Bachelor thesis

Psychology

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Diabetes-related self-efficacy in pediatric patients with diabetes type 1 and its relationship with health-related quality of life

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Preface

This bachelor thesis is the final act of graduating in psychology at the department of health psychology at the University of Twente.

Data for this study were collected at St-Agnes-Hospital, Bocholt, Germany, between March 2011 until July 2011. This study examines psychometric properties of a newly developed questionnaire, measuring diabetes-related self-efficacy in pediatric children with diabetes type 1. Furthermore, it investigates associations between self-efficacy and different aspects of quality of life.

Hereby, I would like to thank my lecturers Peter ten Klooster and Erik Taal of the University of Twente for mentoring me within my final bachelor study. Moreover, I would like to express my gratitude to my contact person of the St-Agnes-Hospital, Dorothea Hartmann. Furthermore, a very emotional thanks goes to my family and especially to my parents who have been supporting me my entire life!

Summary

Objective: This study investigated the concept of diabetes-related self-efficacy in pediatric children with diabetes type 1. The focus was based on two main aspects: 1) The examination of the unidimensionality and internal consistency of a newly developed questionnaire called PSESD (Pediatric Self-efficacy Scale Diabetes) for which the measurement properties had not yet been examined and 2) The examination of the association between diabetes-related self-efficacy and different aspects of health-related quality of life.

Methods: Data were collected at the pediatric department of the St-Agnes-Hospital, Bocholt, Germany. In total, 59 diabetic patients, aged between 8 to 16, participated in this study.

Results: In regard to the unidimensionality, an exploratory factor analysis identified one clear underlying factor which was interpreted as a representation of diabetic management in regard to problematic situations. In regard to the internal consistency, a Cronbach's alpha of 0.86 was calculated. Moreover, the results showed a positive correlation between diabetes-related self-efficacy and the different dimensions of health-related quality of life. However, only the dimensions of 'self-esteem' and 'friends' were significantly related to self-efficacy. In a multiple linear regression analysis only the dimension of 'friends' remained significantly related to self-efficacy.

Conclusions: The PSESD appears to be a promising instrument in regard to the measurement of diabetes-related self-efficacy. The association between diabetes-related self-efficacy and the dimension of 'friends' mirrors the importance of the social integration of the young patients which should be further promoted in future.

Samenvatting

Doel: Deze studie onderzocht het concept van diabetes gerelateerde zelfeffectiviteit bij pediatrische patiënten met diabetes type 1. Dit onderzoek stelde twee doelen: 1) Het onderzoeken van de unidimensionaliteit en interne consitentie van een nieuw ontwikkelde vragenlijst, PSESD (Pediatric Self-efficacy Scale Diabetes), en 2) Het onderzoeken van de associatie tussen diabetes gerelateerde zelfeffectiviteit en verschillene aspecten van de gezondheidsgerelateerde kwaliteit van leven.

Methode: Data werden verzameld op de pediatrische afdeling van het St-Agnes-Hospital, Bocholt, Duitsland. In totaal namen 59 patiënten in de leeftijd van 8 tot 16 jaar deel aan deze studie.

Resultaten: Met betrekking tot de unidimensionaliteit, een verkennende factor analyse toonde één duidelijk onderliggende factor aan die werd geïnterpreteerd als een representatie van het managen van diabetes met betrekking tot problematische situaties. Voor de interne consistentie werd een Cronbach's alpha van .86 berekend. Bovendien toonden de resultaten een positieve correlatie tussen diabetes gerelateerde zelfeffectiviteit en gezondheitsgerelateerde kwaliteit van leven. Echter, alleen de subschalen 'zelfwaardering' en 'vrienden' waren significant gecorreleerd met diabetes gerelateerde zelfeffectiviteit. Uit een meervoudige lineaire regressie analyse bleek alleen nog de subschaal 'vrienden' significant aan zelfeffectiviteit gerelateerd te zijn.

Conclusie: De PSESD blijkt een veelbelovend instrument te zijn om diabetes gerelateerde zelfeffectiviteit bij pediatrisch patiënten te meten. De relatie tussen diabetes gerelateerde zelfeffectiviteit en de dimensie van 'vrienden' geeft het belang van sociale integratie van de pediatrische patiënten aan, waaraan ook in toekomst veel aandacht besteed zal moeten worden.

Contents

1 Introduction

1.1 Theoretical background

1.1.1 Diabetes Mellitus Type 1

Type 1 diabetes (T1D) is considered to be one of the most common chronic illnesses in childhood (Nouwen, Law, Hussain, McGovern & Napier, 2009). Its origin can be defined as a lack of insulin following autoimmune destruction of the insulin-producing pancreatic beta cells. It is a severe metabolic disorder characterized by the body's inability to produce insulin, the hormone responsible for metabolizing glucose, which means that the muscle and liver cells take up glucose from the blood in order to store it as glycogen in muscle and liver tissue (Levitsky & Misra). To date, the exact mechanisms of this disease and the advancement of the disease are not fully understood yet (Levitsky & Misra, 2010). Without treatment, patients with diabetes suffer from a condition called hyperglycemia which is an abnormally high blood glucose level which can result in fainting and unconsciousness (Sacco & Bykowski, 2010). In addition “insufficient insulin levels force the body to break down fat for energy, which can produce dangerously high levels of ketones (ketoacidosis) leading to diabetic coma or even death” (Sacco & Bykowski, 2010). Thus, in order to survive people with diabetes type 1 rely completely on exogenous forms of insulin by means of injections (Sacco & Bykowski, 2010).

The age of onset of diabetes type 1 has a bimodal distribution which has its peak first at the age of 4 to 6 and second at the beginning of puberty at the age of 10 to 14 years (Levitsky & Misra, 2010). In the overall incidence rate of diabetes type 1 no gender difference can be manifested (Levitsky & Misra, 2010).

