

The Relationship of Depression to Treatment Adherence, Quality of Life and Health Outcomes in Type 1 Diabetes Mellitus

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Abstract

The association of depression and diabetes mellitus is supported by numerous studies, although the nature of this relationship is complex. In order to better understand this complex relationship, the present study sought to examine interrelations between depression, diabetes health outcomes, quality of life, treatment compliance, and psychological factors such as hopelessness, self-efficacy and self-perceptions in 50 outpatients with Type 1 diabetes (30 women, 20 men, median age 34 years). Participants with and without depression exhibited differences in expected directions on treatment adherence, quality of life, and psychological factors. Diabetic complications, overall adherence, and physical self-concept were significant predictors of depression, while depression was a significant predictor of overall adherence to diabetic treatment, and physical self-concept. Depression also exhibited a predictive trend with respect to diabetic complications. Finally, only physical self-concept was a significant predictor of quality of life. Advancing our understanding of the nature of the relationship between depression and health outcomes will be important in developing early interventions.

Key Words: *Diabetes; Depression; Adherence; Outcomes; Quality of Life; Cognitions*

An association between diabetes mellitus and depression, either in the form of Major Depressive Disorder (MDD) or depressive symptoms, has been supported by numerous studies. Meta-analyses support that prevalence rates of depression for both Type 1 and

Type 2 diabetes are twice those of comparison samples (de Groot, Anderson, Freedland, Clouse, & Lustman, 2001). While particularly high lifetime prevalence rates of depressive disorders (41.5%) have been reported in outpatients with insulin-independent diabetes mellitus (i.e., Type 1 diabetes) (Friedman, Vila, Timsit, Boitard, & Mouren-Simeoni, 1998), higher odds ratios have not been found consistently (Kruse, Schmitz, & Thefeld, 2003). Furthermore, the nature of the relationship between depression and diabetes appears to be complex, with the confounding effects of sociodemographic variables and possible differences between Type 1 and 2 diabetes (Eaton, Armenian, Gallo, Pratt, & Ford, 1996; Kawakami, Takatsuka, Shimizu, & Ishibashi, 1999; Kruse et al., 2003; Kovacs, Obrosky, Goldston, & Drash, 1997; Lustman, Griffith, & Clouse, 1988). In Type 1 diabetes, MDD characteristically follows its diagnosis (Lustman et al., 1988; Kovacs et al., 1997), although it is unclear whether this temporal association is causative in nature.

Talbot and Nouwen (2000) argue that depression in diabetes results from two possible pathways: (a) biochemical changes directly due to the illness or its treatment; and/or (b) the psychosocial demands or psychological factors related to the illness or its treatment, particularly perceptions about its intrusiveness, the lack of social supports, and poor coping which may indirectly influence health outcomes. Hence, while depression may arise from diabetes, especially in those with a predisposition to mood disorders, it can also influence treatment adherence and health outcomes, particularly diabetes complications and quality of life.

Recent studies provide equivocal support for these contentions. Kinder, Kamarck, Baum, and Orchard (2002) found that, among people who had childhood-onset Type I diabetes, those who reported the fewest depressive symptoms were least likely to develop coronary heart disease over a ten-year period. Differences in insulin resistance, autonomic dysregulation, inflammation, smoking, and complications associated with Type I diabetes could explain this relationship. A recent meta-analysis found significant low to moderate associations between depression and a variety of diabetes-related complications such as retinopathy, nephropathy, neuropathy, macrovascular complications and sexual dysfunction (de Groot, Anderson, Freedland, Clouse, & Lustman, 2001). However, a number of studies have failed to find a significant relationship between depressive symptoms and diabetes complications (Friis & Nanjundappa, 1989; Lustman, Griffith, Clouse, & Cryer, 1986). Furthermore, a longitudinal study of psychiatrically-well individuals with diabetes found that those who developed new diabetic complications during a 5-year follow-up did not exhibit a disproportionate incidence of mood or other mental disorders (Lustman, Griffith, & Clouse, 1988).

