their physician in an out-patient setting. Here, baseline data from the three participating diabetes out-patient clinics are presented: (i) the VU University Medical Centre (VUMC, Amsterdam, the Netherlands) and (ii) Radboud University Nijmegen Medical Centre (RUNMC) and a general hospital: (iii) Haaglanden Medical Centre (Westeinde, The Hague, the Netherlands). All three are specialized diabetes clinics, each serving approximately 2000 patients located in three different regions of the Netherlands. Random samples were drawn from the clinics: 1000 from VUMC, 500 from RUNMC and 555 from Westeinde. Patients who agreed to be informed of the study were invited by letter to participate in the randomized controlled trial testing the effect of screening for depression in people with diabetes. Participants were sent two sequential questionnaire booklets to fill out at home and return in pre-stamped envelopes. This first questionnaire contained questions on age, gender, marital status, ethnic background (native Dutch, Turkish, Moroccan, Surinam, or other such as from Netherlands Antilles or Indonesia), highest level of completed education, alcohol consumption and smoking. The second questionnaire, which was sent to the participants after having received the first questionnaire, contained questions on depression symptoms. From the medical records of the patients, the following data were extracted: type of diabetes, duration of diabetes, treatment regimen, microvascular complications (retinopathy: background or proliferative, nephropathy and neuropathy), cardiovascular disease, most recent HbA_{1c} and blood pressure.

Written consent was obtained from all participants and the study was approved by the local medical ethics advisory committee. The investigations were carried out in accordance with the principles of the Declaration of Helsinki as revised in 2000.

Measures

Assessment of depressive affect and depressive disorder

Measurement is a critical issue in estimating the true prevalence of depression, and there is no consensus on the best depression screener to use in diabetes. We therefore chose to use two validated self-reported instruments and a diagnostic interview in order to achieve maximal precision. The first self-report measure was the World Health Organization-5 (WHO-5). The WHO-5 is a widely used brief measure of emotional well-being [16–18]. It

was conceptualized as a one-dimensional instrument that contains five positively worded items, for example: 'I have felt cheerful and in good spirits'. The degree to which these feelings were present in the last 2 weeks is scored on a six-point Likert scale ranging from 0 (not present) to 5 (constantly present). The raw scores are transformed to a score from 0 (worst thinkable well-being) to 100 (best thinkable well-being). A score < 52 suggests poor emotional well-being and is a sign for further testing. A score ≤ 28 is indicative of depression [16–18]. The WHO-5 is a highly sensitive screener for depressive affect [16–18]. The second screener was the Centre for Epidemiologic Studies Depression Scale (CES-D), a 20-item, widely used self-report scale that asks respondents to indicate the frequency of occurrence of 20 depression symptoms during the last week [19,20]. The CES-D uses a four-point response set, ranging from 'rarely or none of the time' to 'most or all of the time'. Higher scores indicate more depressive symptoms and a cut-off point of 16 or more is generally accepted as indicative of a clinically significant level of depressive affect [19,20].

The automated World Health Organization Composite International Diagnostic Interview (CIDI-auto) was used in a random sample of the study population (50%) with likely depression (CESD score of ≥ 16). The CIDI is a structured diagnostic interview that can be used to diagnose psychiatric disorders, according to the Diagnostic and Statistical Manual for Mental Disorders [21,22]. It is a fully structured diagnostic interview, the two sections D and E being used to determine the presence of mood disorder (major depression/dysthymia) and/or anxiety disorder during the past 12 months. The main advantage of the CIDI-auto is that it was developed so that specially trained lay interviewers can reliably diagnose the appropriate disorders. In our study, lay interviewers, mostly medical or psychology students (3rd or 4th year) were trained by a certified CIDI interviewer (F.P.) to use the CIDI-auto.

Statistical analyses

Statistical analyses were performed using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). Continuous demographic data of the participants were analysed using independent means *t*-tests, and chi square tests for categorical variables. A *P*-value < 0.05 was considered to be statistically significant. Descriptive statistics were applied to calculate means and standard deviations for the self-report measures, and defining 'caseness' on the basis of predefined cut-off scores. Stepwise logistic regression analyses (separately for T1DM and T2DM patients) were applied to explore whether depression could be predicted by means of three subsequent blocks. The first contained the following independent variables, including known demographic risk factors for depression: female sex, being single, having low education (which is defined as equal to or less than vocational training), ethnic minority. The second and third block included clinical variables: HbA_{1c}, body mass index (BMI), retinopathy (background and proliferative retinopathy separately), nephropathy, neuropathy, cardiovascular disease(s).

