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Impact of Family Environment and Support on Adherence, Metabolic Control, and Quality of Life in Adolescents with Diabetes

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Background: *Diabetes is a common disease in pediatric populations. Family functioning has been related to child adaptation to diabetes.* ***Purpose:*** *To determine the impact of family factors on diabetes, particularly the influence of family support and family environment on adherence to treatment, quality of life, and metabolic control in Portuguese adolescents with type 1 diabetes, taking in consideration age, sex, duration of disease, and social class.* ***Method:*** *This study used a cross-sectional design. A sample of 157 Portuguese diabetic patients filled disease-specific measures on adherence and quality of life and family functioning measures. Hypotheses were that family support and an organized family environment (high cohesion and low conflict) would be positively associated with better adherence, metabolic control, and quality of life.* ***Results:*** *This study's results confirmed that adherence was predicted by family support for females and lower-class patients while metabolic control was predicted by family conflict for upper-class patients. Quality of life was predicted by lack of family conflict and family social support for both males and females as well as lower-class patients.* ***Conclusion:*** *The results highlight the importance of studying family variables in adolescents' diabetes care within the wider cultural factors affecting the patient.*

Key words: Diabetes, family support, family environment, adherence, quality of life, metabolic control

Introduction

Diabetes is among the most common chronic conditions in pediatric populations (Sarafino, 1990). Diabetes is not a single disease and includes a group of metabolic disorders that have in common the incapacity or the insufficient insulin production from the pancreas. Type 1 diabetes is usually diagnosed between 6 years of age and puberty. It is very demanding on the family and child because it requires insulin injections that can create serious complications and even death if left untreated. One-third of deaths result from acute complications that could be preventable (Wing, Nowalk, & Guare, 1988). As a result, it is very important that patients adhere to treatment. Few people with diabetes die of acute complications if they follow recommended medical regimens (International Society for Pediatric and Adolescent Diabetes-ISPAD, 1995, 2000; Kilo & Williamson, 1987; Santiago, 1984; Sperling, 1996).

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The presence of a chronic disease is a source of stress for the family, especially if the stress requires changes that interfere with the family's roles and tasks (Horner, 1997). When the family is dealing with an acute disease, the changes are usually brief and transitory. In the case of diabetes, a chronic disease, changes are long term and may create tension and conflicts in the family (McCubbin & McCubbin, 1993; Silver, Stein, & Dadds, 1996). Parents become the most important social support providers for adolescents, directly monitoring meal planning, insulin administration, and glucose monitorization, and, indirectly, through modeling and encouraging a healthy lifestyle (La Greca & Thompson, 1998; La Greca et al., 1995).

Family functioning and parental social support have been related to child adaptation to diabetes' adherence (Hamlet, Pellegrini, & Katz, 1992; Leonard, Garwick, & Adwan, 2005; Leonard, Savik, Plumbo, & Christensen, 2002; Wilson et al., 1986) and psychosocial adaptation to disease (Cohen, Lumley, Naar-King, Partridge, & Cakan, 2004; Johnson, 1994; Leonard et al., 2002, 2005). Organized families in terms of cohesion, conflict resolution, and availability provide social support and promote better psychological conditions for behavioral adherence to diabetes (Barakat & Kazak, 1999; Drotar, 1997; La Greca & Thompson, 1998; La Greca et al., 1995; Seiffge-Krenke, 1998). Lack of

family conflict has been considered the best predictor of therapeutic adherence (Jacobson et al., 1990).

There is an established relationship between adherence and metabolic control (Guttmann-Bauman, Flaherty, Strugger, & McEvoy, 1998). Yet, it is unclear under what conditions and how consistently metabolic control is associated with family functioning (Seiffge-Krenke, 1998). Martin, Miller-Johnson, Kitzmann, and Emery (1998) found family's capacity for conflict resolution and emotional support to be correlated with both therapeutic adherence and metabolic control. The relationship between biological indicators and family functioning though is still unclear, as some researchers find no direct relationship between family factors and metabolic control (McKelvey et al., 1993).

Quality of life is another important factor that has been shown to impact adherence. Quality of life in diabetic adolescents has been related to family social support, but more research is needed to confirm this relationship (Grey, Boland, Yu, Sullivan-Bollyai, & Tamborlane, 1998; Pinar, Erslanoglu, Isguven, Cizmeci, & Gunoz , 2003).

In Portugal, little is known about the impact of psychological factors on diabetes, particularly the influence of family variables on adherence to treatment, quality of life, and metabolic control in adolescents. In order to guide interventions that promote adherence and quality of life in type 1 diabetes, it is important to confirm and assess the relationship among these factors in Portuguese families.

