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Diabetes-related distress and associated factors among adults with diabetes in Germany: Results of the nationwide study "Disease knowledge and information needs – Diabetes mellitus 2017"

Yong Du [a,*], Jens Baumert [a], Rebecca Paprott [a], Francesca Färber [a], Julia Nübel [a], Norbert Hermanns [b], Christin Heidemann [a], Christa Scheidt-Nave [a]

[a] Department of Epidemiology and Health Monitoring, Robert Koch Institute, Berlin, Germany
[b] Research Institute of the Diabetes-Academy Bad Mergentheim (FIDAM), Bad Mergentheim, Baden-Württemberg, Germany

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ABSTRACT

Background: Diabetes-related distress (DRD) can affect diabetes management adversely. In lack of population-based data, the frequency and determinants of DRD among adults with diabetes in Germany remain controversial.

Methods: This study included 1367 adults with diabetes who participated in a nationwide health telephone survey conducted among German adults aged 18 years and older in 2017. The short form of the Problem Areas in Diabetes (PAID-5) scale was used to assess DRD. The associations of high DRD (PAID-5 sum score $\geq$ 8) with socio-demographics, diabetes-related risk factors, diabetes clinical characteristics as well as quality of self-care and chronic illness care assessed by patients were tested in multivariable logistic regression models.

Results: The overall DRD prevalence was 15.1% (95% confidence intervals, 95% CIs, 12.5–18.0%) with no significant difference between men (14.7%, 95% CIs 11.2–19.1%) and women (15.4%, 11.9–19.8%). In multivariable analyses, DRD was significantly associated with younger age (odds ratio 0.96, 95% CIs 0.94–0.98, per year), immigration background (2.26, 1.16–4.42), current smoking (2.06, 1.14–3.70), insulin use (2.57, 1.45–4.56), and the presence of diabetes-specific complications (1.80, 1.10–2.94) or depressive symptoms (5.34, 3.24–8.81). Among those with depressive symptoms (18,4% of the study population), 38.3% also had DRD, which accounted for 7.0% (95% CIs 5.3–9.3%) of the study population.

Conclusion: DRD is a common health problem among adults with diabetes in Germany, and highly correlates with depressive symptoms, current smoking, immigration background, and insulin use. Addressing DRD needs to become an integrative part of ambulatory diabetes care.

1. Introduction

Effective management of diabetes requires multiple long-lasting self-care activities, which can be highly demanding and stressful. This may potentially affect psychological well-being of people with diabetes, leading to the development of psychological symptoms and mental disorders like depression [1] and anxiety [2]. Diabetes-related distress (DRD) is one of psychological problems referring specifically to the negative emotional burden of living with diabetes such as feeling overwhelmed, frustrated or hopeless [3–5]. By definition, DRD differs from other psychological problems e.g. depression in that it is an emotional response to living with diabetes, whereas depression and other psychological symptoms or disorders can also occur in people without diabetes. People with diabetes may suffer from DRD and depression, alone or both [3,6]. According to systemic reviews and meta-analyses, DRD affects approximately 22%–36% of people with diabetes [7,8].

DRD can affect diabetes management adversely, causing a wide variety of health outcomes over time [9]. A high level of DRD has been associated with non-adherence to medication [10], healthy lifestyle guidelines and other self-care activities [11], directly and indirectly resulting in poor glycemic control [11–13]. In addition, DRD may be associated with declined health-related quality of life [14], and patient-perceived chronic illness care [15], increased risk of excess mortality

* Corresponding author.
E-mail address: duy@rki.de (Y. Du).

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[16], adverse pregnancy outcomes [17] as well as work and life productivity loss [18]. However, DRD is responsive to interventions. Psychological interventions are effective in reducing DRD in adults with diabetes [19–21]. Reduction of DRD in adults with diabetes can enhance psychological well-being and improve glycemic control [19–21].

