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Distress and coping mechanisms among people with diabetes: cross-sectional assessment from an NCD screening clinic of a tertiary care hospital in North India

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Abstract

Background Of the numerous complications encountered by people with diabetes (PWD), the effect on mental health is concerning. Within mental health, diabetes distress (DD) occurs when a patient has unfavourable emotional stress while managing their condition, which can be managed by coping strategies but are less studied together in Indian settings. So, the present study aimed to determine the proportion of DD and associated factors and coping skills among the PWD.

Methods Cross-sectional study was conducted among 596 clinically stable, ambulatory PWD visiting the NCD clinic of a tertiary care centre in North India between June 2023 and January 2024 and recruited using a systematic random sampling technique. DD was the primary dependent variable assessed using the Hindi version of the Diabetes Distress Scale (DDS). Coping was assessed using a GlucoCoper scale. Independent variables included socio-demographic and clinic history variables. Bivariate analysis described the sample characteristics. Multivariable binary logistic regression analysis explored the factors affecting the DD. The study was ethically approved, and written informed consent was obtained from the patients.

Results Of the 596 study participants, 17.4% depicted uncontrolled diabetes, while 18.1% PWD experienced moderate to severe DD, with emotional distress depicting the highest prevalence (23.8%). Significantly increased odds of living with DD in professionals compared to Clerical, shop-owners, farmers with less monthly average income (vs. the group with unstable income), tobacco users, and those with uncontrolled disease. Overall, scores for negative coping were higher than positive coping, with significant differences between the two types among the participants with DD.

Conclusions The study underscores the complex interplay between diabetes control, distress, and coping mechanisms in patients attending an NCD screening clinic. The findings highlight the need for a holistic approach to

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diabetes management that addresses not only the physical aspects but also patients' emotional and psychological well-being.

Keywords Diabetes distress, Control, Coping, Microvascular complications

Introduction

Despite constant improvements in our understanding of the pathophysiology of diabetes and its contributing factors, diabetes continues to be a substantial contributor to global morbidity and mortality. As per the 2021 Global Burden of Disease (GBD) estimates, about 529 million people were living with diabetes, with a global age-standardised total diabetes prevalence of 6·1%, contributing to 79·2 million Disability Adjusted Life Years (DALYs) [1]. India, surpassing the global average, demonstrates an alarming weighted prevalence of diabetes and prediabetes at 11.4% and 15.3%, respectively. This burden is attributed to the polygenic and multifactorial nature of diabetes, coupled with its complex aetiology. Beyond its medical implications, diabetes necessitates extensive self-management and self-care to mitigate complications, posing additional challenges for people with diabetes (PWD) [1].

Among the complications, the effect of diabetes on mental health is particularly concerning. The persistent need for disease management and its chronic nature lead to significant emotional and mental stress in PWD and their caregivers, referred to as diabetes distress (DD) [3]. DD is a significant health problem, with a high prevalence across different populations with Type 2 DM (T2DM) [2]. Ramkisson S et al. reported a 44% prevalence of moderate to high levels of DD in South African adults with T2DM, with younger age, high HbA1C levels, and unemployment as contributing factors [3]. In Qatar, 40.3% of people with T2DM reported DD, with regimen distress being the most prevalent subtype [4]. In India, the prevalence of DD was 18%, with emotion-related distress being the most prevalent subtype in PWD, with lower education levels and the presence of diabetic complications as risk factors [5]. In Kuwait, Al-Ozairi E et al. reported the prevalence of DD in T2DM to be around 14%, with a higher prevalence of depression [6]. A systematic review further consolidates these findings, reporting an overall prevalence of approximately 36% in T2DM.[ref] Moreover, DD extends beyond T2DM to encompass the entire diabetes spectrum, including Type 1 DM (T1DM), significantly affecting adolescents and young adults. Luo J et al. reported that the regimen-related distress (mean score: 2.41; Standard deviations: 0.82) and physician-related distress (2.40; 0.80) domains depicted the highest levels of distress among adolescents [7]. The detrimental effects of DD on glycemic control, quality of life, and risk of complications are well-documented [2, 8, 9].

The impact of DD on disease outcomes underscores the need for regular screening for DD in PWD [10]. Managing DD necessitates extra care and assistance to the PWD, which should focus not only on the medical aspects of diabetes but also on the psychological and emotional challenges associated with the condition. Particular attention should be given to enhancing individuals' adaptive responses, also known as coping mechanisms, that represent an individual's ability to constantly change their cognitive and behavioural efforts in managing stressful situations [11]. Different coping strategies (both positive and negative) influence physical and psychological well-being and help achieve improved overall outcomes [12, 13]. Positive coping is a direct, rational approach to problem-solving, while negative coping is an attempt to avoid, deny, or withdraw from a problem. Positive coping can include problem-focused strategies like engagement and approach, while negative coping can include emotion-focused strategies like disengagement and avoidance [14].

