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Abstract

The present study investigated identity formation in adolescents and emerging adults with type 1 diabetes and its relation to psychological and diabetes-specific functioning. As diabetes management is especially challenging in these life periods, identity problems may not only hamper psychological adjustment, but could also impact diabetes management. A total of 431 patients were 1:1 matched with control participants, based on age, gender, and context (student, employed, other). To investigate identity types or statuses, cluster analysis on different identity processes was conducted, resulting in six statuses. Patients in foreclosure and achievement (both characterized by strong identity commitments) presented with the most adaptive functioning. Patients in troubled diffusion and moratorium (both characterized by a maladaptive type of exploration) showed the least adaptive scores on well-being, diabetes-specific problems, treatment adherence, and illness-perceptions. The present study underscores the importance of assessing identity issues in youth with type 1 diabetes.

Keywords

identity, type 1 diabetes, adolescence, emerging adulthood, psychological functioning

Introduction

Type 1 diabetes (T1D) is a chronic illness that poses major challenges, with daily treatment including blood glucose monitoring, insulin administration, and dietary restraints. Especially during the transition to adulthood, diabetes management can be challenging as patients gradually take responsibility in managing diabetes (Hanna, 2012). In western cultures, adolescence and emerging adulthood are characterized by an increase in autonomy and independence (Buhl, 2008; White, Speisman, & Costos, 1983), which may have clear repercussions for diabetes management. Research has demonstrated a decline in treatment adherence and glycemic control throughout these life periods (Bryden, Peveler, Stein, Neil, Mayou, & Dunger, 2001). Although research has examined predictors of diabetes management, identity formation, being a core developmental task of adolescence and emerging adulthood, has been neglected.

According to Erikson (1968), the task of identity formation is a continuous and lifelong process that peaks in adolescence and emerging adulthood. In these age periods, individuals are expected to make personal life choices and attain a set of self-identified values and goals, indicative of identity synthesis. However, when failing to do so, identity confusion may develop, in which a clear sense of purpose and direction is lacking. Luyckx, Schwartz, et al. (2008) distinguished five identity processes which allow for an in-depth examination. Individuals may start by exploring various alternatives (*exploration in breadth*) before making life decisions (*commitment making*). Subsequently, individuals evaluate the degree to which these commitments correspond with internal standards (*exploration in depth*), playing into the degree to which these commitments become integrated as part of one's self (*identification with commitment*). Finally, the model includes a maladaptive identity process that represents individuals continuously worrying about alternatives and having trouble making life decisions (*ruminative exploration*).

Cluster analysis on these processes can derive *identity statuses* or combinations of these processes (Luyckx, Schwartz, et al., 2008). Achievement and foreclosure are defined as the most adaptive statuses as they represent individuals that make strong commitments without exploring in a ruminative manner (Luyckx, Schwartz, et al., 2008). In contrast to foreclosure, individuals in achievement explore their identity options. The moratorium status represents individuals actively exploring various options, yet without making commitments. As these individuals show higher levels of rumination, moratorium may signal an identity crisis in which identity questions remain unanswered. Carefree diffusion and troubled diffusion both represent rather maladaptive statuses, in which individuals do not explore and are unable to make life decisions. Individuals in troubled diffusion experience the most difficulties, as they worry about their lack of identity and engage in ruminative exploration (Luyckx, Schwartz, et al., 2008). Finally, the undifferentiated status represents individuals scoring moderate on all identity processes (Luyckx, Schwartz, et al., 2008).

