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Risk factors and quality of life of patients with high diabetes-related distress in primary care: a cross-sectional, multicenter study

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Abstract

Purpose This study aimed to examine risk factors and quality of life of patients with high diabetes-related distress (DRD) in primary care.

Methods A cross-sectional, multicenter study was conducted in four primary healthcare institutions. Patients aged ≥ 21 years with T2DM were included; patients who were pregnant or unable to communicate independently were excluded from this study. The problem area in diabetes (PAID) measuring DRD, European quality of life-5 dimensions (EQ-5D), and audit of diabetes-dependent quality of life (ADDQoL) measuring quality of life were administered by trained research assistants.

Results A total of 525 patients were eligible for this study. The mean PAID score was 26.90 ± 20.23, with 27.8% of patients reporting having high DRD (PAID score ≥ 40). Patients who were younger than 50 years (OR 4.577, 95% CI 1.977–10.600) and patients with HbA1c greater than 9% (OR 1.720, 95% CI 1.064–2.779) were at higher risk of having high DRD ($p < 0.05$). Patients with high DRD have a lower EQ-5D index value ($B = -0.141$) and ADDQoL AWI ($B = -1.276$) than patients with little/no DRD ($p < 0.001$).

Conclusion High DRD was more common among younger patients and patients with poorer glycemic control. High DRD was associated with poorer quality of life and early screening and management of DRD is recommended.

Keywords Type 2 diabetes mellitus · Psychological distress · Risk factors · Quality of life · Primary healthcare

Introduction

Patients with diabetes are often under significant psychological distress due to strict adherence to medications, diet, exercise, as well as fear of long-term macrovascular complications, such as stroke and coronary heart disease, and microvascular complications such as blindness, kidney failure, and amputation [1]. Diabetes-related distress (DRD) is the most common emotional distress among patients with diabetes. It is defined as patient concerns about disease management, access to care, emotional burden, and social support related to diabetes [2]. The second diabetes attitudes, wishes and needs (DAWN2) study, a global partnership initiative among several international organizations from 17 countries and four continents, showed that 44.6% of patients with diabetes suffered from high DRD, with the lowest at approximately 20% in Netherlands and the highest at approximately 65% in Algeria [3].

Despite the high prevalence of DRD and diabetes worldwide, DRD is still under-recognized and undertreated by healthcare providers, due to limited patient contact time and expertise [4, 5]. In an observational study of 94 patients from an outpatient diabetes clinic, the registration rate of high DRD was reported to be 25%, of which only 28% of the patients have discussed their emotional problem with their healthcare professionals [6]. The situation is further complicated by a lack of access to psychological referrals and interventions, especially in primary care that manage majority of the patients with diabetes [7, 8].

DRD has been consistently found to negatively impact on sugar control and psychosocial well-being among patients with diabetes [9, 10]. In a non-interventional study on 506

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patients with T2DM conducted by Fisher et al., DRD was associated with poorer glycemic control both cross-sectionally and prospectively [11]. Patients with higher DRD also reported to have greater depressive symptoms, and thus at greater risk of complications and mortality [12–14]. The detrimental consequences of DRD in patients with diabetes are not inevitable because effective treatments for DRD are available. A systematic review conducted by Thorpe et al. has provided support for a variety of psychosocial interventions and education to help patients with diabetes to cope with stress and thus manage their disease better [15]. Nevertheless, a pre-requisite for effective management of DRD is the detection of at-risk patients.

Earlier studies have primarily focused on the factors associated with DRD, for example, age, gender, diabetes duration, and insulin use [1, 2, 16–18]. Little attention has been paid to the identification of high-risk patients, especially in primary care. Furthermore, there is a dearth of information of the impact of DRD on patients' quality of life. Health-related quality of life (HRQoL) is an individual's or a group's self-perceived well-being that are related to or affected by the presence of disease or treatment [19]. In recent years, there has been a burgeoning interest in HRQoL assessment in addition to clinical outcomes because HRQoL is found to associate with increased mortality and healthcare utilization [20, 21]. Therefore, the objectives of our study were to examine the risk factors and HRQoL of patients with high DRD in primary care.

