

Paternal Influence on Glycemic Control at Baseline and One Year Post Diagnosis in Children and Adolescents with Type 1 Diabetes Mellitus

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Abstract

Aim: The aim of this exploratory study within an RCT design was to examine the factors with influence on the change in the child's glycemic control from the onset of Type 1 Diabetes Mellitus (T1DM) to 1-year post diagnosis by using the following repeated measures: the child's age, parent and family functioning (PedsQL™ Family Impact Module, FIM) and parent level of education. Glycemic control measured as HbA1c at three months post-diagnosis was used in the analysis

Methods: 101 children, aged 3-15 years, recently diagnosed with T1DM and their parents participated in the study. Data was collected at baseline and at 12 months after diagnosis. A linear mixed model was used for longitudinal analysis. The variables parental and family functioning, parental educational level, and age of the child were regarded as potentially explanatory of the continuous variable HbA1c.

Results: The educational level of the father was the only explanatory variable of glycemic control 1-year post-diagnosis.

Conclusion: Since the paternal influence on the metabolic control of the child is significant, this study highlights the importance of involving fathers in the child's diabetes treatment, both at onset and henceforth in the ongoing care.

Keywords: Family; HbA1c; Type 1 diabetes; Children – adolescents; Glycemic control- paternal; Parental education

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Introduction

The onset of Type 1 Diabetes Mellitus (T1DM) in children places high demands on the entire family. The family needs to reorganize everyday life in order to establish routines on nutrition, physical activity, adjustment of insulin and the monitoring of blood glucose levels. The majority of parents express that the child's onset of diabetes has a significant psychological impact [1]. Parents are frequently reporting a perceived loss of control along with a simultaneous restriction of the family's flexibility. Generally, both parents are encouraged to be involved in the diabetes treatment of the child. However, different social and/or economical support systems of societies and countries can either encourage or discourage paternal engagement, i.e. in participating at outpatient clinic visits, school information meetings etc. During extra demanding time periods in the life of a child with diabetes, there is a need

for additional cooperation and for parent and child to communicate more effectively. Finding a balance between parent and child responsibility is an important part of diabetes management [2-4]. The relation between diabetes related family conflict and metabolic control has to be taken into consideration already from diagnosis. Conflicts around direct diabetes management tasks, such as taking insulin doses, remembering to check blood glucose and coordinating meals and snacks, have been shown to be related to elevated HbA1c levels [5-7]. Parents are over time often affected by stress reactions, overwhelming worry and symptoms of depression as a result of their child's chronic illness. Associations between high levels of stress among parents and poor glycemic control in the child have been found [8-10]. The child's age and gender also affect the degree of metabolic control. In general, adolescents have worse glycemic control compared to younger children, and girls tend to have poorer glycemic control compared to boys [11]. Studies have also shown a correlation between parental educational level and the outcome of the child's glycemic control [12-14]. However, even if the term "parental" is commonly used in pediatric research, there are relatively few studies including both mothers and fathers in the samples [15-17].

Based on the results of earlier studies in the field, the aim of this study, which is part of a 2-year prospective RCT Family intervention study, was to explore the factors influential on the change in glycemic control from the onset of T1DM to 1-year post diagnosis. The following repeated measurements were used; the child's age and parent- and family functioning, and parental level of education.

Methods

Study design

The current exploratory study examined data from a Family intervention study, using repeated outcomes measured at baseline with a prospective follow-up at 1-year post-diagnosis.

Participants

The participants were recruited at the paediatric diabetes centre at the Queen Silvia Children's Hospital, Sahlgrenska University

Hospital, Gothenburg, Sweden during the time period October 2008 - December 2011. The total population consisted of 214 children, recently diagnosed with T1DM, and their primary caregivers.

Eligibility criteria included ages 3-15 years, recent onset of T1DM and fluency in the Swedish language. The T1DM-diagnosis was confirmed with all 6 diabetes specific Ab's (GAD64, IA-2, IAA, Zn3) as well as HLA and P/C-peptide level. Children with developmental disability and/or mental retardation were excluded in addition to children with any significant medical disease other than T1DM. Children receiving their primary medical follow-up at another medical centre were excluded. Participation in any other research study was also an exclusion criterion. Children with well-treated celiac disease and thyroid disorders were accepted for inclusion. Of the 121 families who met the eligibility criteria 104 (86 %) agreed to participate in the study. At the end of year one, three of the families had chosen to terminate the study leaving 101 participants for follow-up. Two of the families were single parent households.

