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**Psychosocial functioning and glycemic control in emerging adults with type 1 diabetes: A 5-year follow-up study**

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## Abstract

***Objective.*** The principal aim of this study was to examine the longitudinal interplay of depressive symptoms, diabetes-specific perceptions and distress, and glycemic control in emerging adults with type 1 diabetes.

***Methods.*** Emerging adults with type 1 diabetes (18-30 years old) participated in a two-wave longitudinal study spanning five years (*N*=164 at Time 1). Patients completed questionnaires on depressive symptoms, diabetes-specific distress (treatment-related, food-related, emotional, and social support problems), and illness perceptions (consequences and personal control) at baseline and follow-up. $HbA_{1c}$ values were obtained from treating clinicians. We investigated the directionality of effects using cross-lagged path analysis.

***Results.*** Stronger perceptions of control predicted a relative decrease in treatment-related problems five years later, whereas stronger perceptions of consequences predicted a relative increase in depressive symptoms, treatment-related, food-related, emotional, and social support problems over time. Furthermore, higher depressive symptoms predicted a relative increase in social support problems five years later. None of the study variables were related to changes in glycemic control over time.

***Conclusions.*** Our findings stress the importance of addressing patients' perceptions and beliefs about their diabetes. Clinicians should find a delicate balance between stressing the importance of diabetes care and preventing patients from feeling overwhelmed or engulfed by the burden of diabetes care. Furthermore, our findings advocate for depression screening and treatment as key elements in holistic diabetes care, given the relatively high prevalence of elevated depressive symptoms in this population.



**Keywords**: depressive symptoms; distress; emerging adulthood; longitudinal; type 1 diabetes.

## Introduction

Emerging adults with type 1 diabetes are generally seen as a high-risk group in terms of physical and psychosocial functioning (Peters & Laffel, 2011). During the transition to adulthood, patients are expected to take increasing responsibility for their own diabetes care (Schulenberg, Sameroff, & Cicchetti, 2004). However, as emerging adults are not yet fully committed to traditional adult roles and parental monitoring typically decreases during this period in life, relatively high levels of risky behaviors have typically been reported during emerging adulthood (Arnett, 2000). Some patients might still find themselves in a phase of experimentation or even rebellion, in which the presence of diabetes is denied and patients feel constrained by the rigid regimen inherent to diabetes care (Paterson & Thorne, 2000). As a result, many patients experience difficulties in achieving optimal glycemic control, putting them at risk for complications later in life (Bryden, Dunger, Mayou, Peveler, & Neil, 2003). In addition, many patients experience emotional distress, having to deal with both normative challenges (such as finding a job and leaving the parental home) and the many demands of the diabetes regimen (comprising diet, exercise, blood glucose monitoring, and daily insulin administrations) (Weissberg-Benchell, Wolpert, & Anderson, 2007).

Although prior research has demonstrated the importance of studying depressive symptoms, and diabetes-specific perceptions and distress in individuals with diabetes, some important gaps remain. First, the cross-sectional designs used do not allow for establishing directional effects. Such directional effects can shed light on whether depressive symptoms play a primary role in the deterioration of glycemic control and the development of diabetes-specific distress and maladaptive perceptions or, alternatively, whether such symptoms constitute a secondary response to diabetes-specific distress and perceptions. Second, prior research has focused mainly on children and adolescents with type 1 diabetes and adults with type 2 diabetes, making emerging adults with type 1 diabetes an understudied population.

Therefore, the principal aim of the present study was to examine the longitudinal interplay of patients' illness perceptions, depressive symptoms, diabetes-specific distress, and glycemic control in the transition to adulthood.

***Depressive Symptoms and Diabetes-specific Distress***

A vast body of research has suggested that individuals with diabetes report more psychological disturbance as compared to the general population (Gendelman et al., 2009). For instance, individuals with diabetes are approximately twice as likely to meet DSM-IV criteria for major depressive disorder and 20 to 25% of patients report depressive symptoms (Anderson, Freedland, Clouse, & Lustman, 2001). In addition, a long-term follow-up study of adolescents with type 1 diabetes showed that nearly 50% were diagnosed with a psychiatric disorder within 10 years after diagnosis, with depression being the most common diagnosis (Kovacs, Goldston, Obrosky, & Bonar, 1997). These findings are alarming given that depressive symptoms have been linked to poorer diabetes self-care and glycemic control, greater symptom severity, various diabetes complications, and increased health care costs (De Groot, Anderson, Freedland, Clouse, & Lustman, 2001; Egede, Zheng, & Simpson, 2002; Gonzalez et al., 2008; Lustman et al., 2000). However, some authors have argued that diabetes-specific distress rather than depressive symptoms is most predictive of such health outcomes (Aikens, 2012; Fisher et al., 2010). According to these authors, diabetes-specific distress is about twice as prevalent in this population as compared to major depressive disorder, is more persistent over time, and is independently associated with a host of outcomes such as diabetes complications and diabetes self-care (Fisher et al., 2010).