In Germany, roughly 21.000 to 24.000 children and adolescents under the age of 20 are affected by T1D (Rosenbauer, Icks, Grabert, Holl & Giani, 2002). The highest reported incidence rate is found in Finland and Sardinia (37 to 45 per 100.000 children younger than the age of 15 years) compared to the 400 times

lower incidence rates in Venezuela and parts of China (0,1 to 0,5 per 100.000 children) (Levitsky & Misra, 2010).

Over the past 20 years, a steady increase in the annual incidence rate of roughly 3 to 5% has been observed. It is estimated that by 2020 the new incidence rate in Germany will be twice as high as in 2001 (Neu, Ehehalt, Willasch, Hub & Ranke, 2001). The reasons for this increase in incidence rate are not known yet (Levitsky & Misra, 2010). According to Rosenbauer et al. (1999) there is a rising risk analogous to the geographical latitude. That is to say the more the distance from the equator the greater the risk of obtaining T1D. It is a striking fact that people moving from an equatorial vicinity up to the north have a higher risk to become ill with diabetes type 1, demonstrating an apparently causal relation with environmental factors. However, the pathogenesis of type 1 diabetes is complex. Great diversity in incidence rate is also shown in regions of similar latitude, which indicates the impact of other risk factors (Rosenbauer et al., 1999).

Genetic susceptibility can be regarded as one of them. There is a significant increase in regard to the risk of developing type 1 diabetes and an affected relative (Tillil & Köbberling, 1987). If there is no family history of T1D, the chance of being affected by diabetes type 1 equals 0.4%. Being an offspring of an affected mother raises the risk of getting diabetes type 1 by 2 to 4%. If both parents are affected the risk is already up to 30%. A monozygotic twin of an affected person has a life time risk of 50% (Levitsky & Misra, 2010). Patients with genetic susceptibility run a high risk of developing diabetes if exposed to one or more supposing environmental factors such e.g. as diet (exposure to cow's milk at an early age), viral infections, immunizations, vitamin D deficiency, perinatal factors such as maternal age, neonatal jaundice and history of preeclampsia. However none of these factors have been verified (Levitsky & Misra, 2010).

1.2 Self-efficacy

According to Ott, Greening, Palardy, Holderby en DeBell (2000) especially the construct of self-efficacy seems to have a positive impact on the metabolic control of T1D. Furthermore Grey, Boland, Davidson, Yu, Sullivan-Bolyai, en Tamborlane

(1998) and Rose, Fliege en Hildebrandt (2002) indicated that diabetes-related self-efficacy has an impact on the quality of lives of adolescents.

Self-efficacy is a key concept from Bandura's social-cognitive theory and is defined as the “conviction that one can successfully execute the behavior required to produce outcomes“ (Bandura, 1977). Self-efficacy is predominantly influenced by direct experience that is to say personal mastery experience. Furthermore, it is also affected by social experience and physical state (Bandura, 1982). The level of self-efficacy determines the amount of effort one spends to a specific behaviour and has an impact on the perseverance in a given task in regard to any difficulties or failure. Bandura (1986, 1997) declared that self-efficacy ideas are situation and behaviour specific. They are based on the expectations of outcomes from a target behaviour in advance and it can also predict the amount of distress and depression experienced in coping with obstacles (Bandura, 1977). In general, it has a good predictive value for health behaviour (Holden, Moncher & Schinke, 1990). In a chronic disease increased self-efficacy improves adherence to advised treatment regimens.

As mentioned previously, self-efficacy corresponds positively to the quality of life (Rose et al., 2002; Grey et al., 1998). Patients with T1D need to control themselves in regard to daily insulin injections, self-monitoring of blood glucose, regular exercise and also an adjusted diet. All these aspects of self-management have an apparently high relation to self-efficacy (Glasgow, Fisher & Anderson, 1999). Especially adolescents with diabetes type 1 are at risk for poor metabolic control and life adjustment problems which might lead into poorer quality of life. As a result, Chih, Jan, Shu en Lue (2009) propose to focus on the identifying factors for a better diabetes control at this age in order to avoid long-term complications. He also states “adolescents with diabetes are prone to avoidance when given increasing responsibility for the management of their chronic illness, therefore, the factor of self-efficacy is worthy of investigation”.

1.3 Health related quality of life

From the medical point of view, the diabetes therapy aims at avoiding long-term life-threatening consequences of the disease and from the psychological point of view the important outcome variable is the patients´ well-being and quality of life. The concept of interest for this study will be the health-related quality of life (HRQOL) of pediatric patients with T1D.

HRQOL assessment of children has only been recently come into focus (Peterson, Schmidt, Bullinger & DISABKIDS Group, 2006). Unlike HRQOL in adults with T1D, the measurement of health-related quality of life in pediatric patients has been neglected for a long time. In recent years, however, it has gained more consideration in health research and health promotion (Ravens-Sieberer, Gosch & Abel, 2001a).

"HRQOL is defined as the physical, emotional and social aspects of an individual's disease and/or its treatment" (Peterson et al., 2006, p. 51). Health-related quality of life is thus a multidimensional construct. Most questionnaires of health-related quality of life measure the impacts in regard to the specific diseases and its treatments or health care policies. According to Polonsky (1996) consensus in assessing HRQOL is reached in regard to three core domains of quality of life, namely physical psychological, and social functioning. These main items can be subdivided into further dimensions and facets.