Nonetheless, depression is an important consideration in maximising treatment adherence. Effective management of diabetes involves a life-long treatment regimen, including behaviours relating to diet, exercise, medication, glucose monitoring and, in the case of Type 1 diabetes, insulin injections. These facilitate the maintenance of acceptable blood glucose levels, alleviate the probability of short-term difficulties (e.g., fatigue, lethargy, concentration problems, irritability) and longer-term complications, maximising quality of life. Much of the responsibility for day-to-day treatment decisions in diabetes falls on patients themselves (Cox & Gonder-Frederick, 1992; Garrison, 1996; McCaul, Glasgow, & Schafer, 1987). Despite its importance, treatment adherence can often be poor (Rubin, Walen, & Ellis, 1990). The influence of depression in noncompliance with medical treatment has generally been supported, although not so consistently for anxiety. Di Matteo, Lepper, and Croghan (2000) concluded that, compared with non-depressed cohorts, depressed patients were three times more likely to be noncompliant with medical treatment recommendations. With specific regard to diabetes, Ciechanowski, Katon, and Russo (2000) found that depression was associated with poorer adherence to dietary recommendations and medication regimens. Several investigators suggest that factors, such as disease duration or age of onset, are also important in altering compliance and health outcomes in diabetes (Cleaver & Pallourios, 1994; Jacobson & Hauser, 1983). However,

fluctuating glycaemic or long-term complications can also deplete emotional strength and determination, creating a negative self-image, and consequently lowering adherence (Rubin, Walen, & Ellis, 1990).

While adherence is linked to glycaemic control, the relationship between depression and glycaemic control in diabetes, however, has proved somewhat difficult to characterise. While a meta-analytic study by Lustman, Anderson, Freedland, de Groot, and Carney (2000) indicated a significant association between depression and poor glycaemic control, with a small to moderate effect size, individual studies have not always supported such findings (see Talbot & Nouwen, 2000). Such equivocal results may be due to differential effects for Type 1 and 2 diabetes. For instance, de Groot, Jacobson, Samson, and Welch (1999) reported significantly worse glycaemic control in Type 1 diabetes with a lifetime history of MDD but not for those with Type 2 diabetes. Van Tilburg et al. (2001) further examined the relationship between glycaemic control and depressed mood in Type 1 and Type 2 diabetes separately. While the groups did not differ in mean depression scores or glycaemic control, correlational analysis revealed differences in the relationship between depression and glycaemic control with a significant positive relationship found in the Type 1 but not Type 2 cohort. This relationship was not restricted to scores indicative of clinical depression. Furthermore, Type 1 diabetics who had worst glycaemic control and higher depression scores reported a lower frequency of blood glucose monitoring (i.e., poorer treatment adherence). The authors concluded that the effect of depression on glycaemic control in Type 1 diabetes may be mediated by decreased self-care behaviours.

There is also evidence that blood glucose levels in diabetes improve with remission of depression, whether treatment is pharmacological, psychological or otherwise (Fakhri, Fadhli, & Rawi, 1980; Lustman, Griffith, Freedland, Kissel, & Clouse, 1998; Normand & Jenike, 1984; Thomas, Petry, & Goldman, 1987). Furthermore, double-blind placebo and controlled treatment studies support the hypoglycemic effect of antidepressant medication (O'Kane, Wiles, & Wales, 1994), although the mechanisms for this are unclear. As few studies have examined changes in adherence to diabetes self-care activities, it remains possible that the effects of depression treatments on metabolic control may result from improved adherence. With respect to psychological interventions for depression, cognitive-behaviour therapy may act on health beliefs, self-efficacy and other aspects of self-perceptions to influence treatment compliance and, hence, health outcomes. It is important to examine the relationships between such factors in diabetes. While

various health beliefs have been investigated in diabetes (Brownlee-Duffeck, Peterson, Simonds, Kilo, Goldstein, & Hoette, 1987), little research has investigated self-perceptions in diabetic patients.

Finally, depression has been reported as being amongst the leading causes of disability (World Health Organisation, 1996). Disability is integrally related to quality of life which has been found to be compromised in diabetes (Koran, Thienemann, & Davenport, 1996), although not consistently (Tahbaz, Kreis, & Calvert, 2006). Quality of life is a multidimensional concept measuring life satisfaction following the physical, mental and social effects of illness on daily living (Bowling, 1996; Schumacher, Olschewski, & Schulgen, 1991). Koran et al. (1996) compared quality of life for patients with obsessive-compulsive disorder, diabetes and depression with a normal cohort. Patients with diabetes showed lower quality of life within physical health domains (i.e., physical functioning, role limitations due to physical problems and bodily pain) than obsessive-compulsive and normal, but not depressed cohorts. Gender may also play a role in quality of life in diabetes (Luscombe, 2000), although this may be due to psychological factors rather than health complications (Enzlin, Mathieu, & Demyttenaere, 2002). Interestingly, the level of current psychiatric symptoms and presence of co-morbid psychiatric disorder influence quality of life in both Type I and Type II diabetes, even after controlling for number of diabetic complications (Jacobson, de Groot, & Samson, 1997).

