


Surabhi Gupta<sup>1</sup>, Lydia Solomon<sup>2</sup>, Jubbin Jagan Jacob<sup>1</sup> 

<sup>1</sup>Department of Endocrinology, Christian Medical College and Hospital, Ludhiana, India

<sup>2</sup>Department of Medicine, Christian Medical College and Hospital, Ludhiana, India

# Diabetic distress and work-related stress among individuals with type 2 diabetes mellitus

## ABSTRACT

**Background:** Work-related diabetes distress was a term introduced in the context of type 1 diabetes mellitus (T1DM). Currently, there are no studies evaluating the contribution of work-related stress to overall diabetes distress among employed persons with type 2 diabetes mellitus (T2DM).

**Methods:** Adult patients over the age of 21 years with T2DM in full-time employment for over a year were interviewed after informed consent. Diabetes distress was identified with the 17-question diabetes distress scale (DDS) and work-related stress was evaluated using the Siegrist effort-reward imbalance (ERI) questionnaire. DDS scores  $\geq 3.0$  were considered significant diabetes distress and effort-reward ratio  $> 1.0$  was considered indicative of work stress.

**Results:** One hundred and thirteen patients consented. 68/133 (51.2%) had clinically significant diabetes distress. Work-related stress was seen in 67/113 (50.3%) of patients. Prevalence of work stress was higher among those with clinically significant diabetes distress (62%) compared to those without diabetes distress (38%) ( $p$ -value = 0.007). Spearman's Rho correlation between diabetic distress and effort-reward imbalance was found to be moderately positively correlated ( $r_s = 0.27$  [2 tailed]  $p = .002$ ).

Address for correspondence:

Prof. Jubbin Jagan Jacob

Department of Endocrinology

Christian Medical College and Hospital Ludhian

Punjab, India

e-mail: jubbin.jacob@gmail.com

Clinical Diabetology 2022, 11; 1: 11–14

DOI: 10.5603/DK.a2022.0005

Received: 16.09.2021

Accepted: 20.12.2021

**Conclusions:** Increased work stress that manifests as an imbalance between effort and reward is associated with increased diabetes distress among employed persons with T2DM. The measure of diabetes distress needs to include work stress as a component to complete the picture. (Clin Diabetol 2022, 11; 1: 11–14)

**Keywords:** diabetes distress, type 2 diabetes mellitus, effort-reward imbalance (ERI), work stress, diabetes distress scale (DDS)

## Introduction

Diabetes distress encompasses the emotional distress (worries, fears, and concerns) that accompanies living and managing a demanding chronic disease like diabetes mellitus with regards to its therapy, threats of acute and chronic complications, and access to care [1]. The diabetes distress score (DDS) questionnaire has been specifically developed for adults with type 2 diabetes mellitus (T2DM) and is among the three common tools used to quantify and monitor diabetes distress. Clinically significant diabetes distress has been reported in 18% (India) to 42% (United States) among adults with T2DM [2, 3]. A recent meta-analysis of 55 studies suggested 36% of patients with T2DM exhibit diabetes distress [4].

Diabetes distress is primarily influenced by age, gender, duration of diabetes, type of diabetes, insulin use, body mass index, glucose control, education levels, and presence of complications like neuropathy and retinopathy [2, 5, 6]. Work-related stress has unfavorable effects on general health but is difficult to quantify. One of the measures used in occupational

health to quantify work stress is a tool called effort-reward imbalance (ERI) [7]. Previous studies have suggested workers with higher ERI have more incident new diabetes [8], poor control of hypertension [9], and poor glucose control [10].

We aim to assess the relationship between diabetes distress and work stress among employed patients with T2DM.