Recent studies have adopted a more differentiated view and stressed the importance of assessing both depressive symptoms and diabetes-specific distress. In a study by van Bastelaar et al. (2010), depression in the absence of diabetes-specific distress did not elevate the risk for poorer glycemic control, nor did diabetes-specific distress in the absence of

depression. Hence, research should examine the interplay of both types of distress, as they may reinforce each other over time. In addition, research should focus on identifying modifiable determinants through which patients' distress could be relieved. A potentially important determinant that also represents a potential target for prevention and intervention programs constitute patients' perceptions about their illness (Edgar & Skinner, 2003).

***Illness Perceptions in Type 1 diabetes***

According to the common sense model proposed by Leventhal et al. (1984), the key to optimal physical and psychosocial functioning lies in the perceptions that patients hold about their illness. Illness perceptions comprise a number of interrelated beliefs about the illness and what it means for the patient's life. Important dimensions include identity, timeline (cyclical, acute versus chronic), personal and treatment control, consequences, and illness coherence (Petrie & Weinman, 2012). In a meta-analysis by Hagger and Orbell (2003), perceptions of consequences and personal control were shown to be important predictors of how well individuals managed and adjusted to their illness. Hence, we focused on these two particular illness perceptions. Whereas some patients might feel as if their treatment impacts on every aspect of their daily life (work, relationships, hobbies), others might consider it just being one of the many daily routines (i.e., high vs. low levels of consequences). Similarly, some patients might feel in control of their diabetes by frequently monitoring their levels of blood glucose, whereas others might feel like their illness is mainly determined by factors beyond their control, such as hormonal changes (i.e., high vs. low levels of personal control).

Perceptions of consequences and personal control have been repeatedly shown to relate to diabetes-specific distress, depressive symptoms, and glycemic control in individuals with diabetes (Edgar & Skinner, 2003; Mc Sharry, Moss-Morris, & Kendrick, 2011; Rassart, Luyckx, Klimstra, et al., 2014). However, due to the lack of longitudinal studies using a cross-lagged panel design, the directionality of effects remains unclear. Perceptions of high

consequences and low personal control indeed could lead to a worsening of glycemic control and a relative increase in depressive symptoms and diabetes-specific distress over time. However, poor glycemic control and heightened levels of distress may also result in further increases in perceived consequences and decreases in perceived personal control, constituting a negative vicious cycle. Identifying such pathways over time is of utmost importance for designing prevention and intervention strategies.

### *The Present Study*

The present longitudinal study examined how patients' illness perceptions, levels of diabetes-specific distress, depressive symptoms, and glycemic control were interrelated over a period of five years. Sex, age, and illness duration were included as covariates given that prior research has linked these variables to several of our study variables. For instance, depressive symptoms are commonly found to be more prevalent in females and patients with longer illness duration (Lloyd, Pambianco, & Orchard, 2010). First, we expected higher perceived consequences and lower perceived personal control to predict relative increases in depressive symptoms and diabetes-specific distress over time. However, as discussed above, some bidirectional associations might be observed as well. We also examined whether differential associations would emerge for different domains of diabetes-specific distress. One might expect that individuals who perceive diabetes as having a strong impact on daily life would report more diabetes-specific emotional problems, such as feeling angry about living with diabetes. Individuals who experience little control over diabetes might be especially at risk for treatment-related problems, such as feeling discouraged with the diabetes regimen.

Second, we expected that diabetes-specific emotional and social support problems would be positively related to depressive symptoms five years later. The latter hypothesis is in line with community research showing that depressive symptoms and loneliness tend to reinforce one another other over time (Vanhalst et al., 2012). Finally, no clear hypotheses

could be forwarded on how patients' illness perceptions, depressive symptoms, and diabetes-specific distress would relate to changes in glycemic control over time given that previous research has been mainly cross-sectional in nature and produced mixed findings.