Spezia Faulkner (2003) states that adolescents with diabetes judge their quality of life as significantly lower than their healthy peers. Other studies are more controversial in regard to the quality of life of children and adolescents with diabetes type 1. On the one hand, the self-assessment in regard to quality of life of children and adolescents with diabetes type 1 are to a great extent similar in comparison to non-affected children as revealed in several studies (Laffel, Connell, Vangsness, Goebel-Fabbri, Mansflield & Anderson 2003; Hoey, Aanstoot, Chiarelli, Daneman & Danne, 2001; Mc Millan, Honeyford, Datta, Madge & Bradley 2004; Bartus et al., 2001). On the other hand, affected children and adolescents complain about a feeling of restriction. These findings are confirmed by Mc Millan et al. (2004) who states that 70% of the affected children and adolescents regard their

quality of life as satisfactory but nevertheless 60% of the questioned patients think diabetes to be a restrictive factor. This apparent paradox can be explained by a study of Wagner, Abbott en Lett (2004) which points out that diabetes is not the predominant factor in assessing the quality of life. Family, friendship and school are rated as more important.

Quality of life of adolescent patients with T1D is especially influenced by metabolic control and the attitude of the family towards the illness. Thus, a bad regulation and family conflicts correspond with a low quality of life (Hoey et al., 2001). In this connection, it can be stated that family parameters are more important than clinical parameters such as the specific treatment (Valenzuela et al., 2006).

The acquisition of data on the health-related quality of life in children and adolescents can help to identify subgroups or individuals who have a higher risk of problematic psychological implications (Ravens-Sieberer et al., 2001a). Especially studies are needed which focus on the health-related quality of life of pediatric patients and which describe factors influencing the construct of health-related quality of life (Ravens-Sieberer, Ellert & Erhart, 2007). “Because the adherence to self-management that ultimately leads to good glycaemic control requires good self-preparation to integrate the experience of the chronic disease, it is essential to explore the HRQOL of children and adolescents with T1DM“ (Kalyva, Malakonaki, Eiser & Mamoulakis, 2011, p. 37). Furthermore, research concerning the issue of health-related quality of life in diabetic patients has been mostly carried out in Australia, North America and UK and there is a lack of research conducted elsewhere (Kalyva et al., 2011).

Although quality of life is considered to be an important outcome variable in pediatric research, little is known about the relationship between HRQOL and other significant constructs (Peterson et al., 2006). This is the reason for the growing interest in identifying factors that shape the pediatric patients’ health-related quality of life either in a positive or negative way (Peterson et al., 2006). In one of the few studies concerning this issue, Ravens-Sieberer, Redegeld en Bullinger (2001b) found that 37% of the variance of HRQOL total score of the KINDL measure in a pediatric obesity group was explained by coping strategies, lack of emotional

support and poor global health. Peterson et al. (2006) pointed out a positive correlation between a positive coping strategy and health-related quality of life. In regard to diabetes type 1 an early onset and a long duration of the disease (Yu, Kail, Hagen & Wolters, 2000) along with poor metabolic control (Debono & Cachia, 2007) can be linked to a poorer health-related quality of life. In regard to gender, girls have demonstrated lower HRQOL, have more worries about diabetes, are less satisfied and have a poorer conception of their own health in comparison with boys (Eiser & Morse, 2001).

1.3.1 Psychological distress

Apart from the three components of the therapy including insulin injections, diet and physical activity, the treatment of diabetics demands a regular control of the blood glucose level which requires an enormous discipline of the patients' daily routine. To achieve the aims of the regimen, the patients have to spend a lot of time, effort and energy which has a great psychological impact on the patients (ADA, 2009). Apart from the major changes in lifestyle, the possibility of developing life-threatening complications such as cardiovascular disease, retinopathy, nephropathy and neuropathy can cause a lot of psychological distress (Landell-Graham, Yount & Rudnicki, 2003). In children, the responsibility of the diabetic management is to a great extent guarded by parents. They are often unable to care for their diabetes on their own. Nevertheless, managing the disease can be overwhelming for children (Debono & Cachia, 2007). When children reach adolescence and thus are entering puberty, they are struggling for their autonomy which is associated with rapid biological changes (Jacobson, Hauser & Wolfsdorf, 1987). This might lead to insufficient handling of their chronic disease which is affected by "poorer adherence to medications and worse metabolic control" which results in a poor quality of life (Chih et al., 2009). Thus, life adjustment problems are common in this age group.

Several studies reveal that children and adolescents have a higher risk to develop psychological disorders (Jacobson et al., 1997; Kovacs, Goldston, Obrosky &

Bonar, 1997; Northam, Matthews, Anderson, Cameron & Werther, 2004). In comparison to healthy children and adolescents, the prevalence of internalized as well as externalized disturbances are two to three times higher in children and adolescents with diabetes type 1 (Grey et al., 2002). Depressive symptoms are shown especially in pediatric patients who do not have as much familiar affection. A bad regulation of metabolic functioning also triggers mood disorders (Hood et al., 2006). Clinical as well as subclinical eating disorders are much more common as revealed in the overall prevalence of 10 to 15 percent in affected adolescents (Grylli, Hafferl-Gattermayer, Schober & Karwautz, 2004). Especially females are prone to defiant eating behaviour and abnormal attitudes towards eating (Maharaj, Rodin, Olmsted, Connolly & Daneman, 2003). There is no difference in occurrence of anorexia as such, but the incidence of bulimia and "binge eating disorder" are higher in comparison to their healthy peers (Jones, Lawson, Daneman, Olmsted & Rodin, 2000). A further issue in female patients is that they manipulate their weight by shortening the amount of insulin intake, a phenomenon called "insulin-purging", which frequency is even higher than eating disorders by 12 to 40 percent (Wiedebusch, Muthny & Ziegler, 2007).