Adolescents with T1D have been found to experience a delay in identity formation (Lugasi et al., 2013), as illness management is highly demanding and patients may feel different from peers (Commissariat, Kenowitz, Trast, Heptulla, & Gonzalez, 2016). The daily restrictions and awareness of long-term complications could negatively impact identity development (Dovey-Pearce, Doherty, & May, 2007). In contrast, several authors have emphasized the developmental competences of patients with T1D and described no delayed psychosocial maturation (Luyckx, Seiffge-Krenke, et al., 2008; Pacaud, Crawford, Stephure, Dean, Couch, & Dewey, 2007; Seiffge-Krenke, 2001). Luyckx, Seiffge-Krenke, et al. (2008) examined identity statuses in emerging adults with and without T1D. Patients and controls were equally distributed across the statuses, which offers support for patients with T1D being as competent in developing a personal identity. Further, patients in achievement and foreclosure experienced fewer depressive symptoms and diabetes-related problems when compared to patients in

diffusion. Especially patients in troubled diffusion displayed maladaptive coping. Hence, developing a clear personal identity may protect emerging adults with T1D against psychosocial problems and may motivate them to adequately cope with their diabetes.

Luyckx, Seiffge-Krenke, et al. (2008) made use of a rather small, exclusively emerging adult sample. In addition, patient and control samples were not matched on demographic characteristics. Hence, differences on identity functioning between both samples could be partly due to differences in demographic characteristics (Verschueren, Rassart, Claes, Moons, & Luyckx, 2017). Finally, a limited number of outcomes were studied. Therefore, the present study included both adolescents and emerging adults, with patients and control participants being 1:1 matched on age, gender, and context. Additionally, a more extensive set of outcome variables was included, with a strong focus on diabetes management (as indicated by treatment adherence and glycemic control). The present study addressed two objectives. First, we compared individuals with and without T1D on identity statuses. We expected achievement, foreclosure, moratorium, carefree diffusion, troubled diffusion, and undifferentiated statuses to emerge, with patients and controls being equally distributed among these statuses.

Second, we examined to what extent variability in identity formation may differentiate individuals with T1D on psychological and diabetes-specific functioning, as developing a clear identity may not only promote psychological adjustment, but efficient diabetes management as well (Luyckx, Seiffge-Krenke, et al., 2008; Seiffge-Krenke, 2001). Moreover, previous research in both community and clinical samples clearly demonstrated the added value of identity formation in the prediction of depressive symptoms, illness adaptation, and coping (Luyckx, Schwartz, Goossens, Beyers, & Missotten, 2011). Regarding well-being, we expected more depressive symptoms in the statuses characterized by high ruminative exploration. Conversely, we expected more life satisfaction in achievement and foreclosure as compared to moratorium and troubled diffusion (Luyckx, Seiffge-Krenke, Schwartz, Crocetti, & Klimstra,

2014). In line with Luyckx, Seiffge-Krenke, et al. (2008), individuals in achievement and foreclosure would report the least diabetes-related problems; individuals in carefree diffusion and especially troubled diffusion would report the most problems. In addition, we examined illness perceptions or patients' cognitive illness representations (Leventhal, Meyer, & Nerenz, 1980). We expected two factors to emerge using exploratory factor analysis (Janssen, De Gucht, van Exel, & Maes, 2013): 'Impact' represents beliefs regarding the physical, emotional, and social consequences of the illness; 'control' represents beliefs regarding the controllability of the illness. Achievement and foreclosure would score higher on perceptions of control, as these statuses are characterized by perceiving more control in life due to strong commitments. We expected higher levels of perceived impact in troubled diffusion and moratorium, as these individuals experience difficulty in coping with their illness and integrating it into their life (Luyckx, Seiffge-Krenke, et al., 2008). Similarly, we expected these individuals to have difficulty following daily treatment guidelines, and, hence, to score lowest on treatment adherence. Finally, with regard to glycemic control, we formulated no specific hypotheses as the relation between glycemic control and self-related functioning (such as personality, self-efficacy, and self-concept; Johnston-Brooks, Lewis, & Garg, 2002; Luyckx & Seiffge-Krenke, 2009; Mazze, Lucido, & Shamoon, 1984) has been inconsistent in both adults and adolescents.

Materials and methods

Participants and Procedure

A total of 1,450 patients with T1D from the Belgian Diabetes Register were invited to participate. Inclusion criteria were: aged 14-25 years, Dutch-speaking, and without cognitive impairment. A total of 575 patients completed the questionnaire and provided informed consent. Parental consent was given for participating minors. The research protocol was IRB approved.