Methods

Study design and sites

This was a cross-sectional, multicenter study conducted in Singapore. This study was conducted in four public healthcare institutions in primary care from May 2013 to Feb 2015. This study was approved by the Singapore Institutional Review Board (Ref No: 2012/01037).

Study subjects

All patients ≥ 21 years old, diagnosed with T2DM, and with active pharmacologic treatments were eligible for this study. Patients who were pregnant or unable to communicate independently in English, Chinese, or Malay (i.e., the three most commonly spoken languages in Singapore) were excluded from this study.

Study procedure

Patients were approached and screened at the study sites by trained research assistants. After obtaining the written informed consent from eligible patients, four questionnaires were administered to patients by research assistants in their preferred languages. The questionnaires included a 7-item survey on patient demographics, a 20-item problem area in diabetes (PAID) measuring DRD, a 5-item European quality of life-5 dimensions (EQ-5D) measuring general health state, and a 21-item audit of diabetes-dependent quality of life (ADDQoL) measuring diabetes-specific HRQoL. Permission to use the questionnaires was obtained from authors. Forward and backward translations were performed for Malay version of PAID and ADDQoL as per guidelines [22].

Study outcome measures

Sociodemographic variables collected included age, gender, ethnicity, highest level of education, marital status, smoking status, and duration of T2DM. Clinical outcomes included patients' most recent glycated hemoglobin A1c (HbA1c), height and weight, body mass index (BMI), as well as number of comorbidities, number of DM-related complications, and type of antidiabetic regimens were obtained from the patient's electronic and paper medical records before administering the questionnaires.

PAID is a psychological tool that measures DRD using a five-point Likert scale which ranges from 0 (not a problem) to 4 (serious problem). The respondents were asked to choose one of the five levels that best described their negative emotions related to diabetes, which would be summed up and multiplied by 1.25 to transform into a scale ranging from 0 to 100. PAID has been validated globally including Singapore in English and Chinese languages [23, 24]. PAID scores have previously been shown to be reliable (Cronbach's $\alpha = 0.95$) and its items to show good item-to-total correlations (ranging from 0.32 to 0.84) [1, 16]. A PAID score of ≥ 40 which represent emotional burnt out warrant medical attention was used as the cut-off for categorizing patients into high DRD [3].

EQ-5D is a generic health-assessment instrument which measures a person's general health status. It consists of a five-dimension descriptive system and a 20 cm-visual analogue scale. Each dimension of the descriptive system has three levels which are no problems, some problems, and extreme problems assessing a person's mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The respondents were asked to choose one of the three levels to describe their current health state, which will then be transformed into an index score ranging from −0.769 to a maximum of 1, with 1 representing full health, 0 representing death, and negative values representing health states worse than death. The visual analogue scale records respondent's self-rated health state on a vertical scale from 0 (worst imaginable health state) to 100

(best imaginable health state). EQ-5D has been validated in all three languages in Singapore [25].

ADDQoL is a diabetes-specific health-assessment instrument which examines the impact of diabetes on different aspects of quality of life (QoL) and the importance of these aspects to the patients [26]. It consists of a general rating of QoL and a diabetes affected QoL, followed by 19 diabetes-related QoL domains, of which five are optional. For each domain, the respondents were asked to rate both their impact which ranged from -3 (greatest negative impact) to $+1$ (greatest positive impact) as well as their importance which ranged from 0 (not at all important) to $+3$ (very important). The impact score of each domain is then multiplied by their corresponding importance score to provide the weighted impact score of each domain and averaged by the total number of domains answered to give the final average weighted impact score (AWI) ranging from -9 (maximum negative impact) to $+3$ (maximum positive impact). ADDQoL scores have previously been shown to be reliable (Cronbach's $\alpha = 0.941$) and it has been validated in English and Chinese in Singapore [27, 28].

