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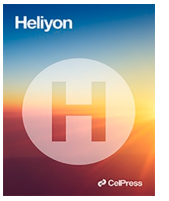

Association between diabetes distress and sociodemographic and/or socioeconomic factors among adults: A cross-sectional study

Aya Ibrahim [a], Aya Rida [a], Diana Dakroub [a], Sarah Cherri [a], Hala Fahs [a], Jana Hammoud [a], Souheil Hallit [b,c,d], Sami El Khatib [e,f], Ahmed E. Altyar [g,h], Mohamed M. Abdel-Daim [i,j], Mohamad Rahal [a], Nehmat Ghaboura [k,*], Diana Malaeb [l,**]

[a] Lebanese International University, School of Pharmacy, Lebanon
[b] School of Medicine and Medical Sciences, Holy Spirit University of Kaslik, P.O. Box 446, Jounieh, Lebanon
[c] Research Department, Psychiatric Hospital of the Cross, P.O. Box 60096, Jal Eddib, Lebanon
[d] Applied Science Research Center, Applied Science Private University, Amman, Jordan
[e] Department of Biomedical Sciences, Lebanese International University, Bekaa, Lebanon
[f] Center for Applied Mathematics and Bioinformatics (CAMB), Gulf University for Science and Technology, Kuwait
[g] Department of Pharmacy Practice, Faculty of Pharmacy, King Abdulaziz University, P.O. Box 80260, Jeddah 21589, Saudi Arabia
[h] Pharmacy Program, Batterjee Medical College, P.O. Box 6231 Jeddah 21442, Saudi Arabia
[i] Department of Pharmaceutical Sciences, Pharmacy Program, Batterjee Medical College, P.O. Box 6231 Jeddah 21442, Saudi Arabia
[j] Pharmacology Department, Faculty of Veterinary Medicine, Suez Canal University, Ismailia 41522, Egypt
[k] Department of Pharmacy Practice, Pharmacy Program, Batterjee Medical College, P.O. Box 6231 Jeddah 21442, Saudi Arabia
[l] College of Pharmacy, Gulf Medical University, Ajman, United Arab Emirates

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ABSTRACT

Diabetes-related distress (DRD) is a psychological syndrome with worsened prognosis in uncontrolled diabetic patients. The current study aimed to assess the factors contributing to DRD among the Lebanese population using the Diabetes Distress Scale (DDS-17) score and its sub-scores. A cross-sectional analysis was conducted between March and September 2021 enrolling. 125 diabetic from six Lebanese governorates through an online survey. The survey included two parts: the first section gathered sociodemographic data sociodemographic and socioeconomic data and the second one focused on assessing the Diabetes Distress Scale (DDS-17) score. Participants 30 years old and above had higher emotional distress compared to younger patients, (65.2 % versus 45.5 %). Those with a primary educational level showed significantly higher emotional distress than those with a secondary and tertiary level of education (72.5 %, versus 66.7 % and 46.4 %). Participants who were treated with both insulin and non-insulin medications or had a diastolic blood pressure of more than 90 mmHg showed significantly moderate to high distress (63.6 % or 53.8 %). Participants who lived in rural areas showed higher distress (35.6 %). Obese and overweight had significant moderate to high distress (64.1 %, and 48.0 %). The same results were found in non-married (divorced or widowed) and married participants (76.9 % and 51.3 %). The association between medical history with total distress showed that participants with glycemic store HbA1c of more than 6.5 followed by those who had HbA1c between 5.7 and 6.4 showed

* Corresponding author.
** Corresponding author.
E-mail addresses: sami.khatib@liu.edu.lb (S. El Khatib), aealtyar@kau.edu.sa (A.E. Altyar), abdeldaim.m@vet.suez.edu.eg (M.M. Abdel-Daim), nehmatghbaoura@gmail.com, pharmacy8.jed@bmc.edu.sa (N. Ghaboura), dr.diana@gmu.ac.ae (D. Malaeb).

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moderate to high total distress (45.9 % and 40.0 %). It is concluded that the prevalence of DRD is high in Lebanon, more common among rural residents, and among participants high HbA1c, low educational level, unmarried and on complex treatment regimens. Screening for DRD and providing better support can optimize clinical outcomes.

1. Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder delineated by reduced and/or absence of insulin secretion from the pancreas and/or insulin resistance leading to impaired glucose uptake, decreased glucose storage, and altered carbohydrate and lipid metabolism) [1]. Globally the prevalence of DM ranges from 8.8 % to 65.5 % among the age of 20 and 79 years, with approximately 463 million adults being diagnosed with diabetes [2,3]. In Lebanon, the prevalence of DM is 7.8 % within an age range similar to the global population [4].

DM one of the most common non-communicable diseases requires ongoing medical treatment and multifactorial risk-reduction strategies along with strict regulation of glycemia [5].

Poor glycemic control engenders vast complications that can manifest either as macrovascular complications or as microvascular complications [6,7]. The progression of the complications can be delayed by achieving the target glycemic goal through improving patient medication compliance and inhancing awareness about self-management behaviors [8]. Self-management, a vital component in DM care, refers to the individual inherent capacity to manage symptoms, minimize physical and psychological disorders, and implement healthy lifestyle measures [9]. DM exerts a profound impact on the psychosocial well-being and affects mental health which is manifested as (depression, anxiety and stress, persistent fear of hypoglycemia, impaired eating habits, and development of diabetes-related distress ([DRD]) [10,11].

DRD, the most common psychological comorbid condition. Encompasses various negative feelings as worrying, frustration, and dependency among type II diabetic patients [8,12]. The manifestation of DRD can be elucidated by patients' emotional response to the diagnosis, the menace of complications, apprehension about support and access to care, and the multi self-management strategies as frequent monitoring of blood glucose, regular follow up with both a healthy dietary plan, and physical activity. It is further associated with detrimental consequences as it impedes the achievement of optimal therapeutic outcomes, impairs appropriate self-care and hinders medication adherence [13]. Consequently, the risk of DRD progression is increased by uncontrolled DM, -development of complications, -concomitant medical conditions, -and complicated treatment regimens [14,15]. In addition to the disease burden, there are other factors that heighten the risk of DRD as lower level of education, younger age, sedentary life, unhealthy diet, and poor self-care behavior [16,17]. Diabetic patients suffer from both DRD and depression where DRD is viewed as a predisposing factor for depression [18].

Several studies have shown that depression and DRD can interrupt self-management, impair glycemic control, increase the risk of complications and, mortality, and decrease the quality of life. Yet, DRD has been shown in previous studies to exert greater impact than depression on complications [19,20].