We conducted analyses on patients from whom HbA1c-values were available, resulting in a final sample of 431 patients (47.1% male; M_{HbA1c}=7.74%, SD_{HbA1c}=1.43). These patients

were younger [$M_{included}$=18.48 (SD=3.36), $M_{excluded}$=20.09 (SD=2.59), F(1,564)=26.49, p<0.001, η^2=0.05] and had a shorter illness duration [$M_{included}$=6.99 years (SD=4.84), $M_{excluded}$=9.53 years (SD=4.90), F(1,564)=28.59, p<0.001, η^2=0.05] when compared to remaining patients (n=144). The majority administered insulin injections (80.7%), whereas 19.3% used an insulin pump. A control sample of 431 individuals without T1D was matched 1:1 with the patient sample based on age, gender, and context (student, employed, other). Fifteen patients could be matched 1:1 on gender and context, but not on age (see Table 1 for demographic information). Control participants were recruited from high schools and work settings (e.g., schools, hospitals, and private companies) in Flanders (Belgium), making use of convenience sampling.

Questionnaires

Identity. We used the Dimensions of Identity Development Scale (DIDS; Luyckx, Schwartz, et al., 2008), which has been validated in both community adolescents and emerging adults and chronically ill emerging adults (Luyckx, Schwartz, et al., 2008; Luyckx, Seiffge-Krenke, et al., 2008). This questionnaire consists of five subscales, measured by five items each rated on a 5-point Likert-type scale (from 1_*completely disagree* to 5_*completely agree*). Cronbach's alphas ranged between .86-.91 in patients and between .82-.91 in controls.

Depressive symptoms. The Center for Epidemiologic Studies Depression Scale (CESD; Bouma, Ranchor, Sanderman, & van Sonderen, 1995) is a valid instrument to screen for depressive symptoms in adolescents and emerging adults (Radloff, 1991). It consists of 20 items assessing how often participants experienced depressive symptoms the past week, scored on a 4-point Likert-type scale (from 0_*seldom* to 3_*most of the time or always*). Cronbach's alpha in patients was .93.

Life satisfaction. The 5-item Satisfaction With Life Scale was used (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), which has been validated in both adolescents (Neto, 1993)

and emerging adults (Arrindell, Heesink, & Feij, 1999). Participants answer on a 7-point Likert-type scale from 1_*disagree strongly* to 7_*agree strongly*. Cronbach's alpha in patients was .86.

Diabetes-related problems. We assessed the 20-items Problem Areas in Diabetes Scale (PAID; Luyckx, Rassart, & Weets, 2015; Polonsky et al., 1995), which consists of four subscales: emotional problems, treatment problems, food problems, and social support problems. Participants answered each item on a 5-point Likert-type scale ranging from 1_*no problem* to 5_*serious problem*. Cronbach's alphas were .74, .73, .75, and .93, respectively.

Illness perceptions. The 8-item Brief Illness Perception Questionnaire (Brief IPQ; Broadbent, Petrie, Main, & Weinman, 2006) is a valid instrument to measure illness representations. An exploratory factor analysis with promax rotation was conducted. Low factor loadings led to exclusion of item 2 (assessing illness timeline). A factor analysis on the remaining seven items revealed two factors with an eigenvalue larger than 1, explaining 64.59% of the variance. In line with previous research (Janssen et al., 2013), the factors were labeled 'impact' (items 1, 5, 6, 8) and 'control' (items 3, 4, 7), with factor loadings on these factors ranging from .68 to .87. Cronbach's alphas were .84 and .67, respectively.

Treatment adherence. The Self-Care Inventory-Revised (SCI-R; Weinger, Butler, Welch, & La Greca, 2005) has been validated in adults (Weinger et al., 2005) and adolescents (Lewin et al., 2009). Item 12 was excluded as it assesses "wearing a medic alert ID", which is not common in diabetes treatment in Belgium. Participants answered on a 5-point Likert-type scale from 1_*never* to 5_*always, without fail*. Cronbach's alpha was .76.