A comprehensive understanding of the determinants of diabetes distress (DD) and evaluating existing coping mechanisms are essential for developing tailored interventions that aim to enhance resilience, improve glycemic control, and reduce the healthcare burden associated with diabetes. Studying DD alongside coping strategies is crucial for understanding their bidirectional influence on disease management, psychological well-being, and health outcomes. While global research Underscores the importance of these factors, there is a notable lack of evidence from Indian settings. This gap is critical because geographical disparities in healthcare access, cultural norms, socioeconomic conditions, and environmental factors significantly influence distress and coping mechanisms. Urban-rural differences and regional healthcare resources further shape stress levels and coping strategies, underscoring the need for context-specific interventions. With this background, the aim of the present study was to determine the proportion of PWD depicting DD, its determinants as per disease control status and assess coping strategies among the PWD visiting the NCD clinic of a tertiary care centre in North India.

Methodology

Study design and settings

The study was done between August 2023 and May 2024, using a cross-sectional study design in the outpatient department of Endocrinology and Metabolism endocrinology OPD of a tertiary care hospital located in Punjab,

a northern state of India. The hospital provides comprehensive preventive, promotive, curative and rehabilitative services.

Study population

The study population incorporated clinically stable, ambulatory adults > 18 years living with diabetes (per the 2020 American Diabetes Association guidelines) and took medical consultations from the hospital during the study period. We included those who agreed to participate in the study and answered all the study questions. At the same time, we excluded those who had serious comorbidities, cognitive impairments or were unable to spare time.

Sample size and sampling technique

A sample size of 510 was calculated using a single population proportion formula of an online sample size calculator (https://clincalc.com/stats/samplesize.aspx.) after considering the prevalence of distress among PWD to be around 33% as per a previous systematic review, with a 95% confidence interval and a margin of error of 1.5% [15]. We collected data from a total of 600 participants in the study, and after data cleaning, we included 596 participants in our final analysis. Eligible participants were recruited using a systematic random sampling technique.

Study variables

Dependent variable

Diabetes Distress was our primary dependent variable assessed using the Hindi version of the Diabetes Distress Scale (DDS) that depicted acceptable validity (content validity index: 0.99) and reliability (Cronbach's α coefficient: 0.958) in North Indian settings [16]. The DDS is a rating scale used to measure potential problem areas that people with diabetes may experience. The DDS consists of 17 items used to measure DD and 4 domains (emotional burden, physician care, disease management, and interpersonal support). Each dimension is rated on a 6-point Likert scale (1 = not a problem; 2 = a slight problem; 3 = a moderate problem; 4 = somewhat serious problem; 5 = a serious problem; and 6 = a very serious problem)0.5,6 The total mean item score is calculated by dividing the total score by 17, and each domain-specific subscale was calculated by dividing the total scores of the subscale by the number of questions associated with it. With a possible range of 1 to 6, a high score indicates a higher distress level. The overall DDS and each sub-component scale were evaluated using the following: a mean score of < 2, considered as "no distress"; a mean score between 2 and 2.9, considered as "moderate distress"; and a mean score ≥ 3, considering as "high distress".

Further, the coping was assessed using a GlucoCoper scale, a six-item tool that analyses six coping styles, two of which are negative (negativity and blame), and the remaining being positive coping strategies. At the same time, the remaining four are positive coping styles (acceptance, optimism, planning and action). The coping styles are assessed on a 10-point Likert scale. The tool then provides a total score, a positive scale score and a negative scale score using an average of two domains, with higher scores depicting better coping in a positive and opposite for the negative styles. The negative scale score can be subtracted from the positive scale score to calculate the total coping score. The GlucoCoper scale has depicted a significant correlation with diabetes distress, with high internal validity in previous studies from India [17].

Independent variables

The independent variables were chosen based on an extensive literature review and data availability in clinical OPD settings [3–6, 18, 19]. We included Age (categorised as < 30, 31–45, 46–60, and > 60 Completed years), Sex (Female, Male), Marital status (Married, Single), Educational qualification (Illiterate, Can read-only, Can read and write, upto Primary, Middle, High School, Graduate & above), Current Occupation (Clerical, shop-owner, farmer, Others), Profession, Semi-profession, Semi-skilled worker, Skilled worker, Unemployed/homemaker, Unskilled worker), Average Monthly Income (Unstable, < 10000, >10000), Tobacco and alcohol usage classified as current users (who consumed at least one time in last 30 days), ever users (who consume but have not in last 30 days), and never users, Type of Diabetes Mellitus (Type 1 DM, Type 2 DM, Type 2 DM + comorbidities), Co-existing Hypertension (No, Yes), Duration of the disease (< 1 year, 1–5 years, > 5 years), and the Type of treatment (Insulin, Lifestyle modifications, Oral Hypoglycaemic agents).

Study protocol

Patients visiting the study area were assessed for eligibility to be included in the study as per inclusion and exclusion criteria by the study investigators, who were adequately trained and sensitised to assess the clinical conditions and distress related to diabetes. Following this, they were informed about the purpose of the study in their vernacular language and were invited to participate. Upon agreement, they were requested to sign the informed consent form, and for those who were unable to read or write, it was read to them, where they consented in the presence of a third person not directly involved in the study. Following the completion of the pre-requisite, they were interviewed in a private room to ensure privacy, and data were collected through a face-to-face interview using a structured interview schedule, which

lasted for around 15 min. Following this, the participants were counselled about the importance of medical adherence, regular monitoring of the disease, and self-management of diabetes as per the department protocols. In case the participants were found to be living with severe distress, study investigators facilitated psychiatry consultations and standard care within the institute.

