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Associations between diabetes-related distress and predicted cardiovascular complication risks in patients with type 2 diabetes

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Abstract

Context: Diabetes-related distress (DRD) is experienced by nearly 50% of people with diabetes at any given time in their diagnosis. The effects of low socioeconomic status (SES) and lacking access to resources can increase DRD. In addition, cardiovascular (CV) complications associated with diabetes are associated with higher DRD scores.
Objectives: This study evaluated the associations between DRD and predicted CV risks in participants with type 2 diabetes.
Methods: This cross-sectional study included 234 individuals with low SES who were Medi-Cal (California version of Medicaid) beneficiaries and sought medical care at a safety-net clinic system. The Problem Areas in Diabetes (PAID) questionnaire assessed DRD levels. The United Kingdom Prospective Diabetes Study Risk Engine was utilized to predict 10-year risks for coronary heart disease (CHD), fatal CHD, stroke, and fatal stroke. A multivariate linear regression model was constructed between the two variables, including other variables to control for potential confounding factors, for assessing the associations.
Results: After controlling for potential confounders, participants' total PAID questionnaire scores were significantly associated with their 10-year predicted fatal CHD risks (B=0.060, 95% CI: [0.00084, 0.12], p=0.047).
Conclusions: After controlling for covariates, DRD levels exhibited a significant association with increased 10-year predicted fatal CHD risks in patients with type 2 diabetes and lower SES. Screening for DRD and provision of appropriate psychosocial interventions may reduce the risks of CHD in those with type 2 diabetes.

Keywords: cardiovascular complications; diabetes-related distress; psychosocial aspect of diabetes management; type 2 diabetes.

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The psychological impact of managing diabetes has been well established in the medical literature, with multiple studies illustrating a negative relationship between diabetes-related distress (DRD) and diabetes self-management decisions [1, 2]. The term "DRD" is to describe patients' psychological and behavioral responses to the diagnosis, management, and fear of complications associated with diabetes [3]. In 2016, the American Diabetes Association (ADA) released a position statement endorsing the use of validated screening tools to assess DRD by incorporating psychological interventions to address perceived gaps in psychological care and encourage optimal medical outcomes [4]. These gaps are often even larger in populations of lower socioeconomic status (SES) because of the strong link between mental and physical health [5]. Experiencing a lower SES often means access to fewer resources, including healthcare and mental-health–related ones. The lack of access often intensifies the distress experienced by those with DRD. This distress is only compounded by the management of a complicated chronic condition such as type 2 diabetes [5].

The Diabetes Attitudes Wishes and Needs (DAWN) study conducted in 2005 brought the prevalence and the impact of DRD to light. The study demonstrated that 41% of patients with diabetes (n=5,104) reported low perceived well-being [6]. Many providers recognized that patients' concerns relating to the condition negatively impacted the outcomes of diabetes management [6]. As one analysis of nearly 500,000 participants found with an average follow-up of 5.8 years, people with diabetes have a 25% increased risk of depression compared to participants without diabetes, which makes the importance of identifying, addressing, and managing distress among patients with diabetes particularly important [7]. This same trend has been associated between cardiovascular disease (CVD) and depression as well. Similarly, the second DAWN study (DAWN2), published in 2013, highlighted the importance of identifying DRD, revealing that study participants (n=8,596) believed their diabetes had negatively impacted their physical health (62.2%) and emotional well-being (46.2%) [8]. For a patient with diabetes, the necessary lifestyle modifications and long-term commitment to treatment are likely to be mentally taxing. This may create an environment in which it is more difficult for patients to manage their diabetes, leading to poorer physical health. Due to the complexity of this issue, early intervention is key to ensure minimizing the impact resulting from what this negative feedback loop can cause.

Previous studies have demonstrated the impact of DRD on long-term health outcomes [1, 2]. Fisher and colleagues [1, 2] investigated the cross-sectional and longitudinal relationships between DRD and HbA1c. These researchers determined that DRD exhibited significant time concordant relationships with HbA1c, suggesting that emotional distress secondary to diabetes management directly impacted diabetes clinical outcomes [1, 2]. Another study concluded that CVD risk factors were significantly associated with DRD [9]. In addition, DRD was the factor found to associate significantly with suboptimal glycemic management after adjusting for covariates [9].