## Method

### Participants and Procedure

Between January 1, 1989 and December 31, 2006, the Belgian Diabetes Registry prospectively registered 5,559 individuals with type 1 and type 2 diabetes, being a representative group of Belgian patients under the age of 40 in terms of demographic and clinical criteria (1). In 2007, a total of 1,111 individuals fulfilled the following criteria: 1) Dutch-speaking, 2) diagnosed with type 1 diabetes, 3) 18 to 30 years old, and 4) the availability of contact details. A random subsample of 500 individuals was invited to participate. After a couple of weeks, all individuals that did not yet respond, were sent a reminder. Five years later, in 2012, patients who participated in 2007 were contacted for follow-up (with, again, reminders being sent out after a couple of weeks). At both points in time, treating physicians were contacted to obtain $HbA_{1c}$ values from patients' medical records. This study was approved by the Institutional Review Board at the KU Leuven and, following a detailed written briefing, all participants signed an informed consent form. It is part of a larger project focusing on the biopsychosocial functioning of emerging adults with type 1 diabetes. Previous cross-sectional studies using data from Time 1 or Time 2 have linked patients' illness perceptions, coping strategies, identity processes, and personality traits to glycemic control and psychosocial outcomes (Luyckx et al., 2008; Luyckx, Moons, & Weets, 2011; Luyckx, Vanhalst, Seiffge-Krenke, & Weets, 2010; Rassart, Luyckx, Moons, & Weets, 2014; Rassart et al., 2014). The present study is the first to use data on illness perceptions, depressive symptoms, and glycemic control from both measurement waves

At Time 1 of the present study, a total of 197 (39%) patients returned the completed questionnaires. For 164 (83%) patients, $HbA_{1c}$ values were available. In the present study, we only included those patients for whom we had questionnaire data as well as $HbA_{1c}$ values at Time 1. Demographic and clinical information on these participants is provided in Table 1. At Time 2, five years later, questionnaire data and $HbA_{1c}$ values were available for 94 (57%) and 105 (64%) patients, respectively. No differences were observed between participants with and without complete data at Time 2 on sex [$\chi^2(1)=1.46$, $p=.227$], age [$F(1,162)=0.58$, $p=.447$, $\eta^2=.00$], illness duration [$F(1,161)=2.57$, $p=.111$; $\eta^2=.02$] or any of the study variables at Time 1 [$F(8,152)=1.65$, $p=.115$, $\eta^2=.08$]. Furthermore, Little's (1988) missing completely at random test indicated that missing values could be reliably estimated [$\chi^2(123)=87.78$, $p=.993$]. Hence, for the cross-lagged analyses in MPLUS 6.1, we used the full information maximum likelihood (FIML) procedure to deal with missing values, allowing us to conduct our analyses on all 164 participants. As suggested by Kline (2005), this number of participants is sufficient to estimate less complex path models. Sensitivity analyses for patients who participated at both time-points resulted in virtually identical cross-lagged findings, further testifying to the robustness of our findings. For the preliminary analyses in SPSS 22.0, we used the expectation maximization (EM) algorithm to deal with missing values.

**Measures**

***Depressive symptoms.*** Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D; Bouma, Ranchor, Sanderman, & van Sonderen, 1995). Each item indicates how often participants had experienced certain symptoms of depression during the past week using a 4-point scale, with higher scores pointing to higher levels of depressive symptoms. A sample item reads "During the last week, I felt depressed". Based on the conventional cut-off point of 16 (Peyrot & Rubin, 1999), a

total of 43 individuals (23%) at Time 1 and 50 individuals (27%) at Time 2 showed elevated levels of depressive symptoms. Cronbach's alpha was .93 at Time 1 and .94 at Time 2.

***Diabetes-specific distress.*** The Problem Areas in Diabetes Scale (Polonsky et al., 1995) was used to assess emotional (12 items), treatment-related (3 items), food-related (3 items), and social support problems (2 items) using a 5-point scale, with higher scores pointing to higher levels of distress. Sample items include: "Feeling scared when you think about living with diabetes" (emotional problems), "Feeling discouraged with your diabetes regimen" (treatment-related problems), "Feelings of deprivation regarding food and meals" (food-related problems), and "Feeling alone with diabetes" (social support problems). Cronbach's alphas for emotional, treatment-related, and food-related problems were .90, .62, and .80 at Time 1 and .93, .63, and .78 at Time 2, respectively. The inter-item correlation for the two social support items was .40 at Time 1 and .51 at Time 2 (*p*s<.001).

***Illness perceptions***. Perceived consequences and personal control were measured with the respective subscales from the revised Illness Perception Questionnaire using a 5-point scale, with higher scores pointing to higher levels of the variable at hand (Moss-Morris et al., 2002). Sample items include: "My diabetes has major consequences on my life" (consequences; 6 items), and "There is a lot I can do to control my symptoms" (personal control; 6 items). Cronbach's alphas were .68 and .73 at Time 1 and .70 and .85 at Time 2,.