1.3.2 Social relationships

Diabetes can impair the social relationships of patients. When children reach puberty they often feel pushed to manage their disease with more discipline. This can lead to feelings of being alone, unsupported and being different from healthy peers (Debono et al., 2007). This idea is supported by a study of Jacobson et al. (2004). He followed adolescents with diabetes type 1 and a control group and found out that those with diabetes had fewer friendships, had more difficulties in intimate love relationships and less sense of trust compared to the control group of the same age.

1.3.3 Physical functioning

In regard to physical functioning short-term complications can affect physical health in children and adolescents. Diabetic patients suffer from frequent infections and recurrent hypoglycaemic episodes, often linked to several side effects, which can be a burden (Debono et al., 2007). This is verified by Davis, Morrissey, Wittrup-Jensen, Kennedy-Martin en Currie (2005) who emphasized the great impact of hypoglycaemia on the productivity, well-being and quality of life of affected patients.

1.4 Research questions

This study further investigates the concept of diabetes-related self-efficacy in pediatric patients with diabetes type 1.
Especially, the focus will be based on two main aspects:

1) The examination of the unidimensionality and internal consistency of the PSESD.

2) The examination of the associations between diabetes-related self-efficacy and different aspects of health-related quality of life.

2 Method

2.1 Case description

Data for this cross-sectional study were collected at the department of pediatrics of St-Agnes-Hospital, Bocholt, Germany, which has a diabetes treatment and training centre with approximately 190 outpatients between 0 to 18 years of age. In May 2009, the department started an additional project called DiNa which is an abbreviation of “Diabetes Nachsorge“ (diabetes aftercare). DiNa advises and trains patients in their outpatients’ department in every single aspect of diabetes. In special cases DiNa even looks after patients at home. DiNa's assistance is free of any cost for the families of the pediatric patients. The project team consists of:

- The department of pediatrics which combines doctors, diabetic counselors, a psychologist, pediatric nurses and diet assistants.
- A 'Caritas' Association
- A pedagogics assitant
- A supportive association called “Diabolinos e.V.“ which offers self-help groups

The listed project team works in cooperation with a DiNa project in Augsburg, Germany.

The aim of DiNa's concept is to strengthen the psychosocial development and social integration of the young patients with diabetes type 1 which is in accordance with the international pediatric guidelines of diabetic therapy (Delamater, 2007).

The process of strengthening the psychosocial development is promoted by an extended training program for the pediatric patients in order to have a better routine in handling their disease, even in difficult situations such as waiting in a restaurant for dinner to be served longer than expected. By means of this training program, the young patients should gain self-confidence and experience personal mastery in the daily routine of handling diabetes type 1. Furthermore it aims at strengthening the perceived self-efficacy in regard to diabetes type 1. This basic

thought of personal mastery experience influencing the task-specific self-efficacy was pointed out by Bandura (1982).

One special concern of DiNa is to detect patients with a low self-efficacy in order to promote their psychosocial development even more. For this reason, the PSESD which stands for “pediatric self-efficy scale diabetes” was developed in order to measure self-efficacy in regard to diabetes type 1 in pediatric patients. Its psychometric properties, however, are not known yet. Thus, a special challenge for this study will be to validate this specific questionnaire.

2.2 Sample and procedure

In the waiting room of the outpatients' department of the pediatric ward of St-Agnes-Hospital, two questionnaires were administered to 59 patients between March and May 2011. Children were asked by the researcher and author of the study if they were willing to participate in a study about HRQOL in children and adolescents with T1D. Parental permission was ensured. Before handing out both self-report questionnaires, informed consent was obtained.

The participation was completely voluntary. The inclusion criteria were as follows:

- age between 8 and 16
- informed consent
- a diagnosis of diabetic type 1
- cognitive ability to understand the questions

It took each patient about 10 minutes to fill out both self-report questionnaires that included basic demographic data consisting of sex, age, number of siblings and type of school.

2.3 Measures

2.3.1 PSESD

The PSESD was specially developed to measure self-efficacy in regard to diabetic management in children and adolescents with diabetes type 1. The items imply typical problematic situations the pediatric patients can be confronted with. Examples of items are: “I can cope with too high and too low levels of blood glucose, even if I don’t expect them“. “Whatever happens with my blood glucose level, I’m sure how to handle it.”

The questionnaire consists of ten items which are answered on a four-point scale. 1) “does not correspond“ (*stimmt nicht*), 2) “hardly corresponds“ (*stimmt kaum*), 3) “mostly corresponds“ (*stimmt eher*) and score 4 means “totally corresponds“ (*stimmt genau*). Higher scores indicate a higher level of self-efficacy whereby the average score was calculated.

2.3.2 Kid Kindl® questionnaire

Health-related quality of life was assessed with the Kid-Kindl®- Diabetes- module which consists of 36 items which can be divided into the three main constructs of physical (items 1-12, e.g. “During last week, I could not do any sports”), psychological (items 13-23) and social functioning (items 25-37). Psychological functioning can be further divided into *psychological well-being* (item 13-17, e.g. “During last week, measuring blood glucose levels was annoying me”) and *self-esteem* (items 18-23, e.g. “During last week, I was ashamed of my diabetes”). Social functioning is subdivided into the categories *family* (items 24-28, e.g. “During last week, my parents controlled me too much”), *friends* (items 29-33, e.g. “During last week, I was excluded because of my diabetes) and *school* (items 34-36, e.g. “During last week, I had difficulties to concentrate because of my blood glucose level”).

The instruction consisted of “Read every single question”, “Answer the question in regard to how things worked out last week” and “Mark with a cross the most suitable answer in regard to you in every line”.