Procedure

The participants were recruited 3-5 days after the diabetes diagnosis while still admitted to in-patient care. One especially assigned diabetes nurse or pediatric diabetologist informed the families about the study, both verbally and by a written information letter. The parents and children who agreed to participate in the study gave their oral and written informed consent.

Study measurements were collected at the paediatric diabetes out-patient clinic during the patients' scheduled medical visits. An especially assigned research assistant collected the study data and assisted the children and parents in answering the questionnaires when needed. Mothers and fathers were asked to answer the questionnaires separately. The study was performed in accordance with the Helsinki declaration and was reviewed and approved by the Regional Ethical Review Board.

Measures

Parent and Family functioning

Parent and family functioning was measured with the PedsQL™ Family Impact Module. The PedsQL™ Family Impact Module is a 36-item questionnaire consisting of six scales measuring parent self-reported functioning (Physical Functioning, 6 items; Emotional Functioning, 5 items; Social Functioning, 4 items; Cognitive Functioning, 5 items; Communication, 3 items; Worry, 5 items), and two scales measuring parent self-reported family functioning (Daily Activities, 3 items and Family Relationships, 5 items). Each item in the PedsQL™ Family Impact Module is measured by a 5-point Likert scale where 0 = never a problem and 4 = always a problem. Items are reverse-scored and linearly transformed to a 0–100 scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0), thus higher scores indicate better functioning or less negative impact. Total scale scores are computed as the mean scale score in order to account for missing data. The total score of the PedsQL™ Family impact Module is computed as the mean score of all items answered. The Parent HRQOL Summary Score (20 items) is computed as the mean score of the items answered in the Physical, Emotional, Social, and Cognitive Functioning Scales. The Family Functioning Summary Score (8 items) is computed as mean score of the items answered in the Daily Activities and Family Relationships Scales. High internal consistency has previously been reported for the questionnaire with an alpha-coefficient of 0.97 for the total scale and alpha-coefficients ranging from 0.75–0.97 for the subscales [18, 19].

Parent educational level

Parent educational level was measured in the Demographic questionnaire as a two point categorical variable where parents were asked to report their educational level as Primary school (9 years) / College (12 years) or education more than 12 years.

Glycemic control

HbA1c was measured with DCA Vantage (Siemens Healthcare Diagnostics Inc., Tarrytown NY, USA) with a normal value of

27–42 mmol/mol (4.6–6.0% NGSP). The quality was assured in accordance with Equalis (External quality assurance in laboratory medicine in Sweden, www.equalis.se). There was no deviation from the set targets during the study period. All patients were initially treated with IV insulin for 1–3 days, thereafter with Multi Daily Injections (MDI) or insulin pump.

Statistical analysis

Statistical analyses were performed with IBM SPSS for Windows, version 20. Descriptive statistics were calculated for the background variables. Internal consistency of the total PedsQL™ Family Impact Module, as well as for the subscales, was assessed with Cronbach's alpha for mother- and father reports [20]. A linear mixed model was used where the effects of the child's age, parental educational level, and parent and family functioning on HbA1c one year post diagnosis were examined. Fixed effects were assumed. Unstructured covariance of the longitudinal data was used. The longitudinal analysis yielded beta (regression coefficients), estimates of least square means with standard error and p-values. Cross-correlations were performed prior to the analysis in order to determine the strength of the relationship between the variables in the models. Variables with correlations > .7 were omitted from the model. In order to control for high baseline HbA1c levels, i.e HbA1c measured immediately at diabetes onset, HbA1c at three months post-diagnosis was used in the model.

Results

Descriptive statistics

The mean age for the responding children in the sample was 8.9 years (range 3–15 years). 55 % of the participating children were boys. HbA1c values at baseline ranged from 36 to 88 mmol/mol with a mean value of 50 mmol/mol (mean value 6.7 % NGSP, range 5.4–10.2% NGSP) 11 patients (11%) suffered from Diabetic Keto Acidosis (DKA), defined as blood pH < 7.3 mmol/l at the time of diagnosis.

The level of education among the parents was generally high, especially among mothers; 64 % of the mothers and 46 % of the fathers stated more than 12 years of education (Table 1).

Table 1: Characteristics of children and caregivers at baseline and at 12 months. Means and (range) is shown. Caregivers' education levels are given in two categories: 9 years and 12 years/>12 years.