Two questionnaires were developed to assess DRD, the Problem Areas in Diabetes (PAID) questionnaire and the Diabetes Distress Scale (DDS) −17 [21]. DDS-17 was recently developed and addressed the apparent drawbacks of the PAID since PAID focused and addressed only the emotional aspect of diabetes distress [21]. It is utterly ascertained and commonly advocated for appraising the degree of distress in participants with DM. Both questionnaires have their advantages in appraising DRD, but the DDS-17 is more precise and has an improved questionnaire structure compared with PAID [21].

Since participants with DM are susceptible to develop microvascular and macrovascular complications and psychological manifestations, and are at higher risk to have distress so, we conduct this study among diabetics.

To our knowledge, no studies have been assessed the factors contributing to DRD among the Lebanese population using the DDS-17 score and its sub-scores, so this cross-sectional study aims to assess the DRD and its associated factors among adult participants with diabetes in Lebanon.

2. Methods

2.1. Study Design and Procedure

An online cross-sectional survey was carried out between March and September 2021, enrolled = from the six Lebanese governorates (Beirut, Mount Lebanon, Nabatiyeh, South, and Beqaa/Baalbeck-Hermel/North) using the snowball sampling method since the Lebanese Government imposed a COVID-19 lockdown. Participants in this study were conveniently recruited via a Google Form link. The research team members distributed this link through various social media platforms such as WhatsApp, Facebook, and Instagram, relying on their personal networks. Recipients of the link were then encouraged to share it with their acquaintances, including friends and family members. To be eligible for participation, individuals had to be Lebanese citizens who were diabetic (type 1 or type 2), 18 years of age or older, regardless of gender, and residing within the country.

To maintain the integrity of the survey, IP addresses were monitored to ensure that no participant submitted multiple responses. The study commenced with an introductory paragraph, clarifying the study's objectives, assuring the anonymity of participants, and emphasizing the voluntary nature of their consent to participate in the research. Once participants provided their digital informed

consent, they were asked to complete a set of instruments. These instruments were presented in a pre-randomized sequence to mitigate any potential order-related effects. It's important to note that the survey was conducted anonymously, and participants willingly took part without receiving any compensation.

2.2. Sample size

The Centers for Disease Control and Prevention's Epi info™ software (version 7, Georgia, United States) was used to calculate the required minimal sample [22]. Considering a prevalence of 7.8 % of DM in Lebanon, a minimum sample size of 112 participants was required to have a study power of 80 %, and a confidence interval (CI) of 95 %.

2.3. Ethical aspects

The study protocol was approved by the Research and Ethics Committee of the School of Pharmacy at the Lebanese International University (2021RC-007-LIUSOP). Participation was voluntary and informed consent was obtained from all participants before filling the questionnaire. Privacy and confidentiality of participants were respected.

2.4. Questionnaire

The self-administered questionnaire was in Arabic, the native language in Lebanon, and required approximately 10–15 min to complete **(*See Supplementary Information*).** The first section of the questionnaire covered the sociodemographic and socioeconomic factors, including gender, age, weight, and height. Body mass index (BMI) was calculated using the weight and height, and categorized into four categories: underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obese (≥30 kg/m^2) [23]. It included cigarette smoking status (yes or no), waterpipe smoking status (yes or no), alcohol intake (yes or no), marital status (single, married, divorced, or widowed), employment status (yes or no), employment in healthcare (yes or no), residence (urban or rural), education level (primary, secondary, or tertiary), medical history (cardiovascular, DM), and medication history (oral antidiabetics, insulin, or both).

Additionally, laboratory values were included and categorized as follows: total cholesterol (<200, 200–239, or ≥ 240 mg/dL), high-density lipoprotein (HDL) (< or ≥ 40 mg/dL), low-density lipoprotein (LDL) (<100, 100–129, 130–159, 160–189, or ≥190 mg/dL), triglycerides (TG) (<150, 150–199, or ≥ 200–499 mg/dL) [24], fasting blood glucose (FBG) (<100, 100–125, or ≥126 mg/dL), hemoglobin A1C (HbA1c) (healthy <5.7, pre-diabetic 5.7–6.4, or DM ≥ 6.5 %) [1], systolic blood pressure (SBP) (<120, 120–129, 130–139, or ≥140 mmHg), and diastolic blood pressure (DBP) (<80, 80–89, or ≥90 mmHg) [25]. Participants were asked to provide any pertinent laboratory data in the past six months. Family income was divided into three categories: low (<1,500,000 Lebanese Lira), intermediate (1,500,000–3,000,000 Lebanese Lira), and high (>3,000,000 Lebanese Lira).

The second section consisted of the DDS-17 score. It was developed by Polonsky et al. [26] and was translated into the Arabic language and validated in Saudi Arabia [27]. The alpha coefficient of the questionnaire was 0.95. The questionnaire is composed of 17 questions grouped in four sub-components: five questions about emotional burden (EB), they included the following questions "Feeling that diabetes is taking up too much of my mental and physical energy every day", "Feeling angry, scared and/or depressed when I think about living with diabetes", "Feeling that I will end up with serious long-term complications, no matter what I do", "Feeling that diabetes controls my life", "Feeling overwhelmed by the demands of living with diabetes".

Five questions about regimen-related distress (RD)

Not feeling confident in my day-to-day ability to manage diabetes.

Feeling that I am not testing my blood sugars frequently enough.

Feeling that I am often failing with my diabetes routine.

Feeling that I am not sticking closely enough to a good meal plan.

Three questions about interpersonal-related distress (ID)

Feeling that friends or family are not supportive enough of self-care efforts (e.g. planning activities that conflict with my schedule, encouraging me to eat the "wrong" foods)

Feeling that friends or family don't appreciate how difficult living with diabetes can be.

Feeling that friends or family don't give me the emotional support that I would like,

and four questions about physician-related distress (PD)

Feeling that my doctor doesn't know enough about diabetes and diabetes care.

Feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes.

Feeling that my doctor doesn't take my concerns seriously enough.

Feeling that I don't have a doctor who I can see regularly enough about my diabetes.

Physician-related distress (PD). Each question is rated on a 6-point scale from 1 (no problem) to 6 (A very serious problems).

The score was calculated by adding up the participant's responses to the relevant questions and then dividing this sum by the total number of questions within that particular scale. For the calculation of the total DDS- 17, responses of all questions were added and divided by 17.

The total score and its sub-components were interpreted according to the mean score.

- Score below than 2 indicates little or no distress

- Score of two and above indicates moderate-high distress.