Answers could be given by means of a five-point Likert-scale consisting of *never* (score 1), *seldom* (score 2), *sometimes* (score 3), *often* (score 4) and *always* (score 5). A higher score is associated with a higher HRQOL score whereby the items 1-17, 19-21, 23-33, 35-36 had to be reversed. The total score was calculated by the sum score divided by the number of items. The same procedure was applied to each subscale. The psychometric properties reveal a high reliability (Cronbach's $\alpha \geq .70$) in the majority of the tested samples (Ravens-Sieberer, 1998). In regard to convergent validity, the total score of the Kid Kindl® had a high correlation with the subscale *general well-being* of the Child Health Questionnaire and the subscales *vitality* and *psychological well-being* of the SF-36 ($r > .60$) (Bullinger & Kirchberger, 1998). Moreover, the questionnaire had a high acceptance by children and adolescents (Ravens-Sieberer, 1998).

2.4 Statistical analysis

Data were analysed using the Statistical Package for Social Scientists (SPSS), version 14.0. In order to get a clear overview of the population, tables of frequencies of the demographic data were drawn up in the first place. In order to test the unidimensionality of the PSESD, an exploratory factor analysis using principal component analysis (PCA) was conducted. By graphing the eigenvalues by means of a scree plot, Cattel's (1966) cut-off point for selecting factors was applied. To get an indication of the internal consistency of the PSESD, inter-item correlations and Cronbach's alpha was calculated. For Cronbach's alpha, Nunnally's advised criterion .70 was taken as a reference point. Means and standard deviations were calculated for the total score and the scores of the six different subscales of the Kid Kindl® questionnaire in order to get an overview of the score results. In order to compare the score results between girls and boys and between age groups (8-11 vs 12-16), means and standard deviations were calculated for those groups, too. In addition, Cronbach`s alpha was calculated for every scale in order to provide an indication of the reliability of the two questionnaires. Mann- Whitney tests were

used to examine differences in age groups (8-11 years vs. 12-16) and gender. Statistical significance was defined at a level of $p \leq .05$ for all analyses.

In order to get an overview of the relations between the scales of the Kid Kindl® questionnaire, the Spearman Rank correlations were calculated. Diabetes-related self-efficay and its relation with health-related quality of life were investigated with an univariate and a multivariate analysis. In an univariate analysis, Spearman's correlation coefficients between the score on the PSESD and the scales of the Kid Kindl® were calculated. In a multivariate analysis, a multiple regression analysis was used in order to further investigate the association between diabetes-related self-efficacy and different aspects of health-related quality of life. During the analysis, several assumptions of the model were checked. To assess the assumption of no multicollinearity, the correlation matrix was scanned. Values of $R > .9$ indicate that there is collinearity in the data (Field, 2009). By means of the collinearity diagnostics of variance inflation factor (VIF), data were checked for subtle forms of multicollinearity. VIF values greater than 5 or 10 or 'tolerance' values (1/VIF) below 0.2 or 0.1 are indications of concern for multicollinearity (Field, 2009). In order to avoid a lack of autocorrelation in residual term, the Durbin-Watson test was used, which tests for serial correlation between errors. A value close to 2 means that the residuals are uncorrelated (Field, 2009). In order to look for cases which might influence the regression model, the standardized residuals and values of Cook's distance were checked. More than 5% of cases of standardized residuals with absolute values above 2 and Cook's distance values exceeding the value 1 indicate cases which might influence the model (Field, 2009).

Finally, the normality of residuals was tested by means of a histogram and a normal probability plot which plots the cumulative probability of a variable against the cumulative probability of a distribution.

3 Results

3.1 Demographic data

Table 1 shows an overview of the demographic data of the sample being studied. In total, 59 pediatric patients participated in the study. More than twice as many girls took part (68%). All ages from 8 to 16 were represented in the sample, however, 43.3% out of the sample was between 13 and 14 years old. More than 50% had one sibling and one quart had two siblings. Approximately one third of the participants attended the *Realschule* followed by attending the *Grundschule* (27%) and attending the *Gymnasium* (24%).

The demographic data between male and female patients did not demonstrate any significant differences in regard to age (p = .206), amount of siblings (p = .943) and educational level (p = .061) by Mann-Whitney U test.

Table 1 Demographic data

variable	n	(%)
gender		
girls	40	(67,8)
boys	19	(32,2)
age		
8	4	(6,8)
9	9	(15,3)
10	5	(8,5)
11	4	(6,8)
12	5	(8,5)
13	12	(20,3)
14	13	(22)
15	5	(8,5)
16	2	(3,4)
mean age = 12.07 (SD = 2.31)		
siblings		
0	5	(8,5)
1	32	(54,2)
2	15	(25,4)
3	6	(10,2)
4	1	(1,7)

school		
Grundschule	16	(27,1)
Hauptschule	4	(6,8)
Realschule	20	(33,9)
Gesamtschule	4	(6,8)
Gymnasium	14	(23,7)
total	58	(98,3)