Given the significant and negative health impacts of DRD on the management of diabetes, recognizing, determining and characterizing DRD among patients with diabetes is of importance. In Germany, DRD has been investigated mainly at clinical settings among outpatients [22,23] or among inpatients in diabetes-specialized treatment centers [24,25]. Prevalence of DRD from these studies varies from 1.2% [22] to 43.5% [25]. Population-based epidemiological studies on DRD are sparse. Among the German participants of the Diabetes Attitude, Wishes and Needs (DAWN2) study, the prevalence of DRD was found to be 27.3% overall [26,27]. In spite of stratified analyses for DRD prevalence, none of the above German studies has systematically investigated factors that may contribute to or protect against DRD. As correlates of DRD vary between studies from different countries [28], identifying characteristics of people with DRD in Germany may help stake-holders to take timely specific interventional measures to address DRD and finally improve well-being and quality of diabetes care.

Against this background, using the data of a nationwide, population-based survey conducted in 2017 among adults in Germany, we investigated the prevalence and correlates of DRD among adults with diabetes in Germany.

2. Methods

2.1. Study design and study population

The nationwide telephone interview survey "Disease knowledge and information needs –Diabetes mellitus (2017)" was conducted by the Robert Koch Institute among adults aged 18 years and older in Germany from August to December 2017 [29,30]. The study design and sampling methods have been published in detail previously [29]. Briefly, this study applied the established dual-frame methodology to generate random samples of telephone numbers at a national level, considering both landline and mobile telephone numbers for all potentially reachable private households [29–31]. The telephone survey consisted of two parts. The first part was based on a randomly selected sample of German-speaking adults over 18 years of age, comprising 2327 adults without diabetes and 263 adults with diagnosed diabetes. The response rate calculated according to the American Association for Public Opinion Research (AAPOR), i.e. the proportion of conducted interviews related to all potentially reachable households in Germany, either via landline or mobile telephone, was 17.9% [30,31]. The second part applied a direct screening procedure for adults with diagnosed diabetes. This part resulted in 1216 adults with diagnosed diabetes. Data were collected through standardized computer assisted telephone interviews (CATI) by trained interviewers. The survey was approved by the Federal Office for Data Protection and the ethics committee of the Berlin Chamber of Physicians (Ärztekammer Berlin; No. Eth-23/17). A verbal informed consent was obtained from survey participants prior to the interview.

A total of 1479 adults who reported ever having been diagnosed with diabetes or were currently taking antidiabetic medications were identified as people with diabetes. Of them, 40 women reporting gestational diabetes only and 43 people reporting no presence of diabetes in the past 12 months were excluded, resulting in 1396 people with diabetes left. Further excluding 29 adults with missing data for DRD led to a final sample of 1367 persons for the present analysis.

2.2. Measurement of diabetes-related distress

DRD was assessed using the German version of the short-form Problem Areas in Diabetes (PAID-5) scale [30,32]. For the five problems contained in PAID-5, participants were asked to rate the extent of each of the problem areas on a 5-point Likert scale (from 0 "not a problem" to 4 "serious problem"). A sum score was calculated by summing the score of the 5 questions, yielding a range of 0–20. A sum score of 8 or higher was defined as having DRD [32].

2.3. Covariables

A number of covariables were considered in this study based on nonsystematic literature review and data availability: socio-demographics, diabetes-related risk factors and clinical characteristics. People with immigration background were defined as those who themselves or whose parents – one side or both sides – did not own a German citizenship at the time of birth. Living with a partner was defined as those who lived with their spouse or with a partner. CASMIN (Comparative Analysis of Social Mobility in Industrial Nations) criteria were applied to define educational attainment as primary, middle and high educational level.

Body mass index (BMI) was calculated based on self-reported body height and body weight and grouped as "<25", "25–30" and "≥ 30" kg/m^2. Smoking status was grouped as current smoker, ex-smoker and nonsmoker. Physical activity was defined according to the question "Do you take part in physical activities at least 5 hours each week, such as sports activities, gardening or bicycling?" (yes/no).

For people reporting diabetes in the past 12 months, we asked about the age at diagnosis, treatment pattern (lifestyle intervention, treatment with insulin and non-insulin antidiabetic medication) at the time of diagnosis and at the time of interview, presence of diabetes-specific complications (diabetic nephropathy, retinopathy, neuropathy, diabetic foot and diabetes-related amputation) and comorbid cardiovascular diseases (CVD) (myocardial infarction, coronary heart disease, and stroke) and whether they had ever participated in a structured diabetes education program (SDEP) (yes/no). We defined people who were likely to have type 1 diabetes (T1D) using the algorithm (age at diagnosis <30 years and using insulin immediately after diagnosis and currently). Diabetes duration was computed by subtracting age at diagnosis from current age, and grouped as "<5", "5–14" and "≥ 15" years. Based on the self-rated presence and frequency of depressed mood or decreased interest/pleasure in the past 2 weeks, people with depressive symptoms were defined as those with a Patient Health Questionnaire −2 sum score (range 0–6) ≥3 [30].

