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Prevalence and determinants of diabetes distress and its association with self-management among patients living with type 2 diabetes: a cross-sectional study from a tertiary care hospital in Sri Lanka

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Abstract

Background Diabetes distress (DD) refers to the emotional and psychological strain related to the management of diabetes and its complications. It can result in poor self-management behaviours and suboptimal health outcomes. This study aimed to evaluate the prevalence, determinants and impact of DD on self-management behaviours and glycaemic control among people with type 2 diabetes mellitus (T2DM) attending a tertiary care hospital in Sri Lanka.

Methods A descriptive, cross-sectional study was conducted at the Diabetes and Endocrine Clinic of the National Hospital, Sri Lanka. DD was measured using the 17-item Diabetes Distress Scale (DDS-17), comprising four domains: emotional burden, physician-related, regimen-related, and interpersonal distress. Self-management was assessed using the Diabetes Self-Management Questionnaire-Revised (DSMQ-R), covering five domains: glucose monitoring, medication adherence, dietary control, physical activity and healthcare use. Both instruments were interviewer-administered. DD severity was defined as clinically significant if DDS-17 score was ≥ 2 (moderate-high level of DD). Logistic regression was used to identify determinants of DD and Spearman's rank correlation was used to assess the associations between DD, DSMQ-R scores and glycaemic control. A p value of < 0.05 was considered statistically significant.

Results Among 322 participants (mean age 59.9 ± 10.2 years; mean diabetes duration 11.4 ± 7.7 years), the prevalence of DD was 30.4% (95% CI: 25.7%–35.7%). After adjusting for confounders, determinants of DD were age range of 41–59 years (OR 3.6, 95% CI: 2.0-6.5, $p < 0.001$), female gender (OR 2.8, 95% CI: 1.4–5.4, $p = 0.01$), suboptimal glycaemic control of HbA1c ≥ 7% (OR 4.4, 95% CI: 1.9–10.1, $p < 0.001$) and the presence of comorbidities (OR 3.1, 95% CI: 1.3–7.3, $p = 0.01$). Self-management activity scores including glucose monitoring, medication adherence, dietary

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control, physical activity and healthcare use had significant and negative correlations with both DD and HbA1C ($p < 0.05$).

Conclusions Diabetes distress significantly impairs self-management and glycaemic control among people living with T2DM. Routine screening for diabetes-related distress using tools such as the DDS-17 should be integrated into diabetes care to identify patients experiencing moderate-to-high levels of distress and who are therefore at risk of poor self-management and adverse disease outcomes.

Clinical trial number Not applicable.

Keywords Type 2 diabetes, Diabetes distress, Diabetes self-care, Lifestyle modification, Glycaemic control, Self-management behaviours, South Asia

Introduction

Type 2 diabetes mellitus (T2DM) is a major public health concern in Sri Lanka. In Sri Lanka, a developing country, the burden of T2DM is evident, and is in line with the global trends. Recent T2DM estimates shows a prevalence of 23% among adults in Sri Lanka [1]. Despite the high burden of T2DM in Sri Lanka, the psychological and emotional challenges of managing diabetes, associated with diabetes, particularly diabetes distress (DD), remain underexplored in Sri Lanka.

Diabetes distress is the negative emotional response resulting from living with diabetes, burden of continuous daily self-management, change in diet, risk of complications, economic burden, social stigma, unsupportive interpersonal relationships and frustration with the healthcare providers [2–6]. Diabetes distress is not viewed as a psychiatric condition, but rather the emotional aspect linked with diabetes related behaviour, experienced by individuals living with diabetes [3, 4]. Many individuals experience distress with no clear sign or symptom that might prompt inquiry and therefore may be overlooked in clinical care. It is estimated that one in every four people with diabetes is affected with DD [7], one in five people with insulin-treated T2DM, and one in ten people with non-insulin treated T2DM [5].

Diabetes distress is likely to have a negative impact on self-care and glycaemic control, hence aggravating the disease outcomes. The patient's concordance with diabetes self-management is a vital factor for glycaemic control. For patients on insulin therapy, additional self-care practices are required such as careful monitoring of blood glucose levels using self-monitoring of blood glucose (SMBG) before meals and exercise, and estimating carbohydrate intake with meals [8]. Non-concordance with self-care activities can be either intentional or unintentional and poor concordance to anti-diabetic medicines can result in suboptimal health outcomes. Additionally, South Asians living with T2DM often show reluctance to adopt recommended lifestyle changes, such as dietary modifications and exercise [9, 10]. These lower rates of concordance stress the need for constant motivation and patient education by healthcare professionals.