It appears that a range of factors including gender, type and history of diabetes, the degree of treatment compliance, glycaemic control, quality of life and health-related beliefs may influence the relationship of depression to diabetes. The present study sought to examine the interrelations between measures of depression, health outcomes, quality of life, treatment compliance, gender, and psychological factors such as self-efficacy and hopelessness in Type 1 diabetes outpatients from a large metropolitan hospital. Specifically, we were interested in examining what factors predict depression in Type 1 diabetes, as well as investigating the role of depression in diabetes health-related behaviours and outcomes.

Method

Participants

The sample consisted of the first 50 consenting adult outpatients with Type 1 diabetes, 30 women and 20 men, attending the Royal Melbourne Hospital as outpatients. Inclusion criteria were: (i) having Type 1 diabetes for at least 6 months, (ii) having at least three glycosylated

hemoglobin (HbA1c) measurements, an index of diabetic control; and (iii) proficiency in English to respond to questionnaires. The overall mean age was 33.54 years (range 18 to 64 years) while the mean number of years of formal education was 16 years. The mean disease duration was 17.17 years (range 1 to 42 years), while the mean age of onset was 16.32 years (range 1 to 45 years).

Materials

Demographic Information All respondents indicated their gender, age, and other demographic details, disease duration and age at diagnosis on a background information sheet.

Treatment Adherence The Summary of Diabetes Self-Care Activities (SDSCA; Toobert & Glasgow, 1993) was used to assess treatment adherence. The SDSCA consists of 12 items measuring the frequency of compliance with treatment regimens over the previous seven days. Areas assessed include diet, exercise, glucose testing and medication taking, with lower standardised scores indicating better treatment adherence. Previous research with Type 2 diabetes outpatients suggested moderate internal consistency (Toobert & Glasgow, 1994).

A supplement to this scale, termed the Supplementary Self Care Activities for Diabetes (SSCAD) devised by the current investigators, asked participants to rate: (a) their adherence to specific treatment requirements; and (b) factors responsible for non-compliance in four specific areas (i.e., diet, exercise, glucose testing and medication). Responses range from rarely or never to often using a 5-point Likert scale. Reasons for non-compliance were not assessed in the original SDSCA questionnaire, even though such information is clinically important so that specific barriers to compliance can be targeted in interventions. A mean score can be calculated, along with the number of reasons for non-compliance.

Scores from the SDSCA and SSCAD were calculated separately, and an Overall Self-care Index was calculated from the mean item score on both measures, with lower scores indicating better adherence. Internal reliability statistics were examined for the present cohort (see Results).

Health Outcomes A 7-item Complications Index was developed by the current investigators, comprising doctor reports of complications and length of complications, doctor rating of severity of complications, and patient ratings of complications, perceived seriousness of complications, frequency over the past year of experiencing problematic complications, and the degree to which complications interfered with treatment for

diabetes. Patients' physicians were asked to provide the average of the previous 2 or 3 HbA1c results from medical records. Internal reliability for the Total Complications Index was examined (see Results).

Quality of Life The Medical Outcomes Study Short-Form General Health Survey (MOS-SF36; Medical Outcomes Trust, 1992), a generic measure of life satisfaction, was completed. This measure comprises 36 items measuring eight physical and mental health dimensions - physical functioning, role limitations due to physical and emotional problems, social functioning, bodily pain, mental health, vitality and general health. Higher scores indicate better quality of life (Ware & Sherbourne, 1992). Psychometric characteristics have been obtained for patient subgroups, including diabetes, with satisfactory reliability coefficients reported (McHorney, Ware, Lu, & Sherbourne, 1994; McHorney, Ware, & Raczek, 1993).

