

Research Article

Diabetes, Depression and Nonadherence: Exploring Hopelessness as a Mediating Factor: A Preliminary Study

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ABSTRACT

Background: A well-documented phenomenon among patients with diabetes is the comorbid occurrence of depression which impacts adherence rates in patients. The symptoms of depression that may cause the most interference include fatigue, loss of motivation, and hopelessness. However, the exact way in which depression impacts nonadherence to diabetes treatment is still unknown. The purpose of the present study was to examine patients diagnosed with diabetes to measure the relationships between depression, hopelessness, and nonadherence.

Methods: Adults with a known diagnosis of Type I or Type II Diabetes (N=100; mean age: 56.2, 63.6% male, 47.5% Caucasian, 33.3% African American, and 14.1% Hispanic) were recruited from a southeastern outpatient family medicine clinic. Patients were asked to complete the Beck Depression Inventory, the Beck Hopelessness Scale, the Summary of Diabetes Self-Care Activities Questionnaire, and the Morisky Medication Adherence Scale to assess for levels of depression, hopelessness, self-care, and medication adherence.

Results: Results of a regression analysis concluded that both depression and hopelessness were significant predictors of level of nonadherence. Thus, as depression and hopelessness increase, so does the level of patient nonadherence. However,

hopelessness was not shown to be a mediator between depression and nonadherence.

Conclusions: It was found that depression and hopelessness have significant negative impacts on adherence levels. These results suggest future research should continue to investigate hopelessness as one potential mediator between depression and nonadherence. In the future, intervention studies for patients with diabetes and comorbid depression should consider implementing a brief, evidence-based treatment for depression and measure the treatment's impact on patient nonadherence rates, patients' depressive symptomology, and hopelessness scores.

Keypoints: Significant findings of this study include the relationship between depression, hopelessness, and nonadherence in patients with diabetes. More specifically, it was found that depression and hopelessness have significant negative impacts on adherence levels. This study paid special attention to hopelessness as one possible factor for this relationship. The study adds to the literature by identifying significant levels of not only depression but also hopelessness among patients diagnosed with diabetes contribute to greater nonadherence rates.

MeSh Headings/Keywords: Diabetes; Depression; Adherence; Nonadherence; Hopelessness

Introduction

Diabetes Mellitus is a chronic illness that affects 25.8 million adults in the United States. This illness is a major cause of heart disease and stroke, and is a leading cause of complications such

as: kidney failure, lower limb amputations, and blindness in almost all high-income countries [1,2]. It is estimated by the CDC that the risk for death among people with diabetes is about twice that of people of a similar age without diabetes. The estimated cost of medical expenses for patients with diabetes in

the United States was \$179 billion in 2012, with an additional \$69 billion of lost productivity [3]. Taken together, these data indicate how problematic diabetes is from both a patient perspective and a public health perspective. Further study of this disease is therefore exceedingly relevant in order to lessen these costs.

A well-documented phenomenon among patients with diabetes is the comorbid occurrence of depression [4]. One study noted an occurrence of depression in 41% of patients with diabetes as compared to 32.7% in other clinical samples [5]. Patients with both illnesses also have a higher rate of complications related to poorer glycemic control and lower functional impairment [6,7]. This correlation between poor management of diabetes and depression has been shown across socioeconomic and cultural groups [8,9]. Importantly, the relationship between diabetes and depression is bidirectional; while depression is associated with fewer health behaviors, a diagnosis of diabetes can contribute to a sense of loss and threat that comes with managing the disease to prevent debilitating complications [10]. Co-occurring diabetes and depression is extremely costly- health care costs for patients with both illnesses are significantly higher than those with either illness alone, and these increased costs persist over time [8].

Diabetes and comorbid depression are prevalent and costly illnesses, so addressing adherence to treatment is a crucial factor in reducing prevalence and cost while increasing patient wellness. Diabetes can be well-controlled by diet alterations and medications, yet nonadherence is high among this population [11]. Patients with diabetes have difficulty meeting dietary and exercise requirements, which can lead to obesity and decrease quality of life [12-15]. Failure to take medications as prescribed can result in uncontrolled glucose and neuropathy [12]; additionally, nonadherence results in lower quality of life among these patients [13]. It is not entirely known what factors constitute barriers to adherence to diabetes treatment; a study by Martinez, et al. [13] suggests that increased knowledge of medication and beliefs about its effectiveness may point towards greater adherence. DiMatteo, et al. [16] present a three-factor model of adherence, which emphasizes providing information, encouraging motivation and strategizing as important to promoting adherence; this may provide direction for future research examining adherence among diabetes patients.