Statistical analysis

The association between demographic/clinical characteristics and DRD level was examined by the Chi-square or Fisher's exact tests. To adjust for potential confounders and account for potential clustering of patients within each institution, six separate generalized linear mixed-effects models (GLMM) using all demographic/clinical characteristics as fixed effects and institution as random effect were built. The first model assumed a binomial distribution with a logit link to explore the independent association between demographic/clinical characteristics and DRD level. The second model assumed a normal distribution to determine differences in PAID score in relation to variables found to be significant in the aforementioned model.

The relationship between DRD level and PAID score with EQ-5D index value were examined using GLMM that assumed a Gamma distribution with log link separately as the EQ-5D index value was highly skewed in the study. GLMM assuming a normal distribution was built to investigate the relationship between DRD level and PAID score with ADDQoL AWI. A two-tailed p value of less than 0.05 was considered statistically significant. All statistical analyses were performed using the Statistical Package for the Social Science version 24.0 (IBM, New York, US).

Results

Patients' demographic and clinical characteristics

A total of 550 patients with T2DM who fulfilled the inclusion criteria were approached, of which 25 were excluded from the study (one patient refused to give consent, two patients were duplicates, and 22 patients had incomplete data). Overall, 525 patients completed the study, with a 100% response rate to the questionnaires. The mean age was 59.8 (SD 7.9) years, of which 55% ($n = 289$) was male and 45% ($n = 236$) was female. The majority of patients were Chinese ($n = 300$, 57.1%), married ($n = 414$, 78.9%), and had a high school education ($n = 228$, 43.4%). The mean HbA1c was 8.6% (SD 1.4%) and the mean BMI was 28.1 kg/m^2 (SD 5.1 kg/m^2). The mean duration of T2DM was 12.7 (SD 8.9) years. The majority of patients ($n = 359$, 68.4%) were on oral hypoglycemic agents only (Table 1).

Problem area in diabetes score and items

The overall mean PAID score was 26.90 (SD 20.23; Cronbach's $\alpha = 0.92$). Approximately 27.8% ($n = 146$) of participants had high distress level (PAID score ≥ 40), and 71.2% ($n = 104$) of these patients ranked their worries about the future and the possibility of serious complications as a serious problem. Approximately 30–40% of those with high distress also reported that they felt scared (42.5%; $n = 62$) and depressed (32.9%; $n = 48$) when they thought about living with diabetes. Most of them felt anxious when their diabetes management got off track (33.6%; $n = 49$) and found food deprivation (31.5%; $n = 46$) as their major problems.

Family support (63.7%; $n = 93$), feelings of loneliness as a diabetic (47.9%; $n = 70$), ability to cope with diabetes-related complications (40.4%; $n = 59$), and ability to accept diabetes as a diagnosis (39.7%; $n = 58$) were among the items that patients with high DRD expressed no problem with (i.e., rank $= 0$). Furthermore, 39% ($n = 57$) of them were generally satisfied with their diabetes physicians and did not feel that the physician-patient relationship was a contributing factor to their high DRD.

Risk factors for high diabetes-related distress

In the univariate analysis, only age groups, gender, HbA1c, and antidiabetic regimens were found to be significantly associated with high DRD (unadjusted $p < 0.05$). In the multivariate analysis, only age groups and HbA1c were found to be significantly associated with high DRD (adjusted $p < 0.05$). Other demographic and clinical characteristics were not statistically significantly associated

Table 1 Demographic and clinical characteristics of patients analyzed ($n = 525$)

Demographic/clinical characteristics	Number	Percentage (%)	Mean	SD
Age (years)			59.8	7.9
Gender				
Male	289	55.0		
Female	236	45.0		
Race				
Chinese	300	57.1		
Malay	119	22.7		
Indian	95	18.1		
Other	11	2.1		
Highest education level				
No education	30	5.7		
Elementary school	171	32.6		
High school	228	43.4		
Community college	71	13.5		
University or post-graduate	25	4.8		
Marital status				
Single	38	7.2		
Married	414	78.9		
Divorced/separated	38	7.2		
Widowed	35	6.7		
Smoking				
Yes	68	13.0		
No	457	87.0		
HbA1c (%)			8.6	1.4
BMI (kg/m^2)			28.1	5.1
Duration of DM (years)			12.7	8.9
Total chronic comorbidities				
None	1	0.2		
<5	395	75.2		
≥5	129	24.6		
Total DM complications				
None	433	82.5		
1	85	16.2		
2	7	1.3		
Antidiabetic regimens				
Oral hypoglycemic agents only	359	68.4		
Insulin-containing regimen	166	31.6		