Depression The Beck Depression Inventory (BDI; Beck & Steer, 1993) comprises 21 items that ask recipients to indicate the extent to which they exhibit cognitive, affective, somatic and vegetative symptoms of depression and dysphoria. The psychometric properties of the BDI are well documented (Beck, Steer, & Garbin, 1988), and it has been widely used with diabetic populations (Haire-Joshu, Heady, Thomas, Schechtman, & Fisher, 1994; Leedom, Meehan, Procci, & Zeidler, 1991; Stone, Bluhm, & White, 1984).

Health and Related Beliefs The Adult Dispositional Hope Scale (HS; Snyder et al., 1991) consists of 12 items, four acting as "filler" items, and the remaining eight evaluating one's concept of hope. Hope is defined as a cognitive set that comprises a sense of successful "agency" (i.e., goal-directed determination) and "pathways" (i.e., planning of ways to meet goals). HS scores have been found to augment the prediction of goal-related activities and coping strategies. The Pathways subscale score is the sum of 4 relevant items, while the Agency subscale is the sum of the remaining 4 items. Hope is the sum of the Pathways and Agency items.

The Self-Efficacy Scale (SES; Sherer et al., 1982) measures general self-efficacy expectancies in relation to educational, vocational, and social areas. The SES contains 23 items with two distinct subscales (general self-efficacy and social self-efficacy) and 7 filler items. Satisfactory internal reliability, construct and criterion validity have been reported (Sherer et al., 1982).

Given the lack of psychometric data for these cognitive measures in diabetic populations, we examined internal reliability in the current cohort (see Results).

Self-Concept Participants completed the Tennessee Self-Concept Scale (TSCS; Fitts, 1964), a 100-item self-administered questionnaire incorporating 9 dimensions - Identity, Satisfaction, Behaviour, Physical, Moral-Ethical, Personal, Family, Social and Criticism. The present paper focuses on the Physical subscale with higher scores indicating positive self-perceptions (Keith & Bracken, 1996). Overall, the TSCS exhibits adequate reliability and validity in normal college student samples (Fitts, 1965). Internal reliability of the Physical scale was examined (see Results).

Procedure

Upon attendance at the Royal Melbourne Hospital for their scheduled outpatient appointment, patients fulfilling the inclusion criteria were approached in the waiting room and briefed on the study's aims and requirements. Consenting patients were given a questionnaires package with written instructions outlining the requirements of the study. All subjects completed the questionnaires at home, with a mobile telephone contact for immediate advice. Pre-paid envelopes were provided. On departure from the clinic, each patient's physician completed the physician information sheet.

Results

Data Preparation and Preliminary Analyses

In accordance with Tabachnik and Fidell (1996), to ensure normality and homoscedasticity, squared transformations were applied to the quality of life and self-concept variables. As all HbA1c levels were in the abnormal range (6.0-14.0), no transformations were required in their use as independent variables. No univariate or multivariate outliers were identified in the data, and no significant violations of multicollinearity or singularity were detected.

Internal reliability was examined for those questionnaires devised by the investigators and/or not validated with a diabetic sample. All Chronbach alpha coefficients were satisfactory ranging from .71 to .92.

Due to the relatively low sample size relative to the number of analyses, a conservative alpha of .01 was set to minimise risk of Type 1 errors.

As gender has been implicated as a factor in the experience of diabetes and incidence of depression, gender differences across a range of variables were examined. No significant gender differences were found, although there was a trend for women to report greater levels of depression.

Depressed versus Non-depressed Cohorts

Differences between depressed and non-depressed respondents were examined by dividing the cohort on the basis of BDI scores (Table 1). A BDI cutoff score of ≥ 14 is used to identify possible "cases" of major depression (Beck & Steer, 1993). In the present study, 12 percent of participants fulfilled this criterion. However, as previous research with diabetes had indicated that a BDI score of ≥ 10 is associated with significant risk (Leedom, Meehan, Procci, & Zeidler, 1991; Stone, Bluhm, & White, 1984; Haire-Joshu, Heady, Thomas, Schechtman, & Fisher, 1994), the current cohort was divided into those scoring 10 or above on the BDI (i.e., notable levels of depression symptoms or "depressed"; $n = 14$; 28%) and those scoring below 10 on the BDI (i.e., no notable levels of depression symptoms or "non-depressed"; $n = 36$; 72%). Analysis of variance found that the depressed cohort reported significantly poorer overall self-care, greater number of reasons for non-compliance, poorer physical self-concept, lower quality of life, greater hopelessness, and lower self-efficacy, and a trend towards poorer compliance. Results were virtually identical when the traditional BDI cutoff score for "caseness" of 14 was used.