The Summary of Diabetes Self-Care Activities (SDSCA-6) scale was applied to measure patients' self-care activities [26]. Participants were asked to mark the number of days in the past 7 days regarding adherence to a healthy eating plan, participating in ≥30 min. of physical activity, blood glucose testing, self-examination of feet, and medication use as recommended. Days with adherence were summarized across 5 subscales, yielding a range of 0–35. The German version of the DAWN Short Form of the Patient Assessment of Chronic Illness Care (PACIC-DSF) was used to examine quality of chronic illness care perceived by patients with diabetes [30]. The PACIC-DSF consists of 9 items assessing the extent to which patients experience the care they received based on a 5-point Likert scale (from 1 "never" to 5 "always"). Mean scale scores within a range of 1 to 5, which were calculated by a standardized PACIC sum score, were used for assessment.

2.4. Statistical analysis

Statistical analyses were performed using Stata (version 17, StataCorp, USA). Weights were used in the analysis to ensure national representativeness of results, and were computed considering the distribution of sex, age and education of the diabetic sample obtained from the "German Health Update" (GEDA) study 2012 [29].

Descriptive statistics were used to assess the characteristics of the study population and the prevalence of DRD in subgroups. Differences in DRD prevalence within subgroups were tested by Rao-Scott chi-square

test. We reported point prevalence estimates for categorical variables and means for continuous variables together with 95% confidence intervals (95% CIs).

Logistic regression models were fit with DRD sum-score ≥8 vs <8 as dependent variable. Odds ratios (ORs) and 95% CIs were obtained from logistic regression models. We computed several models, adding stepwise socio-demographics, diabetes-related risk factors, and clinical characteristics. Since statistical significance did not change substantially by stepwise adding variables, we present results of the final model with all covariables.

Overall, 16.2% of participants had a missing value in at least one variable. Proportions of missing observations in covariables ranged from 0.07% for physical activity and insulin use to 7.5% for PACIC-DSF (footnote Table 1). We applied 15 multiple imputations by chained equations assuming an arbitrary pattern of missingness for missing values. Logistic regression models were performed for the imputed datasets and estimates were combined considering variability within and between the imputations. Sex differences in the associations were tested by adding first order interaction terms to the final model. Complete case analyses (n = 1159 or 84.8% of the study population) were conducted as sensitivity analyses. A p-value <0.05 was considered as statistically significant based on two-sided tests.

3. Results

The mean age of the study population was 66.2 years; half of them were women. >10% of the study population had an immigration background; about 46% had a primary level of education and obesity, nearly one fifth of people were current smokers and one third of people were physically active for <5 h each week. Further descriptive characteristics of study population and by DRD are found in Table 1.

Fig. 1 shows the proportions of subscales of PAID-5. Worrying about the future and the possibility of serious complications was mentioned at the utmost as a (somewhat) serious problem (10.7%), followed by the feeling that diabetes is taking up too much of one's mental and physical energy every day (7.3%) and feeling scared when one thinks about living with diabetes (7.2%). Feeling depressed when one thinks about living with diabetes (3.8%) was the least mentioned problem (Fig. 1).

Table 1
Descriptive characteristics of the study population.