## Methods

### Study design and setting

This was a cross-sectional questionnaire-based study done among patients attending the endocrinology clinics of Christian Medical College and Hospital, Ludhiana which is a tertiary care hospital in Northern India. The study was approved by the institutional ethics committee of Christian Medical College, Ludhiana prior to any patient enrollment. The protocol was also registered prospectively as a short-term studentship project of the Indian Council of Medical Research (STS -2019-07197) for the first author ([http://14.139.60.56:84/Result/STS\\_2019\\_Application\\_Result.pdf](http://14.139.60.56:84/Result/STS_2019_Application_Result.pdf)). They also provided funding to the first author for the study. Patients were recruited between 1<sup>st</sup> July 2019 and 31<sup>st</sup> August 2019.

### Study subjects

Adult patients ( $\geq 21$  years) with T2DM for over 12 months and who were in full-time employment for at least 1 year prior to the day of the interview were enrolled if they provided informed consent. Patients with unclassified diabetes, type 1 diabetes mellitus (T1DM), secondary diabetes, and gestational diabetes were excluded. Additionally, patients with significant neurological disease, significant hearing impairment, a psychiatric disease requiring treatment, women who were currently pregnant or breastfeeding, and those who did not understand English, Hindi, or Punjabi were also excluded.

### Methods and questionnaires used

Demography and details about diabetes mellitus were noted from the patient's charts. Diabetes distress was identified using the 17-question DDS which has been standardized for patients with T2DM. Each of the 17 questions is rated on a 6-point Likert scale, from 'not a problem' to 'a serious problem'. Total scores are calculated using the mean item scores, which are then categorized as little or no distress ( $< 2.0$ ), moderate distress ( $\geq 2.0$  and  $\leq 2.9$ ), and high distress ( $\geq 3.0$ ) [11]. For our study we considered patients with DDS values of  $\geq 3.0$  to have clinically significant diabetes distress.

For assessment of work stress, we used the 2012 long version of the Siegrist's ERI questionnaire [12].

This is a standardized, self-reported measure of ERI, which also has 17 items: 11 measuring reward and 6 measuring effort. Data are collected from participants using four-point Likert scales. To compute the ER-ratio, the effort score is put in the numerator and the reward score in the denominator whereas the latter score is multiplied by a correction factor (0.5454) to adjust for the unequal numbers. ER-ratio values  $> 1.0$  indicate an imbalance between high effort and low reward and suggests the presence of work-related stress [12].

### Statistical methods

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of SPSS software, IBM manufacturer, Chicago, USA, version 21.0. The categorical variables were analyzed using chi-square test and quantitative variables were analyzed using the unpaired student t-test. Spearman rho test was used to find a correlation between two non-parametric variables.

## Results

One hundred and thirty-three consecutive patients with T2DM who were eligible and consented were recruited. 68/133 (51.2%) of patients had clinically significant diabetes distress. In the group with DDS  $< 3$  (no distress) there were 65 patients with a mean age of 47.5 years, of whom 75% were male, and in the group of DDS  $> 3$  (significant distress) the number of patients was 68 with a mean age of 48.2 years, and 82% were male ( $p = \text{NS}$ ). The body mass index (BMI), duration of diabetes, blue/white-collar job distribution was also similar in both these groups.

However, in the group with diabetes distress significantly more patients were on insulin (59% vs. 40%,  $p$ -value 0.03), had significantly higher HbA1c (7.9% vs. 7.5%,  $p$ -value 0.02), significantly higher ER ratios (1.08 vs. 0.95,  $p$ -value 0.02), and significantly higher number of patients with effort-reward imbalance (ERI)  $> 1$  (62% vs. 38%,  $p$ -value 0.007). More detailed baseline details of patients with and without diabetes distress are given in Table 1.