2.5. Statistical analysis

Descriptive statistics were used to describe patient characteristics, with frequencies and percentages for categorical variables and mean ± standard deviation for continuous variables. The chi-square or Fisher's exact tests were used for categorical variables, and student T-test or Mann Whitney tests were used for continuous variables. A p value < 0.05 was statistically significant, with an acceptable margin of error of 5 %. Fisher or Pearson Chi Square tests between two categorical variables were both used. The relationship between categorical and continuous variables, on the other hand, was examined using either the student T test or the ANOVA test.

3. Results

3.1. Sociodemographic characteristics and medical history

Out of the 125 participants enrolled in this study, 90 were females (72.1 %) with a mean age of 49 years. Approximately a third and half of the participants were between 18 and 30 years and were above 30 years, respectively (26.4 % and 52.8 %, respectively). In addition, 50, 78, and 78 participants were overweight, married, and unemployed, respectively (40.3 %, 62.4 % and 62.4 %,

Table 1
Sociodemographic characteristics.

Sociodemographic characteristics	Frequency (%)
Gender	
Male	59 (47.2)
Female	66 (52.8)
Age, Mean ± SD	49 ± 18
Age Range (years)	
18–30	33 (26.4)
>30	92 (73.6)
BMI	
Underweight	3 (2.4)
Desirable weight	32 (25.8)
Overweight	50 (40.3)
Obese	39 (31.5)
Marital status	
Single	34 (27.2)
Married	78 (62.4)
Divorced/widowed	13 (10.4)
Employment status	
Unemployed	78 (62.4)
Employed	47 (37.6)
Work type	
Healthcare worker	10 (8.0)
Non-Healthcare worker	115 (92.0)
Dwelling region	
Beirut	23 (18.4)
Mount Lebanon	40 (32.0)
Beqaa/Baalbeck-Hermel/North	12 (9.6)
South Lebanon	27 (21.6)
Nabatiyeh	23 (18.4)
Residence area	
Rural	59 (47.2)
Urban	66 (52.8)
Educational level	
Primary (school)	51 (40.8)
Secondary (high school)	18 (14.4)
Tertiary (university)	56 (44.8)
Monthly income	
Low income	80 (64.0)
Medium income	25 (20.0)
High income	20 (16.0)
Smoking cigarettes	
No	95 (76.0)
Yes	30 (24.0)
Smoking waterpipe	
No	104 (83.2)
Yes	21 (16.8)

BMI: body mass index; DM: diabetes mellitus.

Table 2
Medical and medication history, and distress scores.

Medical history	Frequency (%)
Cardiovascular diseases	
No	81 (64.8)
Yes	44 (35.2)
DM	
Type I	37 (29.6)
Type II	88 (70.4)
DM duration (years)	
0–10	75 (60.0)
>10	50 (40.0)
DM medications	
Insulin	13 (14.1)
Non-insulin	68 (73.9)
Both	11 (12.0)
FBG (mg/L)	
<100	8 (7.8)
100–125	44 (42.7)
≥126	51 (49.5)
HbA1c (%)	
<5.7	8 (8.5)
5.7–6.4	25 (26.6)
≥6.5	61 (64.9
SBP (mmHg)	
<120	11 (14.9)
120–129	18 (24.3)
130–139	21 (28.4)
>140	24 (32.4)
DBP (mmHg)	
<80	22 (40.0)
80–89	20 (36.4)
>90	13 (23.6)
HDL (mg/L)	
<40	20 (60.6)
>40	13 (39.4)
TG (mg/L)	
<150	19 (40.4)
150–199	10 (21.3)
200–499	18 (38.3)
TC (mg/L)	
<200	29 (56.9)
200–239	15 (29.4)
>240	7 (13.7)
LDL (mg/L)	
<100	13 (34.2)
100–129	7 (18.4)
130–159	12 (31.6)
160–189	5 (13.2)
>190	1 (2.6)
Emotional distress	
Little-no distress	50 (40.0)
Moderate-high distress	75 (60.0)
Physician distress	
Little-no distress	93 (74.4)
Moderate-high distress	32 (25.6)
Regimen distress	
Little-no distress	63 (50.4)
Moderate-high distress	62 (49.6)
Interpersonal distress	
Little-no distress	92 (73.6)
Moderate-high distress	33 (26.4)
Total distress	
Little-no distress	73 (58.4)
Moderate-high distress	52 (41.6)

FBG: fasting blood glucose, HbA1c: Glycated hemoglobin SBP: systolic blood pressure, DBP: diastolic blood pressure, HDL: high-density lipoprotein, TG: triglyceride, TC: total cholesterol, LDL: low-density lipoprotein.

Table 3
Associations between sociodemographic characteristics and medical history of the participants and emotional and physician distress.

