

Risk Factors for Poor Glycemic Control in Diabetic Children in France

Immigrant versus nonimmigrant mothers

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OBJECTIVE — To test whether immigrant versus nonimmigrant origin, among others factors, is associated with differences in glycemic control in diabetic children.

RESEARCH DESIGN AND METHODS — A cross-sectional multicenter survey was performed in 165 French diabetic children aged 7–13 years and their parents. HbA_{1c} was measured by high-performance liquid chromatography in a single laboratory (reference value: $5.1 \pm 0.6\%$). Standardized questionnaires were used to evaluate cognitive, familial, and socioeconomic factors and adherence to diabetes regimen.

RESULTS — The mother's place of birth was found to account for 6.6% of the HbA_{1c} variance. Two groups of children were identified with French-speaking immigrant ($n = 27$) and native French mothers ($n = 138$) who had significantly different HbA_{1c} values of $9.1 \pm 8\%$ vs. $8.1 \pm 1.4\%$, respectively ($P < 0.001$). Adherence to diabetes treatment was significantly lower in immigrant mothers for diet and insulin changes ($P < 0.01$), as well as their level of diabetes knowledge ($P < 0.01$). This immigrant group had no significant differences in parents' socioeconomic status, educational background, family status, family functioning, diabetes education background, and social support compared with the native French mothers' group.

CONCLUSIONS — Despite no differences in socioeconomic status, a group of children with less well-controlled diabetes was identified by the mother's place of birth. Cultural factors have a crucial importance in glycemic control in diabetic children and in parents' adherence to treatment and must be taken into account in the development of educational programs.

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IDDM, insulin-dependent diabetes mellitus.

While research on the impact of psychological (1), familial (2), and cognitive (3) factors on compliance of and glycemic control in diabetic children and adolescents is abundant, the literature is less clear about the impact of cultural and ethnic factors. The few ethnic studies that do exist discuss racial differences (4,5). To our knowledge, no study has shown the importance of familial factors related to immigration on the glycemic control of diabetic children. However, based on clinical experience, it can be speculated that such factors play a role in treatment adherence. The problem is made more difficult by the fact that immigrant populations are often of lower socioeconomic status. If socioeconomic status does not explain poorer glycemic control, then other factors must be identified that could possibly interfere with educational programs.

Therefore, the following two questions were raised in this study: 1) Is migrant origin of the family associated with poor metabolic control in French diabetic children? 2) If yes, are the discrepancies observed due to deficiencies in educational background and knowledge about diabetes, lesser levels of adherence to diabetes regimen, socioeconomic differences, differences in family structure and function, or less social support?

RESEARCH DESIGN AND METHODS

The study was conducted in six university-based pediatric departments in France. Families with diabetic children between ages 7 and 13 years who had been insulin-dependent for more than 6 months and had both children and parents who were able to speak and read French were included. The project was approved by the Paris VII University Ethics Committee.

Between May 1991 and May 1992, 165 (of 173 eligible) children, aged 10 years (median; range 7–13) and suffering from diabetes for 2 years (median; range 0.5–11) agreed to participate in the study with their parents (mothers: 57%;

both parents: 33%). Most of the children were receiving two daily injections of insulin (86%); the others were treated by ≥ 3 injections per day. They attended the clinic with a mean of one visit every 2 months.