		Total (n=1367)			Without DRD (n=1208)			With DRD (n=159)		
		%	95% CIs		%	95% CIs		%	95% CIs	
Socio-demographics										
Sex	Men	50.0	46.7	53.3	50.2	46.8	53.7	48.7	38.7	58.9
	Women	50.0	46.7	53.3	49.8	46.3	53.2	51.3	41.1	61.3
Age group, yrs	18–44	6.8	4.5	10.3	5.4	3.3	8.8	15.0	7.0	29.2
	45–64	36.9	33.8	40.2	34.2	30.9	37.6	52.6	42.3	62.7
	65–79	41.9	38.8	45.1	44.7	41.3	48.1	26.3	19.4	34.7
	≥ 80	14.3	12.5	16.4	15.8	13.7	18.1	6.1	3.4	10.5
Imimmigration background	No	88.3	85.7	90.5	90.2	87.8	92.2	77.5	66.8	85.6
	Yes	11.7	9.5	14.3	9.8	7.8	12.2	22.5	14.4	33.2
Education	Primary	46.3	42.9	49.7	46.4	42.9	50.0	45.5	35.2	56.2
	Middle	40.2	37.1	43.3	39.1	35.9	42.4	46.3	36.5	56.3
	High	13.6	11.9	15.4	14.5	12.7	16.5	8.2	4.6	14.4
Living with a partner	Yes	55.5	52.1	58.7	55.5	52.0	58.9	55.5	44.9	65.5
	No	45.5	41.3	47.9	45.5	41.1	48.0	45.5	34.5	55.1
Diabetes-related risk factors										
BMI, kg/m^2	<25	18.2	15.8	20.9	18.1	15.6	20.8	18.9	11.3	29.8
	≥ 25–30	36.1	33.0	39.2	36.8	33.6	40.1	31.9	23.6	41.6
	≥ 30	45.7	42.4	49.1	45.1	41.6	48.7	49.2	39.1	59.3
Smoking status	Smoker	19.6	17.0	22.6	17.0	14.4	19.9	34.6	25.2	45.3
	Ex-smoker	32.3	29.3	35.4	33.2	30.0	36.5	27.1	19.3	36.5
	Non-smoker	48.1	44.8	51.4	49.8	46.4	53.3	38.4	29.0	48.7
Physical activities ≥5 h/wk	Yes	67.1	63.8	70.2	69.2	65.9	72.3	55.2	44.7	65.2
	No	32.9	29.8	36.2	30.8	27.7	34.1	44.8	34.8	55.3
Diabetes clinical characteristics										
Diabetes type	Type 1	7.7	5.5	10.7	5.1	3.3	4.7	22.4	13.5	34.8
	Type 2	92.3	89.3	94.5	94.9	95.3	96.7	77.6	65.2	86.5
Diabetes duration	<5 yrs	15.0	12.6	17.7	14.9	12.6	17.7	15.2	8.0	26.9
	≥ 5–14 yrs	41.7	38.5	45.0	42.7	39.3	46.2	35.9	26.7	46.3
	≥ 15 yrs	43.3	40.1	46.7	42.3	38.9	45.8	48.9	38.8	59.1
Insulin use	Yes	50.2	46.9	53.5	46.3	42.9	49.8	71.9	62.5	79.8
	No	49.8	46.5	53.1	53.7	50.2	57.1	28.1	20.2	37.5
Ever participating in SDEP	Yes	73.1	70.0	75.9	72.4	69.3	75.4	76.8	66.0	84.9
	No	26.9	24.1	30.0	27.6	24.6	30.7	23.2	15.1	34.0
Any diabetes complication	Yes	36.4	33.2	39.7	33.2	29.9	36.6	54.7	44.0	65.0
	No	63.6	60.3	66.8	66.8	63.4	70.1	45.3	35.0	56.0
CVD	Yes	29.2	26.3	32.2	29.2	26.2	32.3	29.2	21.3	38.7
	No	70.8	67.8	73.7	70.8	67.7	73.8	70.8	61.3	78.7
Depressive symptoms	Yes	18.4	15.8	21.2	13.4	11.1	16.0	46.0	36.1	56.2
	No	81.6	78.8	84.2	86.6	84.0	88.9	54.0	43.8	63.9
Quality of care and PAID										
SDSCA, *unit*	*Mean*	24.0	23.6	24.5	23.9	23.4	24.4	24.6	23.2	26.0
PACIC, *unit*	*Mean*	2.48	2.41	2.54	2.47	2.39	2.54	2.53	2.31	2.75
PAID-5, *unit*	*Mean*	3.38	3.04	3.72	1.85	1.71	1.99	12.0	11.2	12.8

CIs: confidence intervals. DRD: diabetes-related distress. SDEP: structured diabetes education program. CVD: cardiovascular diseases SDSCA: Summary of Diabetes Self-Care Activities. PACIC: Patient Assessment of Chronic Illness Care. PAID: Problem Areas in Diabetes.
Variables with missing values: physical activity and current insulin use (n = 1), immigration background, education and living with a partner (n = 2), diabetes duration (n = 8), depressive symptoms (n = 15), cardiovascular diseases (CVD) (n = 16), body mass index (BMI) (n = 19), diabetes-specific complications (n = 60), PACIC (n = 103).