Results

Demographic and clinical characteristics of the sample

Of the 2055 invited participants, 47% (n = 966, 59% T2DM) completed the first questionnaire, of whom 772 (80%) completed and returned the depression questionnaire. As shown in Table 1, T2DM patients, relative to T1DM, were significantly older, more frequently lived alone and had a lower level of education. About one-quarter of patients with T2DM reported a foreign ethnic background, compared with approximately 6% of patients with T1DM. Patients with T2DM had a shorter disease duration (13 vs. 22 years, $P < 0.001$) and reported a significantly higher BMI, higher blood pressure and more frequent use of antihypertensive medication. More than one-third of patients with T2DM had cardiovascular disease, compared with 10% with T1DM. Likewise, nephropathy and neuropathy tended to be more common among patients with T2DM, but these differences were not statistically significant. Compared with T2DM, significantly more patients with T1DM reported that they had had at least one severe hypoglycaemic episode during the past 12 months.

Prevalence of depression

In Table 2, mean scores and the proportion of elevated scores on the two self-report measures of depression are shown by gender and type of diabetes. Using the commonly used criterion of WHO-5 score < 52, 33–36% of T1DM patients and 37–43% of T2DM patients reported poor emotional well-being. Exactly the same percentages were found when the alternative cut-off value WHO-5 < 50 was used. Findings from the CES-D (≥ 16) were in line with these results, showing that 25–33% of patients with T1DM had elevated depressive affect, compared with 35–38% of patients with T2DM. When using a more strict WHO-5 score, < 29, 11–16% of T1DM patients and 18–25% of T2DM patients had WHO-5 scores that suggested clinical depression.

As shown in Table 2, results of the psychiatric interviews (CIDI) showed that 8–10% of male and female patients with T1DM suffered from a depressive disorder (MDD/dysthymia). Among patients with T2DM, 18% of women had MDD and 6% dysthymia, while the percentage of men with any depressive disorder was surprisingly low (2%). Generalized anxiety disorder was more common in male and female out-patients with T2DM (5% and 6%, respectively) compared with men an women with T1DM (3% and 1%, respectively).

Associations between demographic and clinical factors and depression

In Table 3, the results of a stepwise logistic regression are shown for the group of patients with T1DM. In the first step, female sex [odds ratio (OR) 1.7], low education (OR 1.7) and belonging to an ethnic minority (OR 2.0) were associated with depressive affect, although not statistically significantly. In the second step,

Table 1 Demographic and clinical characteristics of the study sample comparing all patients by type of diabetes and gender

	Type 1 diabetes mellitus			Type 2 diabetes melitus		
	All	Men	Women	All	Men	Women
n						
Demographics						
Age, years	43 ± 14	44 ± 13	43 ± 14	61 ± 12***	61 ± 11	61 ± 13
No partner	21% (82/384)	18% (31/169)	24% (50/212)	30% (167/549)***	20% (58/284)	41% (109/261)§§§
Low education	19% (71/384)	20% (33/169)	18% (37/212)	40% (221/549)***	35% (99/284)	46% (121/261)§§
Ethnicity						
Dutch	94% (337/359)	96% (155/162)	92% (181/195)	74% (372/505)***	75% (201/269)	73% (171/236)
Moroccan-Dutch	1% (3/359)	1% (2/162)	1% (1/195)	2% (9/505)	2% (5/269)	2% (4/236)
Turkish-Dutch	1% (3/359)	0% (0/162)	2% (3/195)	6% (32/505)	7% (19/269)	6% (13/236)
Surinam-Dutch	2% (6/359)	2% (3/162)	1% (2/195)	11% (56/505)	9% (25/26)	13% (31/236)
Other	2% (10/359)	1% (2/162)	4% (8/195)	7% (36/505)	7% (19/269)	6% (17/236)
Hospital						
VUMC Amsterdam	49% (189/384)	51% (87/169)	47% (100/212)	49% (270/549)	51% (146/283)	46% (119/261)
Westeinde The Hague	23% (87/384)	21% (25/169)	24% (51/212)	31% (168/549)	28% (78/283)	34% (90/261)
Radboud Nijmegen	28% (108/384)	28% (47/169)	29% (61/212)	20% (111/549)	21% (59/283)	20% (52/261)
Clinical values						
HbA1c, %	7.8 ± 1.3	7.6 ± 1.2	8.0 ± 1.3	7.7 ± 1.3	7.6 ± 1.4	7.8 ± 1.3
BMI, kg/m^2	25 ± 4	25 ± 4	25 ± 5	30 ± 6***	29 ± 5	31 ± 7 §§§
SBP,c mmHg	131 ± 17	133 ± 17	128 ± 16	138 ± 19***	137 ± 20	140 ± 18
DBP,c mmHg	74 ± 10	76 ± 10	73 ± 10D	77 ± 11*	76 ± 11	77 ± 11
Antihypertensive medication	34% (108/317)	36% (51/143)	32% (54/171)	72% (319/443)	76% (175/230)	67% (142/211) §
Inulin use	100% (384/384)	100% (169/169)	100% (212/212)	76% (412/542)***	75% (210/282)	78% (200/257)
Oral glucose-lowering agent(s)				55% (297/542)	57% (160/282)	53% (135/257)
Diet only				1% (7/542)	1% (2/229)	2% (5/207)
Severe hypo's past 12 months	34% (131/384)	34% (58/169)	34% (71/212)	19% (104/549)***	19% (55/282)	19% (49/261)
Nephropathy	17% (57/337)	20% (31/152)	13% (24/182)	29% (133/466)	33% (80/243)	23% (52/220) §
Background retinopathy	33% (113/336)	36% (55/152)	32% (58/182)	23% (108/461)	20% (48/244)	27% (60/219) §§§
Proliferative retinopathy	5% (17/334)	5% (7/152)	6% (10/182)	5% (22/461)	5% (11/240)	5% (11/219)
Neuropathy	19% (63/334)	23% (34/149)	15% (28/183)	27% (127/465)	28% (69/244)	26% (56/218)
Cardiovascular disease	10% (32/330)	10% (14/148)	9% (17/180)	36% (167/463)***	46% (111/243)	25% (55/217) §§
Duration diabetes (years)	22 ± 13	22 ± 13	22 ± 13	13 ± 9***	13 ± 9	13 ± 10