***Glycemic control.*** $HbA_{1c}$ is a commonly used measure of glycemic control and represents the mean blood glucose concentration for the past 6 to 8 weeks. Higher $HbA_{1c}$ values indicate poorer glycemic control. Treating physicians were contacted to obtain these values from patients' medical records that were closest to the date the patients filled out the questionnaires. Because different methods in different laboratories were used to determine $HbA_{1c}$ values, these values were expressed as the number of standard deviations from the mean of their respective reference intervals (as every method has its own reference interval).

## Statistical Analysis

Cross-lagged analysis with Structural Equation Modelling (SEM) was used to test directionality of effects. Two multivariate outliers were identified and dropped from all subsequent analyses. Furthermore, bootstrapping was performed in MPLUS (with a total of 5,000 resamples) to correct for non-normality in the data. In the cross-lagged models being tested, we included all within-time associations, stability paths, and cross-lagged paths among illness perceptions and diabetes-specific distress (Model 1), illness perceptions and depressive symptoms (Model 2), illness perceptions and $HbA_{1c}$ (Model 3), and depressive symptoms, diabetes-specific distress, and $HbA_{1c}$ (Model 4). Cross-lagged coefficients can be interpreted as variable X assessed at Time 1 predicting relative changes (i.e., relative increases or decreases) in variable Y assessed at Time 2. In all four models, sex, age, and illness duration were controlled for by estimating paths from these variables to each variable at Time 1. Furthermore, in Models 1 and 2, we controlled for patients' $HbA_{1c}$ values at baseline.

To evaluate model fit, we used the chi-squared index, which should be as small as possible; the root mean square error of approximation (RMSEA), which should be less than .08 (< .05 is excellent); and the comparative fit index (CFI) which should exceed .90 (>.95 is excellent) (Kline, 2006). To assess whether cross-lagged paths were invariant in men and women, a multi-group analysis was performed. We compared a constrained model (with all cross-lagged coefficients set as equal across men and women) with an unconstrained model (with all cross-lagged coefficients allowed to vary across men and women). The cross-lagged paths were considered to be invariant if the difference in $\chi 2$, relative to the degrees of freedom, between the constrained and unconstrained model would be non-significant.

# Results

## Mean-Level and Correlational Analyses

To assess mean-level changes across time in all study variables, we conducted repeated-measures ANOVAs. As shown in Table 2, significant mean-level decreases were observed for food-related problems and perceived personal control whereas significant increases were observed for $HbA_{1c}$. Next, to examine the presence of sex differences in our study variables, we performed a MANOVA with sex as independent variable and the study variables at Time 1 as dependent variables. No significant multivatiate sex differences were found [$F(8,153)=1.65$, $p=.115$, $\eta^2=.08$]. However, as shown in Table 3, follow-up univariate analyses indicated that women scored higher than men on diabetes-specific emotional problems and lower than men on perceived personal control. Finally, to examine the role of age and illness duration at Time 1, we calculated Spearman's rho correlations. Longer illness duration was associated with higher $HbA_{1c}$ values [$r(162)=.42$, $p<.001$]. Age was not related to any of the study variables at Time 1.

Table 4 presents all associations among the study variables at Times 1 and 2 using Spearman's rho correlations. At both time points, the different domains of diabetes-specific distress (i.e., treatment- and food-related problems, emotional problems, and social support problems) were positively related to depressive symptoms and perceived consequences and negatively related to perceived personal control. Furthermore, depressive symptoms were positively associated with perceived consequences and negatively associated with perceived personal control. Finally, at both time points, $HbA_{1c}$ was positively associated with treatment-related and emotional problems, and negatively associated with perceived personal control. Moreover, at Time 2, $HbA_{1c}$ was positively associated with social support problems and perceived consequences.

***Directionality of effect***

In the first cross-lagged model, presented in Figure 1, stronger feelings of personal control predicted a relative decrease in treatment-related problems five years later.

Conversely, stronger perceptions of consequences predicted a relative increase in treatment- and food-related, emotional, and social support problems five years later. In the second cross-lagged model, presented in Figure 2, stronger perceptions of consequences predicted a relative increase in depressive symptoms five years later. In the third cross-lagged model, no significant cross-lagged associations emerged among patients' illness perceptions and $HbA_{1c}$ values. Finally, in the fourth cross-lagged model, presented in Figure 3, higher levels of depressive symptoms predicted a relative increase in social support problems five years later. As shown in these figures, all models provided a good fit to the data. None of the relationships were moderated by patients' sex [Model 1: $\Delta\chi2(16)=20.41$, $p=.202$; Model 2: $\Delta\chi2(4)=0.47$, $p=.976$; Model 3: $\Delta\chi2(4)=5.11$, $p=.276$; Model 4: $\Delta\chi2(18)=28.35$, $p=.057$].