Glycemic control. HbA1c-values were provided by treating physicians in a time frame of three months before and after patients' questionnaire completion. Higher HbA1c-values point to poorer glycemic control with values below 7.0% indicating relatively good glycemic control (American Diabetes Association, 2015).

Results

Objective 1: Identity Statuses in the Combined Sample.

Prior to conducting cluster analysis on the identity processes, 15 univariate (values more than 3 *SD*s below or above the mean) or multivariate outliers (with high Mahalanobis distance values) were removed. We used a two-step clustering procedure (Gore, 2000). First, hierarchical cluster analysis was conducted using Ward's method based on squared Euclidian distances. Next, these initial cluster centers were used as starting values in iterative *k*-means clustering. Three- to six-cluster solutions were evaluated in terms of interpretability, parsimony, and explanatory power. Six clusters were retained, explaining between 57% and 61% of the variance in identity processes.

As displayed in Figure 1, individuals in achievement (21.8%) scored high on all adaptive identity processes and scored moderately low on ruminative exploration. Foreclosure (11.2%) consisted of individuals scoring high on commitment, scoring intermediate on exploration in depth, and scoring low on exploration in breadth and ruminative exploration. Individuals in moratorium (15.3%) scored high on exploration, but low on commitment. Individuals in carefree diffusion (10.2%) scored low to very low on all identity processes, whereas individuals in troubled diffusion (11.6%) scored low on all processes except for a high score on ruminative exploration. Finally, undifferentiated (29.9%) had moderate scores on all identity processes. Chi-Square analysis indicated that patients and controls were equally distributed among these clusters [$\chi^2(5)=5.59$, $p=.349$].

Objective 2: Psychological and Diabetes-Specific Functioning in the Patient Sample.

Based on the final cluster centers in the combined sample (using the Classify option in *k*-means clustering), the same clusters emerged in patients: achievement (22.5%), foreclosure (12.1%), moratorium (13.3%), carefree diffusion (11.9%), troubled diffusion (11.1%), and undifferentiated (29.2%). Univariate analysis of variance pointed to a significant age effect [$F(5, 416)=2.27$, $p=.047$, $\eta^2=.03$] with patients in achievement ($M=18.97$; $SD=3.29$) and

undifferentiated (*M*=18.77; *SD*=3.57) being significantly older than in carefree diffusion (*M*=17.16; *SD*=3.37). The clusters did not differ on illness duration [$F(5, 414)=1.04$, $p=.393$], insulin administration type (injection vs. pump) [χ^2 (5)=4.28, $p=.510$], and gender [$\chi^2(5)=4.16$, $p=.526$].

To investigate cluster differences on psychological and diabetes-specific functioning, we conducted a multivariate analysis of variance with cluster membership as fixed variable. Follow-up univariate *F*-values are shown in Table 2. Individuals in moratorium and troubled diffusion scored higher on depressive symptoms, whereas on life satisfaction, troubled diffusion scored lowest. Achievement and foreclosure scored highest on life satisfaction. Relatedly, moratorium and troubled diffusion experienced more diabetes-related problems: moratorium scored higher on food problems and troubled diffusion scored higher on total problems. Overall, individuals in achievement and foreclosure experienced the least diabetes-related problems. With regard to treatment adherence, troubled diffusion scored lowest, but did not differ significantly from moratorium. Conversely, no significant differences were found regarding glycemic control. Finally, regarding perceived impact, moratorium and troubled diffusion scored highest and foreclosure scored lowest. For control, troubled diffusion scored lowest, with carefree diffusion not differing significantly from troubled diffusion.

Discussion

The present study investigated identity formation in adolescents and emerging adults with T1D using an encompassing process-oriented model. Six identity statuses were identified: achievement, foreclosure, moratorium, carefree diffusion, troubled diffusion, and undifferentiated. Patients and controls were equally distributed among these statuses, which corroborates the idea of patients with T1D presenting similar identity agency as healthy individuals (Luyckx, Seiffge-Krenke, et al., 2008).