Statistical analysis

Data was coded and entered in MS Excel. Statistical analysis was performed using Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Bivariate analysis was done to first describe the sample characteristics of the study population with a simultaneous comparison of participants with and without glycaemic control and its association with the socio-demographic characteristics. Further, scores of the DDS were compared after categorising them dichotomously, then depicting the association between DD and socio-demographic characteristics. Multivariable binary logistic regression analysis was used to explore the factors affecting the odds of DD in the study population and depicted using an adjusted Odds ratio and a 95% confidence interval. Subsequently, coping skills per different domains of the DDS were compared by depicting their mean + standard deviations, and an independent student's t-test was used to compare the scores of negative and positive coping skills between the groups. Net coping was calculated as the difference of positive and negative coping scores. A p-value < 0.05 was considered statistically significant.

Ethics approval

The Institutional Ethics Committee of India, AIIMS Bathinda (IEC/AIIMS/BTI/159, Dated 12-03-2022) ethically approved the study. Written informed consent was obtained for patients after reading the patient information sheet in their vernacular language. Participation in the study was voluntary, and their choice did not alter standard care protocols.

Results

Table 1 compiles the sample characteristics of the 596 study participants who attended the NCD clinic segregated per their disease control status. Most of our study participants were between 40 and 60 years, males (57.9%), married (89.9%), at least graduated (29.9%), and unemployed/homemakers (46.8%). Less than 10% had ever consumed tobacco, but nearly one-third had a history of alcohol consumption. Most of the participants were living with T2DM for more than 5 years (48.8%) and were being prescribed OHAs. Overall, 17.4% of participants depicted uncontrolled diabetes during the interview. The control status was significantly affected by marital status, current occupation, co-existing hypertension, and type of treatment.

Further, distress among the study participants was diagnosed in different domains of the DDS (Table 2). Overall, the proportion of participants living with emotional distress was the highest (23.8%), followed by regimen-related distress (19.6%), inter-personal relations related (18.1%), and physician-related distress (16.9%). The emotional and regime-related distress was significantly affected by tobacco and alcohol use, education, and current occupation. In addition to these factors, Physician-related distress was affected by the diabetes control status, while Interpersonal-relations distress significantly varied as per age. Overall, 18.1% of the participants experienced moderate to severe DD (Table 3). The distress was significantly higher among less educated participants (40.5%), unskilled workers (75%), with unstable monthly income (45.3%), tobacco users (57.1%), and having uncontrolled diabetes (25%). Binary logistic regression analysis depicted increased odds of living with DD in professionals compared to Clerical, shop-owners, farmers with less monthly average income (vs. the group with unstable income), tobacco users, and those with uncontrolled disease.

We further compared the PWD's positive and negative coping scores as per the GlucoCoper scale as per the DD domains, disease status and socio-demographic characteristics, to be followed by within-group comparisons. Overall, scores for negative coping were higher than positive coping (Table 4). Overall, there were significant differences between the positive and negative coping scores among the participants having any distress as per the domains of DDS. The negative and positive scores differed significantly in patients with T2DM and higher duration of disease, absent disease control, those having DD, age 46–60 years, male gender, married and single participants, those who had at least attained graduation degree, those with unstable or < 10,000 rupees monthly income, current or ever tobacco or alcohol users. Specifically, the negative coping scores varied significantly (p-value < 0.05) as per disease control status and the presence or absence of DD. On the other hand, positive scores significantly(p-value < 0.05) varied across the presence or absence of DD and across all four domains of DD, and as per average monthly income, tobacco and alcohol use pattern.

Discussion

The findings from this study underscore the significant levels of psychological distress experienced by PWD visiting a tertiary care setting in North India. Additionally, this is among the first few studies from India that assess the preferred coping mechanisms by the PWD. These insights reiterate the importance of comprehensive care models that simultaneously address physical and emotional health and

Table 1 Sample characteristics of the study participants as per their diabetes control status