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$, comparing patients with Type 1 vs. Type 2 diabetes, likewise §$P < 0.05$; §§$P < 0.01$; §§§$P < 0.001$, comparing men and women within the same type of diabetes.

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2 Prevalence of depressive affect (WHO-5 or CES-D) and depressive disorder (CIDI) in men and women with Type 1 or Type 2 diabetes mellitus

	Type 1 diabetes mellitus		Type 2 diabetes mellitus	
	Men	Women	Men	Women
Questionnaires				
WHO-5 (mean ± SD)	59 ± 22	55 ± 23	57 ± 26	52 ± 26
WHO-5 ≤ 28 (depressive affect)	11% (18/169)	16% (33/210)	18% (48/270)	25% (60/240)
WHO-5 < 52 (poor well-being)†	33% (56/169)	36% (75/210)	37% (100/270)	43% (102/240)
CESD (mean ± SD)	10 ± 10	13 ± 11*	14 ± 11	14 ± 11
CES-D ≥ 16 (depressive affect)	25% (33/131)	33% (60/180)	35% (77/222)	38% (73/191)
Percantege of subjects (in a randomly selected subgroup who completed the CES-D), with a CES-D ≥ 16 were invited for a psychiatric diagnostic interview (CIDI)	21% (13/62)	23% (18/79)	28% (29/105)	37% (37/99)
CIDI: major depressive disorder	8% (5/62)	8% (6/80)	2% (2/105)	18% (18/99)***
CIDI: dysthymia	2% (2/62)	0% (0/79)	0% (0/105)	6% (6/100)*
CIDI: generalized anxiety disorder	3% (2/62)	1% (1/79)	5% (5/105)	6% (6/100)
CIDI: blood injection phobia	0% (0/62)	0% (0/79)	1% (1/105)	0% (0/99)
CIDI: nature environment phobia	2% (1/62)	1% (1/79)	2% (2/105)	2% (2/99)
CIDI: social phobia	8% (5/62)	3% (2/79)	2% (2/105)	6% (6/99)
CIDI: panic disorder	0% (0/66)	–	1% (1/105)	3% (2/99)
CIDI: agoraphobia	2% (1/66)	1% (1/79)	3% (3/105)	0% (0/99)
No CIDI (refused/could not be contacted)	3% (2/62)	4% (3/79)	7% (7/105)	2% (2/99)

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; †using the alternative cut-off value WHO-5 < 50 resulted in the same percentages.
CIDI, Composite International Diagnostic Interview.

