The Highly Structured Climate in Families of Adolescents With Diabetes: Functional or Dysfunctional for Metabolic Control?

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Objective: Compare changes in perceived family climate over time in families with healthy adolescents and families with adolescents with diabetes and analyze the links to metabolic control.

Method: In a total of four annually conducted surveys, 89 German adolescents with diabetes and 106 healthy adolescents as well as their parents completed the Family Environment Scale (FES). Metabolic control was determined by physicians’ reports of adolescents’ hemoglobin (HbA1c) levels.

Results: Compared to families with healthy adolescents, families caring for an adolescent with diabetes portrayed their family interactions as considerably more structured and less cohesive and stimulating. Family climate was not associated with metabolic control and varied little with time, illness duration, and adolescents’ gender.

Conclusions: The findings suggest that continued parental monitoring is necessary for good metabolic control. However, a balance must be found between medical adaptation to illness and the adolescent’s developmental needs.

Key words: parents; adolescents with diabetes; healthy adolescents; family climate; metabolic control; longitudinal study.

Adolescence is a phase during which family relationships undergo far-reaching changes, placing great demands on the involvement of all family members. Families of adolescents with a chronic illness are additionally confronted with the task of coordinating this family restructuring with the simultaneous, ongoing process of coping with illness. The complex relationship between the family system’s development, the adolescent’s growing independence from the parents, and illness-specific needs and problems has been demonstrated quite clearly by North American studies on adolescents with diabetes and their families (see, for example, Hanson, Henggeler, & Burghen, 1987; Hanson, Henggeler, Harris, Burghen, & Moore, 1989) and is also the focus of this study conducted in Germany.

Insulin-dependent diabetes mellitus (IDDM) is a relatively prevalent disease in adolescence, affecting 1 out of 600 school-age children in the United States (Ahmed & Ahmed, 1985). Similar prevalence rates have been reported for most European countries, including Germany (Seiffge-Krenke, 1998a). While health professionals provide the medical supervision of the diabetic patient, the patient and his or her family are responsible for daily care involving...
monitoring glucose levels in the blood or urine, attending to dietary regulations, administering insulin, exercising daily, and taking precautions before certain school, recreational or social activities, and vacations (Sargent, 1985). In order to accommodate the demands of illness management, many aspects of day-to-day family life are upset and great strains are placed on adolescents and their parents (LaGreca, 1988; Wysocki, 1993). Illness management is particularly important because of the severe short- and long-term complications associated with poor glycemic control (Orchard et al., 1990). It is expected that in early adolescence, most patients are able to comply with physicians’ instructions, assume the responsibility for their diet, perform their own injections, and check glycemic control. Yet many studies illustrate that adolescents feel strained by the unusual self-discipline and the responsibility for self-care (Anderson, Auslander, Jung, Miller, & Santiago, 1990) and have difficulty adhering to the strict regimen (Hauser et al., 1990; Jacobson et al., 1990; LaGreca, 1990). A recent study by Gowers, Jones, Kiana, North, and Price (1995) found poor glycemic control in nearly 50% of its adolescent sample.

Although the entire family system is confronted with and affected by the illness, usually the mother is the most engaged in monitoring its therapeutic management. Even if her adolescent child is quite self-sufficient, she frequently feels responsible for her child’s health and is often painfully aware of the long-term consequences of diabetes (Hauser, 1991). Studies demonstrating overprotectiveness in mothers of adolescents with diabetes (Hamlett, Pellegrini, & Katz 1992; LaGreca, 1988) may suggest that mothers in particular emphasize closeness and cohesion in family functioning. Little research, however, has been conducted on the contribution of fathers in families caring for an adolescent with diabetes (Auslander, Anderson, Bubb, Jung & Santiago, 1990; Hanson, Henggeler, Rodriguez, Burghen, & Murphy, 1988).

In evaluating the links between family relations and child functioning in families of adolescents with diabetes, researchers have focused on two diabetes-specific outcome measures: degree of metabolic control and overall psychosocial adaptation. With respect to metabolic control, the achievement-oriented family climate described by Billings and Moos (1982) demonstrates how family interaction adjusts to the management of diabetes, which requires a great deal of structure and control. Similarly, Overstreet et al. (1995) found that compared to traditional families (e.g., two-parent or nuclear families with a high level of organization), nontraditional family structure was related to significantly poorer metabolic control.