	Total	Diabetes control		
		Absent	Present	p-value
	Count (Row %)	Count (Row %)	Count (Row %)	
Sample	596 (100)	104 (17.4)	492 (82.6)	
Age (Completed years)				0.157
18–30	62(10.4)	16(25.8)	46(74.2)	
31–45	123(20.6)	25(20.3)	98(79.7)	
46–60	272(45.6)	40(14.7)	232(85.3)	
> 60	139(23.3)	23(16.5)	116(83.5)	
Sex				0.630
Female	251(42.1)	46(18.3)	205(81.7)	
Male	345(57.9)	58(16.8)	287(83.2)	
Marital status				0.020
Married	536(89.9)	100(18.7)	436(81.3)	
Single	60(10.1)	4(6.7)	56(93.3)	
Educational qualification				0.657
Illiterate	118(19.8)	23(19.5)	95(80.5)	
Can read only	7(1.2)	2(28.6)	5(71.4)	
Can read and write	24(4)	2(8.3)	22(91.7)	
Primary	37(6.2)	5(13.5)	32(86.5)	
Middle	92(15.4)	19(20.7)	73(79.3)	
High School	140(23.5)	26(18.6)	114(81.4)	
Graduate & above	178(29.9)	27(15.2)	151(84.8)	
Current Occupation				0.002
Clerical, shop-owner, farmer	110(18.5)	13(11.8)	97(88.2)	
Others	38(6.4)	10(26.3)	28(73.7)	
Profession	70(11.7)	14(20)	56(80)	
Semi-profession	63(10.6)	8(12.7)	55(87.3)	
Semi-skilled worker	5(0.8)	3(60)	2(40)	
Skilled worker	27(4.5)	2(7.4)	25(92.6)	
Unemployed/homemaker	279(46.8)	51(18.3)	228(81.7)	
Unskilled worker	4(0.7)	3(75)	1(25)	
Average Monthly income				0.967
Unstable	270(45.3)	46(17)	224(83)	
< 10,000	195(32.7)	35(17.9)	160(82.1)	
> 10,000	131(22)	23(17.6)	108(82.4)	
Tobacco				0.175
Current users and Ever user	49(8.2)	12(24.5)	37(75.5)	
Never user	547(91.8)	92(16.8)	455(83.2)	
Alcohol				0.903
Current users and Ever user	169(28.4)	30(17.8)	139(82.2)	
Never user	427(71.6)	74(17.3)	353(82.7)	
Type of Diabetes Mellitus				0.341
Type 1 DM	48(8.1)	8(16.7)	40(83.3)	
Type 2 DM	536(89.9)	92(17.2)	444(82.8)	
Type 2 DM + Comorbidities	12(2)	4(33.3)	8(66.7)	
Co-existing Hypertension				< 0.001
No	320(53.7)	85(26.6)	235(73.4)	
Yes	218(36.3)	9(4.1)	209(95.9)	
Duration of the disease				0.639
< 1 year	59(9.9)	12(20.3)	47(79.7)	
1–5 years	246(41.3)	39(15.9)	207(84.1)	
> 5 years	291(48.8)	53(18.2)	238(81.8)	

Table 1 (continued)

	Total	Diabetes control		
		Absent	Present	p-value
	Count (Row %)	Count (Row %)	Count (Row %)	
Type of treatment				0.031
Insulin	129(21.6)	15(11.6)	114(88.4)	
Lifestyle modifications	25(4.2)	8(32)	17(68)	
Oral Hypoglycaemic agents	442(74.2)	81(18.3)	361(81.7)	

help enhance the overall patient well-being and treatment outcomes. We have specific interesting findings emerging from our study. *First*, around one-fifth of PWD were living with uncontrolled diabetes at the time of the study, which depicted significant socio-demographic disparities. *Second*, about one in five participants were experiencing moderate to severe DD at the time of the interview, and its odds were significantly affected by the disease status and certain socio-economic characteristics. *Third*, emotional distress was the most prevalent type. Fourth, the negative and positive coping scores of the participants were below the total average, with negative coping more in those with uncontrolled disease. Lastly, despite similar distress prevalence, coping patterns differed significantly in participants with Type 1 and Type 2 DM.

Achieving and sustaining adequate glycemic control remains the cornerstone of managing diabetes and preventing long-term disease-associated morbidity and mortality. The high prevalence of uncontrolled diabetes observed in our study is similar to other studies from India [20]. Our hospital-based results are very close to estimates from another nationwide community-based study that depicted 15.7% disease control [21]. The same study depicted a significant effect on older adults, urban residents, men with metabolic risk factors and those who received any education on diabetes control. Other studies around the world reaffirm our findings, stating that diabetes control is significantly affected by age, gender, duration of diabetes, type of treatment, BMI, fasting plasma glucose (FPG), lipid profile, level of education, occupation, medication adherence, presence of comorbidities, self-care practice, and mental and psychosocial health problems [22–25]. These factors are deeply embedded within the socio-cultural roots of our society and underscore the need for health education, comprehensive measures to ensure drug adherence and routine monitoring of the physiological parameters [26].

We observed that about one in five participants had DD, which is concerning. Other studies from India that assessed DD among participants in community and hospital settings using different scales like PAID (Problem Areas In Diabetes questionnaire) depicted a prevalence between 2.4 and 24.6% [27, 28]. International Studies from Europe, however, reported a prevalence between 8.9% and 10.7% [29, 30]. DD is an emotional response in PWD attributed to the burden of relentless daily management of the disease and prevention of the associated long-term complications [31, 32]. It can also arise from the social impact of diabetes (e.g., stigma, discrimination, or dealing with other people's unhelpful reactions or their lack of understanding) and the financial implications (e.g., insurance and treatment costs) of the condition [32, 33]. Frequent occurrences of DD can affect self-care, highlighting the necessity of integrating psychological support within routine diabetes care; hence, it is important that every healthcare appointment includes opportunities for the person to express how they are feeling about life with diabetes [34]. Certain treatment options may increase the burden of diabetes self-management and increase the likelihood of DD. Emotional support has been related to better diabetes self-care, while self-blame is linked to poor disease outcomes [12].