Table 3 Sequential multiple logistic regression predicting depressive affect (CES-D score of ≥ 16) by demographic characteristics, metabolic risk factors and diabetes complications in out-patients with Type 1 diabetes

	Model I: Demographic features only	Model II: Metabolic risk factors, corrected for demographic characteristics	Model III: Diabetes complications, adjusted for demographic characteristics and metabolic risk factors
I Demographic features			
Female sex	1.71 (0.92–3.0)	1.58 (0.82–2.79)	0.96 (0.94–0.99)
No partner	1.11 (0.54–2.29)	0.95 (0.46–1.94)	1.19 (0.67–2.11)
Low education	1.72 (0.81–3.53)	1.60 (0.74–3.48)	1.33 (0.74–2.41)
Ethnic minority group	2.0 (0.43–9.20)	1.64 (0.23–8.10)	1.58 (0.92–2.71)
II Metabolic risk factors			
HbA_{1c} > 8.5%		2.69 (1.38–5.23)	1.37 (0.74–2.52)
BMI 25.0–30.0 kg/m^2		1.18 (0.61–2.30)	1.15 (0.63–2.06)
BMI > 30.0 kg/m^2		1.12 (0.48–2.64)	0.40 (0.20–0.79)
III Diabetes complications			
Cardiovascular disease			0.25 (0.04–1.41)
Background retinopathy			1.10 (0.59–2.05)
Proliferative retinopathy			4.11 (2.18–7.72)
Nephropathy			1.19 (0.62–2.32)
Neuropathy			1.26 (0.65–2.47)

having an HbA_{1c} > 8.5% more than doubled the risk for depressive affect (OR 2.69), while BMI was not associated with depression in patients with T1DM. In the third step of the logistic regression analysis, the main significant predictors of depressive affect were higher HbA_{1c} and presence of proliferative retinopathy; these remained so after adjusting for demographics. An additional, explorative chi square analysis revealed that the prevalence of depressive affect was 27% (44/163) in subjects with T1DM without retinopathy or with background retinopathy (26/98), but was significantly higher in patients with proliferative retinopathy: 69% (9/13), $P < 0.001$.

The same regression analyses were conducted for the out-patients with T2DM (Table 4). In contrast, sex in this group was not associated with CES-D scores, while a trend was found for being single to be associated with a higher risk for depression. Also in contrast to the results for out-patients with T1DM, poor

Table 4 Sequential multiple logistic regression predicting depression (CES-D score ≥ 16) by demographic features and metabolic risk factors and diabetes complications in out-patients with Type 2 diabetes

	Model I: Demographic features only	Model II: Metabolic risk factors, corrected for demographic characteristics	Model III: Diabetes complications, adjusted for demographic characteristics and metabolic risk factors
I Demographic features			
Female sex	1.10 (0.68–1.80)	1.04 (0.63–1.73)	1.20 (0.68–2.09)
No partner	1.32 (0.77–2.25)	1.28 (0.75–2.19)	1.20 (0.68–2.10)
Low education	1.46 (0.90–2.38)	1.47 (0.90–2.40)	1.38 (0.82–2.33)
Ethnic minority group	1.61 (0.86–3.01)	1.67 (0.88–3.14)	2.21 (1.09–4.46)
II Metabolic risk factors			
HbA_{1c} > 8.5%		1.18 (0.67–2.05)	1.20 (0.66–2.16)
BMI 25.0–30.0 kg/m^2		1.17 (0.59–2.34)	1.12 (0.55–2.30)
BMI > 30.0 kg/m^2		1.63 (0.84–3.18)	1.42 (0.71–2.85)
III Diabetes complications			
Cardiovascular disease			0.90 (0.52–1.56)
Background retinopathy			0.42 (0.22–0.81)
Proliferative retinopathy			0.21 (0.04–1.10)
Nephropathy			0.99 (0.54–1.82)
Neuropathy			3.27 (1.82–5.90)

glycaemic control, as indicated by HbA_{1c} > 8.5%, was not associated with depressive affect in patients with T2DM. In the same model, obesity (BMI > 30.0 kg/m^2) tended to be associated with depressive affect, increasing the risk for a high depression score by 63%, although this was not statistically significant. In the third model, the main factors that were significantly associated with depressive affect were: ethnic minority [OR 2.21, 95% confidence interval (CI) 1.09, 4.46] and neuropathy (OR 3.3, 95% CI 1.8, 5.9). Additional analyses showed that compared with T2DM patients with a normal weight (BMI < 25.0 kg/m^2), depression was more common among T2DM out-patients who were overweight (BMI 25.0–30.0 kg/m^2) or obese (BMI > 30.0 kg/m^2). For these three groups the prevalence rates of depression were 26%, 34% and 43%, respectively (P < 0.001). Furthermore, 52% of the T2DM patients with neuropathy had a high depression score compared with 31% of the T2DM patients without neuropathy (P < 0.001). In the migrant patients with diabetes (of Turkish, Moroccan, Surinam, Indonesian or Dutch Antilles descent), 50% (39/78) had elevated depression scores, compared with 31% of patients of native Dutch descent (P < 0.003).