Suboptimal self-management is also a common problem associated with diabetes, leading to poorer glycaemic control and increased complications [11]. The cost of diabetes medication can become a significant financial burden over time and the lack of support from family members could cause poor concordance to diabetes medication, leading to suboptimal glycaemic control [12]. It is therefore important to understand the factors behind poor self-care in order to improve diabetes management, especially in resource-limited settings such as Sri Lanka.

Studies from South Asia report that DD affects up to 18%-76% of people living with diabetes [13–19], leading to poor self-management and adverse health outcomes. However, there is a lack of research on the impact of DD on diabetes self-care in the Sri Lankan population. Therefore, the aim of this study was to evaluate the prevalence and determinants of DD and its association with self-management in a Sri Lankan population living with T2DM.

Materials and methods

Study design and setting

This was a descriptive cross-sectional study performed at the Diabetes and Endocrine clinic of National Hospital of Sri Lanka (NHSL) from February 2023 to April 2023. NHSL is a leading tertiary care hospital, located in Colombo, Sri Lanka. As a referral centre, NHSL provides care to patients with complex diabetes cases from across the country with an average daily attendance of approximately 350 patients.

Inclusion criteria

Adults (aged ≥ 18 years) diagnosed with type 2 diabetes mellitus for at least 6 months, who were attending follow-up care at the Diabetes and Endocrine Clinic of the NHSL during the study period and who provided informed consent, were included in the study.

Exclusion criteria

Participants were excluded if they had other types of diabetes, such as type 1 diabetes or gestational diabetes. Patients with acute illnesses requiring hospitalization within the previous three months or with severe chronic comorbidities including advanced chronic kidney disease (eGFR < 30 mL/min), advanced heart failure (LVEF < 40%), advanced cirrhosis (Child grade C), disseminated cancer, severe depression (as documented in clinical records), or advanced chronic respiratory diseases such as severe asthma or chronic obstructive pulmonary disease were also excluded. Additionally, pregnant and lactating women were excluded from the study.

Sampling and data collection

The sample size was calculated using the formula for cross sectional studies $n = Z^2 \times p\,(1 - p) / d^2$ [20]. Assuming an expected prevalence of DD of 30% in Sri Lanka based on previous South Asian studies [13–19], with a 95% confidence level and a 5% margin of error, the required sample size was estimated as 322. Participants were recruited by consecutive sampling. Patients were screened according to the daily clinic number to determine eligibility. Eligible patients were invited to participate, and those who provided written informed consent were interviewed in a separate room next to the clinic waiting area. Participants were interviewed in their preferred language (Sinhala, Tamil, or English). Data were collected by an interviewer administered questionnaire and review of medical records by a trained research assistant, who was not involved in provision of health care.

Diabetes distress scale (DDS-17)

The DDS-17 consists of 17 questions that assess the level of distress associated with diabetes in the past month. It is divided into four different subscales: Emotional Burden (EB) with 5 items, Physician Distress (PD) with 4 items, Regimen Distress (RD) with 5 items and Interpersonal Distress (ID) with 3 items. Each item in the questionnaire is rated on a 6-point Likert scale, ranging from 1 (not a problem) to 6 (a very serious problem), indicating the level of distress. The level of distress was determined based on Diabetes Distress Score (DDS - the mean score out of 6) categorized as follows: scores below 2 indicate low distress, scores between 2 and 2.9 indicate moderate distress, and scores of 3 or above indicate high distress. A score of ≥ 2 was considered clinically significant [2].

Diabetes self-management questionnaire revised (DSMQ-R)

The DSMQ-R consists 20 questions about self-care for non-insulin-treated persons, and 7 added items for people treated with rapid acting insulin (20 + 7 statements). The DSMQ-R has 5 subscales: Dietary control with 4 items, Glucose monitoring with 3 items, Medication adherence with 2 items, Physical activity with 3 items and Healthcare use with 3 items. Each item in the questionnaire is rated on a 4-point Likert scale, ranging from 0 (does not apply to me) to 3 (applies to me very much) [21].