We explored the coping strategies the participants used to counter the DD. We observed that negative coping strategies dominated over positive ones, especially among those with uncontrolled diabetes. In line with the present study, an Indian study that used GlucoCoper as a tool for coping assessment found that negative coping (like having extremely negative thoughts such as suicidal thoughts and behaviours and blaming oneself or other people for their illness) was more marked in older patients. At the same time, those with a longer history of diabetes were better at planning [17]. A study from an African county depicted that Zambian individuals show dissimilar results where positive coping strategies like religious coping and acceptance, among others, were more frequent than Negative (Maladaptive) coping strategies, like self-blame and self-distraction [12]. Another Portuguese study among Non-Insulin-Dependent DM patients from a similar study setting depicted that a greater proportion of PWD used avoidance (Negative) coping styles than active confrontation coping styles [35]. Negative coping, such as negative religious coping and avoidance coping, leads to diabetes being viewed as a threat which worsens the quality of life [35]. Negative coping styles have been significantly associated with increased anxiety and depression [18]. In addition, negative religious coping was associated with a negative relationship of hope in older PWD and results from a path analysis demonstrate that avoidance coping leads to greater DD and depression symptoms [18, 36]. In the present study, we found

Table 2 Diabetes-related distress as per various sub-domains of the diabetes distress scale among the study participants as per their socio-demographic characteristics

Distress Domains	Emotional Distress		Physician-related		Regimen related		Interpersonal	
	Present	p-value	Present	p-value	Present	p-value	Present	p-value
	Count (Row %)		Count (Row %)		Count (Row %)		Count (Row %)	
Total sample	596(100)		596(100)		596(100)		596(100)	
Overall	142(23.8)		101(16.9)		117(19.6)		108(18.1)	
Type of Diabetes Mellitus		0.474		0.084		0.218		0.085
Type 1 DM	14(29.2)		12(25)		14(29.2)		10(20.8)	
Type 2 DM	124(23.1)		85(15.9)		101(18.8)		93(17.4)	
Type 2 DM + comorbidities	4(33.3)		4(33.3)		2(16.7)		5(41.7)	
Diabetes control		0.115		0.034*		0.330		0.546
No	31(29.8)		25(24)		24(23.1)		21(20.2)	
Yes	111(22.6)		76(15.4)		93(18.9)		87(17.7)	
Age (Completed years)		0.235		0.373		0.055		0.004
< 30	17(27.4)		10(16.1)		13(21)		12(19.4)	
31–45	23(18.7)		17(13.8)		19(15.4)		13(10.6)	
46–60	62(22.8)		44(16.2)		47(17.3)		45(16.5)	
> 60	40(28.8)		30(21.6)		38(27.3)		38(27.3)	
Sex		0.585		0.227		0.954		0.160
Female	57(22.7)		48(19.1)		49(19.5)		52(20.7)	
Male	85(24.6)		53(15.4)		68(19.7)		56(16.2)	
Tobacco		< 0.001		< 0.001		< 0.001		< 0.001
Current users and Ever user	29(59.2)		27(55.1)		28(57.1)		28(57.1)	
Never user	113(20.7)		74(13.5)		89(16.3)		80(14.6)	
Alcohol		0.003		0.006		0.007		0.048
Current users and Ever user	54(32)		40(23.7)		45(26.6)		39(23.1)	
Never user	88(20.6)		61(14.3)		72(16.9)		69(16.2)	
Educational qualification		0.018		0.007		0.003		0.003
Illiterate	28(23.7)		20(16.9)		21(17.8)		21(17.8)	
Can read only	1(14.3)		1(14.3)		1(14.3)		1(14.3)	
Can read and write	5(20.8)		3(12.5)		3(12.5)		2(8.3)	
Primary	16(43.2)		15(40.5)		17(45.9)		16(43.2)	
Middle	17(18.5)		13(14.1)		14(15.2)		14(15.2)	
High School	42(30)		26(18.6)		31(22.1)		28(20)	
Graduate & above	33(18.5)		23(12.9)		30(16.9)		26(14.6)	
Current Occupation		0.019		0.017*,b, c		0.042*,b, c		0.011*,b, c
Clerical, shop-owner, farmer	26(23.6)		17(15.5)		23(20.9)		21(19.1)	
Others	1(2.6)		1(2.6)		0(0)		0(0)	
Profession	19(27.1)		13(18.6)		15(21.4)		16(22.9)	
Semi-profession	17(27)		12(19)		16(25.4)		12(19)	
Semi-skilled worker	2(40)		0(0)		0(0)		1(20)	
Skilled worker	7(25.9)		4(14.8)		6(22.2)		5(18.5)	
Unemployed	67(24)		51(18.3)		55(19.7)		50(17.9)	
Unskilled worker	3(75)	1(25)	3(75)		2(50)		3(75)	

that within negative coping, the scores were highest among those who did not have disease control; similar findings were seen in a study from Portugal that depicted a significant correlation of the coping style with several dimensions of quality of life in PWD including disease control status [35]. Acceptance of the condition and optimism that challenges concerning the disease can be overcome should ideally replace such negativity and lead to pragmatic planning and affirmative action, which help alleviate DD and cope with diabetes [36]. These findings also suggest that disease control should be a prime target for physicians to ensure the mental well-being of PWD. Conversely, participants with better disease control demonstrated higher positive coping scores. This suggests a bidirectional relationship between coping mechanisms and effective disease management. A study from Nigeria reported that religion and spirituality are

Table 3 Prevalence of diabetes distress among the study participants and predicting socio-demographic and clinical characteristics