Relationships Amongst Measures

Correlational Analyses Correlational analysis was performed to determine the relationship between depression and other measures in preparation for multiple regressions (see Table 2). Because of power concerns, we were keen to avoid inclusion of variables that were not likely significant predictors of dependent variables. A conservative alpha of .01 was set to minimise risk of Type 1 errors. Given that there was a significant difference between "depressed" and "non-depressed" cohorts on the Overall Self-care Index, but only a trend for the Summary of Self-Care Activities Index, the former was used in the following analyses.

The number of years since onset of diabetes correlated significantly and moderately with overall complications, exhibited a trend with respect to poor glycaemic control, but failed to exhibit notable or significant correlations with treatment adherence, physical self-concept, quality of life, depression, or cognitive measures of hope or self-efficacy. As expected, depression exhibited significant moderate to high magnitude correlations with overall self care, physical self-concept, hopelessness, self-efficacy, quality of life. Quality of life exhibited a profile of correlations similar to that of depression, with the exception of that the correlation with self-efficacy only approached significance.

As expected, overall complications exhibited a significant moderate magnitude correlation only with HbA1c levels. Overall self-care exhibited moderate correlations with physical self-esteem, quality of life and depression. Self-efficacy and hopelessness measures failed to correlate significantly with the overall adherence measure. Poor physical self-concept exhibited moderate-to-high magnitude correlations with hopelessness, poor self-efficacy, diminished quality of life, and depression, but non-significant association with years since onset of diabetes.

Multiple Regression Analyses A series of multiple regression analyses were performed. Firstly, we wanted to identify the best predictors of depression. Secondly, we wanted to examine the role of depression in predicting diabetic complications, adherence to treatment, and quality of life. Finally, given its emergence in the correlational analyses as having a significant association with depression, we wanted to examine the best predictors of physical self concept in diabetic patients. As no significant differences were found between males and females, gender was not included in the multiple regressions as a predictor variable.

Firstly, a regression analysis was conducted with depression as the dependent variable. Years since onset of diabetes, diabetic complications, HbA1c levels, overall adherence, physical self-concept, quality of life, and self-efficacy were entered as independent variables. Hopelessness was not included as an independent variable because of its known construct overlap with depression. The model accounted for 64% (adjusted) of variance ($F(7,42) = 13.62, p < .000$), with physical self-concept exhibiting significant unique contribution to the prediction of depression ($\beta = -.43, p = .002$), and diabetic complications, self efficacy, overall adherence and glycaemic control exhibiting non-significant but notable unique predictive trends ($\beta = -.27, p = .03; \beta = -.26, p = .03; \beta = .19, p = .07; \text{ and } \beta = .18, p = .09$, respectively).

A second multiple regression analysis was conducted with diabetes complications as the dependent variable, and years since onset of diabetes, HbA1c levels, overall adherence, physical self-concept, quality of life, depression, hopelessness, and self-efficacy as independent variables. The model accounted for 51% (adjusted) of variance ($F(8,41) = 7.24, p < .000$), with length of diabetes, the average of the past 3 HbA1c levels, and physical self-concept exhibiting significant beta coefficients ($\beta = .46, p = .000; \beta = .37, p = .002; \text{ and } \beta = -.48, p = .009$, respectively), and depression exhibiting a notable but non-significant beta ($\beta = -.36, p = .05$).

Table 1: Differences and descriptives for non-depressed ($BDI \leq 9$) and depressed ($BDI \geq 10$) groups within diabetic cohort.

	Non-depressed ($n = 36$)		Depressed ($n = 14$)		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age	32.89	11.82	35.21	11.47	0.40 (ns)
Years Since Onset of Diabetes	17.60	9.46	16.07	11.84	0.23 (ns)
Average last 3 HbA1c readings	8.65	1.60	8.49	1.84	0.06 (ns)
Overall Complications Index	7.66	6.49	7.54	7.16	0.00 (ns)
Summary of Self-Care Activities Index	2.52	0.55	2.96	0.72	5.58 (ns)
SSCAD: Number of Reasons for non-compliance	12.03	5.22	16.64	4.65	8.34 *
Overall Self-Care Index	1.76	0.33	2.18	0.37	15.24 *
Tennessee Self-Concept: Physical subscale	66.36	7.51	50.86	9.97	35.59 *
Total Quality of Life	75.39	15.25	55.19	16.95	16.63 *
Hope Scale	25.42	2.98	19.57	4.11	31.18 *
Self-Efficacy Inventory	122.00	16.90	97.93	25.31	15.30 *

Note. All $dfs = 1,48$ * $p < .01$

Table 2: Correlation matrix of selected variables for cohort with Type 1 diabetes.