The design was a multicenter cross-sectional survey using standardized questionnaires answered separately by parents and children. The following areas were included: 1) Health parameters: a clinical examination was performed by the child's usual pediatrician, who completed a standardized medical questionnaire. HbA_{1c} level was measured in a single laboratory by high-performance liquid chromatography (reference value: $5.1 \pm 0.6\%$, mean ± 2 SD). Hypoglycemia episodes (<3.3 mmol/l) during the month preceding the examination were recorded from the children's diabetes diaries. 2) Diabetes knowledge: each parent and child filled out a standardized self-administered questionnaire, a shortened version (2) of the Test of Diabetes Knowledge (3), that we had previously validated in French (6). 3) Diabetes educational background: parents were asked about the frequency of educational sessions they had attended from the onset of the child's disease. 4) Adherence to diabetes regimen: the scale developed by Hanson et al. (2) was adapted and validated in French (7). Four areas of diabetes regimen adherence (diet, insulin therapy, hypoglycemia, and glucose testing) were measured. 5) Socioeconomic status: this was rated according to the French scale from the French National Institute of Social and Economic Statistics (8). The children's scholastic level and school competency, assessed by the percentage of children above the class mean, were also recorded. 6) Health care system use: the number of doctor's visits and familial, economic, or professional difficulties related to diabetes clinic visits were also recorded. 7) Family functioning: the FACES III scale (9), validated in French (10), was used to obtain the parents' perceptions of overall cohesion and adaptability of their family. 8) Social support:

Table 1—Clinical characteristics of diabetic children from native French and immigrant mothers

	Native French mothers	Immigrant mothers	P value
n	38	27	
Age (years)	10.1 \pm 1.9	10.5 \pm 1.7	NS
Sex ratio (M/F)	0.76	0.93	NS
Age at diagnosis (years)	6.5 \pm 2.8	7 \pm 2.6	NS
Duration of diabetes (years)	3.1 \pm 2.6	3 \pm 2.9	NS
Score of body mass index (SDS)	+0.66 \pm 1.2	+0.34 \pm 1.3	NS
Insulin dose (U \cdot kg ⁻¹ \cdot day ⁻¹)	0.85 \pm 0.34	0.77 \pm 0.43	NS
HbA _{1c} (%)	8.1 \pm 1.4	9.1 \pm 1.8	P < 0.001
Number of hypoglycemia episodes per month	4.8 \pm 5.4	2.3 \pm 2.6	P < 0.05
Number of clinic visits per 6 months	3.1 \pm 2.5	3 \pm 1.5	NS
Acute metabolic decompensation (% of children per 6 months)	7.2	7.4	NS

Data are means \pm SD. SDS, standard deviation score.

parents rated how helpful and supportive relatives, friends, general practitioners, pediatricians, nurses, psychologists, and associations of diabetic patients and teachers were with regard to life with a diabetic child.

Statistical analysis

A multiple regression model was used to look for explanatory variables of HbA_{1c} level (dependent variable). Comparisons of qualitative variables were made using a χ^2 test. Comparison of quantitative variables were performed by analysis of variance. Results are expressed as means \pm SD. For all tests, the significance level was set at 5%. Analysis was performed on SPSS statistical software (SPSS France, 92 Boulogne, France).

RESULTS — Mean HbA_{1c} value for the group was $8.3 \pm 1.6\%$ (range 5–13.2%). In a multiple regression analysis, age of the children, duration of the disease, number of hypoglycemia episodes, and mother's birthplace explained 30.5% of the variance of the HbA_{1c} value. The last factor alone explained 6.6% of the HbA_{1c} variance. Other factors were not statistically significant.

All data were further analyzed by comparing the two groups according to

the mother's birthplace: French native mothers versus other (defined as immigrant, $n = 27$, 16.5%). The majority of them (59.2%) came from North Africa, a percentage consistent with the national census data. Mothers from other parts of Africa were seldom seen in this population (7.4%). Other mothers were born in Southern Europe (14.8%), Northern Europe (11.2%), and Reunion Island and Haiti (7.4%). Thus, most of these mothers were of Caucasian origin. All diabetic children were born in France. Comparison of the two groups according to the mother's birthplace is presented in Table 1.