Discussion

This is the first multicentre study to report on the prevalence of depression in a large sample of specialist care diabetic patients, using data from both self-report measures and diagnostic interviews. In our study, more than one out of three patients (33–43%) with T1DM or T2DM reported poor emotional well-being on the WHO-5 questionnaire (WHO-5 < 52). These findings are in line with the results from the CES-D (≥ 16), showing that depressive affect was particularly common in male and female out-patients with T2DM and female patients with T1DM, ranging from 33% to 38%, while a lower prevalence was found in men with T1DM (25%). Using a more strict cut-off value for the WHO-5 (WHO-5 ≤ 28) showed that 11–16% of all participants with T1DM and 18–25% of those with T2DM had scores indicative of clinical depression. The prevalence of depressive disorder (MDD or dysthymia) was 8% in both men and women with T1DM. However, the prevalence of interview-diagnosed depression in men with T2DM was surprisingly low (2%), especially in view of their questionnaire scores (depressive affect 35%). This may be partly due to a higher refusal rate (7% compared with 2% in women with T2DM) for undergoing the psychiatric diagnostic interview in the men.

This prevalence of depressive disorder is comparable to the results of the two earlier studies in diabetic out-patients that used a diagnostic interview, with prevalence rates of 8% and 13%, respectively [14,15]. The high prevalence of depressive disorder in women with T2DM is exceptional and may be explained by the relatively high percentage of patients with a migrant background in this group (27%).

The prevalence of depressive affect in a Dutch primary care diabetes setting was lower (17%) than in the present specialist care sample of T2DM patients [8]. Moreover, recent findings from the Hoorn Study [23] showed that 15% of men and 20% of women with T2DM had elevated depressive symptoms (CES-D). Compared with healthy control subjects, the odds for depression in patients with T2DM were higher in men (OR 2.0, 95% CI 0.75, 5.53) and in women (OR 3.2, 95% CI 1.3, 7.7). In that study, statistical adjustment for cardiovascular risk factors, cardiovascular disease and diabetes symptoms partially attenuated these associations, suggesting that these variables could be intermediate factors.

The second aim of the present study was to determine the demographic and clinical characteristics associated with depressive affect in out-patients with T1DM or T2DM. Multivariate logistic regression analyses showed that poor

glycaemic control (defined as HbA_{1c} > 8.5%) was associated with higher levels of depression in T1DM, but not in T2DM. This finding warrants further study. Proliferative retinopathy was strongly associated with an increased level of depression in both T1DM and T2DM. In T2DM, other factors were also associated with higher levels of depression: neuropathy, a higher BMI and being of non-Dutch descent. We found relatively high levels of depression in patients with a Turkish, Moroccan or Surinam background, which is in accordance with earlier studies [24,25].

Strengths of our study are the documentation of depression using self-report measures and diagnostic psychiatric interview in a large sample of out-patients with diabetes, including patients from different ethnic backgrounds. Rather than having to rely on self-report, we were able to use information from the medical charts to gather information about diabetes, glycaemic control and the presence of diabetes complications. Some limitations also need to be mentioned. First, the cross-sectional design does not allow us to make causal inferences. It is particularly important to increase our understanding of the temporal relationship between the development of secondary complications and the onset or recurrence of depression. While complications and depression often coexist, little is known about the causal relationship and opportunities of (combined) prevention and early treatment [26]. Second, although the total sample was relatively large, selective non-response may have biased the outcomes of our study. We were able to include almost half of the original random sample, and out-patients who suffered from more severe depression might have been less willing to participate. In the study, a relatively large number of elderly male patients refused the diagnostic interview, possibly related to the anticipated burden of and a negative attitude towards mental health care. Future studies should aim to address the problem of selection bias by optimizing recruitment strategies and minimizing attrition, particularly in migrants with diabetes. Including native speakers and using culturally appropriate information material may prove helpful in this context.

In summary, we conclude that depression is a common comorbid health problem in both T1DM and T2DM out-patients in the Netherlands, with about one-third of patients reporting elevated depression scores, and 8–24% being diagnosed with a depressive disorder. Within this group of out-patients with diabetes, women with T2DM, patients with an ethnic background, poorly controlled T1DM patients, obese T2DM patients and those with coexisting complications of diabetes appear to be at even greater increased risk. All patients with diabetes and depression require adequate mental healthcare, for which screening and monitoring have been advocated in earlier studies given the low detection rates in routine clinical care [27–32].

Competing interests

R.J.H. is employed by Eli Lilly and owns shares. The other authors have nothing to declare.

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