Validation of questionnaires

The use of the DDS-17 questionnaire for clinical purposes and non-commercial research has been authorised by the copyright holder. Permission was obtained to use the DSMQ-R from the copyright holder. Linguistic validation was performed on the DDS-17 and DSMQ-R where the questionnaires were translated from English to Sinhala and reviewed by experts. Both forward and backward translations were carried out by independent translators. To ensure the clarity and comprehension of the pre-final questionnaire, a pre-test was conducted at the Diabetes and Endocrine clinic of NHSL. A group of 20 adults participated in the test, and special attention was given to whether the statements in the questionnaires were easily understandable. The participants did not encounter any difficulties or misunderstandings while responding to the questionnaires. Its reliability was tested using Cronbach's Alpha (DDS-17 Cronbach's Alpha – 0.84, DSMQ-R Cronbach's Alpha – 0.81).

Data analysis

The most recent measurements of HbA1c were used. Optimal glycaemic control was considered if HbA1c levels were < 7% in adults [8]. Body mass index (BMI) was estimated according to the South Asian cut offs [22]; underweight, normal, overweight, or obese patients were identified if BMI was < 18.5 kg/m^2, 18.5–22.9 kg/m^2, 23–27.5 kg/m^2 and > 27.5 kg/m^2 respectively.

Data analyses were performed with SPSS version 25.0 (IBM, Chicago, IL). Descriptive statistics were expressed as mean ± standard deviation (SD) for normally distributed continuous variables and median with interquartile range (IQR) for non-normally distributed variables. Categorical variables were summarized as frequencies and percentages. Normality of continuous variables was assessed using plots and Kolmogorov–Smirnov test. Continuous variables were compared across distress categories using ANOVA for normally distributed variables or the Kruskal–Wallis test for non-normally distributed variables. Categorical variables were compared using the chi-square test, or Fisher's exact test. Correlations between the Diabetes Self-Management Questionnaire-Revised (DSMQ-R) scores, HbA1c, and Diabetes Distress Scale (DDS-17) scores were analysed using Spearman's rank correlation. DD severity was defined as clinically significant if DDS-17 score was ≥ 2 [2]. A multivariable binary logistic regression analysis was carried out

to identify the independent determinants of moderate - high levels of DD. The logistic regression model was developed using a purposeful selection approach. Variables that were statistically significant in the univariate analysis (after adjusting for age and sex) were considered for inclusion. Additionally, clinically relevant variables identified in previous literature (duration of diabetes, glycaemic control, comorbidities and insulin therapy) were included regardless of statistical significance to ensure important confounders were considered. The results are presented as adjusted ORs with 95% CIs. A p value of < 0.05 was considered statistically significant.

Results

Baseline characteristics of the study population

The study included 322 participants with T2DM. Demographic and clinical characteristics of the participants stratified according to the DDS score is summarized in Table 1. The mean age of the participants was 59.9 (± 10.2) years. Majority of participants were females (69.3%), were married (77.0%), were unemployed (54.3%) and had an education level of GCE Ordinary Level or lower (72.4%). Around 31.7% of the patients received insulin therapy. The average duration of diabetes was 11.4 (± 7.7) years and the mean HbA1c, fasting plasma glucose and BMI were 8.3 (± 1.9) %, 128.0 (± 58.3) mg/dl and 26.0 (± 4.3) kg/m^2 respectively. More than half of the population were overweight or obese (76.1%). A majority of the patients did not perform self-monitoring of blood glucose (66.5%) and among those who were on insulin treatment, only 36.2% performed regular SMBG.

Prevalence of diabetes distress

A majority of the participants had a low level of overall diabetes related distress; 69.6% (95% CI: 64.3%–74.3%), while 30.4% (95% CI: 25.7%–35.7%) experienced moderate-high distress (Fig. 1). Moderate to high levels of emotional burden was present among 62.4% participants. However, majority of participants (98.8%) experienced low levels of distress in their interactions with physicians. Notably 22% had moderate levels of distress related to their treatment regimen and 10.9% had high levels of distress. Further, 8% of participants experienced high levels of distress in their interpersonal relationships (Table 2).

Proportions of patients living with T2DM experiencing low, moderate, and high levels of diabetes distress based on DDS-17 scores.

Determinants of moderate-high DD

Multivariable binary logistic regression results are summarised in Table 3. After adjusting for confounding factors, age range of 41–59 years (OR 3.6, 95% CI 2.0-6.5), female gender (OR 2.8, 95% CI 1.4–5.4), suboptimal glycaemic control (OR 4.4, 95% CI 1.9–10.1) and the presence of other comorbidities (OR 3.1, 95% CI 1.3–7.3) had significant and greater odds of experiencing DD ($p < 0.05$). This indicates that middle-aged adults, women, people with poor glycaemic control and individuals with other health conditions may be at an increased risk of experiencing diabetes-related distress.