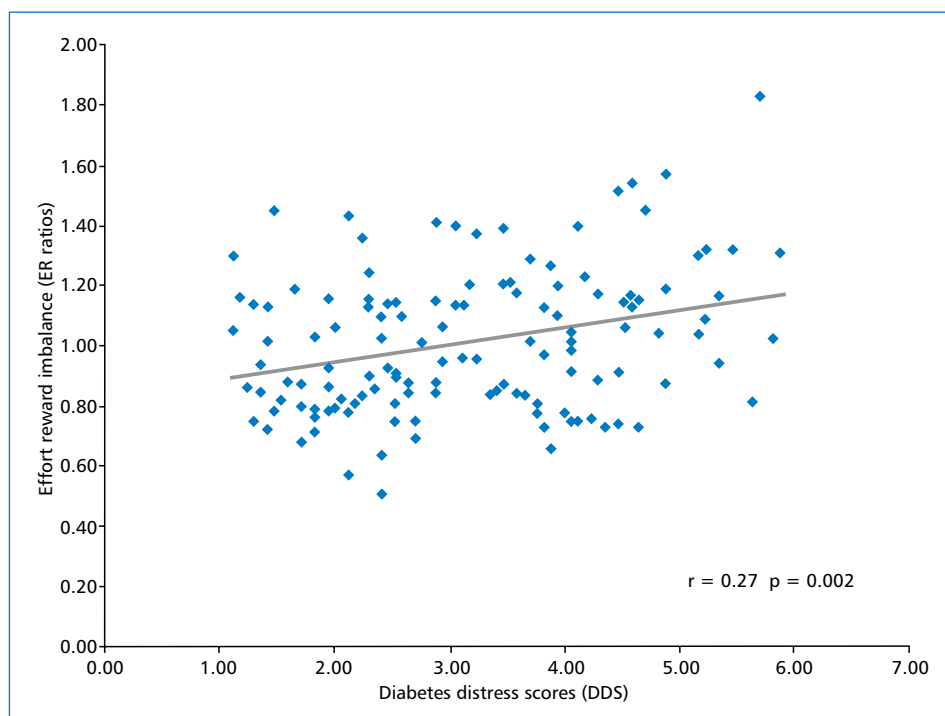
Work stress defined as a higher level of efforts at work with lower levels of rewards (ER-ratio  $> 1.0$ ) was present in 67/133 (50.3%) of patients. Prevalence of work stress was higher among those with clinically significant diabetes distress (62%) compared to those without diabetes distress (38%) ( $p = 0.007$ ).

A Spearman's Rho correlation between diabetic distress and effort-reward imbalance was also done. Spearman's Rho  $r_s = 0.27$  (2 tailed);  $p = .002$ . DDS and ERI were found to be moderately positively correlated. This is depicted in Figure 1.

**Table 1. Comparison of baseline data and effort-reward imbalance ratios between subjects with clinically not significant diabetes distress (< 3) and those with clinically significant diabetes distress ( $\geq 3$ )**

	Subjects with clinically insignificant distress (n = 65)	Clinically significant diabetes distress (n = 68)	P
Age [years] (mean $\pm$ SD)	47.5 $\pm$ 6.6	48.2 $\pm$ 7.7	0.52
Male gender n (%)	49 (75)	56 (82)	0.32
Occupation			
Blue collar workers	33 (51)	30 (44)	0.44
White collar workers n (%)	32 (49)	38 (56)	
BMI [kg/m <sup>2</sup> ] (mean $\pm$ SD)	28.9 $\pm$ 3.2	28.6 $\pm$ 3.9	0.56
Duration of T2DM [years] (mean $\pm$ SD)	6.7 $\pm$ 3.7	7.6 $\pm$ 4.2	0.19
Insulin use n (%)	26 (40)	40 (59)	0.03
HbA1c [%] (mean $\pm$ SD)	7.5 $\pm$ 1.0	7.9 $\pm$ 1.1	0.02
ER-ratio (mean $\pm$ SD)	0.95 $\pm$ 0.21	1.08 $\pm$ 0.24	0.001
ERI < 1 n (%)	40 (62)	26 (38)	0.007
ERI > 1 n (%)	25 (38)	42 (62)	0.007

BMI — body mass index; T2DM — type 2 diabetes mellitus; ERI — effort-reward imbalance; ER ratio — effort-reward ratio; SD — standard deviation



**Figure 1.** Scatter plot showing the relationship between diabetes distress scale (DDS) scores and effort-reward imbalance (ERI) ratio values among employed adult patients with type 2 diabetes mellitus

## Discussion

Our data suggest that in addition to the use of insulin and poor glycemic control, work-related stress was significantly associated with diabetes distress. Diabetes distress was found in 51% of employed adults with T2DM and work-related stress (defined as an

ER-ratio > 1.0) was found in over 50% of these individuals. Work stress was 1.6 fold higher among those who had clinically significant diabetes distress

The term work-related diabetes distress (WRDD) was first introduced by Hakkarainen et.al from Finland in the context of T1DM [13]. A recent paper suggested

that a combination of WRDD and significant diabetes distress among workers with T1DM was associated with intentional work-related hyperglycemia and poor overall glucose control [14].