HbA1c glycated hemoglobin, *BMI* body mass index, *DM* diabetes mellitus

with DRD level (Table 2). Patients who were younger than 50 years (OR 4.577; 95% CI 1.977–10.600; $p < 0.001$) and patients who were between 50 and 60 years (OR 2.051; 95% CI 1.277–3.294; $p = 0.003$) were at higher risk of having risk DRD. Patients with HbA1c greater than 9% (OR 1.720; 95% CI 1.064–2.779; $p = 0.027$) were also at higher risk of having high DRD. For every 10-year incremental increase in age, the PAID score decreased by 6.03 points ($p < 0.001$). The PAID score also increased by 1.72 points for every 1% incremental increase in HbA1c ($p = 0.014$).

Impact of high DRD on EQ-5D

The mean EQ-5D index value and visual analogue scale were 0.849 (SD 0.205) and 70.6 (SD 16.9). In the multivariate analysis, patients with high DRD had a lower EQ-5D index value than patients with little/no DRD ($p < 0.001$, $B = -0.141$) (Table 3). Pain/discomfort was the major problem reported by patients regardless of their DRD level. Most patients had no problems with usual activities and self-care. However, there were fewer patients with high DRD

Table 2 Association between demographic/clinical characteristics and diabetes-related distress level of patients analyzed ($n = 525$)

Demographic/clinical characteristics	Diabetes-related distress level[a]		Unadjusted[b] p	Adjusted[c] p
	Little/no (PAID < 40)	High (PAID ≥ 40)		
	$n = 379$ (72.2)	$n = 146$ (27.8)		
Age groups (years)				
<50	17 (48.6)	18 (51.4)	**<0.001**	**<0.001**
50–60	133 (65.5)	70 (34.5)		
>60	229 (79.8)	58 (20.2)		
Gender				
Male	221 (76.5)	68 (23.5)	**0.019**	0.098
Female	158 (66.9)	78 (33.1)		
Race				
Chinese	227 (75.7)	73 (24.3)	0.180	0.933
Malay	78 (65.5)	41 (34.5)		
Indian	66 (69.5)	29 (30.5)		
Other	8 (72.7)	3 (27.3)		
Highest education level				
No education	26 (86.7)	4 (13.3)	0.212	0.410
Elementary school	123 (71.9)	48 (28.1)		
High school	158 (69.3)	70 (30.7)		
Community college	51 (71.8)	20 (28.2)		
University or post-graduate	21 (84.0)	4 (16.0)		
Marital status				
Single	29 (76.3)	9 (23.7)	0.778	0.205
Married	299 (72.2)	115 (27.8)		
Divorced/separated	28 (73.7)	10 (26.3)		
Widowed	23 (65.7)	12 (34.3)		
Smoking				
Yes	48 (70.6)	20 (29.4)	0.752	0.370
No	331 (72.4)	126 (27.6)		
HbA1c (%)				
≤9	288 (76.6)	88 (23.4)	**<0.001**	**0.027**
>9	91 (61.1)	58 (38.9)		
BMI (kg/m^2)				
<23	49 (76.6)	15 (23.4)	0.498	0.882
23-27.4	145 (73.6)	52 (26.4)		
>27.4	185 (70.1)	79 (29.9)		
DM duration (years)				
<10	149 (73.8)	53 (26.2)	0.525	0.323
≥10	230 (71.2)	93 (28.8)		
Total chronic comorbidities				
None	1 (100.0)	0 (0)	0.588	1.000
<5	281 (71.1)	114 (28.9)		
≥5	97 (75.2)	32 (24.8)		
Total DM complications				
None	318 (73.4)	115 (26.6)	0.369	0.568
1	56 (65.9)	29 (34.1)		
2	5 (71.4)	2 (28.6)		
Antidiabetic regimens				
Oral hypoglycemic agents only	271 (75.5)	88 (24.5)	**0.013**	0.455
Insulin-containing regimen	108 (65.1)	58 (34.9)		