## Conclusions

This five-year follow-up study addressed the psychosocial functioning and glycemic control of individuals with type 1 diabetes and specific concerns in the developmental stage of emerging adulthood. Our findings stress the importance of targeting depressive symptoms and maladaptive illness perceptions in emerging adults with type 1 diabetes as a way to facilitate better adjustment to diabetes during this high-risk time. First, the prevalence rates of elevated depressive symptoms (i.e., a CES-D score of 16 or higher) were similar to the findings from a meta-analysis and more recent studies specifically on type 1 diabetes (Anderson et al., 2001; Gendelman et al., 2009). Although most individuals stayed under the threshold, elevated depressive symptoms were observed in 23% of participants at Time 1 and 27% of participants at Time 2. These elevated depressive symptoms may put patients at risk for developing clinical depression later in life (Judd, Schettler, & Aiskal, 2002) which, in turn, has been linked to poorer self-care and glycemic control, various diabetes complications, and increased health care costs (De Groot et al., 2001; Egede et al., 2002; Gonzalez et al., 2008; Lustman et al., 2000). Hence, screening high-risk patients should be part of a comprehensive treatment

plan and appropriate follow-up care. However, as clinicians often are not trained to treat depressive disorders, interdisciplinary collaboration with psychologists is crucial to this end.

Second, depressive symptoms were found to predict a relative increase in social support problems five years later, such as feeling alone with diabetes and feeling that friends and family are not supportive of diabetes management efforts, even after controlling for the effects of sex, age, illness duration, and $HbA_{1c}$. A non-supportive social network may, in turn, interfere with diabetes self-care by introducing stress which compromises the attitudes and behaviors necessary for self-care (DiMatteo, 2004). The present findings are in line with Coyne's (1976) interpersonal theory of depression which postulates that the interpersonal behaviors and attitudes of depressed individuals tend to induce rejection by significant others. Previous cross-sectional research using this sample at baseline has already shown that depressive symptoms are positively related to different domains of diabetes-specific distress (Luyckx et al., 2010). The present cross-lagged findings add to these findings by demonstrating that depressive symptoms and some domains of diabetes-specific distress are interrelated over time, with depressive symptoms spilling over in diabetes-specific distress rather than vice versa.

Third, our findings stress the importance of addressing the perceptions that patients hold about their illness (Edgar & Skinner, 2003; Mc Sharry et al., 2011). Weaker feelings of control over diabetes were found to predict a relative increase in treatment-related problems five years later, above and beyond the effects of sex, age, illness duration, and $HbA_{1c}$. This finding adds to growing evidence which indicates that perceived self-efficacy to cope with the consequences of chronic illness is essential for developing self-care competencies (Johnston-Brooks, Lewis, & Garg, 2002). Indeed, patients who believe that diabetes is mainly determined by factors beyond their control may become less motivated for performing daily self-care activities and may lack clear and concrete goals for diabetes treatment. Hence, it is

important that clinicians try to identify, challenge, and reframe such negative beliefs regarding diabetes care (Snoek et al., 2008; van der Ven et al., 2005).

Furthermore, we found that stronger perceptions of consequences predicted a relative increase in depressive symptoms, treatment- and food-related, emotional and social support problems five years later. Hence, clinicians should find a balance between stressing the importance of self-care activities on the one hand and encouraging patients to engage in normative developmental tasks (such as building a professional career and starting a family of their own) on the other hand (Weissberg-benchell et al., 2007). Psychologists could assist clinicians in framing the importance of diabetes care to avoid future medical complications without patients feeling overwhelmed or engulfed by the burden of diabetes care. In doing so, their approach should be developmentally appropriate and individually tailored by integrating the patient's life circumstances into their recommendations (Dovey-Pearce, Hurrell, May, Walker, & Doherty, 2005). Taken together, the temporal associations uncovered in the present study indicate that prevention and intervention efforts should not focus exclusively on patients' depressive symptoms; they should also be sensitive to diabetes-specific issues such as the perceptions that patients hold about their illness. Previous cross-sectional research using this sample at baseline has already shown that patients' illness perceptions are substantially related to the presence of depressive symptoms and diabetes-specific distress (Luyckx et al., 2010; Rassart et al., 2014). The present cross-lagged findings add to these findings by demonstrating that patients' illness perceptions, depressive symptoms, and levels of diabetes-specific distress are interrelated over time, with illness perceptions impacting depressive symptoms and diabetes-specific distress rather than vice versa.