In contrast to these findings focusing on a more rigid interaction style and a high level of organization and control, other results have emphasized the importance of a positive emotional family climate—high cohesion, expressiveness, and low conflict in achieving good metabolic control (Hanson, De Guire, Schinkel, & Kolterman, 1995; LaGreca, Siegel, Wallander, & Walker, 1992). Hanson et al. (1995) found strong associations between family cohesion and metabolic control under conditions of short illness duration. As duration lengthened, however, these associations decreased substantially.

With respect to the adolescent’s developmental needs, it appears that a beneficial family climate is marked by a high level of cohesion, flexibility, and organization, yet at the same time emphasizes personal growth and encourages leisure time activities (Hanson et al., 1987; Hauser & Solomon, 1985; Sargent, 1985; Wolman, Resnick, Harris, and Blum, 1994). A study by Hanson, De Guire, Schinkel, Henggeler, and Burghen (1992) has demonstrated that a family climate that is supportive yet also grants independence may exert a positive influence on the course of illness, too. According to this study, a high level of illness-specific support and a high degree of general flexibility in the family were associated with good adjustment to the illness. These findings suggest that the conditions for optimal psychosocial development in both groups are essentially the same; further, if parents are able to unite flexibility in organization and structure with a positive emotional climate, the effects are also beneficial for metabolic control.

The findings summarized so far suggest three hypotheses concerning the links between family climate and metabolic control: (a) the structure hypothesis (i.e., high levels of control and organization in the family are related to good metabolic control of the adolescent), (b) the cohesion hypothesis (i.e., parental warmth and family cohesion are related to good metabolic control), and (c) the flexibility hypothesis (i.e., high support coupled with a high flexibility in structure in the family is associated with good metabolic control). The discrepancies in the empirical research supporting different hypotheses may be due to a lack of control of variables that might influence the family climate, such
as the age of the adolescent, the duration of his or her illness, and the ability of the adolescent to maintain satisfactory metabolic control. It is well understood that parents may exhibit a different amount of cohesion and control depending on the age of the adolescent, and that a more flexible balance between family cohesion and structure is more characteristic of older than younger adolescents. Family structure and organization might also be high shortly after the adolescent has been diagnosed with IDDM or when he or she exhibits poor metabolic control. In addition, families with daughters may display more cohesion than families with sons. That is, the family climate that is optimal for good metabolic control may change over time depending on gender, illness duration, and metabolic control. However, most studies did not approach these questions longitudinally. A further important feature lacking in previous studies is the healthy comparison sample. Control groups are necessary to establish whether the changes in family climate observed in families with an adolescent with diabetes are related to illness-specific demands or more generally to the developmental needs of the adolescent.

In trying to balance illness-specific and developmentally related needs, adolescents’ and parents’ perspectives may be quite divergent. Mothers’ and fathers’ perceptions may differ, too. Therefore, in this study, a longitudinal design was applied, which includes the perspectives of adolescents with diabetes, their mothers, and their fathers as well as allowing for comparison with families of healthy adolescents. An extra feature of this study is that it was conducted in Germany. The use of a sample group that differs culturally from the more traditional North American sample may reveal different relationships or new factors that could influence metabolic control in adolescents with diabetes. Thus, cross-cultural similarities and differences in the links between family relations and metabolic control can be evaluated.

Method

Participants

A longitudinal study, consisting of a total of four annual surveys, was conducted with adolescents both with and without diabetes, as well as their families. All participants resided in Germany. Adolescents with diabetes were recruited from hospitals offering outpatient care; all had been diagnosed with IDDM. During a 9-month period, all adolescents and parents who attended their clinic appointments in 10 children's medical centers were asked to participate in the study. These hospitals were all primary treatment facilities for adolescents with IDDM in the area around Bonn, Germany, and offered standard care for adolescents such as regular blood and urine tests or dietary assistance. Besides offering the standard care four times a year, the centers recommend that the adolescents participate in annual summer camps for diabetes education. Eighty-eight percent of the families we approached in these hospitals agreed to participate. From those agreeing to participate, we selected families with early adolescents ages 12 to 14 years. Further, we had to exclude some families because their command of German was not sufficient for attending the interviews and filling out the questionnaires.