This study predicts that family social support and an organized family environment (high cohesion and low conflict) will be positively associated with better adherence, metabolic control, and quality of life in adolescents.

Methods

Sample Characteristics

A convenient sample from a major hospital in Oporto, Portugal, participated in the study. The 157 volunteer participants were all patients from a diabetes pediatric unit. Criteria for inclusion in the sample were: 10 to 18 years old, fulfilling ISPAD and IDF (International Diabetes Federation—Europe) (ISPAD, 1995) criteria for the diagnosis of diabetes type 1, being diagnosed at least a year before participation in the study, receiving ambulatory treatment, not being pregnant, absence of an acute disease, and having normal intellectual development.

Procedure

Adolescents completed the questionnaires when they came to their regular pediatric appointment. Parents were interviewed separately and filled in the Family Environment Scale. A drop of blood from adolescents was collected by a nurse so that the levels of glycemia and glycated hemoglobin (HbA1c) could be determined. An average, based on the HbA1c values collected through the year (four to six samples/year), was made for each patient. The blood collection took place in three months to minimize the seasonal variations of the diabetes biochemical indicators. Samples were analyzed by DCA 2000 Analyzer (Henry Schein, North America) (Bayer Medical Products). Good metabolic control was defined using Alemzadeh and Wyatt criteria (2004): 6–8.5% good metabolic control, 9–10% fair control, and values 11% or higher as poor control.

Instruments

All the instruments listed below were adapted to the Portuguese population.

Self-Report Questionnaire on Adherence. This questionnaire, developed by the authors (Almeida & Pereira, 2003), assesses two types of adherence: behavioral adherence (meals, physical exercise, frequency of insulin administration) and self-responsibility for medical adherence (insulin self-administration, glucose testing). Since this questionnaire has a small number of items (5), the authors decided, as suggested by Toobert and Glasgow (1996), to analyze the correlation between the items to assess internal consistency instead of the alpha of Cronbach. The results showed a high correlation between the three behavioral components of adherence: diet, exercise, and frequency of insulin administration explaining 25% of the variance. Insulin self-administration and glycemic self-monitorization (self-responsibility for medical adherence) explained 32.7% of the variance. Poor adherence was defined as one standard deviation below average and good adherence as one standard deviation above average. High scores indicate low adherence.

Diabetes Family Behavior Scale (Mckelvey et al., 1993). The adapted version (Pereira & Almeida, submitted for publication) is composed of 38 items, grouped in 4 factors with an alpha of .86: affective family support (21 items), alpha of .91; control and direct support (6 items), alpha of .84; indirect support (6 items), alpha of .78; no support (5 items), alpha of .60. The original version presented a global alpha of .86 and two subscales with alphas of .79 and .81. A higher score indicates low family social support.

Family Environment Scale (Moos & Moos, 1986). Due to its psychometric properties, only three subscales of FES were used: cohesion (9 items), alpha of .70; conflict (8 items), alpha of .68; and organization (8 items), alpha of .70. In the original version, these subscales presented alphas of .78, .75, and .76, respectively. A higher score in each subscale means, respectively, more cohesion, more conflict, and more organization.

Diabetes Quality of Life (Injersoll & Marrero, 1991). The adapted version (Almeida & Pereira, submitted for publication) is composed of 36 items with a global alpha of .90: satisfaction (16 items), alpha of .88; impact of diabetes, (9 items), alpha of .87; worries (11 items), alpha of .73. The original version has a global alpha of .92 and the subscales presented alphas, respectively, of .85, .83, and .82. A high score indicates better quality of life.

Data Analysis

Descriptive statistics were conducted to determine the rate of adherence and metabolic control in our sample. Later, a series of partial correlations (controlling for age, gender, social class, and duration of disease) were conducted to identify the relationships between family, clinical, and demographic variables. Finally, a multiple regression analysis (stepwise method) was conducted to find out the best predictors of adherence to treatment, metabolic control, and quality of life. The variables introduced in the regression models were family social support (DFBS), cohesion (FES), conflict (FES), and organization (FES). Age, sex, duration of disease, and social class were introduced as covariates.

Results

Sample Characteristics

Our sample size consists of 157 children and adolescents, 49% boys and 51% girls ranging in age from 10–18. Average age was 15 years old ($SD = 2.2$ years). The average age at diagnosis for diabetes was 8.3 years old ($SD = 3.5$), and the disease had lasted for 6.4 years on average. No differences were found in gender for age at evaluation, age of diagnosis, and duration of diabetes.