3.2 Unidimensionality and internal consistency of the PSESD

3.2.1 Principal Component Analysis of PSESD

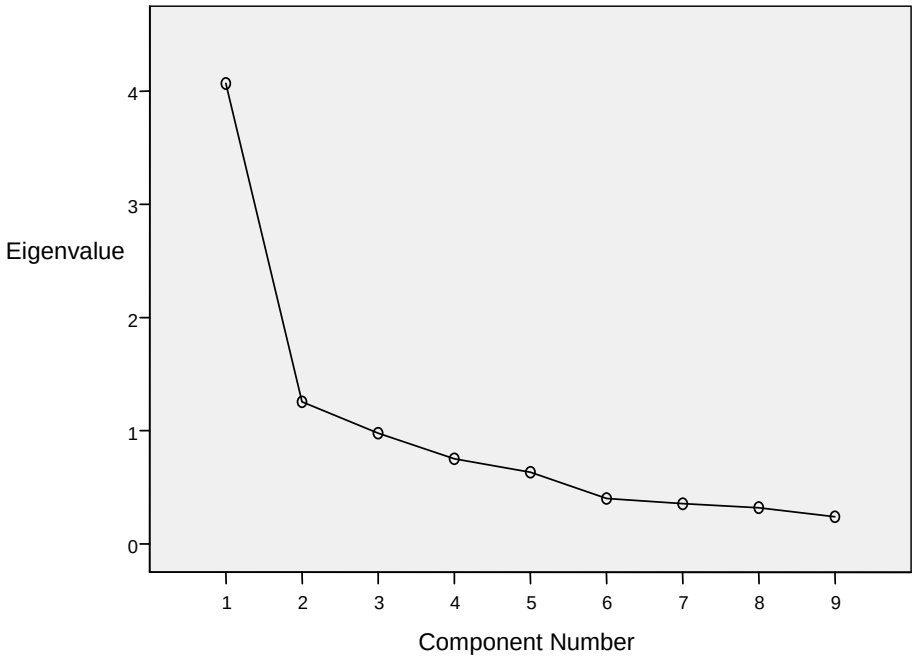
An exploratory factor analysis using principal component analysis (PCA) was conducted on the ten items of the PSESD with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO= .795 (“good” according to Hutchen & Sofroniou, 1999). The KMO values for the individual items 2 to 10 were > .59, which is well above the acceptable limit of .50 (Field, 2009). Item 1 did not reach the bare minimum of .50 and was therefore excluded for further analysis. After excluding item 1, Bartlett`s test of sphericity $\chi^2$ (36) = 190,791, p < .001, indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each component in the data. Two components had eigenvalues over Kaiser`s (1960) criterion of 1 and in combination explained 54.14% of the variance.

Cattel`s (1966) scree test revealed a sharp drop in eigenvalue magnitude after component 1. When plotted the graph revealed a clear drop off with an abrupt transition from vertical to horizontal and a clear “elbow” (see figure 1). In accordance with Cattell`s (1966) criterion, the component lying above the elbow of the plot was retained for the final analysis (Component 1). Table 2 shows the factor loadings after rotation. The items that cluster on component 1 represent diabetic management in regard to problematic situations in contrast to the excluded items that cluster on component 2 which represent more concrete abilities in regard to diabetes.

Table 2 Summary of exploratory factor analysis results for the PSESD questionnaire (N= 57, 2 missing)

Item	Rotated Factor Loadings Component 1	Component 2
Ich kann Blutzuckermessen und mich spritzen, auch wenn ich unter fremden Menschen bin	.02	**.77**
Es fällt mir schwer, meine Blutzucker-Werte gut hinzukriegen	.13	**.80**
Ich komme mit zu hohen oder zu niedrigen Blutzucker-Werten gut klar, auch wenn sie mich überraschen	**.59**	.07
Ich weiß immer, was ich tun kann, wenn ich viel zu hohe oder viel zu niedrige Blutzucker-Werte habe.	**.74**	.28
Ich kann Probleme mit meinem Diabetes lösen (z.B. wenn ich bei Freunden bin, dort übernachte oder ich mein Messgerät vergessen habe)	**.82**	.15
Ich weiß, was ich kann, deshalb bin ich ganz cool, wenn es um Probleme mit meinem Diabetes geht	**.77**	.01
Ich habe meist eine Idee, was ich machen kann, wenn ein Problem auftaucht (z.B. ich auf das Essen im Restaurant länger warten muss als geplant)	**.72**	.02
Ich weiß, wie ich fertig werde, wenn ein ganz neues Problem auftaucht (z.B. die erste Klassenfahrt, ein neuer Freund...)	**.79**	-.06
Was auch immer mit meinem Blutzucker passiert, ich werde schon klar kommen.	**.75**	.34
Eigenvalues	4.07	1.23
% of variance	45.20	13.94
α	.86	.44

Figure 1 Scree Plot of the PSESD items



3.2.2 Internal consistency of the PSESD

Table 3 shows the inter-item correlations of the items 4-10 which were retained for further analysis. Almost all correlations are significant (p (two-tailed) < .01) except item 4 which does not significantly correlate with item 8 and does not correlate as strong with item 9 (p (two-tailed) < .05). The items that cluster on component 1 (items 4-10) had a high reliability, Cronbach's α = .86, which is an indication of a good internal consistency of the PSESD.

Table 3 Spearman's correlation coefficients between the items (4-10) of the PSESD

PSESD	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10
Item 4	-	.50**	.44**	.35**	.21	.27*	.48**
Item 5		-	.45**	.34**	.54**	.39**	.45**
Item 6			-	.56**	.41**	.56**	.55**
Item 7				-	.44**	.54**	.56**
Item 8					-	.63**	.43**
Item 9						-	.53**
Item 10							-

*: p .05
**: p .01 (two-tailed)

3.3 Health-related quality of life

Table 4 shows the means, standard deviations and Cronbach`s alpha`s for the total score and the score of the six subscales of the Kid Kindl® questionnaire. Means and standard deviations are also compared between girls and boys and between age groups (8-11 versus 12-16). Cronbach`s alpha of the total score of the Kid Kindl® was found to be .89 which is an indication for a high reliability of the scale. As Nunnally`s (1978) advised criterion of an alpha of 0.7 is taken as a reference point, it becomes apparent that most of the subscales are sufficiently consistent. The *physical functioning* (alpha=.68) and *school* subscale (alpha=.29), however, do not reach this criterion.