The healthy adolescents and their families were recruited from schools. Seventy-nine percent of the families approached via letters of consent agreed to participate. In the sample of healthy adolescents, the age range was fixed from 12 to 14, and families were selected to match the families of adolescents with diabetes according to marital status of the parents, parental employment, and socioeconomic status (SES). The percentage of families with both parents present was 84% in the diabetic and 76% in the healthy group. All of the fathers and 65% of the mothers were employed. The families came from broad socioeconomic strata; 52% of the families were middle class. Eighty-nine percent of the sample was of German descent while the remaining 11% did not have German citizenship. Their families were of Italian, Greek, and Turkish origin but had lived and worked in Germany for over 10 years and had a good command of German. A total of 228 adolescents ($M = 13.9$ years; $SD = 1.28$) and their 387 parents (218 mothers and 169 fathers) participated in the first survey. At the time of the final survey, the sample consisted of 198 adolescents ($M = 17.1$ years; $SD = 1.25$) and their 325 parents (189 mothers and 136 fathers). The drop-out rates were 17% for families with adolescents with diabetes and 13% for families with physically healthy adolescents. No statistical differences were found between the characteristics of those families that participated in all phases of the study and those that dropped out. The remaining sample was still representative with respect to the selection of criteria.
Complete longitudinal data sets were available for 87 adolescents with diabetes (42 girls and 45 boys) and 105 healthy adolescents (53 girls and 52 boys) together with all their parents (184 mothers and 136 fathers). For the adolescents with diabetes, glycosylated hemoglobin (HbA₁₋) values served as a criterion for metabolic control. These values had been determined during a clinic visit immediately before we visited the families at their homes. At the beginning of the study, the sample was divided into three groups according to their status of metabolic control. Based on physicians' reports, 25% of the adolescents with diabetes had good metabolic control (HbA₁ < 7.6), 48% had achieved a satisfactory level of metabolic control (HbA₁ 7.6 to 9.5), and 27% had poor metabolic control (HbA₁ > 9.5). The mean illness duration at the first survey was 5.4 years; 32% of the adolescents had been ill for less than two years, 24% for 2 to 5 years, and 44% for over 5 years. At the beginning of the study, more than 90% of the adolescents already injected themselves with insulin and were responsible for adhering to their diet as well as performing their daily blood sugar and urine tests.

**Measures**

Family climate was assessed by the Family Environment Scale (FES), as developed by Moos and Moos (1981). The FES registers the assessment of family climate according to the following 10 scales: cohesion, expressiveness, conflict, independence, achievement-orientation, intellectual-cultural orientation, active recreational emphasis, moral-religious emphasis, organization, and control. The reliability and validity values of the German version used in this study are provided by Schneewind (1987).

**Procedure**

After the parents had given informed consent and the samples were carefully matched, the annual surveys started. Each summer, the families were visited at home for interviews with the adolescents and their parents. The semistructured interviews included questions about family relations and the adolescent's psychosocial development. They were first conducted individually with the adolescent and then with his or her parents and had a mean length of about 45 minutes. In families with adolescents with diabetes, additional questions were posed with respect to coping with the illness, compliance, and adherence to the regimen. The questions were formulated in a manner so that both adolescents' and parents' perspectives about these issues were elicited. The results of the interviews have been reported elsewhere (Seiffge-Krenke et al., 1996). At the end of each interview, the adolescents and their parents were requested to independently complete the FES questionnaires.