Statistically significant p-values are in bold ($p < 0.05$)

HbA1c glycated hemoglobin, *BMI* body mass index, *DM* diabetes mellitus, *PAID* problem area in diabetes

[a]Data presented in number and percentage within demographic characteristics

reported to have no problem with all domains of EQ-5D except for self-care. More patients with high DRD ($n = 62$, 42.4%) reported to have anxiety/depression as compared to patients with little/no DRD ($n = 48$, 12.7%) ($p < 0.001$) (Fig. 1). Every 1 point incremental increase in PAID score was associated with 0.004 reduction in EQ-5D index value ($p < 0.001$).

Impact of high DRD on ADDQoL

The AWI score of ADDQoL was − 3.579 (SD 2.218; Cronbach's $\alpha = 0.78$). In the multivariate analysis, patients with high DRD had a lower ADDQoL AWI than patients with little/no DRD ($p < 0.05$, $B = − 1.276$) (Table 3). Patients with high DRD reported to have lower AWI for all domains of ADDQoL. Freedom to eat has the highest AWI and general reaction from people has the lowest AWI regardless of DRD level. However, patients with high DRD reported a lower AWI for feelings about the future than working life as compared to patients with little or no DRD (Fig. 2). Every 1 point incremental increase in PAID score was associated with 0.038 reduction in ADDQoL AWI ($p < 0.001$).

Discussions

This was the first study that identified the risk factors associated with high DRD in patients with T2DM in primary care. Although international guidelines have recommended periodic psychological assessments in patients with diabetes, there is still a lack of uptake due to inadequate resources and insufficient knowledge to offer psychological support, especially within primary care setting [3]. As DRD is a psychological condition known to affect the overall therapeutic outcomes and quality of life of patients with T2DM, the findings of this study elucidated important demographic and clinical characteristics of high-risk diabetic patients. This may potentially assist the healthcare professionals in screening for high-risk patients and ensure timely psychological referrals and management.

Similar to other studies, our study also showed that younger age was negatively correlated with DRD [10, 17, 18, 29]. In our study, patients who were younger than 50 years had approximately 4.5 times higher risk for having high DRD. A cross-sectional study that examined the relationships between DRD and selected demographics conducted by Brown attributed this association to fewer years

of experience in learning how to effectively manage the disease, and additional work and family stress among younger patients [30]. In another cross-sectional study exploring the relationship between age and psychosocial factors among patients with T2DM, it was reported that younger patients had higher stress levels due to social stigma, work and financial pressure, longer working hours, and greater time and energy demands for caring for children and elderly family members, as compared to older diabetic patients [31].

Moreover, our study also found that poorer glycemic control was associated with higher DRD, regardless of patients' antidiabetic regimen [11, 32, 33]. In our study, the risk for having high DRD among patients with HbA1c greater than 9% was approximately 1.7 times higher than among patients with better glycemic control. Although a causal relationship cannot be established, Fisher et al. and Weinger and Jacobson postulated a negative bidirectional mechanism between glycemic control and diabetes distress: higher distress can negatively influence self-management and medication adherence, hence leading to poorer glycemic control and thereby resulting in further increases of stress levels [11, 34]. Recently, a benchmarking network for clinical and humanistic outcomes in diabetes (BENCH-D) study involving 2390 patients with T2DM in Italy also found that higher DRD was correlated with lower levels of empowerment, and higher levels of perceived barriers to taking medication [35]. In our study, the fact that the effect of antidiabetic regimens on DRD was no longer statistically significant after adjusting for age and HbA1c was congruent with Delahanty et al.'s theory that DRD was associated with glycemic control rather than with the antidiabetic regimens [18].

Our study also evaluated the relationship between DRD and HRQoL among patients with T2DM using both generic and disease-specific instruments. In our study, DRD level was the only factor that was consistently associated with both generic and disease-specific quality of life. Patients who were experiencing high distress level from diabetes have a poorer general health and diabetes-specific aspects of life regardless of their demographic and clinical characteristics.