This is probably the first paper looking at work stress and diabetes distress among patients with T2DM. In its current construct, the diabetes distress scale only includes emotional, regimen burden, interpersonal, and physician-related distress components [15]. A more complete picture of ongoing distress requires assessment of work-related distress to complete the scale and provide better interventions. The primary drawback of this study was the cross-sectional design rather than a cohort design. A cohort would have given a better understanding of the relationship between diabetes distress, work stress, and outcomes in patients with T2DM.

In conclusion, increased work stress that manifests as an imbalance between effort and reward is associated with increased diabetes distress among employed persons with T2DM.

## Funding

This study was funded via a short-term studentship (STS) project of the Indian Council of Medical Research (ICMR) (STS -2019-07197).

## Conflict of interest

None declared.

## REFERENCES

1. Fisher L, Polonsky WH, Hessler D. Addressing diabetes distress in clinical care: a practical guide. *Diabet Med.* 2019; 36(7): 803–812, doi: [10.1111/dme.13967](https://doi.org/10.1111/dme.13967), indexed in Pubmed: [30985025](https://pubmed.ncbi.nlm.nih.gov/30985025/).
2. Gahlan D, Rajput R, Gehlawat P, et al. Prevalence and determinants of diabetes distress in patients of diabetes mellitus in a tertiary care centre. *Diabetes Metab Syndr.* 2018; 12(3): 333–336, doi: [10.1016/j.dsx.2017.12.024](https://doi.org/10.1016/j.dsx.2017.12.024), indexed in Pubmed: [29301728](https://pubmed.ncbi.nlm.nih.gov/29301728/).
3. Fisher L, Skaff MM, Mullan JT, et al. A longitudinal study of affective and anxiety disorders, depressive affect and diabetes distress in adults with type 2 diabetes. *Diabet Med.* 2008; 25(9): 1096–1101, doi: [10.1111/j.1464-5491.2008.02533.x](https://doi.org/10.1111/j.1464-5491.2008.02533.x), indexed in Pubmed: [19183314](https://pubmed.ncbi.nlm.nih.gov/19183314/).
4. Perrin NE, Davies MJ, Robertson N, et al. The prevalence of diabetes-specific emotional distress in people with type 2 diabetes: a systematic review and meta-analysis. *Diabet Med.* 2017; 34(11): 1508–1520, doi: [10.1111/dme.13448](https://doi.org/10.1111/dme.13448), indexed in Pubmed: [28799294](https://pubmed.ncbi.nlm.nih.gov/28799294/).
5. Snoek FJ, Bremner MA, Hermanns N. Constructs of depression and distress in diabetes: time for an appraisal. *Lancet Diabetes Endocrinol.* 2015; 3(6): 450–460, doi: [10.1016/S2213-8587\(15\)00135-7](https://doi.org/10.1016/S2213-8587(15)00135-7), indexed in Pubmed: [25995123](https://pubmed.ncbi.nlm.nih.gov/25995123/).
6. Kasteleyn MJ, de Vries L, van Puffelen AL, et al. Diacourse study group. Diabetes-related distress over the course of illness: results from the Diacourse study. *Diabet Med.* 2015; 32(12): 1617–1624, doi: [10.1111/dme.12743](https://doi.org/10.1111/dme.12743), indexed in Pubmed: [25763843](https://pubmed.ncbi.nlm.nih.gov/25763843/).