**Statistical Analysis**

A factor analysis was conducted to derive higher-order factors of the FES. All further analyses were based on scores on the three second-order factors derived. Repeated measurement analyses of variance (MANOVAs) were carried out for the data sets of the families across all four surveys, in order to determine the effect of respondents' gender and health status across time. In the subsample of families with adolescents with diabetes, a 3 (illness duration) × 2 (gender) × 4 (time) MANOVA was conducted for the three subgroups of adolescents varying in illness duration (<2 years, 2 to 5 years, >5 years). A further MANOVA was conducted for the three groups with varying status of metabolic control (good, satisfactory, and poor metabolic control). Finally, the contribution of certain family climate dimensions to metabolic control was analyzed cross-sectionally via correlations and multiple regression analyses.

**Results**

**Factor Analysis of the FES**

Although the 10 scales of the FES have been frequently collapsed into three general dimensions, Interpersonal Relations (scales 1 to 3), Personal Growth (scales 4 to 8) and System Maintenance (scales 9 and 10) (see Moos and Moos, 1981; Schneewind, 1987), it is questionable whether these main dimensions are applicable for the German sample used in this study. In order to derive second-order factor scores of the FES, factor analyses were conducted for each survey, based on the intercorrelations of the total sample's scores on the 10 FES scales. The principal component analysis and varimax rotation (with Kaiser normalization) revealed a three-factor solution accounting for 60%, 65%, 66%, and 67% of the variance in the four surveys.
The factor solutions were highly similar at each time of measurement. Table I displays the factor solution of survey 1 with item loadings >.35.

Factor 1 was termed Normative Authoritarian Climate and accounted for 21% of the variance (Eigenvalue 2.64). This highly structured climate is characterized by low independence, high achievement orientation, control, and organization, combined with an emphasis on moral. Factor 2, termed Positive Emotional Climate, signifies a cohesive, harmonious, and open family climate (Eigenvalue 2.03, variance explained 20%). The third factor, Stimulating Climate, explained 18% of the variance (Eigenvalue 1.82) and signifies a family climate emphasizing cultural and recreational activities. These three factors are highly similar to those reported by Enger, Schneewind, & Hinderer (1977). In a factor analysis of the 10 FES scales, based on a sample of 570 children ages 9 to 14, they also found three factors, termed Positive Emotional Climate, (high cohesion, expressiveness, organization, and low conflict), Stimulating Climate (high cultural and recreational orientation), and Normative Authoritarian Climate (high achievement, moral-religious emphasis, and control).

**Family Climate, Depending on Health Status, Gender, and Respondent Across Time**

Table II provides the means and standard deviations of the family scores in the three second-order FES factors: Normative Authoritarian Climate, Positive Emotional Climate, and Stimulating Climate.

A 2 (health status) × 2 (gender) × 3 (respondent) × 4 (time) MANOVA revealed a significant main effect of health status, $F(1, 500) = 23.01, p < .001$, with families of adolescents with diabetes consistently scoring significantly higher in Normative Authoritarian Climate than families with a healthy adolescent. A significant time effect, $F(3, 1692) = 2.65, p = .047$, and a significant respondent × time interaction effect, $F(6, 1692) = 2.65, p = .014$, revealed a change over time, depending on the family member. As can be seen in Table II, adolescents with diabetes and their mothers consistently perceived a higher amount of achievement orientation, organization, and control than healthy adolescents and their parents.

For Positive Emotional Climate, significant main effects of health status, $F(1, 500) = 16.18, p < .001$, and gender, $F(1, 500) = 15.63, p < .001$, were found, whereby families with adolescents with diabetes perceived a significantly lower Positive Emotional Climate than families with a healthy adolescent. In addition, families with daughters reported a higher score in this family climate dimension than families with sons. Further significant main effects of time, $F(3, 1500) = 9.36, p < .001$, and respondents, $F(2, 500) = 13.69, p < .001$, as well as an interaction effect between respondent and time, $F(6, 1500) = 7.37, p < .001$, illustrate that adolescents, mothers, and fathers perceive the Positive Emotional Climate differently across time. Mothers and fathers perceive a significant decrease in family cohesion, openness, and harmony across time; however, despite this decrease, mothers’ scores remained significantly higher than adolescents’ and fathers’ scores at all four surveys. In contrast, adolescents did not perceive much change in this family climate dimension over time.