Patients with high DRD reported to have more problems with all EQ-5D domains especially anxiety/depression. This observation was not surprising as depressive symptoms have been found to be associated with DRD. In a cohort study of 264 patients with T1DM, overall strong correlations were observed between Beck Depression Inventory and Center for Epidemiological Studies of Depression Scale with PAID. There were 64% of patients with high DRD reported to have

Table 3 Generalized linear mixed-effects model of demographic/clinical characteristics and health-related quality of life of patients ($n = 525$)

Demographic/clinical characteristics	EQ-5D index value		ADDQoL AWI	
	Coefficients	p	Coefficients	p
Age groups (years)				
< 50 (ref)				
50–60	0.077	0.242	− 0.292	0.417
> 60	0.083	0.223	0.070	0.850
Gender				
Male (ref)				
Female	− 0.087	**0.015**	0.048	0.804
Race				
Chinese (ref)				
Malay	− 0.006	0.884	− 1.555	**< 0.001**
Indian	0.010	0.821	− 1.902	**< 0.001**
Other	− 0.107	0.335	− 2.160	**< 0.001**
Highest education level				
No education (ref)				
Elementary school	0.142	**0.048**	0.148	0.773
High school	0.150	**0.037**	− 0.293	0.455
Community college	0.082	0.316	0.174	0.696
University or post-graduate	0.089	0.376	0.158	0.773
Marital status				
Single (ref)				
Married	0.067	0.274	0.288	0.385
Divorced/separated	− 0.047	0.565	− 0.233	0.600
Widowed	0.075	0.382	0.054	0.908
Smoking				
Yes	− 0.010	0.843	− 0.057	0.832
No (ref)				
HbA1c (%)				
≤ 9 (ref)				
> 9	− 0.005	0.893	− 0.124	0.542
BMI (kg/m^2)				
< 23 (ref)				
23–27.4	0.001	0.981	− 0.388	0.165
> 27.4	− 0.022	0.669	− 0.441	0.112
DM duration (years)				
< 10 (Ref)				
≥ 10	− 0.033	0.331	− 0.092	0.623
DRD level				
Little/no (ref)				
High	− 0.141	**< 0.001**	− 1.276	**< 0.001**
Total chronic comorbidities				
None (ref)				
< 5	− 0.116	0.746	− 3.159	0.105
≥ 5	− 0.275	0.444	− 3.263	0.096
Total DM complications				
None (ref)				
1	− 0.053	0.230	− 0.310	0.194
2	− 0.013	0.921	− 1.698	**0.023**
Antidiabetic regimens				
Oral hypoglycemic agents only	− 0.012	0.750	− 0.014	0.946
Insulin-containing regimen (ref)				

Statistically significant p-values are in bold ($p < 0.05$)