7. Siegrist J, Starke D, Chandola T, et al. The measurement of effort-reward imbalance at work: European comparisons. *Soc Sci Med.* 2004; 58(8): 1483–1499, doi: [10.1016/S0277-9536\(03\)00351-4](https://doi.org/10.1016/S0277-9536(03)00351-4), indexed in Pubmed: [14759692](https://pubmed.ncbi.nlm.nih.gov/14759692/).
8. Mutambudzi M, Siegrist J, Meyer JD, et al. Association between effort-reward imbalance and self-reported diabetes mellitus in older U.S. workers. *J Psychosom Res.* 2018; 104: 61–64, doi: [10.1016/j.jpsychores.2017.11.008](https://doi.org/10.1016/j.jpsychores.2017.11.008), indexed in Pubmed: [29275787](https://pubmed.ncbi.nlm.nih.gov/29275787/).
9. Trudel X, Milot A, Gilbert-Quimet M, et al. Effort-reward imbalance at work and the prevalence of unsuccessfully treated hypertension among white-collar workers. *Am J Epidemiol.* 2017; 186(4): 456–462, doi: [10.1093/aje/kwx116](https://doi.org/10.1093/aje/kwx116), indexed in Pubmed: [28486615](https://pubmed.ncbi.nlm.nih.gov/28486615/).
10. Xu W, Hang J, Gao W, et al. Association between effort-reward imbalance and glycosylated hemoglobin (HbA1c) among Chinese workers: results from SHISO study. *Int Arch Occup Environ Health.* 2012; 85(2): 215–220, doi: [10.1007/s00420-011-0650-7](https://doi.org/10.1007/s00420-011-0650-7), indexed in Pubmed: [21626311](https://pubmed.ncbi.nlm.nih.gov/21626311/).
11. Fisher L, Hessler DM, Polonsky WH, et al. When is diabetes distress clinically meaningful?: establishing cut points for the Diabetes Distress Scale. *Diabetes Care.* 2012; 35(2): 259–264, doi: [10.2337/dc11-1572](https://doi.org/10.2337/dc11-1572), indexed in Pubmed: [22228744](https://pubmed.ncbi.nlm.nih.gov/22228744/).
12. Siegrist J, Li J, Montano D. Psychometric properties of the Effort–Reward Imbalance Questionnaire. Düsseldorf, Germany: University Düsseldorf, 2014. . [http://www.uniklinik-duesseldorf.de/fileadmin/Datenpool/einrichtungen/institut\\_fuer\\_medizinische\\_soziologie\\_id54/ERI/PsychometricProperties.pdf](http://www.uniklinik-duesseldorf.de/fileadmin/Datenpool/einrichtungen/institut_fuer_medizinische_soziologie_id54/ERI/PsychometricProperties.pdf) (01.03.2019).
13. Hakkarainen P, Moilanen L, Hänninen V, et al. Work-related diabetes distress among Finnish workers with type 1 diabetes: a national cross-sectional survey. *J Occup Med Toxicol.* 2016; 11: 11, doi: [10.1186/s12995-016-0099-4](https://doi.org/10.1186/s12995-016-0099-4), indexed in Pubmed: [27006684](https://pubmed.ncbi.nlm.nih.gov/27006684/).
14. Hansen UM, Skinner T, Olesen K, et al. Diabetes distress, intentional hyperglycemia at work, and glycemic control among workers with type 1 diabetes. *Diabetes Care.* 2019; 42(5): 797–803, doi: [10.2337/dc18-1426](https://doi.org/10.2337/dc18-1426), indexed in Pubmed: [30765430](https://pubmed.ncbi.nlm.nih.gov/30765430/).
15. Polonsky WH, Fisher L, Earles J, et al. Assessing psychosocial distress in diabetes: development of the diabetes distress scale. *Diabetes Care.* 2005; 28(3): 626–631, doi: [10.2337/diacare.28.3.626](https://doi.org/10.2337/diacare.28.3.626), indexed in Pubmed: [15735199](https://pubmed.ncbi.nlm.nih.gov/15735199/).