Correlation between diabetes distress, HbA1c and diabetes self-management

There was a strong negative correlation between the DDS sum score and domains of DSMQ-R, including blood glucose monitoring, medication adherence, dietary control, physical activity and healthcare utilisation (Table 4). Specifically, higher levels of DD were associated with poorer self-management behaviours across these domains. Emotional distress and interpersonal distress showed significant negative correlations with all aspects of self-management. Nevertheless, physician related distress had weak but significant negative correlations with medication adherence and healthcare use. Regimen distress had the strongest negative correlation with all the domains of self-management. In addition, there were negative and significant correlations between HbA1c levels and all aspects of self-management ($p < 0.05$).

Discussion

This study aimed to evaluate the prevalence and determinants of diabetes distress and its association with self-management behaviours in a Sri Lankan population with T2DM. Our study found that people living with T2DM experienced a notable degree of psychological distress, particularly in the areas of emotional burden and regimen-related distress. These were the most prominent subscales of the Diabetes Distress Scale and showed the strongest associations with poor self-management behaviours. Nearly one-third of individuals with T2DM experienced moderate to high levels of DD (30.4%) and emotional burden was the most commonly affected domain (62%) in our study. Studies conducted in South Asia reported higher prevalence of DD including India; 40.1% [13], 42% [14], Bangladesh; 48.5% [15], 52.5% [16] and Pakistan; 76.2% [17]. Whereas, the study by Gahlan and colleagues reported 18% prevalence of DD in a in a tertiary care centre in India [18]. Further, the Diabetes Attitudes, Wishes and Needs (DAWN2) study found that 44.6% of people with diabetes in 17 countries reported elevated distress (measured by Problem Areas in Diabetes Scale, score ≥ 40) [23]. A systematic review and meta-analysis of 55 papers from different nations reported an overall DD prevalence of 36% [24]. These varying prevalence could be due to the differences in the characteristics of the study population, access to healthcare, differences in assessment tools (DDS-17, PAID), severity of DD considered and cultural factors specific to each country.

Table 1 Demographic and clinical characteristics of the participants stratified by the level of diabetes distress