Despite the fact that patients with T1D generally seemed as agentic as controls in forming strong identity commitments, not all patients managed to do so. Such individual differences in identity were related to psychological and diabetes-specific functioning. With respect to well-being, individuals in moratorium and troubled diffusion presented with the most depressive symptoms and lowest life satisfaction. These findings support previous research describing ruminative exploration as distressing (Luyckx, Schwartz, et al., 2008). Further, individuals in achievement and foreclosure scored highest on life satisfaction, validating earlier research relating commitment to positive functioning and well-being in adolescents and emerging adults (Luyckx, Schwartz, et al., 2008; Luyckx, Schwartz, Soenens, Vansteenkiste, & Goossens, 2010).

With respect to diabetes-related problems, our results were largely in line with expectations, with individuals in foreclosure and achievement reporting the least problems and individuals in moratorium and troubled diffusion reporting the most. Especially the distress of exploring in a ruminative manner and simultaneously lacking strong commitments was related to diabetes-related problems. Relatedly, individuals in carefree diffusion, being not really engaged in pro-active identity work but also not ruminating, did not significantly differ from individuals in achievement and foreclosure.

As expected, individuals in achievement and foreclosure perceived greater control over their illness and treatment. However, rather unexpectedly, individuals in moratorium reported similar results, which suggests that not only having strong commitments, but also pro-active identity exploration may be related to experiencing greater control in life. These results support earlier research describing individuals in moratorium as having an internal locus of control, in which they belief that life events can be controlled by personal choices (Marcia, 1980; Schwartz et al., 2011).

Individuals in troubled diffusion and moratorium reported the greatest illness impact and poorest treatment adherence, which could be related to the fact that these individuals seem to experience the most problems integrating their illness as part of their sense of self (Luyckx, Seiffge-Krenke, et al., 2008). Remarkably, individuals in foreclosure and carefree diffusion perceived less impact of their diabetes than individuals in achievement. This finding may be explained by the fact that foreclosed and carefree diffused individuals adopt a rather emotionally defensive and carefree attitude, respectively, by which they generally present with less anxiety and rumination (Luyckx, Schwartz, et al., 2008). Finally, our results did not reveal differences on glycemic control among the statuses, which corroborates previous research describing no relation between glycemic control and more stable psychological constructs (Mazze et al., 1984). However, as we found differences in treatment adherence among the statuses, an indirect link between identity functioning and glycemic control, via treatment adherence, might exist.

The present study was characterized by several limitations. First, notwithstanding the large sample, response rate was rather low. Hence, a selection bias cannot be excluded. However, glycemic control levels (M_{HbA1c}=7.74%) were nearly identical to those from the larger dataset of the Belgian Diabetes Register (n=2,882, M_{HbA1c}=7.80%) in the same age group, which suggests a representative sample concerning glycemic control. Second, the cross-sectional design does not allow for drawing conclusions about directionality of effects. It is not clear whether identity issues would make patients more vulnerable for experiencing problems in psychological and diabetes-specific functioning, or whether such problems hamper identity development. Third, although self-report questionnaires are optimal to investigate internal processes such as identity, this method may increase associations among variables due to shared method variance. Alternative methods (e.g., interviews) may provide a more in-depth picture. Similarly, other methodologies assessing identity (e.g., narrative identity) are recommended.

Finally, the present study does not take into account confounding variables (e.g., self-esteem) that might be driving the observed associations. Controlling for such variables could help to validate our findings in future research. Despite these limitations, the present study may have important practical implications. Clinicians should take the developmental challenges of identity formation into account when working with youth with T1D. It seems important to identify and support individuals who experience substantial difficulties developing a personal identity, and especially individuals who engage in ruminative exploration, coupled with a lack of strong identity commitments (indicative of moratorium and troubled diffusion). Offering tools to help them explore in an adequate way and engage in strong life commitments may help them to overcome both psychological and diabetes-related difficulties.