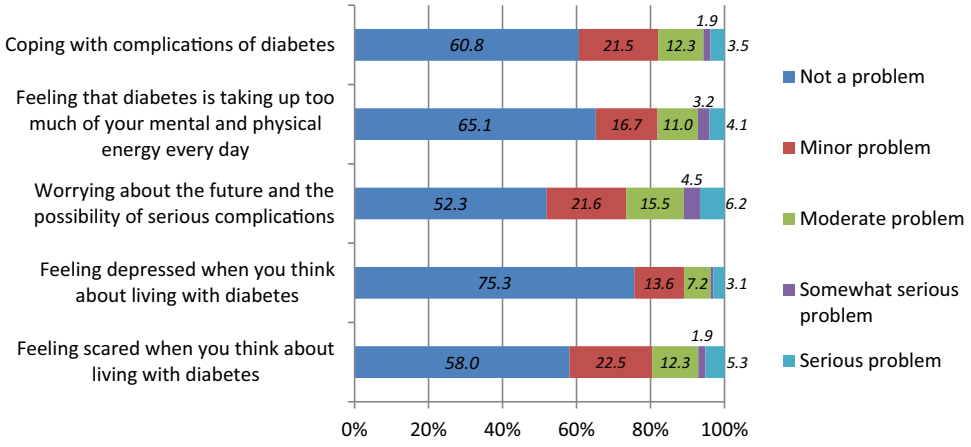

Fig. 1. Distribution of ratings within subscales of the Problem Area in Diabetes short form (PAID-5) among adults with diabetes in Germany.

The overall prevalence of DRD was 15.1% (Table 2). A higher DRD prevalence was found in groups of younger age (<50 years), persons with immigration background, smokers, those with less physical activities, T1D patients, insulin users, and those with diabetes complications and depressive symptoms (Table 2). A number of 73 people had comorbid DRD and depressive symptoms, accounting for 38.3% of people with depressive symptoms or 7.0% (95% CIs 5.3–9.3%) of study population.

Multivariable logistic regression analyses showed that DRD was associated with younger age, having an immigration background, smoking, insulin use, any diabetes complication and depressive symptoms (Table 3). No significant interaction was found between sex and all other co-variables except for immigration background. Sex-stratified analyses showed that DRD was associated with men with immigration background (OR 4.17, 95% CIs 1.65–10.6) whereas this was not the case among women (0.99, 0.35–2.81). Results largely persisted in complete case analysis (data not shown).

Table 2
Prevalence of diabetes-related distress among adults with diabetes in Germany.

		%	95% confidence intervals		p
	Overall	15.1	12.5	18.0	
Socio-demographics					
Sex	Men	14.7	11.2	19.1	0.788
	Women	15.4	11.9	19.8	
Age group, years	18–49	35.8	22.9	51.2	<0.001
	50–64	18.7	14.3	24.2	
	65–79	9.5	7.1	12.6	
	≥ 80	6.4	3.7	10.8	
Immigration background	Yes	28.8	19.0	41.1	<0.001
	No	13.2	10.7	16.1	
Educational level	Low	14.8	10.6	20.3	0.144
	Middle	17.3	13.9	21.4	
	High	9.1	5.2	15.5	
Living with a partner	Yes	15.0	11.8	18.8	0.997
	No	15.0	11.0	20.0	
Diabetes-related risk factors					
Body mass index (BMI), kg/m^2	BMI < 25	15.3	9.2	24.4	0.665
	BMI ≥25–30	13.1	9.6	17.5	
	BMI ≥30	15.9	12.2	20.4	
Smoking status	Smoker	26.5	19.2	35.4	<0.001
	Ex-smoker	12.6	9.0	17.4	
	Non-smoker	12.0	8.8	16.1	
Physical activities ≥ 5 h/wk	Yes	12.4	9.7	15.6	0.007
	No	20.5	15.4	26.9	
Diabetes clinical characteristics					
Diabetes type	Type 1	43.7	27.4	61.5	<0.001
	Type 2	12.7	10.4	15.3	
Diabetes duration, years	<5	15.2	8.1	26.8	0.489
	≥ 5–14	12.9	9.4	17.5	
	≥ 15	17.0	13.3	21.3	
Current insulin use	Yes	21.6	17.3	26.6	<0.001
	No	8.5	6.1	11.8	
Ever participation in SDEP	Yes	15.8	12.9	19.3	0.413
	No	13.0	8.3	19.7	
Any diabetes complication	Yes	22.3	17.7	27.8	<0.001
	No	10.6	7.7	14.4	
CVD	Yes	15.0	11.0	20.1	0.992
	No	14.9	11.8	18.7	
Depressive symptoms	Yes	38.3	30.4	46.9	<0.001
	No	10.1	7.7	13.2	