	Average last 3 HbA1c	Overall Complications Index	Overall Self Care Index	Tennessee Physical Self-esteem	Hope Scale	Self Efficacy Inventory	Quality of Life (SF-36)	BDI Total
Years since onset of diabetes	.31	.57*	-.15	-.05	-.14	-.24	-.12	-.07
Average last 3 HbA1c		.63*	.16	-.33	-.14	-.03	-.35	.31
Overall Complications Index			.03	-.31	-.11	-.14	-.26	.04
Overall Self Care Index				-.42*	-.26	-.23	-.42*	.55*
Physical Self-esteem					.67*	.51*	.64*	-.72*
Hope Scale						.73*	.42*	-.59*
Self Efficacy Inventory							.34	-.51*
Quality of Life								-.60*

Note. * $p < .01$

The third regression analysis was conducted with the Overall Self-Care Index as the dependent variable, and years since onset of diabetes, HbA1c levels, diabetic complications, physical self-concept, quality of life, depression, hopelessness, and self-efficacy as independent variables. Results indicated that a smaller but still significant amount of adjusted variance in adherence (25%) was accounted for ($F(8,41) = 3.08, p < .008$), with only depression severity exhibiting a non-significant but notable unique predictive trend ($\beta = -.40, p = .07$).

A fourth regression analysis was conducted with quality of life as the dependent variable, and overall diabetic complications, overall adherence, physical self-concept, and depression as independent variables. The model accounted for 43% (adjusted) of variance ($F(4,45) = 10.16, p < .000$), with only physical self-concept exhibiting a non-significant but notable unique predictive trend ($\beta = .35, p = .044$).

Finally, given its emergence as a significant predictor of depression, quality of life, and diabetic complications, a regression analysis was conducted with physical self-concept as the dependent variable. Length of diabetes, HbA1c levels, diabetic complications, depression, and health- or self- related beliefs (i.e., self-efficacy and hopelessness measures) were entered as independent variables. The model accounted for 65% (adjusted) of variance ($F(6,43) = 16.26, p < .000$), with overall diabetic complications, depression and hopelessness exhibiting significant beta coefficients ($\beta = -.36, p = .003$; $\beta = -.49, p = .000$; and $\beta = .39, p = .004$, respectively).

Discussion

The present study aimed to examine factors that predict depression in Type 1 diabetes, as well as investigate the role of depression in diabetes health-related behaviours and outcomes such as health complications and quality of life. Overall, the findings supported the important role that depression plays in the experience of people with Type 1 diabetes.

Use of a self-report measure of depression precluded a reliable examination of the incidence of major depression in the present cohort. However, taking a BDI cut-off score of 14 to identify "casesness" (Beck & Steer, 1993), 12 percent of the cohort could be considered as likely "depressed". The prevalence of depression in the general Australian population is around 8 percent, indicating the possibility of some increased risk associated with having diabetes, although estimates of depression in the present study are not in the range of up to 30 percent reported in a range of studies (de Groot, Anderson, Freedland, Clouse,

& Lustman, 2001). The nature of the present cohort, recruited through hospital outpatient clinics with good quality health and mental health care may account for the results. Nevertheless, the main aims of the present study were to examine ways in which depression might influence treatment adherence and health outcomes, particularly diabetes complications and quality of life, as well as elucidating what factors predicted depression in Type 1 diabetes.