Parameter	Low distress (*n* = 224)	Moderate distress (*n* = 79)	High distress (*n* = 19)	*p* value	Total Sample (*n* = 322) *
Age; years (mean ± SD)	61.2 ± 10.1	55.6 ± 9.5	55.8 ± 8.4	< 0.001	59.9 ± 10.2
< 40 years n (%)	5 (2.2)	3 (3.8)	1 (5.3)	< 0.001	9 (2.8)
41–59 years n (%)	79 (35.3)	50 (63.3)	10 (52.6)		139 (43.2)
≥ 60 years n (%)	140 (62.5)	26 (32.9)	8 (42.1)		174 (54.0)
Gender					
Male n (%)	84 (37.5)	14 (17.7)	1 (5.3)	< 0.001	99 (30.7)
Female n (%)	140 (62.5)	65 (82.3)	18 (94.7)		223 (69.3)
Marital Status					
Single n (%)	11 (4.9)	2 (2.5)	3 (15.8)	0.003	16 (5.0)
Married n (%)	171 (76.3)	66 (83.5)	11 (57.9)		248 (77)
Widowed n (%)	41 (18.3)	7 (8.9)	4 (21.1)		52 (16.1)
Divorced n (%)	1 (0.5%)	4 (5.1)	1 (5.3)		6 (1.9)
Educational Status					
No formal education n (%)	7 (3.1)	2 (2.5)	0 (0)	0.803	9 (2.8)
Primary education n (%)	76 (33.9)	23 (29.1)	11 (57.9)		110 (34.2)
Up to GCE O/L n (%)	85 (38.0)	33 (41.8)	5 (26.3)		123 (38.2)
Up to GCE. A/L n (%)	45 (20.1)	17 (21.5)	3 (15.8)		65 (20.2)
Undergraduate and above n (%)	11 (4.9)	4 (5.1)	0 (0)		15 (4.7)
Employment Status					
Unemployed n (%)	108 (48.2)	54 (68.4)	13 (68.4)	0.007	175 (54.3)
Employed n (%)	72 (32.1)	20 (25.3)	4 (21.1)		96 (29.8)
Retired n (%)	44 (19.6)	5 (6.3)	2 (10.5)		51 (15.8)
Household Monthly Income; LKR (mean ± SD)	48808.0 ± 31,635 0.4	42784.8 ± 24567.4	27789.5 ± 14,827. 1	0.001	46090.1 ± 29697.0
< 25,000 n (%)	18 (8.0)	12 (15.2)	8 (42.1)	0.001	38 (11.8)
25,000–75,000 n (%)	176 (78.6)	57 (72.2)	11 (57.9)		244 (75.8)
> 75,000 n (%)	30 (13.4)	10 (12.6)	0 (0)		40 (12.4)
Number of comorbidities					
None n (%)	56 (25.0)	8 (10.1)	0 (0)	0.004	64 (19.9)
One or two comorbidities n (%)	131 (58.5)	57 (72.2)	14 (73.7)		202 (62.7)
Three or more comorbidities n (%)	37 (16.5)	14 (17.7)	5 (26.3)		56 (17.4)
Hours slept at night (mean ± SD)	6.6 ± 1.3	6.3 ± 1.3	6.0 ± 1.3	0.047	6.5 ± 1.3
Family history of diabetes n (%)	94 (42)	48 (60.8)	11 (57.9)	0.010	153 (47.5)
Weight; kg (mean ± SD)	63.5 ± 11.1	64.0 ± 12.4	64.2 ± 17.3	0.863	63.7 ± 11.8
BMI; kg/m^2(mean ± SD)	25.7 ± 3.9	26.6 ± 4.6	26.7 ± 5.9	0.404	26.0 ± 4.3
Underweight < 18.5 kg/m^2 n (%)	3 (1.3)	1 (1.3)	1 (5.3)	0.306	5 (1.6)
Normal weight 18.5–22.9 kg/m^2 n (%)	57 (25.5)	12 (15.2)	3 (15.8)		72 (22.4)
Overweight 23–27.5 kg/m^2 n (%)	92 (41.1)	34 (43.0)	9 (47.4)		135 (41.9)
Obese ≥ 27.5 kg/m^2 n (%)	72 (32.1)	32 (40.5)	6 (31.6)		110 (34.2)
Duration of Diabetes; years (median, IQR)	10 (10)	11 (11)	10 (13)	0.409	10 (10)
Fasting plasma glucose; mg/dl (median, IQR)	102 (41)	139 (67)	141 (78)	< 0.001	112 (53.4)
HbA1c; % (mean ± SD)	7.8 ± 1.8	9.2 ± 1.7	10.0 ± 2.5	< 0.001	8.3 ± 1.9
Glycaemic Control					
Sub-optimal T2DM control (HbA1c ≥ 7) n (%)	139 (62.1)	73 (92.4)	17 (89.5)	< 0.001	229 (71.1)
Self-monitoring of blood glucose n (%)	77 (34.4)	28 (35.4)	3 (15.8)	0.250	108 (33.5)
Number of oral medications (DM and other) (mean ± SD)	5.6 ± 1.9	5.7 ± 1.9	6.1 ± 1.5	0.437	5.6 ± 1.9
Insulin Therapy					
Yes n (%)	58 (25.9)	34 (43.0)	10 (52.6)	0.003	102 (31.7)
No n (%)	166 (74.1)	45 (57.0)	9 (47.4)		220 (68.3)

* Presented as n (%) for categorical variables and mean ± SD or median IQR for continuous variables