For Stimulating Climate, a significant main effect of gender, $F(1, 500) = 7.02, p = .008$, was found, signifying that families with daughters perceive the family climate as being more stimulating than families with sons. A further main effect of health status, $F(1, 500) = 45.09, p < .001$, revealed that families with an adolescent with diabetes judged the family climate as less stimulating than families with a healthy adolescent. However, a significant interaction of respondent × time, $F(6, 1500) = 5.94, p < .001$, indicates that family members perceive a different amount of stimulation across time, with adolescents reporting the strongest increase, while mother’s and father’s scores did not vary much across time.

Throughout the entire study, compared to families with an healthy adolescent, families with an ad-

### Table I. Results of Factor Analyses of the FES

<table>
<thead>
<tr>
<th>Factor</th>
<th>Normative Authoritarian Climate</th>
<th>Positive Emotional Climate</th>
<th>Stimulating Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion</td>
<td>.783</td>
<td>.393</td>
<td></td>
</tr>
<tr>
<td>Expressiveness</td>
<td>-.425</td>
<td>.446</td>
<td>.443</td>
</tr>
<tr>
<td>Conflict</td>
<td>-.337</td>
<td>-.813</td>
<td>.685</td>
</tr>
<tr>
<td>Independence</td>
<td>-.440</td>
<td></td>
<td>.800</td>
</tr>
<tr>
<td>Achievement-orientation</td>
<td>.685</td>
<td></td>
<td>.848</td>
</tr>
<tr>
<td>Intellectual-cultural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>orientation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active-recreational emphasis</td>
<td>.624</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moral-religious emphasis</td>
<td>.587</td>
<td>.546</td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>.754</td>
<td>-.337</td>
<td></td>
</tr>
</tbody>
</table>

Table II. Means and Standard Deviations of Family Climate, Perceived by Families of Adolescents With Diabetes and Healthy Adolescents

<table>
<thead>
<tr>
<th></th>
<th>Time 1 M (SD)</th>
<th>Time 2 M (SD)</th>
<th>Time 3 M (SD)</th>
<th>Time 4 M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normative Authoritarian Climate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetic adolescents</td>
<td>136.9(15.0)</td>
<td>138.1(13.4)</td>
<td>138.1(14.4)</td>
<td>138.6(13.5)</td>
</tr>
<tr>
<td>Healthy adolescents</td>
<td>132.5(13.2)</td>
<td>131.9(12.0)</td>
<td>132.3(12.1)</td>
<td>131.7(11.6)</td>
</tr>
<tr>
<td>Mothers of diabetics</td>
<td>138.1(14.1)</td>
<td>137.7(13.2)</td>
<td>137.6(13.1)</td>
<td>136.7(12.5)</td>
</tr>
<tr>
<td>Mothers of healthy</td>
<td>132.2(13.6)</td>
<td>132.2(11.5)</td>
<td>132.4(12.6)</td>
<td>132.4(12.9)</td>
</tr>
<tr>
<td>Fathers of diabetics</td>
<td>137.6(14.1)</td>
<td>135.7(15.1)</td>
<td>137.2(13.1)</td>
<td>135.8(13.2)</td>
</tr>
<tr>
<td>Fathers of healthy</td>
<td>132.4(13.0)</td>
<td>131.8(11.3)</td>
<td>131.3(12.2)</td>
<td>131.4(12.0)</td>
</tr>
<tr>
<td><strong>Positive Emotional Climate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetic adolescents</td>
<td>87.3 (7.6)</td>
<td>88.6 (9.1)</td>
<td>89.2 (7.9)</td>
<td>89.2 (7.9)</td>
</tr>
<tr>
<td>Healthy adolescents</td>
<td>90.9 (8.3)</td>
<td>91.8 (8.3)</td>
<td>91.3 (8.2)</td>
<td>90.6 (9.0)</td>
</tr>
<tr>
<td>Mothers of diabetics</td>
<td>93.0 (8.5)</td>
<td>92.0 (7.1)</td>
<td>91.6 (7.2)</td>
<td>90.3 (7.8)</td>
</tr>
<tr>
<td>Mothers of healthy</td>
<td>96.0 (8.2)</td>
<td>94.3 (7.4)</td>
<td>94.6 (7.6)</td>
<td>94.6 (7.7)</td>
</tr>
<tr>
<td>Fathers of diabetes</td>
<td>91.8 (7.2)</td>
<td>90.2 (6.7)</td>
<td>89.5 (6.4)</td>
<td>88.9 (7.3)</td>
</tr>
<tr>
<td>Fathers of healthy</td>
<td>94.4 (6.7)</td>
<td>91.9 (6.6)</td>
<td>91.2 (6.5)</td>
<td>90.8 (6.8)</td>
</tr>
<tr>
<td><strong>Stimulating Climate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetic adolescents</td>
<td>56.7 (9.7)</td>
<td>58.5 (10.6)</td>
<td>59.7 (11.4)</td>
<td>60.0 (10.5)</td>
</tr>
<tr>
<td>Healthy adolescents</td>
<td>63.1 (11.3)</td>
<td>64.4 (11.6)</td>
<td>65.1 (11.6)</td>
<td>64.7 (11.5)</td>
</tr>
<tr>
<td>Mothers of diabetics</td>
<td>59.4 (10.3)</td>
<td>59.4 (11.1)</td>
<td>60.0 (10.3)</td>
<td>59.2 (10.1)</td>
</tr>
<tr>
<td>Mothers of healthy</td>
<td>66.2 (11.7)</td>
<td>64.4 (11.4)</td>
<td>65.2 (11.5)</td>
<td>65.6 (11.7)</td>
</tr>
<tr>
<td>Fathers of diabetics</td>
<td>57.1 (9.8)</td>
<td>56.7 (9.8)</td>
<td>56.7 (9.1)</td>
<td>56.8 (9.4)</td>
</tr>
<tr>
<td>Fathers of healthy</td>
<td>65.6 (10.5)</td>
<td>63.6 (10.5)</td>
<td>63.7 (10.5)</td>
<td>64.3 (9.5)</td>
</tr>
</tbody>
</table>