	Diabetes distress				
	Total	Present	*p*-value	Adjusted OR(95% CI)	*p*-value
	Count (Row %)	Count (Row %)			
Total sample	596(100)	108(18.1)			
Age (Completed years)			0.464		
18–30	62(10.4)	12(19.4)		**Reference Cat**	
31–45	123(20.6)	19(15.4)		0.8(0.2–2.5)	0.677
46–60	272(45.6)	46(16.9)		0.9(0.3–2.6)	0.814
> 60	139(23.3)	31(22.3)		1.4(0.5–4.4)	0.544
Sex			0.911		
Female	251(42.1)	46(18.3)		**Reference Cat**	
Male	345(57.9)	62(18)		1(0.6–1.8)	0.895
Marital status			0.508		
Married	536(89.9)	99(18.5)		0.8(0.3–2.5)	0.73
Single	60(10.1)	9(15)		**Reference Cat**	
Educational qualification			0.005		
Illiterate	118(19.8)	19(16.1)		0.5(0.1–2.4)	0.389
Can read only	7(1.2)	1(14.3)		0.5(0.1–2.2)	0.362
Can read and write	24(4)	2(8.3)		**Reference Cat**	
Primary	37(6.2)	15(40.5)			
Middle	92(15.4)	11(12)		2.1(0.4–10.3)	0.359
High School	140(23.5)	31(22.1)		0.8(0.2–3.4)	0.769
Graduate & above	178(29.9)	29(16.3)		1.2(0.3-5)	0.78
Current Occupation			0.010		
Clerical, shop-owner, farmer	110(18.5)	16(14.5)		**Reference Cat**	
Others	38(6.4)	1(2.6)		0.2(0-2.1)	0.194
Profession	70(11.7)	15(21.4)		2.6(1–7)	0.06
Semi-profession	63(10.6)	16(25.4)		2.9(1–8)	0.04
Semi-skilled worker	5(0.8)	1(20)		3(0.3–34.8)	0.384
Skilled worker	27(4.5)	5(18.5)		2.4(0.7–8.4)	0.181
Unemployed	279(46.8)	51(18.3)		1.6(0.7–3.4)	0.255
Unskilled worker	4(0.7)	3(75)		11.5(0.6-232.8)	0.112
Average Monthly income			< 0.001		
Unstable	270(45.3)	31(11.5)		**Reference Cat**	
< 10,000	195(32.7)	57(29.2)		4.3(2.3–8.1)	< 0.001
> 10,000	131(22)	20(15.3)		1.5(0.7–3.3)	0.294
Tobacco			< 0.001		
Current users and Ever user	49(8.2)	28(57.1)		**Reference Cat**	
Never user	547(91.8)	80(14.6)		0.1(0-0.2)	< 0.001
Alcohol			0.929		
Current users and Ever user	169(28.4)	31(18.3)		**Reference Cat**	
Never user	427(71.6)	77(18)		1.1(0.5–2.1)	0.84
Type of Diabetes Mellitus			0.191		
Type 1 DM	48(8.1)	13(27.1)		**Reference Cat**	
Type 2 DM	536(89.9)	92(17.2)		0.6(0.3–1.5)	0.282
Type 2 DM + comorbidities	12(2)	3(25)		0.1(0-2.3)	0.149
Diabetes control			0.045		
No	104(17.4)	26(25)		2.1(1-4.1)	0.039
Yes	492(82.6)	82(16.7)		**Reference Cat**	
Duration of the disease			0.352		
< 1 year	59(9.9)	8(13.6)		**Reference Cat**	
1–5 years	246(41.3)	41(16.7)		0.7(0.3–1.9)	0.506
> 5 years	291(48.8)	59(20.3)		0.8(0.3–2.1)	0.662

Table 3 (continued)

	Diabetes distress				
	Total	**Present**	***p*-value**	**Adjusted OR(95% CI)**	***p*-value**
	Count (Row %)	**Count (Row %)**			
Type of treatment			0.233		
Insulin	129(21.6)	28(21.7)		**Reference Cat**	
Lifestyle modifications	25(4.2)	2(8)		0.3(0.1–2.1)	0.24
Oral Hypoglycaemic agents	442(74.2)	78(17.6)		0.7(0.3–1.3)	0.247
Co-existing Hypertension			0.364		
No	320(53.7)	58(18.1)		**Reference Cat**	
Yes	218(36.6)	33(15.1)		1.1(0.6–1.9)	0.864

the most commonly employed coping mechanisms in individuals with diabetes, but religion was not associated with DD, depression and diabetes self-care [37]. The significant difference in coping strategies scores adopted by the PWD with or without distress underscores the need for targeted interventions that promote positive coping mechanisms, especially among high-risk groups. Health professionals can actively provide PWD with a list of effective coping strategies to enhance their awareness and help adopt new strategies including diabetes self-management education, support groups, problem-solving approaches, and coping skills interventions for improving a range of outcomes, Cognitive Behavior Therapy and collaborative care for treating depression, and family therapy [38, 39].