A meta-analysis and systematic review totaling 346,037 people with diabetes and depression, and 614,574 with diabetes only, demonstrated that emotionally distressed patients with type 2 diabetes exhibit an increase in cardiovascular (CV) morbidity and mortality rates [10]. This meta-analysis found statistically significant findings, including a 48% increase in CV mortality, a 37% increase in CHD, and a 33% increase in stroke risk [10]. Comparably, there is less evidence in the literature on DRD as a separate risk factor for CV complication risks. A pilot study at a safety-net clinic in Northern California (n=48) revealed significant associations between DRD and predicted 10-year fatal and nonfatal CHD in patients with type 2 diabetes [11]. Several hypotheses have been proposed to explain this phenomenon, such as endothelial microparticles triggering pro-inflammatory signaling cascades, leading to endothelial damage and subsequent CVD [12]. Regardless of the underlying mechanism that causes CVD, the identification of DRD is an essential step in managing patients' psychological health and preventing the future development of CVD [12]. This study evaluated the associations between DRD and predicted CV risks in participants with type 2 diabetes. Thus, the authors hypothesized that significant associations exist between DRD and predicted 10-year CV risks in patients with type 2 diabetes.

Methods

Study design

This study employed an observational, cross-sectional design for data collection through a survey instrument, enrolling those seeking medical attention at two federally qualified health clinics, both Solano County Family Health Services, in Vallejo and Fairfield, CA. The Institutional Review Board at Touro University California and Solano County Family Health Services approved the research protocol (IRB # P-2314). All participants provided written informed consent on paper by the research team, including principal investigators and student researchers. The study received intramural funding by Touro University California, and each study participant was compensated for their time in the form of a gift card.

Setting

A member of the research team interviewed each participant in a patient room either before or after their clinic encounter to collect information utilizing the survey instrument. Data collection was performed from May 2015 to September 2017.

Participants

The inclusion criteria included patients: (1) with type 2 diabetes; (2) between 40 and 85 years of age; (3) who had at least one visit at a study site in the past year; and (4) who had been prescribed and taking at least one antidiabetic medication. The exclusion criteria included: (1) history of stroke and/or heart attack; (2) not able to complete or understand the Problem Areas in Diabetes (PAID) questionnaire (excluded after the interview); (3) insufficient information to calculate the complication risks at the point when the participant's electronic medical record was reviewed; and (4) a self-reported total PAID score of 0 (indicating no DRD from having to manage diabetes, thus excluded after the interview). No study participant was excluded due to having a self-reported total PAID score of 0. Potential subjects who presented to this safety-net clinic system for diabetes consultation services or primary care services were asked to participate in the study following the inclusion criteria. This clinic system only accepts patients with Medi-Cal health insurance coverage, and most Medi-Cal beneficiaries must meet the Medicaid income/financial eligibility at or below a certain threshold for receiving the health insurance coverage. Thus, most patients who seek medical care at this clinic system have lower SES, defined by and measurable via income, education level, and occupation.

This study's primary outcomes were to identify associations between the total PAID scores (an indicator of DRD level; independent variable) and the four levels of 10-year CV complication risks (dependent variable). Potential confounders were identified as depression status, systolic blood pressure, BMI, tobacco use, LDL-C levels, gender, and age.

The initial gathering of demographic information was from the clinic system's electronic medical records (EMRs), and the gathered information was confirmed with the participant before the interview for administering the study survey. Information relating to race/ethnicity was obtained within the "Patient Information" section in the EMR.

Data sources

This study utilized the PAID questionnaire to quantify participants' self-reported levels of DRD. The PAID questionnaire includes 20 questions about emotional distress, self-care behavior, and perceived diabetes burden [13]. The research team also utilized the United Kingdom Prospective Diabetes Study (UKPDS) Risk Engine 2.0 to predict 10-year fatal and nonfatal stroke and CHD risks for participants with diabetes [14].

The survey instrument's demographic data included age, sex, SES, ethnicity, exercise patterns, and current medical history. The SES was determined by proxies, such as education level, occupation, and income. For this study, the research team specifically utilized the occupation component for categorizing SES; the Nam-Powers-Boyd Occupational Status Scale was utilized to assess participants' occupations [15]. The reason for choosing occupation as the primary proxy was because occupation, to a certain extent, is a reflection of education, income, and social status as well as a demonstration of relative rank in social hierarchies. For the same reason, a participant's occupation has been utilized as a proxy to predict health outcomes in health studies [16].