SDEP: structured diabetes education program. CVD: cardiovascular diseases. *P*-values, for the statistical difference in diabetes-related distress prevalence within subgroups. Rao-Scott chi-square test.

Table 3
Correlates of diabetes-related distress among adults with diabetes in Germany.

	OR*	95% CIs		p
Socio-demographics				
Women vs. men	1.40	0.82	2.38	0.213
Age, per year	0.96	0.94	0.98	<0.001
Immigration background: yes vs. no	2.26	1.16	4.42	0.017
Middle education v. low education	1.48	0.86	2.55	0.158
High education vs. low education	0.75	0.36	1.56	0.436
Living with a partner: yes vs. no	1.02	0.61	1.69	0.946
Diabetes-related risk factors				
BMI ≥25–30 vs. <25	1.03	0.55	1.92	0.928
BMI ≥30 vs. <25	0.82	0.42	1.58	0.547
Smoker vs. non-smoker	2.06	1.14	3.70	0.016
Ex-smoker vs. non-smoker	1.29	0.74	2.27	0.372
Physical activities ≥ 5 h/week: no vs. yes	1.37	0.82	2.28	0.234
Diabetes clinical characteristics				
Type 1 diabetes vs. type 2 diabetes	1.61	0.61	4.27	0.341
Diabetes duration: ≥ 5–14 vs. <5 years	0.78	0.37	1.68	0.527
Diabetes duration: ≥ 15 vs. <5 years	0.87	0.38	1.98	0.745
Current insulin use: yes vs. no	2.57	1.45	4.56	0.001
Ever participation in SDEP: yes vs. no	0.90	0.50	1.65	0.749
Diabetes complication: yes vs. no	1.80	1.10	2.94	0.020
CVD: yes vs. no	1.24	0.74	2.08	0.419
Depressive symptom: yes vs. no	5.34	3.24	8.81	<0.001
Quality of care				
SDSCA-6, per unit	0.998	0.96	1.04	0.926
PACIC, per unit	1.04	0.80	1.36	0.767

BMI: body mass index. SDEP: structured diabetes education program. CVD: cardiovascular diseases SDSCA: Summary of Diabetes Self-Care Activities. PACIC: Patient Assessment of Chronic Illness Care.

* Weighted odds ratios (OR) and 95% confidence intervals (95% CIs) were derived from logistic regression model with high diabetes-related distress as dependent variable and all other variable in the table as independent variables.

4. Discussion

In the present population-based study, we found that the prevalence of DRD was 15% among adults with diabetes in Germany. Worrying about the future and the possibility of serious complications was the most frequently mentioned concern of people with diabetes. DRD was disproportionately frequent among people of younger age, with immigration background, smokers, people with less physical activities, T1D, insulin users, and those with any diabetes complications or depressive symptoms, which were confirmed as corelates of DRD in multivariable regression analyses except for T1D.

4.1. Prevalence of DRD

The prevalence of DRD varied greatly between studies depending on study populations, settings and instruments used for assessment as well as cut-offs used for the definition of DRD as shown by results of studies in meta-analyses [7,8]. Dennick and colleagues reviewed studies conducted between 1995 and 2013 for a meta-analysis and found that on average 22% (95% CIs 19–26%) of adults with diagnosed T1D or T2D (ranging 2.7–53.7%) had DRD [7], which is higher than our finding of 15% in the present study. By using a less strict cut-off to define DRD, a later meta-analysis for studies conducted up to 2016 reported an overall DRD prevalence of 36% (ranging 4.0%–79.5%) among T2D patients [8].