HbA1c glycated hemoglobin, *BMI* body mass index, *DM* diabetes mellitus, *DRD* diabetes-related distress, *EQ-5D* European quality of life-5 dimensions, *ADDQoL AWI* audit of diabetes-dependent quality of life average weighted impact score, *Little/no DRD level* PAID score < 40, *High DRD level* PAID score ≥ 40
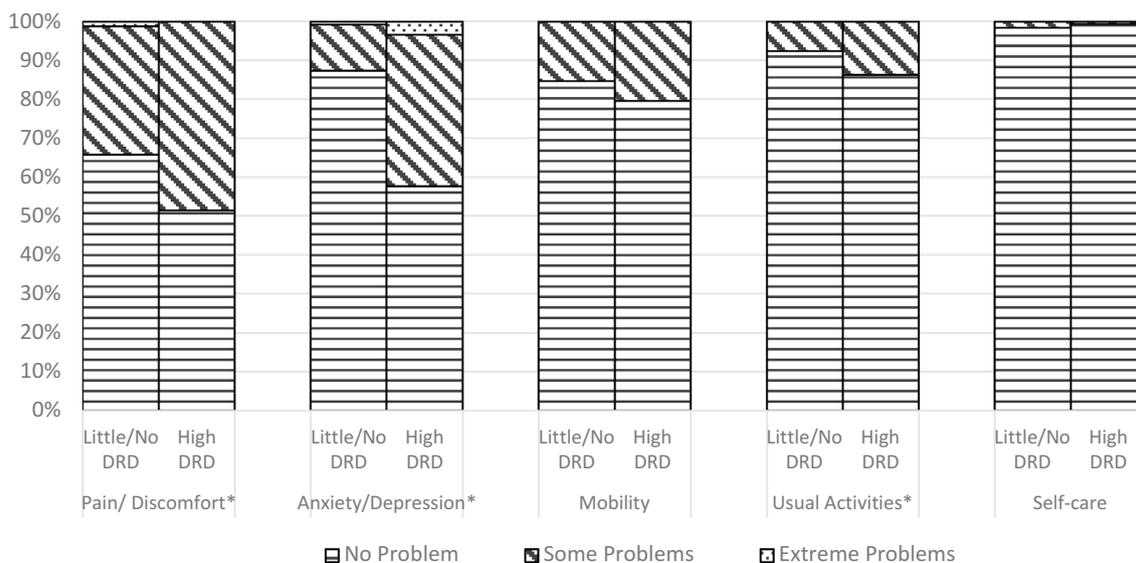
Fig. 1 Percentage of patients reported at different levels of EQ-5D domains for different DRD levels (*n*=525). *DRD* diabetes-related distress, *EQ-5D* European quality of life-5 dimensions, *Little/No DRD level* PAID score < 40, *High DRD level* PAID score ≥ 40. *p < 0.05

clinically significant depressive symptoms [13]. Furthermore, more patients with high DRD found to have problem with pain/discomfort as compared to patients with little/no DRD. This may be explained by the positive correlation between DRD and glycemic control [32]. Patients with poorer glycemic control and thus higher DRD are often on insulin injections and with more DM complications which resulted in greater pain.

In our study, patients with high DRD had lower quality of life in all diabetes-specific domains. Similar finding was reported by Carper et al. who examined the association between diabetes distress measured by diabetes distress scale and quality of life measured by quality of life inventory [36]. Another Chinese study also found that emotional distress was the most important explanatory factor for quality of life in 220 patients with T2DM [37]. In addition, DRD had a greater negative impact on feelings about the future domain than working life domain. This finding was not surprising as several studies including our study have reported that the most commonly reported concern by patients with high DRD was the possibility of developing serious complications in the future [18].

This study had several limitations. The impact of DRD on HRQoL may have been confounded by the presence of depressive symptoms, which was not evaluated and controlled in our study. Although depressive symptoms has been shown to be a more consistent and significant predictors for poorer HRQoL, DRD was found to affect different aspects of

HRQoL from depressive symptoms by several studies [36]. Due to the cross-sectional design of the study, causal relationship between DRD and HRQoL cannot be established. Although questionnaires in different languages used in the study have been validated in their respective contexts, the invariance of scores across different languages has not been established and this is an area for potential future research to increase the cross-cultural comparability of questionnaires' results. Lastly, all questionnaires used in our study were self-reported which may be subjected to reporting error and social stigma, resulting in underestimation of the true level of distress and its impact on quality of life. Although our study involved a large multiethnic sample size from multiple primary healthcare institutions, the findings were not generalizable to more complicated patients who require specialized care from other settings or from western countries with different ethnicities. Future study is needed to assess the longitudinal impact of DRD on HRQoL as well as the economic burden of DRD.