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Table 1

Demographics Table of Patient and Control Group with Percentages, Means and Standard Deviations

	Patients (*N*=571)	Controls (*N*=571)
Gender (%female)	53.8%	53.8%
Age	18.89 (3.25)	18.95 (3.28)
Context		
Student	75.7%	75.7%
Employed	19.7%	19.7%
Other	4.8%	4.8%

Note. The group means on age are slightly different, as fifteen patients could only be matched 1:1 on gender and context, but not on age.

Table 2

Univariate ANOVA's, Means, Standard Deviations and Post-hoc Cluster Comparisons based on Tukey HSD Tests for the Six Clusters in Patients

Variable	Achievement	Foreclosure	Moratorium	Carefree Diffusion	Troubled Diffusion	Undifferentiated	*F*-value	η^2
Age	18.97 (3.29)^{a}	18.57 (3.43)	18.18 (2.84)	17.16 (3.37)^{b}	18.64 (3.27)	18.77 (3.57)^{a}	2.27*	.03
Illness duration	6.29 (0.49)	8.04 (0.68)	6.61 (0.64)	7.40 (0.68)	7.21 (0.70)	7.02 (0.44)	1.04	.39
Well-being								
Depression	8.48 (8.33)^{a}	6.82 (6.49)^{a}	16.16 (11.39)^{b}	10.15 (9.72)^{a}	20.40 (12.34)^{b}	9.82 (8.50)^{a}	16.14***	.17
Life satisfaction	5.49 (1.00)^{a}	5.64 (0.94)^{a}	4.65 (1.15)^{cd}	4.94 (0.98)^{bc}	4.05 (1.32)^{d}	5.16 (0.95)^{ab}	16.61***	.17
Diabetes problems								
Emotional	1.07 (0.89)^{a}	0.79 (0.66)^{a}	1.56 (0.96)^{b}	1.00 (0.80)^{a}	1.70 (0.95)^{b}	1.10 (0.79)^{a}	8.81***	.10
Treatment	0.80 (0.91)^{a}	0.59 (0.74)^{a}	1.10 (0.91)^{ab}	0.73 (0.88)^{a}	1.28 (1.09)^{b}	0.91 (0.93)^{ab}	3.77***	.04
Food	1.11 (0.90)^{ab}	0.86 (0.80)^{a}	1.63 (0.99)^{c}	1.01 (0.86)^{ab}	1.46 (0.94)^{bc}	1.20 (0.88)^{ab}	5.37***	.06
Social support	0.40 (0.82)^{a}	0.29 (0.58)^{a}	0.90 (1.09)^{b}	0.63 (1.12)^{ab}	1.10 (1.13)^{b}	0.68 (1.03)^{ab}	5.22***	.06
Total	0.85 (0.76)^{a}	0.63 (0.56)^{a}	1.30 (0.85)^{bc}	0.84 (0.72)^{a}	1.39 (0.91)^{c}	0.97 (0.75)^{ab}	7.45***	.08
Illness perceptions								
Impact	0.05 (0.91)^{bc}	-0.52 (0.86)^{a}	0.37 (0.90)^{c}	-0.17 (0.91)^{ab}	0.62 (1.00)^{c}	-0.14 (1.04)^{ab}	9.30***	.10
Control	0.25 (0.81)^{a}	0.36 (0.83)^{a}	-0.04 (0.91)^{a}	-0.13 (1.03)	-0.69 (1.35)^{b}	-0.03 (0.96)^{a}	7.60***	.09
Treatment adherence	3.85 (0.53)^{a}	3.88 (0.42)^{a}	3.70 (0.60)	3.87 (0.46)^{a}	3.51 (0.55)^{b}	3.79 (0.55)^{a}	3.66**	.04
HbA1c-value	7.90 (1.65)	7.52 (1.24)	7.79 (1.33)	7.50 (1.06)	7.73 (1.42)	7.71 (1.52)	0.73	.01

Note. A cluster mean is significantly different from another mean if they have different superscripts. A mean without a superscript is not significantly different from any other mean. Standard deviations are in parentheses. * $p < .05$. ** $p < .01$. *** $p < .001$

Figure 1

Z-scores for the identity processes for the final six-cluster solution in the combined sample