The occupation status scale scores were stratified into three tiers: low (1–33), medium (34–66), and high (67–100). Individual annual income was categorized as: <$20,000; $20,000 to $34,999; $35,000 to $49,999; $50,000 to $75,000; or >$75,000. Ethnicity categorization was based on the UKPDS Risk Engine 2.0 with the categories: White, Afro-Caribbean, and Asian-Indian [14].

Study sample size

The study sample size was predetermined to be 206 with an alpha level at 0.05, power at 0.95, and squared partial correlation at 0.09, and both numbers of the test and control covariates were set at 5.

Quantitative variables

The predicated 10-year CV risks from the UKPDS Risk Engine 2.0 were reported in continuous data. This risk engine included two components: inputs and outputs. Input items included age, duration of diabetes, sex, atrial fibrillation status, ethnicity, smoking status, HbA1c, systolic blood pressure, total cholesterol, and HDL cholesterol; the four outputs were CHD, fatal CHD, stroke, and fatal stroke [14].

The information captured by the PAID questionnaire was in categorical data. The 20 questions in this instrument were in Likert-scale format with five options/scoring categories, e.g., "not a problem" (0), "minor problem" (1), "moderate problem" (2), "somewhat serious problem (3), and "serious problem" (4) [13]. A linear transformation process was performed, converting the data to continuous (e.g., summing the scores from all the questions and multiplying by 1.25 with a maximum score of 100). The exact statements on the PAID questionnaire can be found in the publication in 1995 by Polonsky and colleagues [13].

Statistical methods

To link DRD levels to predicted 10-year CV complication risks, the research team analyzed the data obtained from both instruments and constructed statistical models to examine the relationships between PAID scores and predicted 10-year CV risks. Statistical analyses were performed utilizing STATA Version 14.1 (College Station, TX). One simple linear regression model and one multivariate linear regression model were constructed between the two variables. The covariates included in the multivariate linear regression model were depression status, ethnicity, gender, age, insulin usage, number of diabetes medications, annual income, occupational index score, systolic blood pressure, BMI, and tobacco use.

Results

Demographics: participants and descriptive data

A total of 280 participants were interviewed, and survey data were collected from these individuals. Forty-six participants were subsequently excluded due to missing clinical data from their electronic medical records or exhibiting a zero on the PAID questionnaire (indicating no DRD). Among the 234 participants included in this study's analyses, 47.9% were male and 52.1% female. The study setting was a racially diverse setting, with Afro-Caribbean being the most common ethnicity (38.9%) in the sampled population. [Note: The UKPDS Risk Engine provided three categories of "ethnicity": White, Afro-Caribbean, and Asian-Indian.] The mean age was 56.7 years (ranging from 40 to 81), 54.3% of the participants either have smoked in the past or currently smoke, and 27.8% expressed a known depression status. A majority of the participants expressed participating in some form of physical activity at least 3 days a week (62.8%), utilizing insulin (60.7%), and having systolic blood pressure <140 mmHg (65.0%). These baseline characteristics are summarized in Table 1.

Social characteristics

According to the Nam-Powers-Boyd Occupational Status Scale, the average occupational index score was 35.5 (ranging from 1 to 94), which is equivalent to the occupational score of a receptionist in an administrative office or a bartender [15]. The maximum score on this scale is 100.

Clinical characteristics

The mean total PAID score was 22 ± 16.7 points (ranging from 1.25 to 78.5). The average BMI among all the

Table 1: Demographic characteristics (n=234).

Characteristics	Count	Percentage, %
Gender		
Male	112	47.9
Female	122	52.1
Ethnicity		
White	80	34.2
Afro-Caribbean	91	38.9
Asian-Indian	63	26.9
Occupational index score		
Low (1–33)	134	57.3
Medium (34–66)	67	28.6
High (67–100)	33	14.1
Individual annual income		
<$20,000	195	83.3
$20,000 to $34,999	23	9.8
$35,000 to $49,999	12	5.1
$50,000 to $75,000	3	1.3
>$75,000	1	0.4
Count, %	Yes	No
Smoking status		
Current	55 (23.5)	107 (45.7)
Prior	72 (30.8)	
Physical activities (at least three days per week)	147 (62.8)	87 (37.2)
Depression status	65 (27.8)	169 (72.2)
Insulin use	142 (60.7)	92 (39.3)
Systolic blood pressure <140 mmHg	152 (65.0)	82 (35.0)

Table 2: Descriptive statistics (n=234).