Fourth, we found that none of the study variables were related to changes in glycemic control over time. However, when looking at the within-time associations, we did find that poorer glycemic control was related to higher treatment-related, emotional, and social support

problems. This finding corresponds to prior research linking diabetes-specific distress to poorer glycemic control, reduced self-care, and increased morbidity (Beverly, 2014). In contrast, no significant association emerged between depressive symptoms and glycemic control. This is in line with the recent findings of Aikens (2012) and Fischer et al. (2010) who found that diabetes-specific distress and not depressive symptoms predicted patients' level of glycemic control. Hence, our findings add to the growing literature differentiating between depressive symptoms and diabetes-specific distress. Finally, in line with a recent meta-analysis by Mc Sharry et al. (2011), poor glycemic control was associated with weaker feelings of control over diabetes and stronger perceptions of consequences. According to the common sense model, such perceptions inform illness-related coping behaviors which, in turn, impact on more distal outcomes such as glycemic control (Leventhal, 1984). Future research should include a broader array of illness perceptions given that the present study focused exclusively on perceived consequences and personal control. In addition, future research should examine whether other factors such as patients' involvement in specific self-care activities such as blood glucose monitoring (Rohan et al., 2014) can predict relative changes in glycemic control over time.

***Limitations and Suggestions for Future Research***

First, except for $HbA_{1c}$, data were gathered through self-report questionnaires only. Although questionnaires are most appropriate to gather information about patients' perceptions and feelings of distress, future studies should use other methods as well (e.g., interviews). Second, the internal consistencies of some of the scales (and the scale assessing treatment-related problems in particular) were quite low. Future research should develop and use more reliable measures of treatment-related problems. Third, some factors might compromise the generalizability of our findings. The voluntary nature of participation might have introduced sample bias, potentially resulting in an under- or overestimation of the

prevalence of depressive symptoms and diabetes-specific distress in this population. Furthermore, in addition to the relatively small sample size, a substantial proportion of the data was missing at Time 2 due to drop-out. Nonetheless, ancillary analyses in patients who participated at both time-points resulted in virtually identical cross-lagged findings. Finally, the present sample was limited to emerging adults with diabetes living in Belgium. As countries differ substantially in the access to high quality care and the long-term management of chronic illness (Samb et al., 2010), future research with larger and more diverse samples of emerging adults is needed. Despite these limitations, the present findings highlight the importance of identifying and targeting maladaptive illness perceptions and depressive symptoms in emerging adults with type 1 diabetes. Maladaptive illness perceptions and depressive symptoms most likely affect diabetes-specific functioning which, in turn, could set the patient on a vicious circle towards poor health. Hence, a long-term perspective seems warranted to uncover the full impact of these variables on functioning and health.

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Table 1

*Demographic and Clinical Characteristics of the Participants at Times 1 and 2*

| | Time 1 (*N* = 164) | Time 2 (*N* = 94) |
|---|---|---|
| **Sex** | | |
| Men | 70 (43%) | 34 (36%) |
| Women | 94 (57%) | 60 (64%) |
| ***M* age (*SD*)** | 23.48 (3.70) | 27.82 (3.61) |
| **Working status** | | |
| Studying | 56 (35%) | 10 (11%) |
| Full- or part-time work | 88 (54%) | 74 (79%) |
| Unemployed | 18 (11%) | 9 (10%) |
| **Marital status** | | |
| Living with parents | 61 (37%) | 15 (16%) |
| Single | 30 (18%) | 15 (16%) |
| In a relationship/Married/Co-habiting | 71 (44%) | 61 (67%) |
| Divorced | 2 (1%) | 1 (1%) |
| **Children** | | |
| Yes | 21 (13%) | 33 (35%) |
| No | 143 (87%) | 60 (65%) |
| ***M* Illness duration (*SD*)** | 7.29 (5.30) | 12.29 (5.36) |
| **Insulin administration type** | | |
| Injections | 143 (88%) | 67 (72%) |
| Pump | 20 (12%) | 26 (28%) |