	Baseline	12 Months
N	101	101
Male (%)	55	55
Age, years (mean, range)	8.9 (3-15)	9.9 (4-16)
HbA1c mmol/mol (mean, range)	50 (36 – 88)	56 (34 – 112)
pH (first 24 hours) (mean, range)	7.35 (7.04 – 7.45)	
Therapy injections (%)	89	71
Therapy pump (%)	11	29
Education mother(%)	36/64	36/64
Education father (%)	54/46	54/46
PedsQL, Fathers (mean, range)	67 (33- 97)	73 (38 -100)
PedsQL, Mothers (mean, range)	59 (25- 89)	68 (17- 100)

Internal consistency

The total PedsQL™ Family Impact Module reached high Cronbach's alpha coefficients both for mother- and father reports, $\alpha = .97$ and $\alpha = .96$ respectively. The Cronbach's alpha coefficients for the subscales ranged from .77 to .94 for both mother- and father reports, where only three of the 16 subscales had coefficient levels below .80. The Parent Functioning Score had alpha coefficients of .96 (mother reports) and .95 (father reports) and the Family Functioning Score had alpha coefficients of .90 (mother reports) and .92 (father reports).

Longitudinal analysis

The model had an Akaike's Information Criterion (AIC) of 1008. The educational level of the fathers was the only explanatory variable of glycemic control in the model, $p < .01$ (Table 2).

Table 2: Linear model for repeated measures (baseline and 12 months)

Dependent Variable: HbA1c at three months

Model	β	SE β	Sig.
Age	.302	.231	.196
Education, Fathers	5.052	1.636	.003
Education, Mothes	2.178	1.773	.223
PedsQL, Fathers	.029	.058	.613
PedsQL, Mothers	-.047	.050	.345

Discussion

Research on children and adolescents with T1DM usually focus primarily on the mothers as they often are regarded as the primary caregivers. In many countries, it is more often the mother who accompanies the child to the outpatient visits at the hospital, where also most of the research studies take place [21]. In Sweden the parental leave system allows both parents to attend to the child's regular out-patient clinical visits [22]. The linear model in this study showed that the father's level of education was the only explanatory variable of the child's glycemic control one year post diagnosis. A higher educated father was related to a lower HbA1c-level in the child. Research has previously shown a relationship between the mother's educational level and the child's glycemic control. It has been shown that mothers with a moderate level of education have better diabetes knowledge than mothers with a low level of education, and that better diabetes knowledge is associated with lower HbA1c levels [14]. Another study, bringing both mothers and fathers into the sample, showed a significant relationship between the mothers' educational level and the child's glycemic control while no such relationship was found for the fathers [13]. These findings, as well as ours, might reflect a better capacity among higher educated parents to integrate abstract diabetes information and put it into practice, as well as an ability to keep this up in a stressful and overwhelming situation. The present study also highlights the importance of expecting the fathers to participate in the everyday diabetes care and at the

out-patient clinical visits. This should be the case not only at the diabetes onset but also in the ongoing diabetes care. The diabetes information should be targeted to the individual family members of both sexes.

Somewhat surprisingly neither the results of the PedsQL Family Impact Module nor the age of the child were significant in the model. Considering the relatively high educational level of the parents, especially in the mothers, one explanation could be that parental education serves as an overall protective effect on the child's HbA1c. Furthermore, in the present study both parents were represented in the sample. Previous studies focusing on parental coping strategies in families with a child with T1DM have found that fathers are more inclined to use distancing as a coping strategy [23, 24]. In one of the studies the fathers' own rationale for this choice was that they used it as a way to balance the anxiety of the mothers [23]. In a study of patterns of adjustment over one year in families with T1DM it was found that a decline in the fathers' adjustment was a significant predictor of better adjustment of mothers at follow-up, suggesting that there is a buffering effect in the parent dyad where one parent compensates for the other parents' reactions [25]. When it comes to the non-significant result of the child's age one possible explanation for this could be the sustained insulin remission in children during the first year post diagnosis.

This study had some limitations. The parents in the study sample consisted of a rather homogenous group regarding the level of education with as many as 64% of the mothers and 46% of the fathers in the sample having a higher degree of education. Furthermore, the fact that only 7% had an immigrant background adds to the homogeneity of the sample. A more diverse sample would have added to the generalizability of the results.

Conclusion

This study shows an association between paternal educational level and the child's glycemic control which provides further support for the importance of actively including fathers into the ongoing diabetes care.

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