Variables	Emotional distress		*p* value	Physician distress		*p* value
	Little to no distress N = 50 (%)	Moderate to high distress N = 75 (%)		Little to no distress N = 93 (%)	Moderate to high distress N = 32 (%)	
Gender						
Male	25 (42.4)	34 (57.6)	0.715	46 (78.0)	13 (22.0)	0.418
Female	25 (37.9)	41 (62.1)		47 (71.2)	19 (28.8)	
Age range (years)						
18–30	18 (54.5)	15 (45.5)	**0.047***	29 (87.9)	4 (12.1)	**0.039***
>30	32 (34.8)	60 (65.2)		64 (69.3)	28 (30.4)	
Age, Mean ± SD	45.980 ± 1870	51.347 ± 18.063	0.112	46.699 ± 19.272	50.656 ± 2.845	0.607
BMI						
Normal	16 (45.7)	19 (54.3)	0.177	25 (71.4)	10 (28.6)	0.868
Overweight	23 (46.0)	27 (54.0)		38 (76.0)	12 (24.0)	
Obese	11 (28.2)	28 (71.8)		30 (76.9)	9 (23.1)	
Marital status						
Single	17 (50.0)	17 (50.0)	0.232	29 (85.3)	5 (14.7)	0.107
Married	30 (38.5)	48 (61.5)		53 (67.9)	25 (32.1)	
Divorced or widowed	3 (23.1)	10 (76.9)		11 (84.6)	2 (15.4)	
Employment status						
Unemployed	31 (39.7)	47 (60.3)	1	58 (74.4)	20 (25.6)	1
Employed	19 (40.4)	28 (59.6)		35 (74.5)	12 (25.5)	
Work						
Healthcare worker	6 (60.0)	4 (40.0)	0.197	8 (80.0)	2 (20.0)	1
Non-Healthcare worker	44 (38.3)	71 (61.7)		85 (73.9)	30 (26.1)	
Dwelling region						
Beirut	11 (47.8)	12 (52.2)	0.761	17 (73.9)	6(26.1)	0.743
Mount Lebanon	16 (40.0)	24 (60.0)		31 (77.5)	9 (22.5)	
Beqaa/Baalbek/ North	3 (25.0)	9 (75.0)		7 (58.3)	5 (41.7)	
South Lebanon	10 (37.0)	17 (63.0)		21 (77.8)	6 (22.2)	
Nabatiyeh	10 (43.5)	13 (56.5)		17 (73.9)	6 (26.1)	
Residence Area						
Rural	23 (39.0)	36 (61.0)	0.857	47 (79.7)	12 (20.3)	0.224
Urban	27 (40.9)	39 (59.1)		46 (69.7)	20 (30.3)	
Educational level						
Primary (school)	14 (27.5)	37 (72.5)	**0.018***	40 (78.4)	11 (21.6)	**0.007***
Secondary (high school)	6 (33.3)	12 (66.7)		8 (44.4)	10 (55.6)	
Tertiary (university)	30 (53.6)	26 (46.4)		45 (80.4)	11 (19.6)	
Monthly Income						
Low income	32 (40.0)	48 (60.0)	0.835	58 (72.5)	22 (27.5)	0.530
Medium income	11 (44.0)	14 (56.0)		18 (72.0)	7 (28.0)	
High income	7 (35.0)	13 (65.0)		17 (85.0)	3 (15.0)	
Smoking cigarette						
No	38 (40.0)	57 (60.0)	1	73 (76.8)	22 (23.2)	0.337
Yes	12 (40.0)	18 (60.0)		20 (66.7)	10 (33.3)	
Alcohol intake						
No	50 (41.7)	70 (58.3)	0.083	89 (74.2)	31 (25.8)	1
Yes	0 (0.0)	5 (100.0)		4 (80.0)	1 (20.0)	
Smoking waterpipe						
No	39 (37.5)	65 (62.5)	0.229	73 (70.2)	31 (29.8)	**0.025***
Yes	11 (52.4)	10 (47.6)		20 (95.2)	1 (4.8)	
Cardiovascular diseases						
No	36 (44.4)	45 (55.6)	0.055	62 (76.5)	19 (23.5)	0.522
Yes	14 (31.8)	30 (68.2)		31 (70.5)	13 (29.5)	
DM						
Type I	16 (43.2)	21 (56.8)	0.857	26 (70.3)	11 (29.7)	0.397
Type II	32 (39.0)	50 (61.0)		61 (74.4)	21 (25.6)	
I don't know	2 (33.3)	4 (66.7)		6 (100.0)	0 (0.0)	
DM duration (years)						
0–10	32 (42.7)	43 (57.3)	0.576	55 (73.3)	20 (26.7)	0.835
>10	18 (36.0)	32 (64.0)		38 (76.0)	12 (24.0)	
DM medications						
No	15 (46.9)	17 (53.1)	0.406	27 (84.4)	5 (15.6)	0.163
Yes	35 (37.6)	58 (62.4)		66 (71.0)	27 (29.0)	
DM medications type						

(*continued on next page*)

Table 3 (*continued*)

Variables	Emotional distress		*p* value	Physician distress		*p* value
	Little to no distress N = 50 (%)	Moderate to high distress N = 75 (%)		Little to no distress N = 93 (%)	Moderate to high distress N = 32 (%)	
Insulin	5 (38.5)	8 (61.5)	0.386	9 (69.2)	4 (30.8)	**0.033***
Non-Insulin	28 (41.2)	40 (58.8)		52 (76.5)	16 (23.5)	
Both	2 (18.2)	9 (81.8)		4 (36.4)	7 (63.6)	
FBG (mg/L)						
<100 healthy	2 (25.0)	6 (75.0)	0.195	6 (75.0)	2 (25.0)	1
100-125 pre-diabetic	22 (50.0)	22 (50.0)		31 (70.5)	13 (29.5)	
≥126 diabetic	17 (33.3)	34 (66.7)		36 (70.6)	15 (29.4)	
HbA1c (%)						
<5.7 healthy	6 (75.0)	2 (25.0)	0.114	7 (87.5)	1 (12.5)	0.584
5.7–6.4 pre-diabetic	11 (44.0)	14 (56.0)		19 (76.0)	6 (24.0)	
≥6.5 diabetic	22 (36.1)	39 (63.9)		43 (70.5)	18 (29.5)	
SBP (mmHg)						
<120	5 (45.5)	6 (54.5)	0.527	6 (54.5)	5 (45.5)	0.510
120–129	8 (44.4)	10 (55.6)		13 (72.2)	5 (27.8)	
130–139	8 (38.1)	13 (61.9)		14 (66.7)	7 (33.3)	
≥140	6 (25.0)	18 (75.0)		19 (79.2)	5 (20.8)	
DBP (mmHg)						
<80	8 (36.4)	14 (63.6)	0.776	13 (59.1)	9 (40.9)	**0.019***
80–89	9 (45.0)	11 (55.0)		18 (90.0)	2 (10.0)	
≥90	4 (30.8)	9 (69.2)		6 (46.2)	7 (53.8)	
TC (mg/L)						
<200	14 (48.3)	15 (51.7)	0.123	19 (65.5)	10 (34.5)	0.321
200–239	3 (20.0)	12 (80.0)		13 (86.7)	2 (13.3)	
≥240	4 (57.1)	3 (42.9)		6 (85.7)	1 (14.3)	
LDL (mg/L)						
<100	5 (38.5)	8 (61.5)	0.134	9 (69.2)	4 (30.8)	0.767
100–129	6 (85.7)	1 (14.3)		6 (85.7)	1 (14.3)	
130–159	4 (33.3)	8 (66.7)		10 (83.3)	2 (16.7)	
160–189	2 (40.0)	3 (60.0)		3 (60.0)	2 (40.0)	
≥190	1 (100.0)	0 (0.0)		1 (100.0)	0 (0.0)	
HDL (mg/L)						
>40	8 (40.0)	12 (60.0)	0.493	16 (80.0)	4 (20.0)	0.681
≤40	7 (53.8)	6 (46.2)		9 (69.2)	4 (30.8)	
TG (mg/L)						
<150	9 (47.4)	10 (52.6)	0.092	16 (84.2)	3 (15.8)	0.330
150–199	7 (70.0)	3 (30.0)		6 (60.0)	4 (40.0)	
200–499	5 (27.8)	13 (72.2)		14 (77.8)	4 (22.2)	

BMI: Body mass index, DM: diabetes mellitus, FBG: fasting blood glucose, HbA1c: Glycated hemoglobin, SBP: systolic blood pressure, DBP: diastolic blood pressure, TC: total cholesterol, LDL: low-density lipoprotein, HDL: high-density lipoprotein, TG: triglyceride, SD: standard deviation.

respectively). Half of the participants lived in urban areas (52.8 %), and two thirds had low income (64.0 %). A summary of sociodemographic characteristics is provided in Table 1.