Table 4 Descriptive statistics of the Kid Kindl® scores

	Total		**Girls**		**Boys**		**age 8-11**		**age 12-16**		
Kid Kindl® scales	M	SD	M	SD	M	SD	M	SD	M	SD	α
Total[1]	4.04	0.50	4.03	0.48	4.08	0.55	4.16	0.57	3.99	0.46	.89
Physical functioning[2]	3.98	0.55	3.96	0.53	4.04	0.60	4.18	0.57	3.88	0.51	.68
Psychological well-being[2]	3.71	0.83	3.68	0.81	3.76	0.90	3.93	0.80	3.58	0.85	.73
Selfesteem	4.13	0.66	4.09	0.64	4.20	0.72	4.31	0.69	4.02	0.63	.67
Family[2]	3.83	0.96	3.82	0.96	3.82	0.98	4.00	0.89	3.72	1.01	.87
Friends[2]	4.72	0.50	4.84	0.24	4.49	0.76	4.56	0.74	4.82	0.26	.75
School[2]	4.15	0.71	4.10	0.69	4.20	0.74	4.29	0.81	4.09	0.64	.29

[1] = 3 missing [2] = 1 missing

As the maximal score of the scales amount to the value of 5, the descriptive statistics show that the sample scores were relatively high with a mean total score of 4.04 which means that the tested sample had a good overall health-related quality of life. The scores on the total scale of the Kid Kindl® neither differed significantly by gender (U = 323,5; p = .789) nor by age group (U = 248; p = .096). Significant age differences were only identified between the two age groups for the subscale *physical functioning* (U = 239, p = .021). Younger children scored systematically higher on this scale.

3.3.1 Correlations Kid Kindl® scales

Table 5 shows the inter-correlations between the different scale scores of the Kid Kindl® questionnaire by means of the non-parametric statistic of Spearman's correlation coefficients. It is an overview of how the different subscales and the total scale correlate to one another. It is noticeable that the subscale *friends* is not as strong or even not at all related with other aspects of health-related quality of life. The rest of the correlations are significant (p (two-tailed) < .01); they are measuring constructs which bear a significant relation to one another.

Table 5 Spearman's correlation coefficients between Kid Kindl® scales

Kid Kindl® scales	Total	Body	Psy. well-beeing	Self-esteem	Family	Friends	School
Total	-	.87**	.67**	.83**	.76**	.29*	.64**
Body		-	.50**	.74**	.52**	.21	.42**
Psychological well-being			-	.41**	.45**	.12	.41**
Self-esteem				-	.59**	.26*	.44**
Family					-	.10	.45**
Friends						-	.29*
School							-

* : p < .05
**: p < .01 (2-tailed)

3.4 Relation diabetes-related self-efficacy and health-related quality of life

3.4.1 Univariate analysis

Table 6 shows an overwiew of the correlations between the scores on the PSESD and the Kid Kindl® scales. Diabetes-related self-efficacy was significantly related to a higher *self-esteem*, r_s= .37, p < .01. There was also a significant relationship between diabetes-related self-efficacy and the overall health-related quality of life, r_s= .28, p < .05. The same is true between diabetes-related self-efficacy and a better quality with *friends*, r_s= .34, p < .05.

Table 6 Spearman`s correlation coefficients between the PSESD and the Kid Kindl® scales

	Kid Kindl® scales						
	Total	Physical functioning	Psychological well-being	Self-esteem	Family	Friends	School
PSESD	.28*	.21	.21	.37**	.19	.34*	.16

* : p < .05

** : p < .01

3.4.2 Multivariate analysis

Multiple regression analysis

Based on a multiple regression analysis it was studied in what way diabetes-related self-efficacy is related to the six subscales of the Kid-Kindl®, measuring specific constructs of health-related quality of life. The score on the PSESD was defined as dependent variable. The method of "Forced entry" was used in which the Kid-Kindl® scales were put into the model simultaneously. Before proceeding with the analysis, several assumptions were checked:

1. Multicollinearity: In order to identify multicollinearity, the correlation matrix (see table 5) was scanned. Correlations of above .80 or .90 could not be detected. The average VIF found in this study was 1.86 which is far away from 10 and the tolerance statistics all well above 0.2. Based on this value, it can be concluded that there is no collinearity within these data.

2. Independent errors: The Durbin-Watson value found in this study was 2.08, which is close to 2, meaning that the residuals were uncorrelated.

3. Residuen: In the sample there was one case (0.54%) diagnosed having a standardized residual beneath -2. This is clear beneath the criterion of 5 %. As there was no value of Cook`s distance greater than 1, no unwanted influence was detected. The histrogram looked except for slight deficiencies like a normal

distribution. The probability plot revealed that all points lay near the straight line which was another indication for a normal distribution. It could be concluded that no assumption was violated.

Table 7 gives the b-values, their standard errors and the standardized betas with their significance.

Table 7 Multiple Regression Model

	B	SE B	β
Constant	-0,15	0,79	
Physical functioning	-0,01	0,21	-.01
Psychological well-being	-0,02	0,11	-.03
Self-esteem	0,35	0,18	.38
Family	0,01	0,1	.01
Friends	0,54	0,16	.44*
School	-0,12	0,13	-.14

Note: $R^2 = 0.34$; *: $p < .05$

Together, all scores of the subscales of the Kid-Kindl® account for 34% of the variance in diabetes-related self-efficacy ($F(6, 47) = 4.03$; $p = 0.002$). The b-values tell us about the relationship between diabetes-related self-efficacy and each predictor. The b-values of the *physical functioning* (B = -0.01), *psychological well-being* (B = -0.02) and *school* subscale (-0.12) represent a negative but non-significant relationship with diabetes-related self-efficacy. In regard to the *physical functioning* subscale it means that if the score on the *physical functioning* subscale increases by one unit, scores on diabetes-related self-efficacy would decrease by 0.011 units if all other scores on the subscales are held constant. However the t-statistic did not indicate that the B-values of the scores of the *physical functioning*, *psychological well-being* and *school* subscale significantly differ from zero ($t(47) = -0.051$, $p = 0.96$; $t(47) = -0.205$, $p = 0.839$; $t(47) = -0.908$, $p = 0.369$).