As noted, depression can have an impact on health behaviors, and this is especially relevant when considering adherence to diabetes treatment, which includes behaviors such as medical appointment attendance [17]. The symptoms of depression that may cause the most interference include fatigue, loss of motivation, and hopelessness [18]. However, the exact way in which depression impacts nonadherence to diabetes treatment is still unknown; several studies have attempted to identify the mechanisms at play. Wing, Phelan, and Tate [18] postulated that adherence may be mediated by such factors as hopelessness (and thus lower expectations that treatment will be effective), lower cognitive resources to remember treatment regimens, and fatigue due to depression. Others have postulated that there are both behavioral and cognitive symptoms of depression that are problematic; the reduction in reinforcement of positive behaviors that comes from changing life circumstances

influences engagement in adherence, while illness related cognitions including negative self-evaluation and perceived helplessness may disrupt functioning as well [19].

One theory that has been applied to diabetes adherence, particularly in the context of patients with comorbid depression, is the self-determination theory (SDT), which posits that people are more likely to engage in positive health behaviors when their basic needs of autonomy, competency, and relatedness are met [20-25]. Robins et al. [25] found that lower levels of autonomy were related to hopelessness and feelings of failure among depressed patients, which suggests that SDT is an appropriate theoretical perspective for linking hopelessness to depressed patients' limited adherence and provides some direction for an avenue of intervention development. A recent review of the literature suggests that SDT-based interventions may be useful for diet, exercise, and weight management, making it an appropriate foundation for the study of diabetes adherence [21]. These authors also suggest that the three basic components of SDT, because of their humanistic and client-centered origins, may encourage psychological well-being - again, suitable for this population. Several studies have shown previously that perception of autonomy and competence in following treatment regimens increased glycemic control, medication use, and quality of life in patients with diabetes [22]. Another study showed that teaching self-determination skills to diabetes patients resulted in greater adherence and communication with health care providers, making SDT an excellent theoretical basis for the current study [24]. Finally, Robins et al. [25] found that lower levels of autonomy were related to hopelessness and feelings of failure among depressed patients, which further suggests that SDT is an appropriate theoretical perspective for linking hopelessness to depressed patients' limited adherence and provides some direction for an avenue of intervention development.

There have not been causal links in either direction established in the literature examining depression and diabetes [26,27]. An important intersectionality of depression and diabetes is the three basic needs of the self-determination theory being met. In particular, the mechanism behind many patients with diabetes who are also depressed may be feelings of hopelessness. Hopelessness is a common symptom of depression and co-occurs in an estimated 40% of patients with diabetes; hopelessness pointed to worse future expectations and higher suicidality in this population [28]. Pedersen et al. [29] have shown that diabetes patients with high hopelessness were at a 12.4% higher risk of mortality three years after experiencing a coronary infection than those without those conditions, and were still at a 7.7% higher risk of mortality than patients with diabetes alone. If patients feel hopeless, they likely do not feel autonomous, competent, or a sense of relatedness to others; in this way, hopelessness might mediate the link between depression, diabetes, and nonadherence.

The purpose of the present study was to examine 100 patients diagnosed with diabetes at a family medicine clinic in an academic health center in Fort Lauderdale, Florida (USA) to measure the relationships between depression, nonadherence, and hopelessness. Depression was measured using a cutoff score of >20 on the Beck Depression Inventory-

II (BDI-II), nonadherence was measured using both subjective questionnaires and appointment attendance, and hopelessness was measured using a cutoff score of >9 on the Beck Hopelessness Scale (BHS). It was first hypothesized that depression and hopelessness would be significantly associated with nonadherence. Second, it was hypothesized that depression would be significantly associated with hopelessness. Third, it was hypothesized that hopelessness would mediate the association between depression and nonadherence among these patients. Specifically, depressed patients endorsing feelings of hopelessness would be more nonadherent than depressed patients not endorsing these feelings. Lastly, these relationships were tested after controlling for covariates shown in previous research to be related to depression: age, gender, household income and marital status.

Methods

This preliminary cross-sectional study attempted to provide an essential insight into the low levels of medication use, lifestyle adjustment, and appointment attendance among this population. If hopelessness impacts the relationship between depression and medical non-adherence, then implications can be drawn to further the development of effective treatment interventions for diabetic patients with the goal of increasing adherence rates and reducing complications and healthcare costs.