	Mean	SD	Minimum	Maximum
Total PAID score	22.0	16.7	1.25	78.75
Age, years	56.7	8.5	40	81
Occupational index score	35.5	23.1	1	94
BMI	33.5	8.1	20	63
HbA1c	9.0	2.3	5.5	16.5
Duration of diabetes, years	10.0	7.9	0.083	35
Lipid panel				
TG	180	106	49	991
LDL-C	97	45	18	400
TC	178	47	79	348
HDL-C	45	13	15	90
10-year predicted risks for cardiovascular complication via UKPDS risk engine, %				
CHD	14.6	11.0	1.4	57.8
Fatal CHD	10.4	9.1	0.5	47.9
Stroke[a]	6.7	4.8	0.8	21.6
Fatal stroke[b]	1.0	0.8	0.1	3.8

[a]Excluding outliers, n=221. [b]Excluding outliers, n = 224.BMI, body mass index; CHD, coronary heart disease; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; PAID, Problem Areas in Diabetes; SD, standard deviation; TC, total cholesterol; TG, triglycerides; UKPDS, United Kingdom Prospective Diabetes Study.

participants was 33.5 ± 8.1 kg/m^2 (ranging from 20 to 63). The mean HbA1c was 9.0 ± 2.3% (ranging from 5.5 to 16.5%), and the mean LDL-C level was 97 ± 45 mg/dL (ranging from 18 to 400 mg/dL). Participants had an average duration of diabetes of 10.0 ± 7.9 years (ranging from 0.25 to 35 years). Regarding the 10-year predicted risks for cardiovascular complications utilizing the UKPDS Risk Engine, participants in this study had an average risk for CHD of 14.6% and an average fatal CHD risk of 10.4%. With the exclusion of outliers, the mean stroke risk was 6.7%, and the mean fatal stroke risk was 1.0%. The descriptive statistics for these parameters, as well as for other lipid panel parameters, are summarized in Table 2. Table 3 summarizes stratified data based on the baseline characteristics and the UKPDS Risk Engine outputs. In addition, Table 4 shows the correlation coefficients between stratified PAID scores and the UKPDS Risk Engine outputs.

Main results

In the simple linear regression model, there was no statistical significance in the associations between the total PAID scores and the predicted CHD risks, fatal CHD risks, stroke risks, and fatal stroke risks; the results are summarized in Table 3. The multivariate linear regression model was constructed by incorporating covariates, and the results are summarized in Table 5. The total PAID scores were revealed to be significantly associated with the predicted 10-year fatal CHD risks (B=0.060, 95% CI: [0.00084, 0.12], p=0.047). For each unit increase in the total PAID score, the 10-year predicted fatal CHD risk was increased by 0.060%.

Discussion

Key result

The distinction between clinical depression and diabetes distress is worth mentioning here. Clinical depression is a mental health disorder with certain symptoms (e.g., loss of motivation and feeling down); on the other hand, diabetes distress is an emotional reaction—not a mental illness—to

Table 3: Stratified data based on baseline characteristics and UKPDS Risk Engine outputs.

	CHD			Fatal CHD			Stroke			Fatal stroke
	L*	M*	H*	L*	M*	H*	L*	M*	H*	L*
Gender										
Male	54	38	20	76	28	8	95	13	4	112
Female	96	22	4	107	12	3	110	10	2	122
Ethnicity										
White	36	30	14	55	19	6	71	7	2	80
Afro-Caribbean	81	9	1	86	4	1	81	7	3	91
Asian-Indian	33	21	9	42	17	4	53	9	1	63
Occupational index score										
Low (1–33)	90	33	11	111	19	4	116	15	3	134
Medium (34–66)	43	14	10	49	11	7	59	5	3	67
High (67–100)	17	13	3	23	10	0	30	3	0	33
Individual annual income										
<$20,000	121	53	21	151	36	8	170	19	6	195
$20,000 to $34,999	18	3	2	20	1	2	21	2	0	23
$35,000 to $49,999	8	3	1	9	2	1	11	1	0	12
$50,000 to $75,000	2	1	0	2	1	0	2	1	0	3
>$75,000	1	0	0	1	0	0	1	0	0	1
Subtotal (for each UKPDS risk engine output category)	150	60	24	183	40	11	205	23	6	234

*L, Low (<15%); M, Medium (15–30%); H, High (>30%). CHD, coronary heart disease; UKPDS, United Kingdom Prospective Diabetes Study.