We examined whether increased risk for diabetic outcomes and complications, adherence difficulties, and health-related beliefs were evident between depressed and non-depressed subgroups. On the basis of previous research that had shown increased risk even in mildly dysphoric diabetic patients (Haire-Joshu, Heady, Thomas, Schechtman, & Fisher, 1994; Leedom, Meehan, Procci, & Zeidler, 1991; Stone, Bluhm, & White, 1984), a less conservative BDI cutoff of 10 was used to determine whether individuals reported notable levels of depression symptoms. Significant differences between those with and without notable levels of depression symptoms were found on measures of physical self-esteem, quality of life, hopelessness, self-efficacy, and overall diabetic self care activities. However, there were no differences between the "depressed" and "non-depressed" subsamples on glycaemic control and diabetic complications, nor in the number of years since having been diagnosed with diabetes. Again, the quality of health and mental health care in the present outpatient setting may account for the relatively positive results for these depressed patients with Type 1 diabetes. As expected, depressed patients with Type 1 diabetes were more likely to acknowledge a more negative physical self-concept, a lower sense of self efficacy and a lower sense of hope. As such, it was not surprising to find that the group with notable depression levels also reported lower quality of life. Interestingly, the overall pattern of results did not change when we used a less conservative BDI cutoff of 14.

With respect to self-care, our findings supported its association between depression on a number of levels. "Depressed" participants acknowledged a greater number of reasons for non-compliance in specific areas of treatment adherence, such as diet, exercise, glucose testing and medication over the past week. Possibly due to the small sample size and conservative significance levels, there was only a tendency for differences on the frequency of behavioural adherence. Furthermore, depression severity exhibited the sole predictive trend regarding overall non-adherence to diabetic treatment. The limited time frame of the adherence measure may account for this unexpected result. However, depressed patients reported more reasons for non-compliance and

experienced these reasons more frequently. One would expect that relatively lower levels of behavioural activation in depressed individuals would be associated with decreased self-care activities.

We also examined the association between depression and other diabetes-related variables. The complexity and reciprocity of the relationship between depression and diabetes was supported. Depression levels were best predicted by poorer physical self-concept, with predictive trends for diabetic complications, lower levels of overall treatment adherence, poorer self efficacy, and poorer glycaemic control. As expected, diabetic complications were significantly associated with length of time since onset of diabetes, poorer glycaemic control, and poorer physical self-concept, while depression exhibited a predictive trend. Poorer physical self-concept, however, was the only notable, albeit nonsignificant, predictor of decreased quality of life. Nonetheless, depression was a significant predictor of poorer physical self-concept, along with greater overall diabetic complications and hopelessness. The complex and often reciprocal nature of these interrelationships are consistent with Rubin, Walen, and Ellis (1990) who discuss the effects of fluctuating glycaemic control and diabetes complications on psychological functioning (e.g., mood, cognitions) and, subsequently, on treatment adherence.

The specific relationship between depression and glycaemic control also appears to be complex. Consistent with Lustman Anderson, Freedland, de Groot, and Carney (2000), the present study found a low-to-moderate association between depression and glycaemic control but, given relatively low participant numbers, this constituted only a nonsignificant association. Investigating the relationship between glycaemic control and depressed mood in Type 1 and Type 2 diabetes separately, van Tilburg et al. (2001) reported a significant positive relationship in Type 1 but not Type 2 cohorts. Given that Type 1 respondents who had poorer glycaemic control and higher depression scores also reported a lower frequency of blood glucose monitoring, the authors concluded that the effect of depression on glycaemic control is mediated by decreased self-care behaviours. Similarly, as discussed previously, our findings supported some association between depression and self-care.

The present findings also supported the poorer quality of life associated with depression amongst people with diabetes. Diabetic patients have been reported as showing greater decrements within physical health domains (i.e., physical functioning, role limitations due to physical problems and bodily pain) than obsessive-compulsive and normal controls (Koran, Thienemann, & Davenport,

1996), but not compared to depressed cohorts. The comorbid presentation of diabetes and depression is likely to be associated with even greater disability and burden of disease than normally associated with diabetes on its own. Hence, given decrements in physical capacity, the focus on physical identity in diabetes is expected. This would suggest a need to consider early intervention programs to prevent onset of depression in diabetes. While it has been proposed that gender plays a role in quality of life in diabetes, with women reporting poorer quality of life than men (Kauffman et al., 2000), the present study failed to find evidence that gender was related to diabetic outcomes.