Participants

Potential participants were identified from a computer generated list of patients with upcoming appointments at a southeastern outpatient family medicine clinic in Fort Lauderdale, Florida (USA) between November 2009 and October 2010. Only patients with known diagnosis of either Type I or Type II diabetes and who were at least 18-years-old were eligible for the study. Recruitment efforts resulted in a sample of 100 participants with a mean age of 56.24 (SD = 12.96). The majority were male (63.6%), married (43.3%), and had at least a high school education (48.5%). Financially, 53.5% of the participants had an annual income of \$10,000 - \$60,000. Within the sample, 47.5% were Caucasian, 33.3% African American, and 14.1% Hispanic. For the purposes of this study, other medical co-morbidities related to a diagnosis of diabetes (i.e., weight, body mass index, alcohol and/or substance abuse, and/or glycemic index) were not collected. Full approval from the Institutional Review Board was received prior to the recruitment of any participants (IRB 10300922Exp.). Potential participants were approached by the principal investigator (PI) after they completed their appointments with their physician. All participants were provided the details of the study, the risk and benefits of the study, and were consented before participation. Participants of this study did not receive any form of compensation or incentive for their participation. Once the goal of 100 participants was achieved, recruitment was concluded.

Materials

During the initial meeting with the PI, participants completed a number of questionnaires including a demographic survey, the Beck Depression Inventory (BDI-II), the Beck Hopelessness Scale (BHS), the Summary of Diabetes Self-Care

Activities Questionnaire (SDSCA), and the Morisky Medication Adherence Scale (MMAS).

Self-report measures

Demographics: The demographic survey asked participants to provide several pieces of demographic information including their age, gender, material status, ethnicity, race, educational level and household income (Table 1).

Depression: To assess for the presence of depressive symptomatology participants completed the Beck Depression Inventory (BDI-II). The BDI-II is the most widely used tool for self-assessment of depression in clinical research and was also used to determine the severity of depressive symptomatology [30]. The BDI-II consists of 21 items that assess for the presence of depressive symptomatology across several domains including: sadness, pessimism, past failure, loss of pleasure, guilty feelings, punishment feelings, self-dislike, self-criticalness, suicidal thoughts or wishes, crying, agitation, loss of interest, indecisiveness, worthlessness, loss of energy, changes in sleeping pattern, irritability, changes in appetite, concentration difficulty, tiredness or fatigue, and loss of interest in sex [30]. All items on the Beck Depression Inventory are rated on a four-point Likert scale that ranges from 0 (absence of a symptom) to 3 (severe manifestation of a symptom) with higher scores indicating increased depressive symptoms. A cut-off score of ≥ 20 indicates a higher likelihood of the presence of depression.

Hopelessness: The Beck Hopelessness Scale (BHS) is a 20-item true/false scale which has been validated to capture

Table 1: Demographics.

Age	M = 56.2 years
Gender	Male = 36 Female = 63
Race	Black = 33 White = 47 Asian = 4 Hispanic = 14 Other = 1
Education	Less than high school = 2 High school = 48 Some college = 13 Associate's = 22 Bachelor's = 8 Higher Education = 4
Marital Status	Single = 25 Married = 43 Separated/Divorced = 23 Widowed = 9
Household Income	<\$10,000-\$20,000 = 11 \$20,000-\$30,000 = 26 \$31,000-\$50,000 = 18 \$51,000-\$80,000 = 12 \$81,000- <\$100,000 = 5

the cognitive component of depression. Specifically, the BHS measures three components associated with hopelessness: feelings about the future, loss of motivation, and expectations – both positive and negative. Per Beck, Weissman, Lester, Trexler (1974) a cut-off score equal to or greater than nine (≥ 9) indicates a greater likelihood of the presence of hopelessness in patients [31]. For the purposes of this study, it was decided to use this cut-off point when assessing for the presence of hopelessness in the participants.

Self-care: Patient self-care was measured using the Summary of Diabetes of Self-Care Activities Questionnaire (SDSCA). The SDSCA has been widely used with diabetic patient populations as a self-report assessment measure of self-care adherence with diabetic patients. The SDSCA assesses the patient's adherence over the last seven days to a number of daily healthcare activities including: diet, exercise, smoking, glucose testing, and foot care. The SDSCA has been utilized in a number of studies and has demonstrated reliability, validity, and sensitivity with this population [32]. The variables of diet, exercise, blood sugar, foot care, and smoking were coded binomially as either adherent or nonadherent based on the SCDSCA 2009 guidelines (Table 2).