In terms of family income, 17.2% of families belong to high social class, 20.4% to average middle class, and 62.5% to low social class as assessed by Graffar (1956), taking into consideration income, type of profession, academic level, and home characteristics. Most of the participants (81.5%) live with their nuclear families, 8.9% with extended families, 7% with monoparental families, and 2.5% live with stepfamilies. Most of our sample's fathers (57.3%) and mothers (64.3%) have 4 years of education.

Our sample showed a reasonable adherence to treatment: 59% presented results above average and only 22% showed some degree of difficulty. Adherence to medical treatment was better than behavioral adherence. Insulin administration adherence was also high: 79.6% of our sample followed the regimen with no problems. In terms of diet adherence, adolescents have some difficulty in following the regimen (only 15% follow completely the prescription, and the remaining 85% showed some deviance from the prescribed diet plan). Similarly, only 33% followed medical prescriptions for physical exercise; 55% of participants were in good metabolic control (HbA1c $< 8.5\%$); average was 8.9%, $SD = 1.5$, taking into consideration Alemzadeh and Wyatt criteria (2004) (HbAlc $< 8.5\%$). Regarding quality of life, 48% of patients with diabetes reported fewer worries than average, 52% perceived diabetes as having little impact on their lives, 51% reported above average satisfaction with their life. Table 1 summarizes how age, diabetes, and social class varied across the three dependent variables: adherence to treatment, metabolic control, and quality of life. Results are also reported by gender. Note that males showed better adherence than girls ($p < .01$). Older adolescents had lower family social support ($p < .001$) and lower adherence ($p < .01$) than younger adolescents. As the duration of the disease increased, adherence to treatment ($p < .001$) and metabolic control decreased ($p < .05$).

Adolescents in upper and middle class families showed better adherence when compared with adolescents from lower social class families ($p < .05$). Adolescents in upper class families, showed better metabolic control when compared with adolescents from lower social class ($p < .01$). Adolescents in upper and middle class families showed higher quality of life than adolescents from lower social class ($p < .001$).

Table 1. *Characteristics of the Sample Across Variables*

Variables	Stat	Adherence	Family Metabolic Control	Quality of Life	Social Support	FES Cohesion	FES Conflict	FES Organization
Age	*r*	0.221**	0.149	–0.170*	0.311***	–0.141	0.150	0.040
Diabetes Duration	*r*	0.308***	0.202*	–0.157	0.173*	–0.132	–0.003	0.047
Social class	*F*	3.46*	5.79**	8.89***	1.66	0.18	1.35	6.39**
High	m(SD)	7.5(1.5)	8.2(1.2)	209(19)	75.8(17.9)	28.6(2.9)	13.2(3.1)	24.5(1.9)
Middle	m(SD)	7.4(1.6)	9.1(1.9)	206(17)	80.7(19.4)	28.6(3.4)	13.3(2.7)	25.1(2.5)
Lower	m(SD)	8.1(1.5)	9.4(1.5)	193(22)	83.1(18.5)	28.3(3.6)	14.1(3.0)	26.6(3.4)
Gender	t	2.52*	1.74	0.04	0.14	2.79**	–1.25	0.16
Male	m(SD)	7.6(1.5)	8.9(1.4)	198(20)	81.1(20.3)	27.6(3.6)	14.1(2.9)	25.9(3.5)
Female	m(SD)	8.2(1.6)	9.3(1.7)	198(23)	81.6(17.1)	29.1(3.2)	13.5(3.0)	26.0(2.7)

Statistics: *r* Pearson, *F* de Fisher, t student, mean (standard deviation); $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Table 2. *Relationship Between Family Environment, Family Social Support and Adherence, Metabolic Control, and Quality of Life*

Variables	Stat	Adherence	Metabolic Control	Quality of Life (QL)	QL Satisfaction	QL Impact	QL Worry
FES cohesion	*r*	−0.014	0.026	0.142	0.109	0.157	0.075
FES conflict	*r*	0.053	0.023	–0.238**	–0.127	–0.282***	–0.170*
FES organization	*r*	0.053	0.084	–0.037	0.068	–0.077	–0.078
Family social support (FSS)	*r*	0.245**	0.081	–0.349***	–0.423***	–0.207**	–0.195*
FSS affective	*r*	0.234**	0.102	–0.369***	–0.408***	–0.211**	–0.256***
FSS indirect	*r*	0.144	−0.051	–0.204**	–0.339***	–0.097	–0.045
FSS control	*r*	0.148	0.053	–0.080	–0.192*	–0.031	0.042
FSS no support	*r*	−0.095	−0.006	–0.280***	–0.265***	–0.220**	–0.196*

Statistics: *r* Pearson, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Family Environment, Family Social Support, Adherence, Metabolic Control, and Quality of Life

A significant correlation was found between family conflict and global quality of life ($p < .01$), on one hand, and with family conflict and the subscales "impact of diabetes" ($p < .001$) and "worry" ($p < .05$), on the other. Family cohesion and family organization were not related to quality of life, adherence, or metabolic control.