Additionally, we observed non-significant differences in the prevalence of distress among people with T1DM and T2DM, reflecting shared societal stressors, challenges in disease management, and individual psychosocial factors. While diabetes distress (DD) is common across the spectrum, higher prevalence in T2DM noted in some studies may arise from additional lifestyle burdens, late-onset challenges, and comorbidities [40]. Despite similar distress prevalence in our study, coping patterns differed significantly. Negative coping scores were markedly higher than positive scores in T2DM, compared to T1DM, where differences were non-significant. A previous study highlighted that T2DM patients reported higher levels of emotional distress and utilised more passive coping strategies compared to T1DM patients, who tended to use more active coping mechanisms. As a result, T2DM patients often employ coping strategies that may not effectively mitigate distress, potentially leading to poorer glycemic control. In contrast, adolescents with T1DM who utilise active coping strategies experience better psychological adjustment and glycemic control, indicating a potential difference in coping effectiveness between T1DM and T2DM populations [17, 41]. These disparities highlight the distinct psychological burden in T2DM, likely influenced by added stress, lifestyle constraints, and limited social support, whereas T1DM patients often benefit from earlier interventions and more structured support systems [38].

Important implications and recommendations are emerging from this study. The high burden of distress among PWD highlights the existing gaps in care. The identified associations between DD and socio-demographic factors highlight that healthcare providers must adopt a holistic approach to diabetes management. Healthcare professionals can tailor interventions that address medical needs and support mental health by considering patients' socioeconomic backgrounds. Moreover, the study underscores the importance of integrating psychological support into diabetes care. Programs to enhance education about diabetes management and coping strategies could be beneficial, particularly for those with lower educational attainment and unstable income. At the same time, our study suggests a strong need to integrate the NP-NCD and National mental health program. Available evidence suggests that such integration can also improve outcomes in NCDs and vice versa [42]. However, the integration is inadequate mainly due to competing priorities of other health programs, leading to significant unmet needs [43]. The World Health Organisation's (WHO) Mental Health Gap Action Programme guidelines for mental health interventions delivered by primary care doctors and nurses to address this gap need to be supported with evidence for feasibility and effectiveness [44].

Our study has particular strengths and limitations. This is amongst the first few studies from India and abroad that have assessed the relationship between distress, coping and disease control. We report our findings using a large sample size and validated study tools. The major limitation is that the interview patterns to record the responses may distort our estimates due to a response bias, as participants may sometimes be reluctant to open up about their distress or may feel uncomfortable disclosing to you that they are not "on top" of their diabetes. The cross-sectional design limits the ability to draw causal inferences, and the reliance on self-reported measures may introduce bias. The single-centre nature of this research and the lack of comparison with other diagnostic tools, such as the DDS, are limitations that need to be addressed in future studies. Future research should consider longitudinal studies to explore the

Table 4 Comparison of the positive and negative coping ability scores of people living with diabetes, as per different domains of the diabetes distress scale

	Negative coping	Positive Coping	Net coping	*p*-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Overall	4.54 ± 1.98	4.10 ± 2.37		< 0.001
Diabetes distress				
Absent	4.55 ± 1.98	4.42 ± 2.42	0.12 ± 2.83.0	0.318
Present	4.01 ± 1.90	2.64 ± 1.35	1.36 ± 2.08	< 0.001
p-value	0.048	< 0.001		
Subdomain wise				
Emotional Distress				
Absent	4.54 ± 1.98	4.35 ± 2.39	0.18 ± 2.76	0.155
Present	4.17 ± 1.96	3.28 ± 2.10	0.88 ± 2.62	< 0.01
p-value	0.567	< 0.001		
Physician-related				
Absent	4.46 ± 1.92	4.31 ± 2.41	0.15 ± 2.76	0.224
Present	4.46 ± 2.13	3.09 ± 1.84	1.33 ± 2.47	< 0.001
p-value	0.183	< 0.001		
Regimen related				
Absent	4.53 ± 1.99	4.32 ± 2.39	0.22 ± 2.78	0.088
Present	4.11 ± 1.90	3.20 ± 2.02	0.90 ± 2.54	< 0.001
p-value	0.122	< 0.001		
Interpersonal related				
Absent	4.52 ± 1.99	4.32 ± 2.40	0.19 ± 2.81	0.135
Present	4.15 ± 1.90	3.07 ± 1.86	1.08 ± 2.3	< 0.001
p-value	0.22	< 0.001		
Type of Diabetes Mellitus				
Type 1 DM	4.40 ± 2.00	3.94 ± 2.34	0.3 ± 2.7	0.454
Type 2 DM	4.47 ± 2.00	4.06 ± 2.41	0.3 ± 2.8	0.005
Type 2 DM + comorbidities	3.67 ± 2.57	4.58 ± 2.02	0.6 ± 2.6	0.461
p-value	0.899	0.965		
Duration of the disease				
< 1 year	4.44 ± 2.09	4.22 ± 2.47	0.2 ± 2.8	0.678
1–5 years	3.94 ± 2.37	4.45 ± 1.93	0.4 ± 2.8	0.026
> 5 years	4.48 ± 2.04	4.10 ± 2.43	0.3 ± 2.8	0.041
p-value	0.965	0.697		
Diabetes control status				
Absent	5.28 ± 2.27	3.81 ± 2.4	1.46 ± 3.14	< 0.001
Present	4.28 ± 1.87	4.16 ± 2.35	0.11 ± 2.60	0.317
p-value	< 0.001	0.609		
Age (Completed years)				
< 30	4.45 ± 2.03	4.13 ± 2.36	0.2 ± 3.0	0.587
31–45	4.58 ± 2.18	4.09 ± 2.57	0.4 ± 3.0	0.172
46–60	4.42 ± 1.93	3.98 ± 2.32	0.4 ± 2.8	0.022
> 60	4.47 ± 1.96	4.09 ± 2.47	0.3 ± 2.5	0.169
p-value	0.939	0.916		
Sex				
Female	4.51 ± 2.06	4.16 ± 2.36	0.3 ± 2.7	0.066
Male	4.43 ± 1.95	3.97 ± 2.44	0.4 ± 2.8	0.018
p-value	0.337	0.274		
Marital status				
Married	4.45 ± 1.99	4.07 ± 2.42	0.3 ± 2.8	0.016
Single	4.65 ± 2.04	3.80 ± 2.28	0.8 ± 2.4	0.013
p-value	0.230	0.156		
Educational qualification				