Adolescent with diabetes reported on the average a significantly worse emotional climate, but a higher amount of structure and organization in the family. While there is high similarity in the perception of the amount of structure between all members of families with an adolescent with diabetes, family members differ in their perceptions of positive emotional family climate across time. In addition, families with an adolescent with diabetes perceive the family climate to be less stimulating than families with an healthy adolescent.

**Illness Characteristics and Perceived Family Climate**

Further MANOVAs on the data set of adolescents with diabetes explored the effects of illness duration and metabolic control, broken down by gender, on perceived family climate.

Adolescents assigned to three groups with varying illness duration (<2 years, 2-5 years, >5 years) did not differ in their perception of Normative Authoritarian Climate. In addition, no gender or time effects were found in this dimension of perceived family climate. A significant main effect of gender, $F(1, 82) = 5.25, p = .025$, in Positive Emotional Climate revealed that girls scored significantly higher than boys. As regards Stimulating Climate, a significant main effect of time, $F(3, 246) = 5.01, p = .002$, was found, illustrating an increase in cultural and recreational activities perceived by all adolescents with diabetes. A significant interaction effect, duration of illness $\times$ gender, $F(2, 82) = 4.19, p = .018$, as well as a significant time $\times$ duration of illness $\times$ gender interaction, $F(6, 246) = 2.37, p = .030$, illustrates that male and female adolescents perceive different amounts of stimulation, depending on illness duration and time. As can be seen in Table III, female adolescents with a recent onset of diabetes, as well as girls with an intermediate duration of illness, perceived a more stimulating climate, which even increases over time, compared to girls who had already been ill for over five years at the beginning of the study. This pattern was not precisely followed by boys. As with girls, boys with short duration of illness reported comparably high scores in Stimulating Climate, as well as an increase in this family climate dimension over time. An increase in Stimulating Climate was also perceived by boys with a long illness duration. However, male adolescents who had been ill for two to five years at the beginning of the study described the lowest
Stimulating Climate of all groups, and this did not vary across time.