Table 4: Correlations between stratified PAID scores and UKPDS Risk Engine outputs.

R (correlation coefficient)	PAID score < 40 (n=195)	PAID score ≥ 40 (n=39)
CHD	0.0907	0.3010
Fatal CHD	0.0983	0.2483
Stroke	0.0250	−0.1405
Fatal stroke	0.0294	−0.1713

CHD, coronary heart disease; PAID, Problem Areas in Diabetes; UKPDS, United Kingdom Prospective Diabetes Study.

living with diabetes. This study demonstrated that DRD was significantly associated with the predicted 10-year fatal CHD risks after controlling for covariates as noted under Table 3. These covariates ranged from baseline demographics to clinical diagnoses to medication usage factors to tobacco use. The discrepancy in statistical significance observed between simple and multivariate linear regression models can be explained by the presence of covariates that influence either or both the PAID score levels (capturing the levels of DRD) and the UKPDS Risk Engine outputs (predicting CV risks).

The finding that DRD is significantly associated with fatal CHD risks confirms similar findings from prior studies, which have identified statistically significant associations between DRD and cardiovascular heart disease [17]. Specifically, Dalsgaard and colleagues [17] determined that patients (n=1,533) between the ages of 40 and 69 with type 2 diabetes mellitus, and patients with psychological distress, had a 1.7-fold higher risk of having a CVD event and a 1.8-fold higher mortality rate compared to individuals without reported distress. They also concluded that patients with higher psychological distress at the time of diagnosis had a higher risk of CVD events than individuals without reported stress [17]. Although their study did not utilize the PAID questionnaire to assess DRD levels, the overall findings still support the assumption that DRD influences the risks of adverse cardiovascular complications. Understanding this association is critical for managing the cardiovascular health of patients with diabetes. The elevated risk of cardiovascular complications at baseline for people with diabetes is well accepted among researchers and healthcare professionals. The suggested amplification of 10-year CHD risks in the presence of DRD, as shown in this study, highlights the need to classify DRD when considering possible intervention points as a potential risk factor for CVD. Table 4 shows the correlations between stratified PAID scores and the UKPDS Risk Engine outputs with varying degrees and directions; although none of the correlation coefficients are considered strong, the differences seen between high and low PAID score strata as well as between predicted CHD and stroke risks warrant further investigation.

A pilot study conducted by Young and colleagues [11] that investigated associations between DRD and predicted

Table 5: Linear regression models.

	Coefficient	p-Value	95% CI
Simple linear regression models			
Predicted coronary heart disease risks vs. PAID scores	0.016	0.714	−0.070, 0.10
Predicted fatal coronary heart disease risks vs. PAID scores	0.012	0.733	−0.059, 0.083
Predicted stroke risks vs. PAID scores	−0.047	0.148	−0.111, 0.017
Predicted fatal stroke risks vs. PAID scores	−0.0078	0.139	−0.018, 0.0026
Multiple linear regression model*			
Predicted coronary heart disease risks vs. PAID scores	0.068	0.068	−0.0050, 0.14
Predicted fatal coronary heart disease risks vs. PAID scores	0.060	**0.047**	0.00084, 0.12
Predicted stroke risks vs. PAID scores	0.011	0.64	−0.037, 0.060
Predicted fatal stroke risks vs. PAID scores	0.0013	0.74	−0.0064, 0.0090

*Covariates included in this statistical model include: depression status, ethnicity, gender, age, insulin usage, number of diabetes medications, annual income, occupational index score, systolic blood pressure, BMI, and tobacco use. BMI, body mass index; CI, confidence interval; PAID, Problem Areas in Diabetes. Bold to indicate statistically significant result.

10-year cardiovascular complication risks in patients with type 2 diabetes and lower SES (n=48) also found that DRD was significantly associated with predicted fatal and nonfatal CHD risks. Specifically, this study found that with each unit increase in the total PAID score, nonfatal CHD risk was increased by 0.149%, and fatal CHD risk increased by 0.129% [11]. These findings agree with the current study's results and further support the association between predicted 10-year fatal CHD risks and DRD. Also, no significant associations were found between the total PAID scores and the predicted 10-year stroke risks in the previous study [11], which agrees with this current study's results.