Participants had different comorbidities with the most common disease being DM type II (70.4 %) for less than 10 years (60.0 %) treated with non-insulin medications (73.9 %), The second disease was cardiovascular diseases (35.2 %). The participants had mainly little to no physician, regimen, interpersonal and total distress (74.4 %, 50.4 %, 73.6 % and 58.4 %, respectively). Details about medical and medication history, and distress scores are listed in Table 2.

Associations between sociodemographic characteristics and medical history of the participants and different types of distress.

Participants of 30 years and above had higher emotional distress compared to younger patients, (65.2 % versus 45.5 %, p value = 0.047). Those with primary educational level showed significantly higher emotional distress than those with a secondary and tertiary level of education (72.5 %, versus 66.7 % and 46.4 %, respectively, p value = 0.018). The association between sociodemographic characteristics and physician distress showed that participants of 30 years and above had more distress than younger participants (30.4 % versus 12.1 %, p value = 0.039). Participants with secondary educational level had significantly higher distress than those with primary and tertiary level of education (55.6 % versus 21.6 % and 19.6 %, respectively, p value = 0.007). Non-smokers had a significant distress (29.8 %, p value = 0.025). However, the association between medical history with physician distress showed that participants who were treated with both insulin and non-insulin medications or had DBP more than 90 mmHg showed significantly moderate to high distress (63.6 %, p value = 0.033 or 53.8 %, p value = 0.019). Associations between sociodemographic characteristics and medical history of the participants and emotional and physician distress are presented in Table 3.

The association between sociodemographic characteristics with interpersonal distress showed that participants who lived in Beqaa/Baalbek/North Lebanon followed by Nabatiyeh (58.3 % versus 39.1 %, p value = 0.021) along with those who lived in rural area showed higher distress (35.6 %, p value = 0.041). There was a significant relation between age and interpersonal distress as those with an aged between 18 and 30 years had distress more than those with ages above 30 years (39.4 % versus 21.7 %, p value = 0.048).

Table 4
Associations between sociodemographic characteristics and medical history of the participants and interpersonal and regimen distress.

Variables	Interpersonal distress		*p* value	Regimen distress		*p* value
	Little to no distress N = 92 (%)	Moderate to high distress N = 33 (%)		Little to no distress N = 63 (%)	Moderate to high distress N = 62 (%)	
Gender						
Male	46 (78.0)	13 (22.0)		28) 47.5)	31 (52.5)	0.593
Female	46 (69.7)	20 (30.3)	0.317	35 (53.0)	31 (47.0)	
Age range (years)						
18–30	20 (60.6)	13 (39.4)		24 (72.7)	9 (27.3)	**0.003***
>30	72 (78.3)	20 (21.7)	**0.048***	39 (42.4)	53 (57.6)	
Mean age ±SD	51.239 ± 18.027	43.515 ± 18.766	**0.039***	46.508 ± 20.276	51.935 ± 16.135	0.1
BMI						
Normal	25 (71.4)	10 (28.6)		23 (65.7(	12 (34.3(	**0.037***
Overweight	37 (74.0)	13 (26.0)		26 (52.0(	24 (48.0(	
Obese	30 (76.9)	9 (23.1)	0.812	14 (35.9(	25) 64.1(	
Marital status						
Single	22 (64.7)	12 (35.3)	0.398	22 (64.7)	12 (35.3)	**0.038***
Married	60 (76.9)	18 (23.1)		38 (48.7)	40 (51.3)	
Divorced or widowed	10 (76.9)	3 (23.1)		3 (23.1)	10 (76.9)	
Employment status						
Unemployed	55 (70.5)	23 (29.5)	0.403	41 (52.6(	37 (47.4(	0.582
Employed	37 (78.7)	10 (21.3)		22 (46.8(	25 (53.2(	
Work						
Healthcare worker	9 (90.0)	1 (10.0)	0.289	8 (80.0(	2 (20.0(	0.095
Non-Healthcare worker	83 (72.2)	32 (27.8)		55 (47.8(	60 (52.2(	
Dwelling region						
Beirut	20 (87.0)	3 (13.0)	**0.021***	13 (56.5)	10 (43.5)	0.714
Mount Lebanon	32 (80.0)	8 (20.0)		19 (47.5)	21 (52.5)	
Beqaa/Baalbek/North	5 (41.7)	7 (58.3)		4 (33.3)	8 (66.7)	
South Lebanon	21 (77.8)	6 (22.2)		15 (55.6)	12 (44.4)	
Nabatiyeh	14 (60.9)	9 (39.1)		12 (52.2)	11 (47.8(	
Residence Area						
Rural	38 (64.4)	21 (35.6)	**0.041***	32 (54.2)	27 (45.8)	0.475
Urban	54 (81.8)	12 (18.2)		31 (47.0)	35 (53.0)	
Educational level						
Primary (school)	41 (80.4)	10 (19.6)	0.342	20 (39.2)	31 (60.8)	**0.021***
Secondary (high school)	13 (72.2)	5 (27.8)		7 (38.9)	11 (61.1)	
Tertiary (university)	38 (67.9)	18 (32.1)		36 (64.3)	20 (35.7)	
Monthly Income						
Low income	58 (72.5)	22 (27.5)	0.135	40 (50.0)	40 (50.0)	0.225
Medium income	16 (64.0)	9 (36.0)		10 (40.0)	15 (60.0)	
High income	18 (90.0)	2 (10.0)		13 (65.0)	7 (35.0)	
Smoking cigarette						
No	69 (72.6)	26 (27.4)	0.813	47 (49.5)	48 (50.5)	0.835
Yes	23 (76.7)	7 (23.3)		16 (53.3)	14 (46.7)	
Alcohol						
No	88 (73.3)	32 (26.7)	1	61 (50.8)	59 (49.2)	0.680
Yes	4 (80.0)	1 (20.0)		2 (40.0)	3 (60.0)	
Smoking waterpipe						
No	74 (71.2)	30 (28.8)	0.190	51 (49.0)	53 (51.0)	0.663
Yes	18 (85.7)	3 (14.3)		12 (57.1)	9 (42.9)	
Cardiovascular diseases						
No	58 (71.6)	23 (28.4)	0.532	43 (53.1)	38 (46.9)	0.457
Yes	34 (77.3)	10 (22.7)		20 (45.5)	24 (54.5)	
DM						
Type I	23 (62.2)	14 (37.8)	0.113	21 (56.8)	16 (43.2)	0.129
Type II	65 (79.3)	17 (20.7)		37 (45.1)	45 (54.9)	
I don't know	4 (66.7)	2 (33.3)		5 (83.3)	1 (16.7)	
DM duration (years)						
0–10	58 (77.3)	17 (22.7)	0.302	41 (54.7)	34 (45.3)	0.276
>10	34 (68.0)	16 (32.0)		22 (44.0)	28 (56.0)	
DM medications						
No	21 (65.6)	11 (34.4)	0.252	20 (62.5)	12 (37.5)	0.151
Yes	71 (76.3)	22 (23.7)		43 (46.2)	50 (53.8)	
DM medications type						
Insulin	9 (69.2)	4 (30.8)	0.664	9 (69.2)	4 (30.8)	0.109
Non-Insulin	53 (77.9)	15 (22.1)		30 (44.1)	38 (55.9)	