As can be seen in Table IV, a slight worsening in metabolic control over time was observed. However, the decrease in percentage of adolescents who exhibited good to satisfactory metabolic control (Time 1: 73%, to Time 4: 61%) failed to reach significance in a chi-square test.

Based on their longitudinal status of metabolic control, the adolescents with diabetes were assigned to one of three groups. Thus, 16 adolescents with good, 40 adolescents with satisfactory, and 28 adolescents with poor metabolic control were identified longitudinally. The 3 (good, satisfactory, and poor metabolic control) x 2 (gender) x 4 (time) MANOVAs did not reveal an effect of either factor on Normative Authoritarian Climate and Positive Emotional Climate. For Stimulating Climate, a significant time effect was found, $F(3, 243) = 4.99, p = .002$; all adolescents with diabetes reported an increase in this family dimension over time.

### Relationships Between Family Climate and Illness Characteristics

Throughout the entire study, only insignificant correlations ($r = .03$ to $r = .19$) were found between metabolic control and the diabetic adolescents' and their parents' ratings in the three general dimensions of the FES. In addition, the duration of illness also did not correlate significantly at any time of measurement with the three dimensions of the FES.

### Predicting Metabolic Control by Perceived Family Climate

A multiple regression analysis was conducted to determine whether metabolic control at each time can be predicted by family climate as perceived by the adolescents. Metabolic control was the predicted variable, and the predictor variables were the three dimensions of the FES. At none of the four surveys was any family climate factor able to predict metabolic control at each time.

### Discussion

The primary goal of this study was to determine the associations between important dimensions of family relations, perceived by all family members, and the metabolic control of adolescents with diabetes. Because this study was conducted in Germany, cross-cultural similarities and differences in the links between family relations and metabolic control can be evaluated. The three second-order factors derived from the FES in this study, termed Normative Authoritarian Climate, Positive Emotional Climate, and Stimulating Climate, seem typical for German samples, since they correspond to those found by Engfer et al. (1977). In American samples, other factors appear to underlie the 10 scales. Three main dimensions were found, termed Interpersonal Relations, Personal Growth, and System Maintenance (Moos & Moos, 1981). Hence, there are some cultural differences between the
types of family climate. However, in other respects, this study reflected findings from the United States and pointed to cross-cultural similarities in the links between family relations and metabolic control.

In agreement with the results of previous studies on diabetic samples (Hauser & Solomon, 1985; Sargent, 1985), adolescents with diabetes and their parents in this study quite uniformly depicted a family climate characterized by a high amount of structure, organization, control, and achievement-orientation. In addition, they described the family climate as clearly less cohesive and less stimulating than in families with a healthy adolescent. The typical pattern of low cohesion but high organization and control found in this study closely matches more recent findings reported by Hanson et al. (1995), as well as Overstreet et al. (1995). According to Billings and Moos (1982), this highly structured family climate clearly indicates how family interaction adjusts itself to the management of diabetes, which requires a great deal of structure and control. Considering that the majority of diabetic adolescents had good to satisfactory metabolic control, which remained comparably stable over time, the differences in these family relations, compared to families with a healthy adolescent, might be indicative of a successful adaptation to the illness. The results thus support the structure hypothesis—that high levels of control and organization in the family are related to good metabolic control. Continuous parental monitoring seems to be necessary even for adolescents who have been ill for a longer time. Rather unexpected, positive family climate dimensions such as cohesion, expressiveness, and low conflict did not contribute to good metabolic control, irrespective of duration of illness. This finding speaks against the cohesion hypothesis detailed above, and, more specifically, contrasts with results reported by Hanson et al. (1989). They found that good metabolic control was associated with high family cohesion and family flexibility, particularly under conditions of short illness duration.