The comparatively low DRD among German adults with diabetes can be seen in the multinational DAWN2 study, which recruited adults in 17 countries with each comprising of about 420 T2D and 80 T1D patients [26,33]. Overall 44.6% of adults had DRD, with the lowest DRD being found in the Netherlands and the highest in Algeria [26]. The DRD prevalence of 27.3% found among German participants [26,27] is comparable to that in the Netherlands, USA, Canada, Denmark and UK, which falls between about 20–30%, but well below that in France, Italy, Spain and other countries, which falls between about 40–60% [26].

DRD prevalence estimates from previous German studies suggest a gradient corresponding to patients at different levels of care - from low DRD at primary care, to moderate and high DRD at secondary and tertiary care. For example, in a sample comprising mainly of T2D patients recruited in a general practice, a low mean PAID score of 3.9 and a low DRD prevalence of 1.2% was reported [22]. The authors argued that patients of a general practice taking part in the diabetes Disease Management Program attended the clinics regularly and participation in SDEP may play a role [22]. Yet, we found no association of DRD with participation in SDEP. Among inpatients with T1D and T2D, a much higher DRD prevalence rate of 43.5% [25] and 23.8% [24] was reported. Our study was conducted among adults drawn from the general population under ambulatory care, it is not unexpected that the prevalence estimate falls between that at primary care and tertiary care, and is roughly comparable to that at secondary care [23]. In the present study 15.1% of adults with diabetes had DRD, which is considerably lower compared to 27.3% among adults with diabetes from Germany who were included in the DAWN2 study [26,27]. These differences are likely to be due to differences in recruitment methods between the two studies leading to differences in the composition of the study samples. In particular, the proportion of adults with T1D was twice as high in the DAWN2 study compared to the present study (16% vs. 8%). Both the DAWN2 study and the present study consistently showed that DRD was about twice as prevalent among adults with T1D than those with T2D [27]. Thus, differences in the proportion of adults with T1D are likely to account for at least some of the difference in DRD prevalence, although other factors cannot be excluded.

4.2. Factors associated with DRD

In agreement with findings of previous studies, we found people with younger age [34,35], diabetes complications [34,36] and depressive symptoms [8,12] were significantly more likely to have DRD compared to reference groups. Insulin use [35,36] was consistently found to be associated with DRD, too. We did not find an association between sex and DRD, which was reported previously in some studies [7,8] though not all [37]. In addition, we did not find a relationship between DRD and SDSCA-6 and PACIC, either. Yet, factors associated with DRD vary between studies [28,34]. A study of large sample of T2D outpatients in Italy identified younger age, female sex, living alone, and the number of diabetes complications as correlates of DRD [34]. With consideration of psychological well-being factors, the association with female sex and presence of diabetes complications disappeared [34]. Consistent with our findings, no association was found for DRD with education, BMI, diabetes duration, SDSCA-6 and PACIC [34], whereas in a cohort study of younger adults aged 20–45 years with early onset T2D in Denmark, lower DRD was found to be associated with higher PACIC [15].

DRD, as a matter of fact, is an emotional response to living with diabetes. In our study and many other studies [22,26,38], worrying about 'the future and the possibility of serious complications' was the most frequently mentioned concern of patients with diabetes. This may reflect particularly the concerns of young people. Younger people, when diagnosed with diabetes, are faced with a chronic and demanding disease that will lead to a significant change in daily life. Further, younger people may have a stronger emotional response and more worries about the course of disease and possible complications compared to older people due to age-dependent expression of depression and anxiety symptoms [39] and mental health literacy [40]. According to guidelines for the management of T2D, insulin will be initialized when the first-line antidiabetic agents do not work successfully in glycemic control. Initiation of insulin use per se implies thus the progress of disease, which may make patients feel more worried and anxious. In addition, use of insulin requires precise dosing and regular repeated injections by patients themselves, which may also make users feel upset. All these can lead to an emotional response and contribute to high DRD.