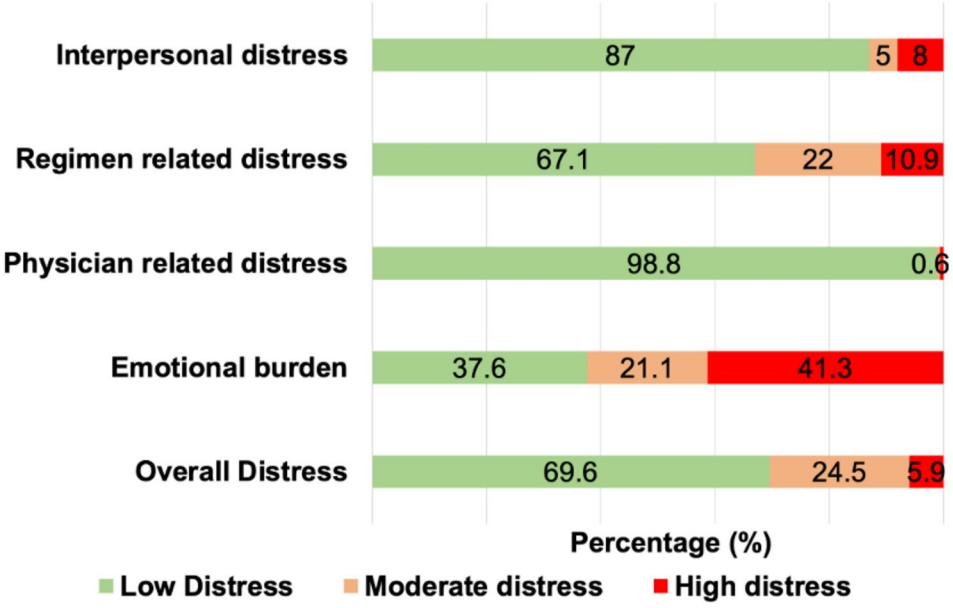

Fig. 1 Prevalence of diabetes distress in the study population

Table 2 Mean DD scores and distribution of distress levels across DDS-17 subscales

Parameter	Mean score (SD)	Level of diabetes distress		
		Low, *n* (%)	Moderate, *n* (%)	High, *n* (%)
DDS sum score	1.8 ± 0.6	224 (69.6)	79 (24.5)	19 (5.9)
Emotional burden	2.6 ± 1.2	121 (37.6)	68 (21.1)	133 (41.3)
Physician related distress	1.0 ± 0.2	318 (98.8)	2 (0.6)	2 (0.6)
Regimen related distress	1.7 ± 0.8	216 (67.1)	71 (22)	35 (10.9)
Interpersonal distress	1.4 ± 1.0	280 (87)	16 (5)	26 (8.0)

Table 3 Determinants of moderate and high diabetes distress

Parameter	Adjusted OR (95% CI)	*p* value
Age		
< 40 years	3.9 (0.8–19.9)	0.10
41–59 years	3.6 (2.0-6.5)	< 0.001
≥ 60 years	Reference	
Gender		
Male	Reference	
Female	2.8 (1.4–5.4)	0.01
Duration of diabetes		
< 5 years	Reference	
5–10 years	1.5 (0.6–3.6)	0.46
> 10 years	1.7 (0.7–4.1)	0.28
Glycaemic Control		
Controlled T2DM (HbA1c < 7%)	Reference	
Suboptimal T2DM control (HbA1c ≥ 7%)	4.4 (1.9–10.1)	< 0.001
Other comorbidities		
Absent	Reference	
Present	3.1 (1.3–7.3)	0.01
Insulin therapy		
Yes	1.5 (0.8–2.7)	0.19
No	Reference	

Females had 2.8 odds of experiencing DD compared to males, which is consistent with findings from previous studies [3, 25–27]. However, some studies reported no significant gender difference in DD [16, 28]. One possible explanation for the higher prevalence of DD among females could be their proactive approach to self-management and preventive care, leading to increased awareness of potential complications of the disease and high distress. Conversely, men often underestimate the severity of diabetes-related complications until they experience high blood glucose levels, leading to heightened distress upon realization [25].

Previous reports showed that younger age was significantly associated with DD [26, 29]. In our study middle aged patients (41–59 years) demonstrated significant higher odds of DD compared to those > 60 years. Middle-aged individuals may face additional stressors, such as work-related challenges and the development of diabetes-related complications, which could contribute to increased distress. Additionally, the financial burden of diabetes management, including the costs of medications and glucose monitoring supplies, could exacerbate distress. This is demonstrated by the significant and negative correlation of DSMQ-R and regimen distress domain (Table 4).

Patients with comorbidities had higher odds of experiencing distress in our study and this was consistent with previous research [29, 30]. Our findings suggest that diabetes duration of > 5 years is associated with higher odds

Table 4 Spearman's rank correlation between DD, HbA1c and DSMQ-R among people with T2DM