These results are disquieting, since for all adolescents with diabetes, regardless of metabolic status, it indicates a family influence that could inhibit psychosocial development. The duration of the illness influenced only some aspects of the family climate, that is, the emphasis on cultural and recreational activities. It should be recalled that nearly a third of the adolescents in the diabetic sample had been ill for only a short time. One would expect differences to exist with respect to family cohesion and structure between these adolescents and those who had been ill for a long time. Only minor differences were found, concentrating on perceived stimulating family climate. Male and female adolescents with diabetes reported different emphasis on cultural and recreational activities across time, depending on the duration of the illness. Boys along with girls who had been recently diagnosed with diabetes reported the highest score in cultural and recreational emphasis with increases over time. However, whereas girls who had been ill between 2 and 5 years perceived a continuous increase in stimulating family climate across all four surveys, boys who had been ill between 2 and 5 years reported the lowest score in this family dimension, which did not vary across time. This finding of a varying external orientation in groups with varying illness duration is rather unexpected. Further studies may help to clarify whether parents offer a different amount of stimulation to their daughters as compared to their sons, depending on illness duration.

Family climate scores were not related to metabolic control cross-sectionally, a finding that parallels the results of the study by Gowers et al. (1995). Moreover, family climate scores failed to predict metabolic control via multiple regression analyses, again underlining that family functioning did not contribute directly to variance in HbA1c-values. This is rather unexpected, because the strong emphasis on structure and organization in families of adolescents with diabetes may suggest such a relationship. However, Hanson et al. (1995) similarly found no direct effects of family climate on metabolic control. In using structural modeling, Hanson and coworkers found that positive family relations (high cohesion and low conflict) were indirectly related to good metabolic control through positive adherence. Thus, it seems likely that the links between family climate and metabolic control are mediated through other variables such as adherence. Further studies are necessary to explore this suggestion.

As already pointed out, over 90% of the adolescents with diabetes in our sample performed their insulin injections themselves at the beginning of the study, at an average age of 13.9 years. Our results suggest that continuous parental monitoring is necessary for good metabolic control, but the perspectives of the individual family members diverge. Adolescents with diabetes described a rather ambivalent family climate, with increasing options for external activities but at the same time no decrease in...
control and structure. This perspective is not shared by their mothers or their fathers, who reported no change in structure and stimulation over time. Possibly, the adolescents feel they need less structure and organization than their parents are offering them. Also, the discrepancies in perceived stimulating climate suggest that the amount of external orientation offered by parents depends on their child's gender and illness duration and varies with time. Also noteworthy are the discrepancies between fathers' and mothers' perspectives, with fathers portraying a less involved family climate than mothers.

The strong discrepancies found in the perspective of adolescents, their fathers, and mothers should be considered in counseling and intervention in families with adolescents with diabetes. The results of this study suggest that family therapy approaches might be appropriate particularly at early and midadolescence (Minuchin, Rosman, & Baker, 1989) and that a more individual approach is necessary with increasing age of the adolescent (Wood, Watkins, Nogueira, Zimand, & Carroll, 1989). Prevention and intervention strategies must take these differences into account and, further, must acknowledge that the rigid style of family interaction and the emphasis on control may interfere with developmental tasks requiring flexibility and emotional investment, which are necessary for later developmental steps. Other findings obtained in this sample confirmed lower developmental status in some developmental tasks and illustrated the difficulties adolescents with diabetes had in maintaining a balance between normative developmental progression and satisfactory metabolic control (Seiffge-Krenke, 1998b).

Although the results presented here contribute to our general understanding of family processes in families with adolescents with diabetes, compared to families with a healthy adolescent, a number of issues need to be addressed in future work. First, the validity of the key instrument used in this sample needs to be proved. The second-order factors of the FES found in this study were highly similar to those reported by Engfer et al. (1977) and can thus be considered as a cross-validation of this earlier study on a German sample. However, an analysis of the interview data on our sample may help to clarify whether the family climate in families with an adolescent with diabetes is indeed so different from the family interactions in families with healthy adolescents. Future analyses on a larger longitudinal sample may confirm whether this type of family climate has different effects on boys and girls who have diabetes. In particular, the interaction between gender and illness duration with respect to external orientation of the family needs to be further investigated. An analysis of the interview data may help to substantiate the divergent perspectives of adolescents, their mothers, and fathers and thus add to the validity of the study. Further research might be directed to clarifying the processes that lead to satisfactory metabolic control. As suggested in this study, the links are not direct but mediated by a number of factors.

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