(*continued on next page*)

Table 4 (*continued*)

Variables	Interpersonal distress		*p* value	Regimen distress		*p* value
	Little to no distress N = 92 (%)	Moderate to high distress N = 33 (%)		Little to no distress N = 63 (%)	Moderate to high distress N = 62 (%)	
Both	8 (72.7)	3 (27.3)		3 (27.3)	8 (72.7)	
FBG (mg/L)						
<100 healthy	7 (87.5)	1 (12.5)	0.703	5 (62.5)	3 (37.5)	0.219
100-125 pre-diabetic	31 (70.5)	13 (29.5)		24 (54.5)	20 (45.5)	
≥126 diabetic	38 (74.5)	13 (25.5)		20 (39.2)	31 (60.8)	
HbA1c (%)						
<5.7 healthy	5 (62.5)	3 (37.5)	0.519	6 (75.0)	2 (25.0)	0.226
5.7–6.4 pre-diabetic	16 (64.0)	9 (36.0)		13 (52.0)	12 (48.0)	
≥6.5 diabetic	46 (75.4)	15 (24.6)		26 (42.6)	35 (57.4)	
SBP (mmHg)						
<120	6 (54.5)	5 (45.5)	0.570	4 (36.4)	7 (63.6)	0.747
120–129	12 (66.7)	6 (33.3)		9 (50.0)	9 (50.0)	
130–139	16 (76.2)	5 (23.8)		9 (42.9)	12 (57.1)	
≥140	18 (75.0)	6 (25.0)		8 (33.3)	16 (66.7)	
DBP (mmHg)						
<80	17 (77.3)	5 (22.7)	0.407	8 (36.4)	14 (63.6)	0.368
80–89	13 (65.0)	7 (35.0)		11 (55.0)	9 (45.0)	
≥90	7 (53.8)	6 (46.2)		4 (30.8)	9 (69.2)	
TC (mg/L)						
<200	21 (72.4)	8 (27.6)	0.261	12 (41.4)	17 (58.6)	0.790
200–239	10 (66.7)	5 (33.3)		6 (40.0)	9 (60.0)	
≥240	7 (100.0)	0 (0.0)		4 (57.1)	3 (42.9)	
LDL (mg/L)						
<100	10 (76.9)	3 (23.1)	0.816	5 (38.5)	8 (61.5)	0.216
100–129	6 (85.7)	1 (14.3)		6 (85.7)	1 (14.3)	
130–159	10 (83.3)	2 (16.7)		5 (41.7)	7 (58.3)	
160–189	3 (60.0)	2 (40.0)		2 (40.0)	3 (60.0)	
≥190	1 (100.0)	0 (0.0)		1 (100.0)	0 (0.0)	
HDL (mg/L)						
>40	14 (70.0)	6 (30.0)	0.431	9 (45.0)	11 (55.0)	0.481
≤40	11 (84.6)	2 (15.4)		8 (61.5)	5 (38.5)	
TG (mg/L)						
<150	14 (73.7)	5 (26.3)	0.480	8 (42.1)	11 (57.9)	0.342
150–199	9 (90.0)	1 (10.0)		7 (70.0)	3 (30.0)	
200–499	12 (66.7)	6 (33.3)		8 (44.4)	10 (55.6)	

BMI: Body mass index, DM: diabetes mellitus, FBG: fasting blood glucose, HbA1c: Glycated hemoglobin, SBP: systolic blood pressure, DBP: diastolic blood pressure, TC: total cholesterol, LDL: low-density lipoprotein, HDL: high-density lipoprotein, TG: triglyceride, SD: standard deviation.

The association between sociodemographic characteristics with regimen distress showed that ages above 30 years had more distress than ages between 18 and 30 years (57.6 % versus 27.3 %, p value = 0.003). Obese and overweight participants had a significant moderate to high distress (64.1 %, and 48.0 %, respectively, p value = 0.037). The situation was similar for non-married (divorced or widowed) and married participants (76.9 % and 51.3 %, respectively, p value = 0.038), and those with secondary high school and primary school (61.1 % and 60.8 %, respectively, p value = 0.021) (Table 4).

The association between medical history with total distress showed that participants with HbA1c of more than 6.5 followed by those who had HbA1c between 5.7 and 6.4 showed moderate to high total distress (45.9 % and 40.0 %, p value = 0.035) (Table 5).

Multinomial logistic regression was used to assess sociodemographic characteristics (independent variables) associated with a nominal/categorical dependent variable (little to no distress versus moderate-severe distress). The results of the multinomial logistic regression, acknowledged as being moderate-severe distress vs. little to no distress as the dependent variable and each variable as an independent variable, showed that high school level of education (aOR = 29.93) was significantly associated with higher odds of having moderate-severe physical distress and residence area outside Beirut (aOR = 15.42) was significantly associated with higher odds of having moderate-severe interpersonal distress, whereas advanced age (aOR = 0.97), and having university level of education (aOR = 0.4) were significantly associated with lower odds of being in the moderate -severe total distress **(**Table 6**, Model 1).**

4. Discussion

DRD is a common health issue that frequently accompanies DM [28]. Our study showed that a noted percentage of participants (41.6 %) had moderate to high DRD, with emotional distress being the most common type of distress (60.0 %). These results were in accordance with a study conducted in Bangladesh by Islam et al. [29] as it revealed that most of their study participants (48.5 %) had DRD (22.4 % high, and 26.1 % moderate), and with emotional distress being its most common concern in their study. Our findings are aligned with the results of a study conducted in Nigeria conducted by Belonwu et al. [16], where 51.9 % of participants had DRD. However, our findings revealed that DRD was more common among Lebanese adults with DM in comparison to other countries.