Cigarette smoking may have anxiolytic and antidepressant effects and was found to be associated with a greater probability of severe distress [41]. People with immigration background belong to socially disadvantaged groups and are found to be more likely to have adverse health outcomes in Germany and other countries [42]. Language barriers leading to communication problems with health professionals and limited access to health service possibly contribute to people with immigration background being prone to respond emotionally to coping with diabetes [43,44].

People with diabetes may suffer from DRD and depression, alone or both. We found 7.0% (95% CIs 5.3–9.3%) of people reported the co-occurrence of high DRD and current depressive symptoms, which is comparable to 5.3% found in a Canadian study [45]. High correlation of depression and DRD might be due to a construct overlap [46] since symptoms of depression and DRD have much in common [5] such as loss of energy, feeling of hopelessness, and recurring thinking of failure and forthcoming threats. Despite the intricate and probably bidirectional interrelationship between DRD and depression it is crucial to differentiate DRD from depression. Since DRD is an emotional reaction to living and coping with diabetes and diabetes-related sequelae, it is amenable to intervention. Successful intervention DRD may hence also help to prevent or alleviate depressive symptoms [3,6–8].

4.3. Implications

Although DRD has been recognized for decades, DRD is not a clinical diagnosis. Health professionals working with people with diabetes should be aware that DRD is a common emotional problem that is closely correlated to symptoms of mental disorders such as depression and anxiety, which can alone or jointly affect diabetes management in an unfavorable way [12]. Psychosocial care is an important part of successful diabetes management. Various psychological interventions such as mindfulness-based cognitive therapy, acceptance and commitment therapy, self-directed mindfulness practice, etc. have been proved

to be effective in the reduction of DRD and improvement of glycemic status in randomized clinical trials [19,21]. Further, interventions addressing comorbidities in people with diabetes are used increasingly [47], which improve not only quality of life overall, but also can reduce DRD potentially given diabetes complication is closely associated with DRD in the present study. With this in mind, screening of DRD should be done as early as possible and special attention should be paid to smokers, people with immigration background and people with depressive symptoms. Assessment of DRD may be repeated when insulin therapy is initialized or diabetes complications emerge, so that timely appropriate psychological interventional measures can be taken in target groups at risks of DRD. Implementation of effective psychological interventions into diabetes care largely depends on successfully integrating patient-reported outcome measures (PROMs) into routine medical care. Research identifying and overcoming the challenges and barriers to PROM implementation is therefore essential [48,49].

4.4. Strengths and limitations

The major strength of the study is the use of data from a nationwide population-based survey. Weighted results allow for the conclusions to be generalized to the whole non-institutionalized adults with diabetes in Germany. However, there are several limitations. Due to limited interview time in telephone surveys, we used the short-form PAID-5 instead of the 20-item full version to measure DRD. It was therefore impossible for us to look into other emotional problems of people with diabetes. In the context of a national health telephone survey, data collection was limited. In particular, we could not collect blood samples for measurements of biomarkers such as fasting plasma glucose or glycated hemoglobin A1 (HbA1c), preventing us from testing the association of DRD with glycemic control. A significant positive association between depressive symptoms and higher fasting glucose or HbA1c has previously been reported [50,51], while the association between glycemic control and DRD is less clear and needs to be investigated in future studies [7,50]. As a further limitation, the present study did not examine regional differences in DRD and depressive symptoms. People with diabetes in rural areas may be at a higher risk of DRD than in urban areas and could particularly benefit from interventions [52,53]. Selection bias is unavoidable in telephone surveys as people without mobile and landline telephones, immigrants with limited German language may have been precluded from our study. Further, people with depression may be reluctant to take part in a health survey. This may potentially result in a low DRD given the high correlation between depression and DRD. Furthermore, information on diabetes and all other health conditions was self-reported; verification by medical records and/or laboratory tests was impossible.

5. Conclusions

In a nationwide population-based sample of adults with diabetes in Germany, we found that about 15% of them had DRD. Correlates of high DRD included younger age, smoking, immigration background, insulin use, presence of diabetes complication and depressive symptoms. Clinical professionals in Germany should pay attention to subgroups at risk of DRD identified in the present study. Given the high coexistence of DRD and depressive symptoms, DRD should be addressed in routine ambulatory care in order to improve care outcomes and wellbeing among people with diabetes.

Declaration of Competing Interest

The authors have no competing interests to report.

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