Table 2

Repeated-Measures ANOVAs, Means, and *F*-Values

| Variables | Time 1<br>*M* (*SD*) | Time 2<br>*M* (*SD*) | *F*-value ($\eta^2$) |
|---|---|---|---|
| **Diabetes-specific distress** | | | |
| Treatment problems | 1.77 (0.78) | 1.79 (0.63) | 0.11 (.00) |
| Food problems | 2.22 (0.95) | 2.02 (0.78) | 15.37*** (.09) |
| Emotional problems | 2.19 (0.75) | 2.25 (0.77) | 2.27 (.01) |
| Social support problems | 1.51 (0.74) | 1.46 (0.65) | 1.33 (.01) |
| **Depressive symptoms** | 9.78 (9.26) | 10.74 (9.03) | 2.93 (.02) |
| **Illness perceptions** | | | |
| Consequences | 3.03 (0.69) | 3.06 (0.63) | 0.83 (.01) |
| Personal control | 4.12 (0.52) | 4.04 (0.50) | 4.65* (.03) |
| **$HbA_{1c}$** | 5.79 (3.40) | 6.25 (2.79) | 4.71* (.03) |

*Note.* *$p < .05$. **$p < .01$. ***$p < .001$. $HbA_{1c}$ values are standardized.

Table 3

Univariate ANOVAs, Means, and *F*-Values for Sex at Time 1

| Variables | Sex | | *F*-value ($\eta^2$) |
|---|---|---|---|
| | Men | Women | |
| | *M* (*SD*) | *M* (*SD*) | |
| **Diabetes-specific distress** | | | |
| Treatment problems | 1.63 (0.69) | 1.87 (0.84) | 3.52 (.02) |
| Food problems | 2.11 (0.89) | 2.30 (0.99) | 1.65 (.01) |
| Emotional problems | 2.00 (0.66) | 2.33 (0.79) | 7.71** (.05) |
| Social support problems | 1.43 (0.71) | 1.58 (0.77) | 1.62 (.01) |
| **Depressive symptoms** | 8.87 (7.94) | 10.44 (10.12) | 1.14 (.01) |
| **Illness perceptions** | | | |
| Consequences | 2.93 (0.69) | 3.10 (0.69) | 2.28 (.01) |
| Personal control | 4.22 (0.49) | 4.05 (0.53) | 4.01* (.02) |
| **$HbA_{1c}$** | 5.22 (3.16) | 6.22 (3.52) | 3.46 (.02) |

*Note.* *$p < .05$. **$p < .01$. ***$p < .001$. $HbA_{1c}$ values are standardized.

Table 4

*Spearman's Correlations Among Study Variables at Times 1 and 2*

| Variable | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| 1. Depressive symptoms | .32***/.49*** | .32***/.41*** | .47***/.67*** | .36***/.61*** | .37***/.61*** | -.33***/-.32*** | .09/.10 |
| 2. Treatment problems | --- | .46***/.54*** | .61***/.76*** | .30***/.58*** | .36***/.48*** | -.28**/-.56*** | .37***/.22** |
| 3. Food problems | | --- | .73***/.72*** | .49***/.62*** | .43***/.49*** | -.33***/-.28*** | .11/.14 |
| 4. Emotional problems | | | --- | .57***/.71*** | .50***/.60*** | -.30***/-.41*** | .16*/.23** |
| 5. Social problems | | | | --- | .38***/.48*** | -.24**/-.35*** | .14/.22** |
| 6. Consequences | | | | | --- | -.24**/-.35*** | .06/.20* |
| 7. Personal control | | | | | | --- | -.18*/-.17* |
| 8. $HbA_{1C}$ | | | | | | | --- |

*Note*. The first coefficient is for Time 1, the second for Time 2. $HbA_{1c}$ values are standardized.

* $p < .05$. ** $p < .01$. *** $p < .001$.