Medication adherence: Medication adherence data was gathered from participant completion of the Morisky Medication Adherence Scale. The Morisky Medication Adherence Scale is a self-report consisting of 4-items concerning the patient's medication taking behaviors. A number of studies have demonstrated the reliability and validity of the Morisky Medication Adherence Scale with this population [33]. Patient medication adherence was determined using a pre-determined cut-off score of greater than or equal to 2 (≥ 2) [34].

Procedure

After providing consent for participation to the principle investigator, participants were asked to complete the above listed assessment battery before leaving the office. Participants took an average of 33 minutes (range: 21-45 minutes) to complete the questionnaires. The questionnaires were returned to the PI before the patient exited the family medicine healthcare clinic. To protect patient confidentiality, all returned assessment batteries were de-identified of any and all participant identifying information and kept under the lock and key of the PI. Further, 3 years post-data collection, all assessment data was destroyed via shredding.

Table 2: Variable Cutoff Guidelines.

	Nonadherent	Adherent
Diet	Score of <5	Adherence to 1800 kcal/day for 5 out of 7 days
Exercise	Score of <3	20 min. of walking or bicycle 3 days/week
Blood Sugar	Score of <5	Measure 5 days/week
Foot Care	Score of <1	Foot exam once weekly
Smoking	Answer of "yes"	Answer of "no"

Statistics

An analysis of the data (n=100) initially involved a determination of adherent and non-adherent patients. This analysis utilized and subjective measures of adherence administered during the first visit and served to create two comparison groups. From these groups a mean of depression and hopelessness was calculated, compared, and analyzed. Further analyses were conducted with all demographic variables using a linear regression analysis. Statistical significance was two-tailed and defined as $p \leq 0.05$. A composite adherence variable was created based on the individual binomial adherence scores. A sum for each participant's adherence was calculated. Because there were six variables (Table 3), and all were coded binomially with (0 = adherent, 1 = nonadherent), each participant gained 1-point for every variable they were deemed to be nonadherent on. Thus, the overall adherent variable ranged from 0 (adherent) to 6, with scores from 1 through 6 indicating increasing levels of nonadherence. Overall, higher numbers on the composite adherence variable indicate greater levels of nonadherence. This was done to prepare the variables for linear regression analysis and to ensure the results were easily interpretable.

Results

The sample consisted of 100 participants with a mean age of 56.24 ($SD = 12.96$). The majority were male (63.6%), married (43.3%), and had at least a high school education (48.5%). Financially, 53.5% of the participants had an annual income of \$10,000 - \$60,000. Within the sample, 47.5% were Caucasian, 33.3% African American, and 14.1% Hispanic. The variables used to represent an adherence score are broken down in Table 3. It should be noted that the majority of participants were most adherent in regards to not smoking and foot care. However, many of them were not adherent to diet and exercise recommendations.

Once the adherence variable was created, 19.1% of all participants were considered to be completely adherent across all variables. The majority of participants (43.4%) were nonadherent on two to three of the above listed categories. This suggests an overall pattern of nonadherence within the sample. When measuring for depression and hopelessness, 23.2% of the sample fell within the cutoff range and were deemed depressed, while 17.2% were deemed hopeless. Of note, 14.1% were both depressed and hopeless which suggests the majority of those endorsing hopelessness were also depressed. Thus, there was a significant association between depression and hopelessness $\chi^2(1) = 36.72, p < 0.001$ (Table 4).

Table 3: Adherence Variables.

	Adherent	Nonadherent
Medication	66.70%	33.30%
Diet	37.40%	61.60%
Exercise	41.40%	56.60%
Blood Sugar	42.40%	55.60%
Foot Care	70.70%	28.30%
Smoking	85.90%	14.10%
Overall	19.10%	80.90%

Table 4: Depression and Hopelessness Variables.

Variable	Percentage of sample meeting criteria
Depressed	23.2%
Hopelessness	17.2%
Depressed and Hopelessness	14.1%**

**Indicates an association within significance and a p-value of <0.001

Results of the regression analysis concluded both depression and hopelessness to be significant predictors for levels of nonadherence ($\beta = 0.310$, $t = 3.13$, $p = 0.002$, $R^2 = 0.096$; $\beta = 0.247$, $t = 2.38$, $p = 0.020$, $R^2 = 0.061$). Thus, as depression and hopelessness increase, so does the level of patient nonadherence. However, hopelessness was not shown to be a mediator between depression and nonadherence.