The impact of DRD on cardiovascular complication risks highlights the need for appropriate screening strategies and education geared toward managing psychosocial stressors. This is particularly important among those experiencing lower incomes, because they are more likely to have limited access to healthcare and diabetes management support and are at higher risk for higher baseline distress, which could impede their ability to manage their diabetes. According to Fisher and colleagues [18], 45.4% of patients with type 2 diabetes reported moderate levels of diabetes distress, with even higher levels observed in other studies.

Additionally, identifying patients at an increased risk for DRD could benefit healthcare professionals in combating the high levels of diabetes burnout or symptoms related to distress. Delahanty et al. [19] identified that PAID scores were significantly higher among insulin-treated patients than oral or diet-controlled treatments. These findings highlight the increased stress that often results from the burden of self-management and identify ways that healthcare professionals can provide education and resources for patients regarding disease expectations and individualized treatment/management goals.

Research is now being undertaken to investigate strategies that can be implemented to combat the adverse effects of DRD on diabetes management. Lee and colleagues [20] surveyed 308 veterans with type 2 diabetes on autonomy support, defined as social support for a patient's free agency to make decisions, and the effects of DRD on glycemic management. The study demonstrated a significant reduction in HbA1c over 12 months with a higher patient-reported level of perceived autonomy [20]. The authors proposed that promoting autonomy for disease management from a health supporter mitigated the adverse effects of DRD on glucose management [20]. Further studies that aim to investigate implementable measures adopted by healthcare professionals, family members, and health supporters are needed for addressing the high rates of distress relating to diabetes and its potential amplification of CV risks in the future.

Our finding, which is generalizable to middle-aged patients with type 2 diabetes and lower SES, illustrates the significant association between DRD and predicted 10-year fatal CHD risks and provides further support for mobilizing various resources to address psychological health and medical care when treating people with diabetes. Further research dedicated to analyzing the cascade of effects that result from reducing DRD on disease-related complications and economic costs will further support the shift toward providing all-encompassing care for people with diabetes. Based on the findings of this study, healthcare professionals should be encouraged to include DRD assessment/screening as part of their routine visits and to understand the possible implications that suboptimal psychosocial well-being can have on CV and overall well-being of patients, as suggested by the 2016 ADA position statement on providing psychosocial care for those with diabetes [4].

Relating to the practice of osteopathic medicine

Psychosocial aspects in chronic disease evaluation and management are essential components of osteopathic physicians' practice of medicine. The osteopathic approach to patient care includes five models, e.g., biomechanical, respiratory-circulatory, metabolic-energy, neurological, and behavioral. A patient-centered approach to type 2 diabetes includes treating the whole person—e.g., integrating mental and physical health (the body-mind connection)—through preventative care, longitudinal care, timely medical interventions, and integration of structure and function. This current study integrates the assessments of participants' diabetes-related psychological states and their risks of cardiovascular events, which are essential for guiding and designing preventative and longitudinal care in a patient-centered, holistic manner for those with type 2 diabetes, combining the behavioral and metabolic-energy models of the osteopathic approach.

Limitations and future directions

The cross-sectional study design would be a limitation, because participants' data were collected only at a specific point in time without accounting for changes in their lives as time progressed. The potential step to enhance the robustness of data will be to assess participants' DRD levels utilizing the PAID questionnaire at various points with an interval of 3 months apart from each data collection; then, predictions on 10-year CV risks can be performed after every data collection. Additionally, household size data were not collected, and this information would put financial data in perspective.

Another limitation was that DRD was reflected via subjective data collected by a survey instrument. It would be possible that the statements from the PAID questionnaire were misunderstood by study participants even if the statements were read aloud to some participants who were having trouble reading and/or understanding the survey instrument.

Conclusions

In this study population with lower SES and type 2 diabetes, DRD levels and 10-year predicted fatal CHD risks exhibited a significant and positive association after adjusting for certain covariates (e.g., depression status, ethnicity, gender, age, insulin usage, number of diabetes medications, annual income, occupational index score, systolic blood pressure, BMI, and tobacco use). Physicians and other healthcare professionals are thus encouraged to incorporate a screening process for DRD in patients with type 2 diabetes in safety-net clinics as part of a routine healthcare visit. Through early detection of DRD, these patients can be supported and receive individualized approaches to psychosocial interventions that may potentially reduce their future CHD risks.

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