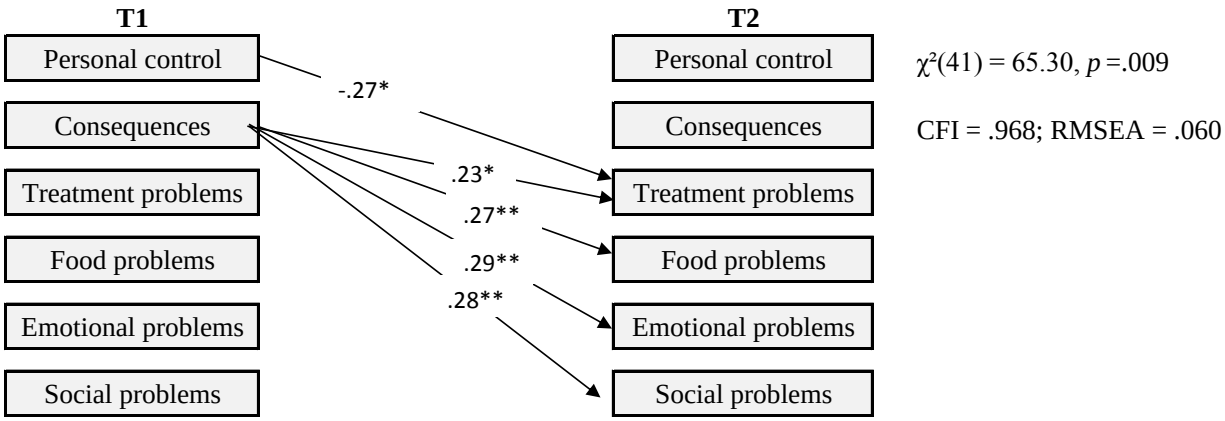


*Figure 1.*

Cross-lagged path model linking illness perceptions to several domains of diabetes-specific distress. Within-time associations, stability paths, and paths from sex, age, illness duration, and $HbA_{1c}$ are not presented for reasons of clarity. Stability paths ranged between .11 and .60. All path coefficients are standardized. * $p < .05$. ** $p < .01$. *** $p < .001$.

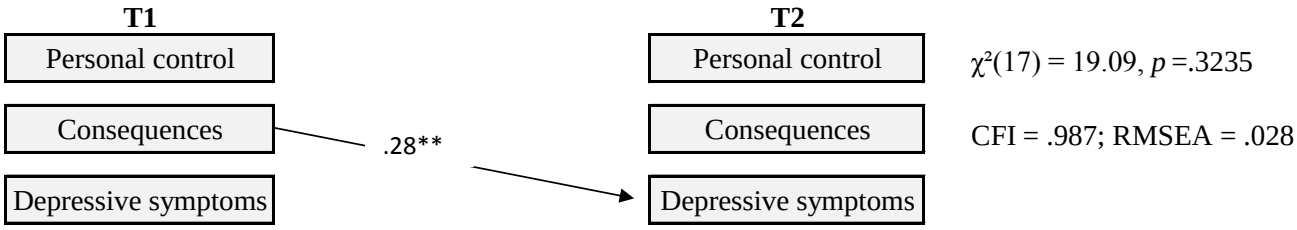


*Figure 2.*

Cross-lagged path model linking illness perceptions to depressive symptoms. Within-time associations, stability paths, and paths from sex, age, illness duration, and $HbA_{1c}$ are not presented for reasons of clarity. Stability paths ranged between .39 and .60. All path coefficients are standardized. * $p < .05$. ** $p < .01$. *** $p < .001$.

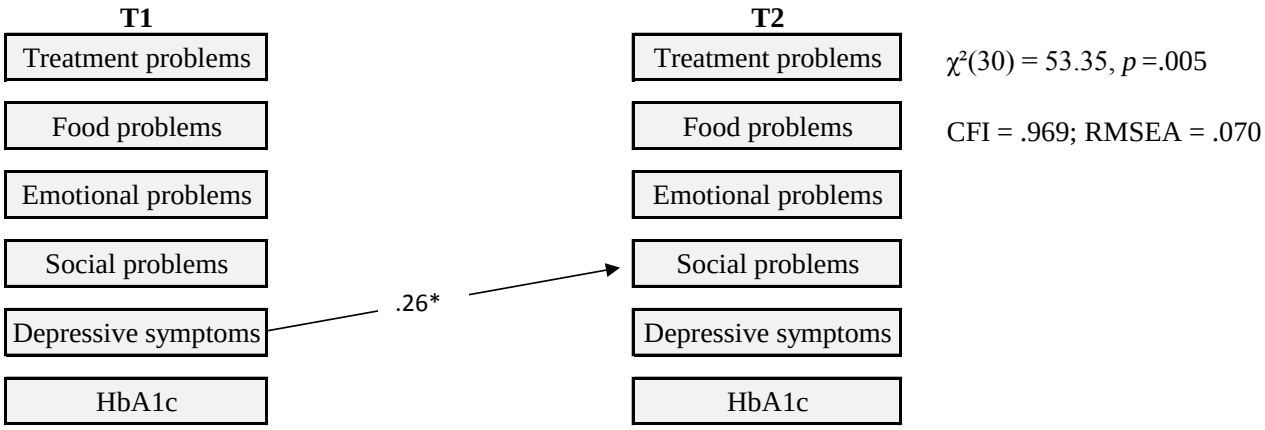


*Figure 3.*

Cross-lagged path model linking several domains of diabetes-specific distress, depressive symptoms, and $HbA_{1c}$. Within-time associations, stability paths, and paths from sex, age, and illness duration are not presented for reasons of clarity. Stability paths ranged between .15 and .53. All path coefficients are standardized. * $p < .05$. ** $p < .01$. *** $p < .001$.