The b-values of the scores of the subscales of *self-esteem* (b = 0.352), *family* (b = 0.005) and *friends* (b = 0.54) represent a positive relationship. However, only

the scores of the subscale of *friends* indicate that the b-value significantly differs form zero (t(47) = 3,366, p= .002).

The value of the standardized beta of the subscale of *friends* indicates that as the score on the subscale increases by one standard deviation (0.51059), the score on diabetes-related self-efficacy increase by 0.44 standard deviations. The standard deviation for the score on the PSESD is 0.63 and so this constitutes a change of 0.28 (0.44 * 0.63). This interpretation is true if the scores on the other subscales are held constant. The standardized beta values of the other five subscales did not reveal any significance (see table 6). From this data and restricted to the sample used, it can be concluded that the subscale of *friends* is found to be a unique construct in bearing a significant relation with diabetes-related self-efficacy.

4 Conclusion & Discussion

The first goal of this study was to examine the unidimensionality and internal consistency of the PSESD. In regard to the unidimensionality, an exploratory factor analysis could identify one clear factor which was interpreted as a representation of diabetic management in regard to problematic situations. For future use of the PSESD, it is recommended to exclude the first three items because of lying on a different factor which was interpreted as measuring more concrete abilities. In regard to the internal consistency, a Cronbach's α of .86 was found which is an indication of a very high internal consistency of the questionnaire of the PSESD. Overall, the PSESD appears to be a promising instrument in regard to the measurement of diabetes-related self-efficacy. Therefore, future research should be focused on further psychometric properties. It would be interesting to measure the construct validity which is directly concerned with the theoretical relationship of a variable. As studies have revealed that self-efficacy and quality of life are positively correlated (e.g. Rose et al., 2002), the same empirical relationship with the PSESD could be used as evidence of construct validity in forthcoming research.

The second goal of the study was to examine the associations between diabetes-related self-efficacy and different aspect of health-related quality of life in pediatric patients with T1D. In regard to this aspect, the study discloses a positive correlation between health-related quality of life and diabetes-related self-efficacy which is consistent with the studies of Grey et al. (1998) and Rose et al. (2002) who already pointed out a positive relationship between both constructs. Especially the dimensions of *self-esteem* and *friends* revealed a significant positive correlation. As Branden (1969) defined self-esteem as "... the experience of being competent to cope with the basic challenges of life and being worthy of happiness", it is not surprising that this construct is found to be related to diabetes-related self-efficacy, gained through personal mastery experience in the daily routine of handling diabetes type 1. The findings of the relation between the dimension *friends* and diabetes related self-efficacy is somewhat more complex though. It seems that a higher reported diabetes-related self-efficacy is associated with a better social

integration but causal directions cannot be concluded. This association mirrors the importance of social integration which is a main aspect of the project DiNa of the St-Agnes-Hospital, Bocholt, Germany, and which should be further promoted in future. In forthcoming research, it would be interesting to investigate the relationship between diabetes-related self-efficacy and social integration in depth. An interesting result refers to the fact that the pediatric patients in this sample had a very high score on the subscale of *friends* (4.72 out of a maximal score of 5). This could not be expected from Jacobson's et al. (2004) point of view who stated that pediatric patients had fewer friendships and less sense of trust compared to healthy peers. A limitation in regard to this aspect is that the scores of the pediatric patients in this study could not be compared to healthy peers.

Running a multiple regression analysis, health-related quality of life accounted for 34% of the variance in diabetes-related self-efficacy. Only the dimension of *friends*, however, turned out to have a significant relation with diabetes-related self-efficacy. Again, it becomes clear that a follow-up study concerning the relationship between the dimension *friends* and diabetes-related self-efficacy is requested.

In regard to the two age groups, significant differences were only identified for the construct of physical functioning. Younger children scored systematically higher on this subscale. As Chih et al. (2009) stated that pediatric children having reached puberty were at risk for poor metabolic control, this might be associated with a poorer physical functioning but more research is needed in regard to this aspect.

A gender effect did not play any role in this study which stands in contrast to a study from Eiser & Morse (2001) who reported that girls had a lower health-related quality of life than boys. One limitation is here that twice as many girls took part in this study and boys were clearly under-represented in the tested sample.

Several limitations of the study have to be stated. First of all, this study had a cross-sectional design which means that there is absolutely no evidence for causal relationships. Longitudinal or experimental studies have to be conducted in order to reach firm causal conclusions. Secondly, the sample used was relatively small (N=59) and only recruited from one medical centre in a relatively small city in

Germany (Bocholt) near the border of the Netherlands. Moreover, the sample was enrolled in the DiNa project which provides optimal care for the young patients with diabetes type 1. The results can therefore not be generalized to other populations. Thirdly, data collection was based on self-report questionnaires. The desire to please, misunderstandings or especially adolescents not feeling like decently filling out the questionnaires could have influenced the results.

In general, this investigation is meant to serve the DiNa project to collect data of HRQOL and diabetes-related self-efficacy which can be used for the evaluation of their program. Furthermore, the finding of an association between diabetes-related self-efficacy and health-related quality of life can serve as an instantaneous motivational factor for pediatric patients for improving their HRQOL which means to say that young patients can be motivated to hold sway over their diabetic management in order to improve their health-related quality of life in short-term. Especially young patients living at present can hardly be motivated to control their diabetic management in order to avoid long-term threatening complications.

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