A significant relationship was found between family social support and adherence to diabetes ($p < .01$). Affective social support was related to adherence ($p < .01$). We found no overall relationship between family social support and metabolic control. However, there was a relationship between family social support and global quality of life ($p < .001$) and each of the quality of life subscales: "satisfaction" ($p < .001$), "impact" ($p < .01$), and "worries" ($p < .05$). Table 2 shows these results.

Predictors of Adherence, Metabolic Control, and Quality of Life

Overall, adherence was predicted by family social support ($p < .05$), gender ($p < .05$), diabetes duration ($p < .001$), and social class ($p < .05$) explaining 17% of the total variance (Table 3). None of the family variables predicted metabolic control. The latest was predicted by gender ($p < .05$), diabetes duration ($p < .05$), and social class ($p < .001$), explaining 10% of the variance. Quality of life was predicted by family social support ($p < .001$), family conflict ($p < .05$), and social class ($p < .001$), explaining 20% of variance.

A path analysis confirmed that family social support moderated the relationship between adherence and metabolic control ($p = .027$). While the correlation between adherence and metabolic control is positive, regardless of the level of family social support, when family social support was very high, the correlation between adherence and metabolic control was stronger ($p < .001$ vs. $p = .042$) than when family social support was low.

Since gender and social class were significant predictors of adherence, metabolic control, and quality of life, a regression analysis was run by gender and by social class (Table 4). The results showed that quality of life was predicted by family social support for both males ($p < .05$) and females ($p < .001$), and overall ($p < .001$) accounted for 11% of the total variance. For the females, family support accounted for 16% of the variance, but for the males it accounted only for 6% of the variance. Only among the lower-class participants was family support ($p < .001$) predictive of quality of life, and it accounted for 16% of the variance. For the upper-class participants, family conflict was significantly predictive of quality of life ($p < .01$), accounting for 23% of the variance, and for the middle class participants, family organization predicted quality of life ($p < .05$), accounting for 12% of the variance.

Metabolic control was predicted only by high social class ($p < .05$), accounting for 13% of the variance, and, finally, adherence was predicted by family social support in females ($p < .001$), explaining 10% variance, and by lower social class ($p < .001$), explaining 19% of the variance.

Discussion

In our study, adherence to glycemic control (93.7%) is quite high and is consistent with the review of literature for this population (Anderson, Brackett, Finkelstein, & Laffel, 1997; Glasgow, 1991; Glasgow, McCaul, & Schafer, 1987; Johnson, Freund, Silverstein, Hansen, & Malone, 1990; Kovacs, Brent, Steinberg, Paulauskas, & Reid, 1986; Palardy, Greening, Ott, Holderby, & Atchinson, 1998; Warren & Hixenbaugh, 1998; Williams, Freedman, & Deci, 1998). Difficulties, when reported, are related to diet, one of the most difficult aspects in diabetes treatment. In terms of physical exercise, 33% of our sample was enrolled in

Table 3. *Predictors of Adherence, Metabolic Control, and Quality of Life with Gender, Diabetes Duration, and Social Class as Covariates*

Predictors	Stat	Adherence	Metabolic Control	Quality of Life (QL)
Family social support	β	0.155*		–0.281***
FES conflict	β			–0.158*
Gender (male)	β	–0.198**	–0.157*	
Diabetes duration	β	0.273***	0.157*	
Social class (high)	β		–0.248**	
Social class (lower)	β	0.178*		–0.256**
	R^2 Adj	0.174	0.099	0.196

Statistics: Beta standard coefficient; adjusted R square; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

physical exercise activities beyond the school-required gym classes.

The results on adherence to treatment are in accordance with the literature that shows patients having better adherence to the medical aspects of diabetes treatment (insulin administration and glycemia control) than to the recommended lifestyle changes (Anderson et al., 1997; Johnson et al., 1990; Palardy et al., 1998; Warren & Hixenbaugh, 1998). The progressive autonomy for self-care and peer pressure to join in junk food orgies are common among older adolescents and may explain the increased resistance to adherence (Lewin et al., 2006).

