The Relationship between Diabetes Distress and Clinical Depression With Glycemic Control Among Patients with Type 2 Diabetes

Running title: Distress and clinical depression

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**Objective** – To clarify previous findings that diabetes distress is related to glycemic control and self-management, whereas measures of depression are not, using both binary and continuous measures of depression.

**Research design and methods** – 463 type 2 patients completed measures of diabetes distress (DDS) and clinical depression (Patient Health Questionnaire 8-PHQ8). The PHQ8 was employed as either a binary (≥10) or continuous variable. Dependent variables were HbA1C, diet, physical activity (PA), and medication adherence (MA).

**Results** – The inclusion of a binary or continuous PHQ8 score yielded no differences in any equation. DDS was significantly associated with HbA1C and PA, whereas PHQ8 was not; both DDS and PHQ8 were significantly and independently associated with diet and MA.

**Conclusions** – The lack of association between depression and glycemic control is not due to the use of a binary measure of depression. Findings further clarify the significant association between distress and HbA1C.
Recent studies have drawn a distinction between major depressive disorder (MDD), and diabetes-related distress (DD) among patients with type 2 diabetes (1, 2). These studies have generally shown that DD is significantly associated with self-management variables and glycemic control whereas MDD is not (3, 4).

MDD has been assessed primarily by a binary diagnostic indicator using a structured interview (e.g., Comprehensive International Diagnostic Interview—CIDI (5)), whereas DD has been most often assessed by a continuous questionnaire scale score (6). Binary scores contain less information and are less powerful than continuous measures. These differences in measurement may account for why continuous DD scores are associated with diabetes markers and binary scores of MDD are not when both are included in the same or in separate analyses (2). Also, many studies assess “depression” using symptom inventories not tied to DSM-IV criteria for MDD. Thus, it is difficult to link scores from these measures to well-defined clinical conditions, like MDD. We address both problems by assessing MDD with a continuous and a binary questionnaire score tied directly to DSM-IV criteria for MDD, the Patient Health Questionnaire (PHQ) (7), and evaluating the relationship between both MDD measures and continuous DDS scores on disease management behaviors and glycemic control.

METHODS

Data were part of the pre-intervention assessment of a new Internet-based diabetes self-management education study of patients with type 2 diabetes. Patient characteristics included age, gender, ethnicity (white/nonwhite), education (years), and use of insulin (yes/no). HbA1C was gathered from recent clinical records. The PHQ9 is a 9-item questionnaire tied to DSM-IV criteria for MDD (8). One question, suicidal ideation, was excluded (PHQ8) in keeping with non-clinically based studies (8). Items were scored 0 (“not at all”) to 3 (“nearly every day”) and were summed to create a total score and a binary score (≥10) for MDD (8). The Diabetes Distress Scale (DDS) is a 16-item scale (alpha=.92), that assesses diabetes-specific distress (6). Six items from the regimen-distress subscale were included. Summed items were scored on a 6-point scale from “not a problem” to “a very serious problem,” with a score of ≥3 as the cut-point. This subscale was selected because it is directly related to health behaviors and is highly correlated with the scale total (6).

The Community Healthy Activities Model Program for Seniors (CHAMPS) Questionnaire (9) assessed physical activity (PA), calculated as weekly caloric expenditure (10). Diet was assessed by the 7-item “Starting the Conversation” scale (14), which assesses the frequency of consumption of sugary beverages and fast food. It is sensitive to change in assessing healthy eating patterns (11). Adherence to medications (MA) was assessed by the Hill-Bone Compliance Scale (12) that identifies how often and why respondents miss taking medications. The study was approved by the Kaiser-Permanente, Colorado IRB.

RESULTS

Of 463 patients, average age was 58.8 years (SD=9.1), 51.5% were female, mean BMI = 34.8 kg/m$^2$ (SD=6.5), 28.0% were nonwhite, and mean HbA1C = 8.1% (SD=1.21). PHQ8 was significantly correlated with DDS (r=.40, p<.001). Similar to previous studies, 51.3% of the sample scored above the cutpoint for significant diabetes distress and 15.3% scored above the cutpoint for MDD; and of those with high
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Diabetes distress, only 22.5% were clinically depressed, whereas of those who reached criterion for MDD, 75.4% reported significant diabetes distress.

In hierarchical multiple regression with HbA1C, diet, PA, or MA as dependent variables, and with patient characteristics entered in Step 1, the inclusion of either a binary or a continuous PHQ8 score in Step 2 yielded no differences in any equation. DDS was significantly associated with both HbA1C and PA, whereas PHQ8 was not. Higher diabetes distress was associated with higher HbA1C and lower PA. Both DDS and PHQ8 were significantly and independently associated with diet and medication adherence: poor diet and poor medication adherence were associated with high DDS and high PHQ8. Findings were the same when only or both DDS or PHQ8 was included in separate equations, or whether continuous or binary DDS and PHQ scores were included. There was no evidence of multi-collinearity among the predictor variables in any analysis.

**DISCUSSION**

The results of this new study suggest that the lack of association between PHQ8 and glycemic control or self-management found in previous studies is not due to the lack of power that sometimes occurs when binary variables are included with continuous variables in the same analyses. Results are similar regardless of type of PHQ8 or DDS score used—continuous or binary.

Only DD, and not MDD, is significantly and positively associated with HbA1C and negatively associated with PA. In contrast to previous findings, in which clinical depression, as assessed by the CIDI, was unrelated to any disease management variable (2), both DDS and PHQ8 scores are moderately and independently associated with diet and MA. We speculate that PHQ8-assessed MDD provides a wider lens for inclusion than does CIDI-assessed MDD. A recent study showed that, among high risk primary care patients, the PHQ9 displayed high sensitivity but poor specificity when compared to the CIDI (13), suggesting that the PHQ8 records a high number of false positives in this population. This also may have contributed to the somewhat higher prevalence of PHQ8-assessed MDD (15.3%) in our sample than is generally reported in community samples when using interview schedules (2). Thus, the PHQ8 may tap into other aspects of mood unrelated to clinical depression that contributes to its association with diet and medication adherence (14).

Limitations include the fact that although the sample was of moderate size (N=463), it was too small to investigate potential subgroup variations comprehensively. Also, the use of only the regimen subscale of the DDS may have reduced relationships between DDS, self-management and HbA1C. However, the findings provide evidence that this subscale alone also has important relationships to these outcomes.

Our results parallel earlier findings that high DD and clinical depression are selectively related to disease management variables, but only DD is linked to HbA1C and PA. Furthermore, the potential lack of statistical power that is sometimes found when using binary diagnostic variables does not account for the less-frequent associations between clinical depression and diabetes markers. Ongoing screening for both clinical depression and diabetes distress may be warranted in clinical settings.

**ACKNOWLEDGEMENTS**

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REFERENCES
Table 1—*Standardized regression coefficients (B) for distress and clinical depression on HbA$_{1C}$ and self-care behavior*

<table>
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<th></th>
<th>HbA$_{1C}$</th>
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<td>PHQ8</td>
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</table>

HbA1C, diet, physical activity and medication adherence are dependent variables in separate hierarchical multiple regression equations. Each was run twice: PHQ8 was entered into step-2 as either a binary or a continuous variable. Step-1 data are the same in both analyses with the same dependent variable.

DDS = Diabetes Distress Scale; PHQ8 = Patient Health Questionnaire 8

* $p = .05$; † $p = .01$; ‡ $p = .00$