Table 5
Associations between sociodemographic characteristics and medical history of the participants and total distress.

Variables	Total distress		*p* value
	Little to no distress N = 73 (%)	Moderate to high distress N = 52 (%)	
Gender			
Male	36 (61.0)	23 (39.0)	0.591
Female	37 (56.1)	29 (43.9)	
Age range (years)			
18–30	24 (72.7)	9 (27.3)	0.052
>30	49 (53.3)	43 (46.7)	
Age, Mean ± SD	47.397 ± 19.517	51.731 ± 16.741	0.186
BMI			
Normal	21 (60.0)	14 (40.0)	0.265
Overweight	33 (66.0)	17 (34.0)	
Obese	19 (48.7)	20 (51.3)	
Marital status			
Single	24 (70.6)	10 (29.4)	0.201
Married	43 (55.1)	35 (44.9)	
Divorced or widowed	6 (46.2)	7 (53.8)	
Employment status			
Unemployed	50 (64.1)	28 (35.9)	0.134
Employed	23 (48.9)	24 (51.1)	
Work			
Healthcare worker	7 (70.0)	3 (30.0)	0.520
Non-Healthcare worker	66 (57.4)	49 (42.6)	
Dwelling region			
Beirut	14 (60.9)	9 (39.1)	0.415
Mount Lebanon	23 (57.5)	17 (42.5)	
Beqaa/Baalbek/North	4 (33.3)	8 (66.7)	
South Lebanon	18 (66.7)	9 (33.3)	
Nabatiyeh	14 (60.9)	9 (39.1)	
Residence Area			
Rural	37 (62.7)	22 (37.3)	0.370
Urban	36 (54.5)	30 (45.5)	
Educational level			
Primary (school)	26 (51.0)	25 (49.0)	0.070
Secondary (high school)	8 (44.4)	10 (55.6)	
Tertiary (university)	39 (69.6)	17 (30.4)	
Monthly Income			
Low income	44 (55.0)	36 (45.0)	0.274
Medium income	14 (56.0)	11 (44.0)	
High income	15 (75.0)	5 (25.0)	
Smoking cigarette			
No	58 (61.1)	37 (38.9)	0.297
Yes	15 (50.0)	15 (50.0)	
Alcohol			
No	71 (59.2)	49 (40.8)	0.648
Yes	2 (40.0)	3 (60.0)	
Smoking waterpipe			
No	59 (56.7)	45 (43.3)	0.472
Yes	14 (66.7)	7 (33.3)	
Cardiovascular diseases			
No	51 (63.0)	30 (37.0)	0.186
Yes	22 (50.0)	22 (50.0)	
DM			
Type I	22 (59.5)	15 (40.5)	0.906
Type II	47 (57.3)	35 (42.7)	
I don't know	4 (66.7)	2 (33.3)	
DM duration (years)			
0–10	47 (62.7)	28 (37.3)	0.269
>10	26 (52.0)	24 (48.0)	
DM medications			
No	21 (65.6)	11 (34.4)	0.408
Yes	52 (55.9)	41 (44.1)	
DM medications Type			
Insulin	8 (61.5)	5 (38.5)	0.407
Non-Insulin	39 (57.4)	29 (42.6)	
Both	4 (36.4)	7 (63.6)	
FBG (mg/L)			
<100 healthy	4 (50.0)	4 (50.0)	0.257

(*continued on next page*)

Table 5 (*continued*)

Variables	Total distress		*p* value
	Little to no distress N = 73 (%)	Moderate to high distress N = 52 (%)	
100-125 pre-diabetic	29 (65.9)	15 (34.1)	
≥126 diabetic	25 (49.0)	26 (51.0)	
HbA1c (%)			
<5.7 healthy	8 (100.0)	0 (0.0)	**0.035***
5.7–6.4 pre-diabetic	15 (60.0)	10 (40.0)	
≥6.5 diabetic	33 (54.1)	28 (45.9)	
SBP (mmHg)			
<120	6 (54.5)	5 (45.5)	0.415
120–129	8 (44.4)	10 (55.6)	
130–139	13 (61.9)	8 (38.1)	
≥140	9 (37.5)	15 (62.5)	
DBP (mmHg)			
<80	10 (45.5)	12 (54.5)	0.283
80–89	13 (65.0)	7 (35.0)	
≥90	5 (38.5)	8 (61.5)	
TC (mg/L)			
<200	17 (58.6)	12 (41.4)	0.482
200–239	7 (46.7)	8 (53.3)	
≥240	5 (71.4)	2 (28.6)	
LDL (mg/L)			
<100	8 (61.5)	5 (38.5)	0.6
100–129	6 (85.7)	1 (14.3)	
130–159	6 (50.0)	6 (50.0)	
160–189	3 (60.0)	2 (40.0)	
≥190	1 (100.0)	0 (0.0)	
HDL (mg/L)			
>40	11 (55.0)	9 (45.0)	0.485
≤40	9 (69.2)	4 (30.8)	
TG (mg/L)			
<150	12 (63.2)	7 (36.8)	0.550
150–199	7 (70.0)	3 (30.0)	
200–499	9 (50.0)	9 (50.0)	

BMI: Body mass index, DM: diabetes mellitus, FBG: fasting blood glucose, HbA1c: Glycated hemoglobin, SBP: systolic blood pressure, DBP: diastolic blood pressure, TC: total cholesterol, LDL: low-density lipoprotein, HDL: high-density lipoprotein, TG: triglyceride, SD: standard deviation.

Alijuaid et al. indicated that 25.0 % of the participants had DRD in Saudi Arabia [30]. Alzughbi et al.. Showed that 22.3 % of participants in Saudi Arabia had DRD [31]. A study in Vietnam and in Thailand by Nguyen et al. [32], and Tunsuchart et al. [33] showed that 12.5 %, and 8.9 % of the participants had DRD, respectively. The percentage in our study is higher, possibly because there is an economic crisis ongoing in Lebanon [34,35] aggravated by the COVID-19 lock down [36], and the explosion of the Port in the capital city, Beirut [37], when the study was conducted.