Adherence scores to diabetes regimen were significantly lower in the immigrant mothers group for diet (6.0 ± 1.5 [immigrant] vs. 6.9 ± 1.1 [French native]; $P < 0.01$) and insulin therapy (3.9 ± 1.1 [immigrant] vs. 4.6 ± 1.1 [French native]; $P < 0.01$), but did not significantly differ for hypoglycemia and glucose testing scores. Selected items of the adherence subscales that differed significantly concerned management of the diabetic child's diet at home and outside (at home, a special meal for the diabetic child is significantly more frequently reported in the [immigrant] group) and for insulin dosage adjustment. For example, during

episodes of illness, insulin dosages are significantly less frequently changed (29.2% [immigrant] vs. 62% [French native], $P < 0.001$) in immigrant mothers who called physicians or nurses more often to change the dosages: 15.4% [immigrant] vs. 1% [French native] ($P < 0.01$). Immigrant mothers are less likely to talk about the diet when their child is invited out.

The frequency of educational training received by the families since the onset of the disease did not differ significantly between the two groups. Diabetes knowledge in immigrant mothers was significantly lower in the problem-solving subscale: 10.6 ± 1.1 [immigrant] vs. 11.3 ± 1.0 [French native] ($P < 0.01$). Children's scores did not differ significantly between the two groups.

Parents' professional status, scholastic level, marital status, and mothers' employment did not differ significantly between the immigrant and nonimmigrant families. The immigrant families were significantly larger ($P < 0.01$). Scholastic level and school competency of the diabetic children did not significantly differ between the two groups.

There were no significant differences between the two groups in health care system use. It should be noted that the French Sécurité Sociale covers 100% of the medical costs incurred by diabetic patients.

No differences were found between the two groups when scores of FACES scales on family cohesion and adaptability were compared, as well as in the practical help that the families of the two groups received from each category of their social network.

CONCLUSIONS— In addition to other factors known to affect the glycemic control of diabetic children, i.e., age, insulin-dependent diabetes mellitus (IDDM) duration, and the frequency of hypoglycemic attacks, our study shows the impact of the mothers' birthplace on level of control. A group of children with less well-controlled diabetes born in France was identified who had mothers who

spoke and read French, were integrated in France, but were born outside of France. These immigrant mothers had a lower level of compliance with major aspects of diabetic treatment, such as diet and adjustment of insulin dose, as well as a lower level of knowledge about diabetes despite the same frequency of educational training sessions about management of the disease.

In literature, the few ethnic studies that do exist discuss racial differences. Two North American studies have shown a lower level of glycemic control among black children and adolescents with IDDM compared with whites (4,5). Hanson et al. (4), in a study of black and white adolescents matched by age and social class, showed that blacks had a higher HbA_{1c} level and more hospitalizations for ketoacidosis. In that study, no other factors, such as family functioning, psychosocial factors, knowledge of diabetes, compliance with treatment, or social support were significantly related to glycemic control. Delamater et al. (5) also showed racial differences in glycemic control among children and adolescents. Young black patients with IDDM ($n = 102$) took higher insulin doses, were in a lower socioeconomic levels, and had more frequent episodes of ketoacidosis than whites of the same age ($n = 108$).

Our study population is particularly interesting because mothers did not differ as to race or socioeconomic level but only as to mother's place of birth. In addition, unlike other countries, the differences cannot be attributed to additional medical charges incurred by a family in which one of the members is diabetic. In France, these charges are completely absorbed by the National Health Insurance including transportation for clinic visits, if necessary.

Classical factors traditionally related to HbA_{1c} do not differ significantly in these two groups; insulin dosages cannot account for this difference. We note, however, that the frequency of hypoglycemic episodes is slightly lower among the children of immigrant mothers and can be attributed to their poorer meta-

bolic control. Quantitative and qualitative analyses of the mothers' responses to the adherence and knowledge questionnaires allowed us to identify specific difficulties. While general knowledge about diabetes, including nutritional knowledge, is comparable in the two groups of mothers, immigrant mothers are more likely to miss the questions that demand problem-solving skills. This would indicate the need for more applied educational programs.