Metabolic control in our sample is quite high (55% show HbA1c less than 8.5%), and this result is in accordance with previous results for this age range (Diabetes Control and Complications Trial Research Group (DCCT), 1993; Hoey et al., 2001; Leonard et al., 2002).

The results showed the importance of reaching out to the families of certain high-risk adolescent patients with diabetes type 1, since some interdependence was found between family variables and the patients' adherence to treatment, metabolic control, and quality of life.

In fact, higher family social support predicts higher adherence and higher quality of life. On the other hand, higher family conflict predicts lower quality of life. These results are in accordance with the literature (Garay-Sevilla et al., 1995) that showed high family social support to be a predictor of adherence and family conflict to predict diminished quality of life for the child (Dickenson, Ye, Sack, & Hueston, 2003).

Diabetes duration predicted adherence and metabolic control, i.e., the longer the disease, the lower is metabolic control and adherence. These results are in accordance with previous studies (Donnelly, Morris, & Evans, 2007; Krapek et al., 2004). Those adolescents who have diabetes for a longer period of time, generally, are also the oldest and show, as a result of their quest for autonomy, less compliance with adherence and lower metabolic control. Male and female patients showed some similarities and some differences in terms of the influence of family variables on disease management. For both groups, increased family social support predicted a better quality of life. For the females, increased family support also predicted an increase in adherence. The current gender effect found with adolescents is different from findings reported with young adults that social support from a partner is

Table 4. *Predictors of Adherence, Metabolic Control, and Quality of Life by Sex and Social Class*

			By Sex		By Social Class		
Predictors	**Stat**	**All**	**Male**	**Female**	**High**	**Middle**	**Lower**
Predictors of adherence							
Family social support	β	0.226**		0.329**			0.308**
	R^2 Adj	0.045		0.096			0.187
Predictors of metabolic control							
FES conflict	β				0.404*		
	R^2 Adj				0.130		
Predictors of quality of life							
Family social support	β	–0.309***	–0.272*	–0.418***			–0.410***
FES conflict	β	–0.188*			–0.513**		
FES organization	β					0.382*	
	R^2 Adj	0.108	0.061	0.164	0.233	0.117	0.159

Statistics: Beta standard coefficient; adjusted R square; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

related to better diabetes management for males, but not females (Gillibrand & Stevenson, 2006). Thus, it is possible that social support differentially affects diabetes management as a function of the source of support (partner vs. parent) and the developmental stage of the individual.

The lower-class participants were most sensitive to the variables being investigated. They were significantly lower in adherence and quality of life compared to upper-class participants. Only among the lower-class adolescents did family support predict better adherence and a better quality of life. Among the middle-class adolescents, the only significant finding was that family organization predicted a better quality of life. Among the upper-class participants, a poor quality of life was predicted by family conflict, and family conflict, in turn, predicted metabolic control. The social class findings have an intuitive validity since the greater stressors of the lower class need to be countered by powerful social support. Similarly, the upper-class families who create conflict and disarray within an otherwise comfortable environment can have a negative impact on the adolescent's quality of life. And among the middle classes, it is the regularity and orderliness of the family that most affects well-being. Thus, it appears that economics affects the family structure such that different factors become important in promoting medical compliance and improved health status. Quality of life, which directly affects metabolic control in this and other studies, is in turn affected by different family factors, depending on social class.

According to literature, the influence of family environment on physiological variables is indirect, mediated by psychological factors such as self-efficacy or coping strategies (Grey et al., 1998; Hanson, Henggeler, & Burghen, 1987; Hanson et al., 1989a; Hanson, Cigrang, Harris, Carle, Relyea, & Burghen, 1989b). Our results suggest that family environment exists in a broader cultural context and greatly influences adherence, metabolic control, and quality of life in adolescents.

In conclusion, this study's results show that family factors have a complex relationship to health indicators in diabetic children. Family support appears more crucial to females and lower-class patients. Family conflict affects upper-class patients more directly in terms of metabolic control and more indirectly in terms of quality of life. Hopefully, continued research in this area will help identify families at risk for poor outcomes before those outcomes occur and help us design more effective, targeted family-based interventions.

Overall, the results highlight the importance of incorporating family variables in psychological interventions in adolescents' diabetes care. According to our results, an assessment of high-risk adolescents seems appropriate when designing interventions to improve adherence to treatment. For those who live in families with high conflict or don't provide strong social support or are disorganized, brief family therapy may be required to help the adolescent better manage diabetes. Cultural variables may help the clinician develop priority areas of assessments.

Limitations of this study include the fact that the adherence measure used was a self-report measure and the assessment instruments were validated within the sample that participated in the study.

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