Table 4 (continued)

	Negative coping	Positive Coping	Net coping	*p*-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Illiterate	4.45 ± 1.97	4.16 ± 2.36	0.19 ± 2.72	0.437
Can read only	4.57 ± 1.72	4.57 ± 2.64	0.14 ± 2.34	0.877
Can read and write	5.17 ± 2.04	4.25 ± 2.61	0.83 ± 2.99	0.185
Primary	4.76 ± 2.39	3.92 ± 2.49	0.81 ± 2.46	0.052
Middle	4.70 ± 2.21	4.43 ± 2.57	0.14 ± 3.17	0.670
High School	4.21 ± 1.97	3.78 ± 2.33	0.34 ± 2.85	0.157
Graduate & above	4.40 ± 1.82	3.96 ± 2.36	0.41 ± 2.68	0.043
p-value	0.859	0.219		
Current Occupation				
Clerical, shop-owner, farmer	4.67 ± 2.10	4.25 ± 2.39	0.0 ± 4.2	0.950
Others	4.39 ± 1.90	4.18 ± 2.32	0.2 ± 2.6	0.666
Profession	4.53 ± 1.93	3.87 ± 2.35	0.5 ± 2.9	0.126
Semi-profession	4.44 ± 1.97	3.37 ± 2.13	0.6 ± 2.5	0.072
Semi-skilled worker	3.80 ± 0.84	5.60 ± 3.51	0.0 ± 4.2	> 0.999
Skilled worker	4.11 ± 1.89	4.22 ± 2.24	0.0 ± 2.7	0.943
Unemployed/homemaker	4.43 ± 2.48	4.13 ± 2.48	0.4 ± 2.8	0.010
Unskilled worker	4.75 ± 2.50	2.0 ± 00	1.3 ± 0.5	0.015
p-value	0.616	0.568		
Average Monthly income				
Unstable	4.36 ± 1.98	3.91 ± 2.38	0.4 ± 2.7	0.027
< 10,000	4.50 ± 2.05	3.72 ± 2.29	0.7 ± 2.8	< 0.001
> 10,000	4.64 ± 1.97	4.80 ± 2.50	0.3 ± 3.0	0.319
p-value	0.363	< 0.001		
Tobacco				
Current users and Ever user	4.71 ± 2.20	3.10 ± 1.76	1.59 ± 2.86	< 0.001
Never user	4.44 ± 1.98	4.13 ± 2.44	0.23 ± 2.77	0.048
p-value	0.160	< 0.001		
Alcohol				
Current users and Ever user	4.55 ± 2.06	3.75 ± 2.25	0.76 ± 2.74	< 0.001
Never user	4.43 ± 1.97	4.16 ± 2.46	0.18 ± 2.81	0.18
p-value	0.228	0.023		
Co-existing Hypertension				
No	4.42 ± 2.01	4.01 ± 2.47	0.37 ± 2.67	0.01
Yes	4.50 ± 1.98	4.07 ± 2.34	0.31 ± 2.98	0.10
p-value	0.197	0.443		

dynamics of distress and coping over time, as well as interventions that effectively enhance coping strategies among diabetic patients.

In conclusion, this study underscores the complex interplay between diabetes control, distress, and coping mechanisms in patients attending an NCD screening clinic, emphasising the interplay between socio-demographic factors, diabetes control, and coping mechanisms. The findings highlight the need for a holistic approach to diabetes management that addresses not only the physical aspects of the disease but also the emotional and psychological well-being of patients. Tailored interventions focusing on improving coping strategies and reducing distress, particularly among vulnerable groups such as those with lower educational levels, unstable incomes, and uncontrolled diabetes, could play a critical role in enhancing the overall quality of life for individuals living with diabetes.

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Author contributions
MV, SD, PK: conceptualised the study, developed an analytical framework, interpreted the results, and wrote the first draft of the manuscript; OS, VE, KB: Acquisition of data, analysis of data, and writing of the first draft; NK, RK, SK: interpreted local policy implications of the results and reviewed and approved the early and advanced drafts of the manuscript. All authors reviewed the manuscript.

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Data availability
The data is available with the first author and is available upon reasonable request.

Declarations

Ethics approval
The study was ethically approved by the Institutional Ethics Committee of all India Institute of Medical Sciences Bathinda wide letter number: ORCID iD: Madhur Verma: https://orcid.org/0000-0002-1787-8392.

Patient and public involvement
Patients and the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

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Competing interests
The authors declare no competing interests.

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