Concerning the educational level, Islam et al. study [29] showed that participants who had primary educational level had higher total DRD score compared to those who had minimum a secondary educational level. In addition, Islam et al. revealed that people who had a primary educational level had more emotional distress, which is aligned with our findings. Addressing other sub-scores of the DDS-17 score showed that those with secondary educational level had more physician related distress and regimen related distress whereas those with primary education had more emotional distress. Research demonstrates a notable correlation between educational attainment and mental health outcomes [38]. Individuals holding a High School Diploma or less tend to exhibit poorer mental health, whereas those possessing an academic associate degree, bachelor's degree, or higher educational qualifications tend to experience more favorable mental health outcomes. As for treatment regimen, studies have shown that there is a positive correlation between treatment adherence and educational level. So the less the educated the patient the less for him to be adhere to treatment which might cause low treatment outcome and hence increase his distress [39]. Moving on to the physician related distress, a study by Fiscella et al. showed that the less educated patients had similar overall visit satisfaction to the physicians Clinique, however, they were less likely to have their expectations met, and that might cause them distress [40].

Adding to this, Islam et al. revealed that people who lived in the sub-urban (rural) areas had a significant higher emotional distress than those who live in the urban area. Our results also revealed that persons who live in the sub-urban areas had a significantly higher distress, but for the interpersonal distress sub-score. This could be because participants living in rural areas might face multiple drawbacks, including low access to DM education [41] medical services [42], poor cell phone signal and internet access [43], limited transportation, long travel distance, as well as higher rates of poverty [44].

Moving on to medication regimen, Islam et al. [29] study revealed that those who take a combination of oral and injectable medications had higher distress, which is in accordance with our findings where participants on a combination of oral and injectable medications had more physician related distress. A study by Yeh et al. showed that complex treatment regimens are harder to implement for participants and can cause more distress [45]. In the realm of type 2 diabetes mellitus (T2DM) management, the

Table 6
Multivariable analysis: Binary regression, taking different types of distresses as the dependent variables.

Variables	OR	CI	P value
Emotional distress			
LDL			
100-129 vs < 100	0.062	0.003–1.112	0.059
130-159 vs < 100	1.249	0.190–8.198	0.817
160-189 vs < 100	0.940	0.098–9.010	0.957
≥190 vs < 100	0	0.000–0.000	1.000
TG			
150-199 vs < 150	0.397	0.053–2.984	0.369
200-499 vs < 150	6.134	0.593–63.464	0.128
Physical distress			
Educational level			
High school vs. primary	29.932	1.853–483.412	0.017
University vs. primary	1.028	0.167–6.311	0.976
DM medication type			
Non-insulin vs. insulin	0.268	0.027–2.714	0.265
Both vs insulin	5.953	0.332–106.745	0.226
DBP ranges			
80-89 vs < 80	0.088	0.007–1.102	0.059
>90 vs < 80	4.246	0.539–33.470	0.170
Interpersonal distress			
Age	0.972	0.948–0.997	0.028
Dwelling region			
Mount Lebanon vs Beirut	1.337	0.298–6.009	0.705
Beqaa/Baalbek/North vs Beirut	15.426	2.364–100.660	0.004
South Lebanon vs Beirut	1.660	0.340–8.102	0.531
Nabatiyeh vs Beirut	3.148	0.662–14.972	0.149
Monthly income			
Medium income vs Low income	1.287	0.429–3.860	0.653
High income vs Low income	0.184	0.029–1.176	0.074
Smoking waterpipe			
Yes vs no	0.315	0.078–1.281	0.106
Regimen distress			
Age	0.943	0.892–0.998	0.041
BMI			
Overweight vs Normal	1.109	0.279–4.409	0.883
Obese vs Normal	5.238	1.170–23.449	0.030
Total distress			
Educational level			
High school vs. primary	1.372	0.457	0.573
University vs. primary	0.400	0.176	0.029

evolving demands of this progressive disease often necessitate the implementation of additional pharmacological interventions or modifications to existing medication regimens over time. Patients afflicted with uncontrolled diabetes, especially when compounded by diabetic complications, typically find themselves exposed to an increased pharmacotherapeutic load. Consequently, this therapeutic approach contributes to the escalation in the complexity of the treatment regimen. It is proposed that patients with T2DM get into a cycle of poor glycemic control, increased medication complexity, hence as increased risk for distress [46].

Our study showed that participants who are obese had more emotional distress which is in accordance with Islam et al. study [29]. Obesity might be associated with total distress since obese persons may have poor body estimation and require extra attention in diets, exercise, and weight-loss medications; all of these variables may exacerbate their mental health [47]. Another study by Huizinga et al. showed that BMI was significantly and negatively associated with physician perception of medication adherence. This might cause regimen related distress [48].

For the marital status, Alijuaid et al. [30] showed that divorced marital status had a significant regimen distress compared to single, married, and widowed participants in Saudi Arabia. These findings are in accordance with our study results. That is because divorced people tend to have higher levels of distress than single and married persons [49].

For the HbA1c levels, Islam et al. [29], Alijuaid et al. [30], Belonwu et al. [16], Alzughbi et al. [31], and Van Bang et al. [32], studies showed that participants who had higher HbA1c levels had more DRD, which is in accordance with our study. As a higher level of HbA1c reflects treatment failure and this could be attributed to more distress [50].

Majed et al. and Islam et al. showed that smokers tend to have more level of physician related distress. This was opposite to our findings as our study revealed that non-smokers had more physician distress. The relationship between smoking and distress is bidirectional, as some people tend to use smoking to relieve distress [51].

Concerning the association between DRD and the age, Alzughbi et al. revealed that age below 45 years was significantly associated with DRD in Saudi Arabia. Belonwu et al. showed that younger age is associated with higher levels of distress in Nigeria. Our study revealed that young patients who's (age is between 18 and 30 years) had more interpersonal distress, but for the other sub-scores, it was more common among older participants (age >30 years). These findings can be explained by Jaser et al., as he stated that the

diagnosis of DM at a young age, might affect the mental status of the patient causing him more distress [52].

4.1. Limitations

Our study was conducted using a self-administered survey that reflected the participants' point of view, and possible incorrect interpretation of the questions. The study is a cross-sectional one, hence a causal relationship between the factors and distress can't be confirmed. Our study did not assess the mental and physical health in the recruited participants population, and we did not correlate it with socioeconomic and sociodemographic characteristics.

4.2. Strengths

This study was the first of its kind to be conducted in Lebanon to study the association between patients' characteristics and DRD.

5. Conclusion

DRD is prevalent in Lebanon. It is most common among people living in rural areas, having high HbA1c, low educational level, being divorced or widowed, and on complex treatment regimens. Screening for distress may provide better support, decrease DRD complications and optimize clinical outcomes.

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Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e21767.

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