Discussion

The current study examined the role of hopelessness as a mediator linking depression with nonadherence among patients with diabetes. The results supported two of the three proposed hypotheses. Depression and hopelessness were significantly associated with nonadherence, and depression was significantly associated with hopelessness. However, hopelessness was not found to mediate the association between depression and nonadherence. These results suggest that while depression and hopelessness are independently related to nonadherence in patients with Diabetes, there is still more that should be explored in order to identify what other variables contribute to nonadherence in this population.

There is considerable support in the literature indicating that patients with diabetes tend to have elevated rates of nonadherence. The same was true for this sample population with less than one-fourth of the sample being deemed adherent by pre-established standards [32]. The majority of patients experience heightened levels of difficulty following diet, exercise, and blood sugar recommendations. The current study adds to the literature by providing information for doctors, nurses, and behavioral health specialists highlighting areas of concern for adherence in this population specifically. Interestingly, patients were most adherent to medication and foot care regimens; perhaps future research could investigate what potential barriers exist for patients in adhering to some areas and what contributed to adherence in other areas. It is clear that depression and hopelessness have an impact on adherence to several major areas of diabetes treatment and must be addressed by behavioral health specialists working with this population.

Integration of behavioral health care and primary care has become increasingly common as the literature identifies the links between health behaviors and overall wellness [35]. The self-determination theory (SDT) components can easily be integrated into primary care treatment to address depression and hopelessness in the context of diabetes management, and have been successful in encouraging change in some of the areas of lowest adherence among the population in this study – namely, diet and exercise. This theoretical orientation also appears to improve communication between providers, which could impact

identification of nonadherence and depressive symptoms, which are in turn linked to hopelessness. Using the SDT components of autonomy, competence and relatedness may then be most impactful in addressing concerns such as depression and nonadherence to medical regimens in this population.

Future research could implement a brief evidence-based treatment and see if nonadherence rates decrease along with depression and hopelessness scores. Furthermore, although this study did not find a significant interaction, hopelessness should continue to be investigated as a potential mediator. A larger sample size might reveal this effect, as almost all hopeless patients were depressed, but not all depressed patients were hopeless. This suggests there might be something unique to hopelessness that could potentially be interfering with adherence.

While A1c values, used as an indication of diabetes management, are typically used in diabetes research, they were excluded as an indicator of adherence for this study. Johnson [36] found that A1c levels are a poor indicator of patient adherence and that a heightened A1c level could be indicative of several other processes besides nonadherence. Furthermore, Johnson [36] also suggested that while abnormal A1c levels can be a biological red flag, they provide no insight into actual adherence. Based on this and other studies indicating the limitations of using A1c levels as an adherence measurement, this study chose to use behavioral measures such as the SDSCA and the MMAS to gain a better measurement and clearer understanding of actual patient adherence levels.

Although our findings contribute to the literature in connecting diabetes, depression and hopelessness, there are some limitations worth mentioning. First, the study includes a small sample size from a single location, so results may not generalize to populations in other areas of the country. Second, measurement of adherence lacked an objective measure, such as appointment adherence or glycemic control, BMI, etc. The measures used were reliant on patient self-report which could have been inflated due to patients wanting to be seen in a more desirable manner. Third, only one facet of adherence was measured, whereas a multimodal approach may have produced better outcomes when measuring adherence, having a multimodal approach produces better outcomes [16]. Inclusion of a physician measure of adherence may have been beneficial and provided greater internal validity.

In summary, this study examined the impact of depression and hopelessness on adherence among patients with diabetes. Our findings support the existing literature in showing high levels of nonadherence among our sample, and add to the literature by identifying significant levels of not only depression but also hopelessness, both of which were linked to greater nonadherence. Specifically, as depression and hopelessness increase, so does the level of patient nonadherence. Although we did not find hopelessness to mediate the link between nonadherence and depression, this is an important area for future investigators to explore. Our findings suggest that integration of behavioral health specialists into treatment as usual for patients with diabetes will be important to improving adherence and reducing

depression. In conclusion, depression and hopelessness impact adherence to medications and health behaviors for patients with diabetes and must be addressed regularly in order to improve overall health for these patients.

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Disclosure

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