Conclusion

In conclusion, this study suggested that younger age and poorer diabetes control were associated with high DRD in patients managed in primary care. This study also reported a poorer quality of life among patient with high DRD. Early screening for DRD is recommended, especially in high-risk
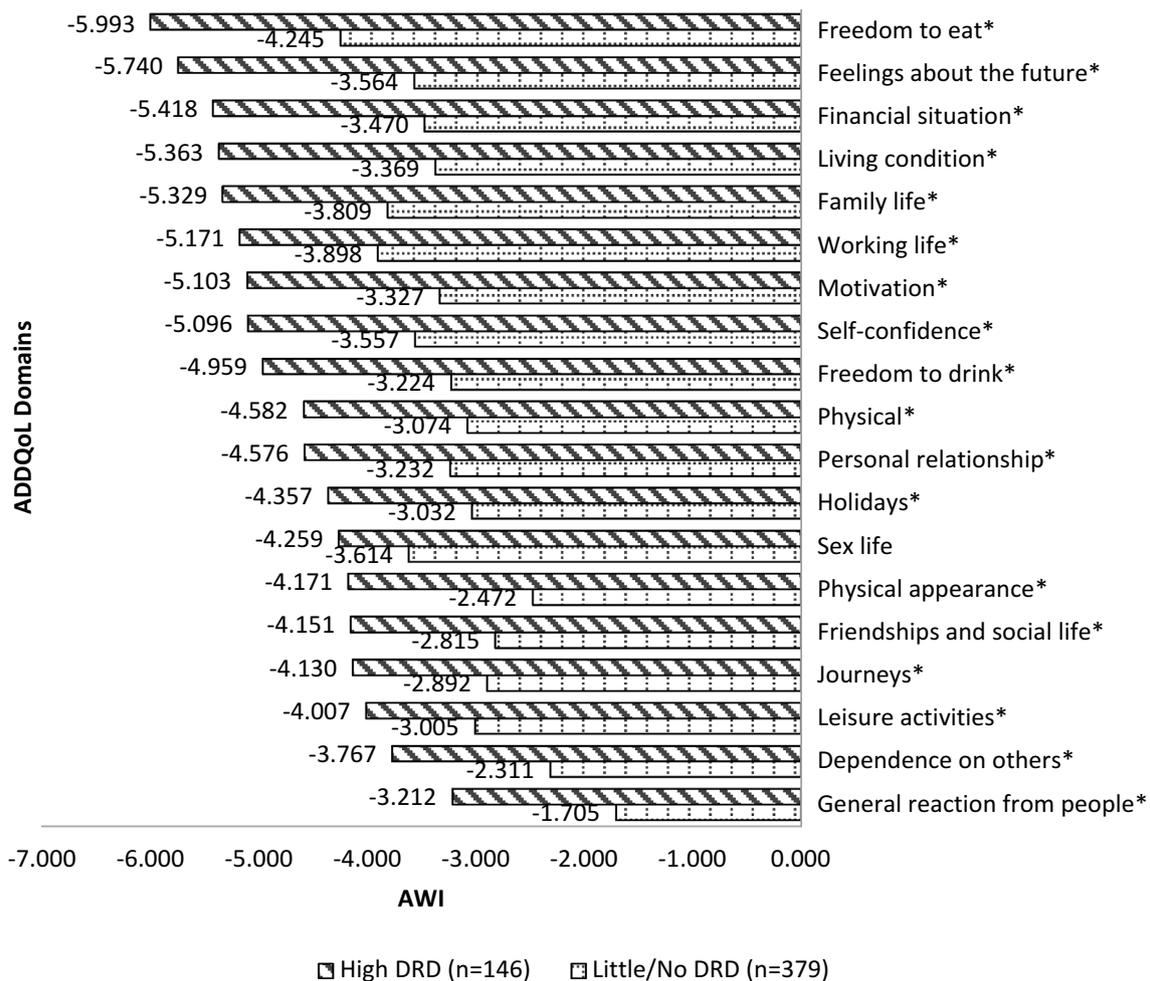
Fig. 2 AWI of ADDQoL domains for different DRD levels ($n = 525$). *DRD* diabetes-related distress, *ADDQoL* audit of diabetes-dependent quality of life, *AWI* average weighted impact score, *Little/no DRD level* PAID score < 40, *High DRD level* PAID score ≥ 40. *$p < 0.05$

patients, to achieve better psychological outcomes and quality of life with timely management.

Compliance with ethical standards

Conflict of interest The authors declare no conflict of interest in this study.

Ethical approval All procedures performed in studies involving human participants were in accordance with ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Written informed consent was obtained from all individual participants included in the study.

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