Parameter	DSMQ-*R* Sum		Glucose monitoring		Medication adherence		Dietary control		Physical activity		Healthcare use	
	Correlation coefficient	*p* value	Correlation coefficient	*p* value	Correlation coefficient	*p* value	Correlation coefficient	*p* value	Correlation coefficient	*p* value	Correlation coefficient	*p* value
DDS Sum score	-0.608	< 0.001	-0.305	< 0.001	-0.320	< 0.001	-0.552	< 0.001	-0.288	< 0.001	-0.238	< 0.001
Emotional burden	-0.421	< 0.001	-0.197	< 0.001	-0.220	< 0.001	-0.345	< 0.001	-0.236	< 0.001	-0.130	< 0.001
Physician distress	-0.104	0.062	-0.012	0.824	-0.160	0.004	-0.092	0.098	-0.073	0.192	-0.149	0.007
Regimen distress	-0.762	< 0.001	-0.387	< 0.001	-0.366	< 0.001	-0.766	< 0.001	-0.289	< 0.001	-0.351	< 0.001
Interpersonal distress	-0.255	< 0.001	-0.123	0.027	-0.190	0.001	-0.218	< 0.001	-0.188	< 0.001	-0.195	< 0.001
HbA1c	-0.436	< 0.001	-0.267	< 0.001	-0.176	0.002	-0.316	< 0.001	-0.168	0.002	-0.232	< 0.001

of DD. This may be due to the development of additional health complications over time, which increases the demands of self-management and subsequently elevates distress levels. This is supported by the fact that duration of diabetes was no longer associated with DD when adjusted for co-morbidities. However, patients who have lived with diabetes for a longer duration may also be better psychologically adapted and have developed coping strategies resulting in lower levels of distress [31].

Being unemployed, having suboptimal glycaemic control and the use of insulin had higher prevalence of distress, and the findings are in concordance with other studies [32, 33]. Increased healthcare needs, challenges of maintaining a healthy lifestyle, the need to adhere to numerous medications, burden of managing multiple conditions and coordinating hospital appointments may exacerbate the emotional distress of the patients [29, 30, 32, 33]. However, it is important to recognise that emotional distress in diabetes may be influenced by non-clinical factors, including subjective variables such as self-efficacy, coping style, self-esteem and social support [31]. Therefore, psychosocial approaches may have a greater impact on levels of distress rather than metabolic control alone.

Diabetes distress showed a significant negative correlation with diabetes self-management particularly in domains such as glucose monitoring, medication adherence, dietary control, physical activity, and healthcare use. This is supported from the findings of Natarajan et al. 2023, among adults with diabetes in rural Tamil Nadu, India. The authors found that many participants struggled with dietary and medication adherence, had poor health-seeking behaviour and had poor SMBG, which could contribute to their reported emotional perceptions such as fear, distress and burden [34]. Furthermore, adherence to carbohydrate-restricted dietary recommendations is particularly challenging in cultures such as South Asia where rice-based and starchy diets are central to social and cultural practices, often resulting in feelings of frustration and helplessness. Struggling to modify lifelong eating habits can lead to increased regimen-related and emotional distress as highlighted by the qualitative ethnographic study among Sri Lankan adults with diabetes, which identified "changing food habits is a struggle" as a key theme influencing diabetes self-care behaviours [35].

It is evident that suboptimal glucose control is strongly associated with DD [26], and patients with sub-optimal glycaemic control had a 4.4 times higher odds of experiencing distress in our population. The relationship between glycaemic control and diabetes distress could be bidirectional [30], and self-management skills could be a mediating factor. High levels of DD can reduce the patient's motivation and ability to adhere to their

prescribed self-care routines, including taking their medication, managing their diet and monitoring their glucose levels [26, 34], leading to worsening of blood sugar control. When blood sugar levels remain poorly controlled despite significant effort, individuals may further experience frustration, helplessness and an emotional burden, fuelling further distress [36].

Performing self-monitoring of blood glucose can have positive effects on achieving better glycaemic control. However, majority of the participants (66.5%) did not perform SMBG, demonstrating sub-optimal glucose monitoring. As evident from our study, most patients attending public hospitals for tertiary care in Sri Lanka come from a lower socio-economic background. They may struggle to afford glucose monitoring devices/strips and maintain a healthy diet, which can lead to poor self-management behaviours and worsened glycaemic control [11].

Although weak, a significant negative correlation was observed between interpersonal distress and self-management domains in our study. Poor glycaemic control can exacerbate DD, as individuals may feel additional pressure from healthcare providers, family and friends to improve disease management. This distress may be further exacerbated by higher rates of diabetes-related complications and comorbidities. Evidence suggests that better communication between patients and healthcare providers, greater social support and higher self-efficacy are associated with improved diabetes self-care and glycaemic outcomes [12]. In low-resource settings such as Sri Lanka, it has been recommended that interactive health education programmes and family involvement could enhance adherence to treatment and effective disease management [37].