While Tavormina, Kastner, Slater, and Watt (1976) reported poorer physical self-concept in diabetic cohorts compared to controls, we found that our sample of "depressed" respondents with Type 1 diabetes reported poorer physical identity than the "non-depressed" diabetic cohort. Patients with Type 1 diabetes may experience disruptions in their perceptions of their physical self as complications emerge and ongoing physical activities are affected by hyper- or hypo glycaemic episodes. They may also construct a negative self-identity (Charmaz, 1994; 1995) as daily demands (e.g., regular glycaemic monitoring, insulin injections, dietary restrictions) are encountered. Our study further confirmed that poorer physical self-concept was best predicted by greater depression, hopelessness, and complications. Furthermore, there were associations with poorer treatment adherence and lowered quality of life. These findings highlight the importance of self-concept in diabetes care, and can be accounted for in a number of ways.

First, cognitive theories can be used to account for aspects of the current results. While both optimism and self-efficacy exhibited moderate-to-high correlations with physical self-concept, contrary to expectations, they failed to be associated with diabetic variables such as complications, treatment adherence, glycaemic control, or even length of illness. They were, however, associated with depression. According to information processing theories, depressed affect is likely to trigger dysfunctional thinking (Dobson & Kendall, 1993). On the other hand, more traditional cognitive theories suggest that dysfunctional thinking constitutes a vulnerability factor for depression. Either way, pessimism and poor self-efficacy were both associated with both poor physical self-concept and depressed mood which, in turn, were predictive of negative diabetic outcomes.

Individuals with Type 1 diabetes are also likely to become frustrated at the prospect of being responsible for bodily concerns forever, with no guarantee that their condition will stabilise with adherence or even of

successful outcomes. It was not surprising to find that overall complications were significantly correlated with years since onset of diabetes and poorer glycaemic control. A sense of compromised control and self-efficacy may manifest as a lack of optimism about the future, ultimately leading to depression. Poorer health outcomes, poorer treatment adherence, and a decline in overall quality of life are expected consequences. The lack of a significant association between disease duration and perceived self-concept and life satisfaction may actually highlight an unstable self-concept that waxes and wanes with different phases of the disease. The tenuous nature of self-perceptions may be particularly true for individuals with Type 1 diabetes who experience wide swings in their glycaemic control. If an individual with diabetes lacks a positive self image or adaptive cognitions such as optimism and self-efficacy, then he/she is more likely to engage in nonadaptive behaviours (e.g., non-compliance). The subsequent onset of depression will further exacerbate maladaptive psychological, adherence and biological processes. Such formulations have important implications for therapeutic practice (Harter, 1990).

The present study exhibited a number of limitations including a small selective sample, power concerns, and the lack of structured interviews for psychiatric diagnoses. Future research will need to account for these limitations through replication with larger and more representative samples; perhaps including samples recruited through primary care and other community settings where specialist care may not be as intensive as that in hospital outpatient settings. Furthermore, longitudinal studies are required to examine the temporal relationships amongst psychological and health-related factors in Type 1 diabetes. Given the strong association between depression and anxiety, it would also be worthwhile to investigate anxiety disorders in diabetes. Despite the present study's limitations, the strength and pattern of relationships found supported the significance of depression in a number of aspects of diabetes. In particular, support in a Type 1 diabetic cohort for the relationships between depression and cognitive factors that are of relevance to contemporary psychological treatments is an important additional contribution to the literature. Advancing our understanding of relevant factors that may mediate the relationship between depression and health outcomes in diabetes will be important in developing early interventions. While psychological interventions for depression have generally been found to be effective in improving adjustment, adherence, and glycaemic control, there is room for improvement particularly with respect to consistency in concurrent improvements in health and mental health

outcomes (Padgett, Mumford, Hynes, & Carter, 1988; Anderson, Wolf, Burkhart, Cornell, & Bacon, 1989; Lustman, Griffith, Freedland, Kissel, & Clouse, 1998; Lustman & Clouse, 2002; Silverman, Hains, Davies, & Parton, 2003). On the basis of the present study, interventions that target the impact of self-efficacy and optimism on self-perceptions as a way of influencing mood states, treatment compliance, and health outcomes in Type 1 diabetes may be advantageous.

Overall, a range of factors was found to be related to depression levels in a cohort with Type 1 diabetes from a large metropolitan hospital, while depression itself was implicated in factors such as treatment compliance, glycaemic control, quality of life and health-related beliefs. Future research will need to be better powered and focus on other settings in order to further our understanding of the complex interrelations between depression, cognitive and behavioural factors, and health outcomes in diabetes.

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