Compliance scores are lower among immigrant mothers. With regard to mothers' compliance with treatment, nutrition and adjustment of insulin doses are the most affected in this group. It is certainly extremely difficult for them to modify the diet of the entire family. This puts the current nutritional counseling in question. Major changes in diet may not be realistic for these families, especially considering the strong association between culture and diet. To better understand these behaviors, we evaluated other factors such as family functioning, social support, use of health care services, and experiences with diabetes education without finding significant differences between the two groups. Difficulty in making certain decisions, such as modification of insulin doses, calls other dimensions into question, e.g., health locus of control and health beliefs, which were not included in this study because validated scales do not presently exist in French. Previous studies performed in diabetic adolescents and adults showed correlations between health locus of control, health beliefs, and compliance with diabetic regimen (11,12). As these values could differ within different cultural groups, we might better understand the behaviors observed if these dimensions had been included (12).

In conclusion, diabetic children of immigrant mothers in France had poorer glycemic control. A lower adherence of these mothers to major aspects of diabetes management has been identified, as well as a lower level of diabetes knowledge particularly as related to problem-solving skills. The dissociation between

immigrant origin and low socioeconomic status is particularly interesting in this group. Until now, studies have correlated economic factors and poor glycemic control in different ethnic populations. Differences that do exist can thus be attributed to traditional, cultural values rather than racial, organizational, or socioeconomic factors. The development of adapted educational programs to cultural factors is needed to improve glycemic control of these diabetic children.

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APPENDIX — PEDIAB COLLABORATIVE GROUP

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References

1. Jacobson AM, Hauser ST, Lavori P, Wolfson JI, Herskowitz RD, Milley JE, Bliss R,

Gelfand E, Wertlieb D, Stein J: Adherence among children and adolescents with insulin-dependent diabetes mellitus over a four-year longitudinal follow-up. I. The influence of patient coping and adjustment. *J Pediatr Psychol* 15:511-526, 1990

2. Hanson CL, Henggeler SW, Burghen GA: Model of association between psychosocial variables and health outcome measures of adolescents with IDDM. *Diabetes Care* 10:752-758, 1987

3. Johnson SB, Pollak RT, Silverstein JH, Rosenbloom AL, Spillar R, McCallum M, Harkavy J: Cognitive and behavioral knowledge about insulin-dependent diabetes among children and parents. *Pediatrics* 69:708-713, 1982

4. Hanson CL, Henggeler SW, Burghen GA: Race and sex differences in metabolic control of adolescents with IDDM: a function of psychosocial variables? *Diabetes Care* 10:313-318, 1987

5. Delamater AM, Albrecht DR, Postellon DC, Gutai JP: Racial differences in metabolic control of children and adolescents with type I diabetes mellitus. *Diabetes Care* 14:20-25, 1991

6. Tubiana-Rufi N, Bean K, Moret L, Czernichow P, Chwalow AJ: Validation en langue Française d'une échelle d'évaluation des connaissances (TDK), destinée aux enfants diabétiques insulinodépen-

dants: méthodologie et intérêts pour la recherche et la pratique clinique. *Rev Epidemiol Sante Publique* 40:191-200, 1992

7. Moret L, Tubiana-Rufi N, Chwalow J, Czernichow P: Validation en langue française d'une échelle mesurant l'adhésion au traitement des enfants diabétiques. *Rev Epidemiol Sante Publique*. 43:361-370, 1995

8. National Institute of Social and Economic Statistics: *Recensement Général de la Population de 1990*. Paris, INSEE Ed, 1991

9. Olson DH, Portner J, Lavee Y: FACES III. In *Family Social Sciences*. St. Paul, University of Minnesota, 1985

10. Tubiana-Rufi N, Moret L, Bean K, Feard S, Deschamps JP, Czernichow P, Chwalow AJ: Validation en langue Française d'une échelle d'évaluation du fonctionnement familial (FACES III): un outil pour la recherche et la pratique clinique. *Rev Epidemiol Sante Publique* 39:531-541, 1991

11. Schlenk EA, Hart LK: Relationship between health locus of control, health value, and social support, and compliance of persons with diabetes mellitus. *Diabetes Care* 7:566-574, 1984

12. Rosenstock IM: Understanding and enhancing patients compliance with diabetic regimens. *Diabetes Care* 8:610-616, 1985