The observed burden of DD and its adverse impact on self-management highlight the need for policy interventions. Policies should encourage the integration of validated diabetes distress screening tools such as DDS-17 and PAID into standard diabetes care [19]. Early identification would allow for targeted interventions to be implemented before distress leads to patients disengaging or experiencing poor clinical outcomes. Diabetes care teams, including primary care providers, should be trained with the skills to detect, discuss and address diabetes distress as part of routine consultations [38], and also access to behavioural specialists should be facilitated, particularly for those with high levels of distress or poor glycaemic outcomes [39]. Further, culturally sensitive psychological and educational interventions that address specific sociocultural barriers, such as traditional dietary practices and health beliefs should be incorporated in order to reduce DD and improve self-management in Sri Lanka [35].

The results of this study should be interpreted with caution due to several limitations. Firstly, the data on lifestyle and distress may be vulnerable to recall bias. We aimed to minimize this bias by limiting the period of interest to preceding month. Secondly, the use of an interviewer-administered method instead of a self-administered method may have introduced reporting bias and social desirability bias, which could result in participants underreporting their distress or overreporting their adherence behaviours. However, due to the use of standardised procedures, neutral questioning and the explanation of the condition (DD) prior to data collection, we can assume that the risk of reporting bias was minimized. Thirdly, the participants were recruited from a single tertiary care clinic in the public sector and therefore the findings may not be generalizable to the whole country. However, it is important to highlight that the National Hospital of Sri Lanka is a leading tertiary care hospital in the country and receives patients referred for diabetes management from various regions. Therefore, despite this limitation, the inclusion of patients from NHSL provides valuable insights into a diverse patient population. Another key limitation of our study is the absence of cultural validation for the questionnaires used. While linguistic validation ensures clarity, cultural validation ensures that questions are culturally appropriate and relevant. Without this, there is a risk that the questionnaires may not fully capture the cultural context, beliefs and values of participants, potentially leading to misunderstandings or inaccuracies in responses. To address this, we reviewed the questionnaires with experts and pilot tested them with participants from the target population, incorporating feedback to identify and address any cultural discrepancies or areas for clarification. Another limitation of this study is that, although the DDS-17 and DSMQ-R had been linguistically validated in Sinhala, a formally validated version in Tamil was unavailable at the time. Tamil-speaking participants were interviewed in their preferred language, with translations provided by the research assistant. While this enabled Tamil speakers to participate, the absence of a culturally validated Tamil version may have affected the accuracy of the responses. Lastly, the cross-sectional nature of the study limits causal interpretations of the relationship between DD, HbA1C and self-management. Therefore, longitudinal/experimental studies are encouraged to assess the causal relationships between DD and outcomes.

Conclusions

Diabetes distress has a negative impact on self-management and glycaemic control of patients living with T2DM. Female sex, age group of 41–59 years, presence of co-morbidities and sub optimal glycaemic control (HbA1c ≥ 7%) were major determinants of DD. The

findings of this study demonstrate the clinical usefulness of routinely screening for diabetes-related distress using a simple, validated tool such as the DDS-17. Identifying patients with moderate-high distress during routine care can help clinicians recognise those at higher risk of poor self-management behaviours and suboptimal glycaemic control. This enables targeted, patient-centred psychological and educational interventions to be implemented, thereby improving outcomes. These approaches are particularly relevant in low-resource settings such as Sri Lanka, where integrating mental health and chronic disease care could be highly beneficial. Future research should focus on identifying pragmatic screening strategies and interventions to reduce distress and enhance self-management skills among people living with T2DM.

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Author contributions
TS conceived the research question and developed the protocol. PK and HD supervised the study. TS, HD, PK, UB and MS developed and validated the data collection tools. HL conducted the data collection and data entry. TS and LDS conducted the statistical analysis. TS wrote the first draft of the manuscript. UB, MS edited the final manuscript. PK and HD critically reviewed the paper. All the authors read and approved the final manuscript.

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Data availability
The data set is available with the principal investigator (TS) and can be provided upon request.

Declarations

Ethical approval
No identifiable data were collected to ensure confidentiality. Participants had the autonomy to withdraw their consent to participate at any time by verbally expressing their unwillingness to participate in the study, with or without giving reasons. The study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo, Sri Lanka (FMPG/2021/HD/029).

Consent to participate
All participants gave written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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