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ORIGINAL ARTICLE

Lower Frequency of Insulin Pump Treatment in Children and Adolescents of Turkish Background with Type 1 Diabetes: Analysis of 21,497 Patients in Germany

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Abstract

Aim: This study investigated insulin pump therapy in pediatric patients with type 1 diabetes and Turkish origin compared with those without migration background in Germany.

Subjects and Methods: Using a nationwide documentation program, we estimated the prevalence of insulin pump therapy in patients < 20 years of age with Turkish origin and those without migration background. Logistic regression was used to adjust for age, sex, diabetes duration, body mass index SD score (BMI-SDS), glycated hemoglobin, number of outpatient visits, number of daily blood glucose self-measurements, and area-based socioeconomic conditions.

Results: In 1,695 pediatric type 1 diabetes patients with Turkish background and 19,802 patients without migration background (respectively: 51.2% and 53.0% boys; mean age, 12.4 ± 4.1 and 12.6 ± 4.2 years; mean diabetes duration, 4.7 ± 3.9 and 5.3 ± 4.0 years), fully adjusted prevalences of insulin pump therapy were 18.5% and 30.9%, respectively (odds ratio 0.51, 95% confidence interval 0.43–0.60, $P < 0.001$). Age, sex, BMI-SDS, outpatient visits, and blood glucose self-control were significantly associated with the prevalence of insulin pump therapy but did not alter the difference substantially.

Conclusions: The prevalence of insulin pump therapy is roughly half among pediatric diabetes patients with Turkish background compared with those without migration background. Several covariates could not explain this difference. Individual characteristics or access barriers within the healthcare system may play a role. Further research is needed.

Introduction

Compared with non-migrants, children and adolescents with type 1 diabetes from ethnic minorities or with migration background have a higher risk to be hospitalized, poorer metabolic control, higher incidences of hypoglycemia or diabetic ketoacidosis, higher risks to develop late complications, and higher mortality risks.[1–4] In Germany in particular, people with Turkish background, the largest ethnic minority, have been found to have poor health outcomes.[5–7] As possible reasons for lower acceptance of prevention and treatment offers, language barriers, lower socioeconomic status, another disease belief, or, on the other hand, factors within the healthcare system have been discussed.[5] However, little is known regarding differences in diabetes care processes between pediatric diabetes patients with and without Turkish migration background. During the past few years, insulin pump therapy in pediatric diabetes care has

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become common, with nowadays 20–35% of patients using insulin pump therapy.[8,9] Differences in the prevalence of pump therapy between population groups may be interpreted as an indicator for differences in usage of, but also in access to, high-quality medical care. Whereas the majority of healthcare services is provided free of charge, insulin pump treatment is not generally reimbursed by the statutory health insurance, but patients have to apply for reimbursement individually. The aim of our study was to investigate whether the proportion of patients with pediatric type 1 diabetes receiving insulin pump therapy differs between children and adolescents with Turkish origin and those without migration background.

Subjects and Methods

We used 2009 data from 211 pediatric diabetes care centers (almost all pediatric centers in Germany) and 62 medical centers of a nationwide electronic pediatric diabetes documentation program (DPV).[3,4,10] All patients who had at least one visit in 2009 were included. Sociodemographic data including the district of residence, laboratory measures, and clinical data are documented longitudinally. Twice annually, all centers send their anonymized data sets to a central data registry. After plausibility checks, data are centrally analyzed. Patients with Turkish migration background were identified using two features of the DPV system. First, patients and their parents were asked for their country of birth. Second, a well-validated name-based algorithm was used.[11–13] Family and first names of the patients were compared with a large data set of Turkish names. The algorithm has been proven to identify Turkish origin with a sensitivity and specificity of > 0.975, respectively.[11–13] Patients with origin from other countries were excluded. Age, sex, diabetes duration, body mass index SD score (BMI-SDS), glycated hemoglobin (HbA1c), number of outpatient visits in 2009, and the daily number of blood glucose measurements were taken from the DPV documentation (mean of values when multiple visits in 2009). Area sociodemographic variables (district-level, 415 districts in Germany) were taken from official statistics (www.regionalstatistik.de). We estimated the crude prevalence of insulin pump therapy in patients less than 20 years of age with Turkish and without migration background. Using mixed logistic regression we adjusted for age, sex, and diabetes duration as fixed effects and for treatment center as random variable. In further models, we additionally included (each variable separately) BMI-SDS, HbA1c, number of outpatient visits, number of daily blood glucose self-measured controls, and various indicators of area level socioeconomic status (proportion of persons with high school education or with high or low vocational education, population density, proportion of welfare recipients, level of income, unemployment rate, proportion of foreigners, and living space per person). All covariates that constituted significantly were included in a final model. Adjusted proportions were straightforwardly derived from estimates of regression coefficients of the regression model assuming observed marginal figures in the cohort for confounding variables (LSmeans option in SAS procedure "Glimmix"; SAS Institute, Inc., Cary, NC).[14] Additionally, we present adjusted odds ratios.

Furthermore, we divided patients with Turkish origin into those who lived in Turkey when diabetes was diagnosed and those who lived already in Germany at diabetes onset and repeated all analyses.

Table 1. Characteristics of Pediatric Patients with Type 1 Diabetes, 0–19 Years Old, for Treatment Year 2009

	Patients with Turkish origin	*Patients without migration background*	P *value*[a]
Number	1,695	19,802	
Male (%)	51.2	53.0	0.958
Age (years) in 2009	12.4 (4.1)	12.6 (4.2)	0.405
Diabetes duration (years) in 2009	4.7 (3.9)	5.3 (4.0)	< 0.001
BMI-SDS	0.62 (0.97)	0.44 (0.89)	< 0.001
HbA1c (%)	8.2 (1.5)	7.9 (1.5)	< 0.001
Number of outpatient visits in 2009	4.7 (2.3)	4.1 (2.1)	< 0.001
Number of blood glucose measurements per day	5.8 (1.8)	6.1 (2.0)	< 0.001
Proportion of patients with Turkish background living in Germany since diabetes onset (%)	90.9		
Indicators for area-level socioeconomic status			
High school education (%)	33.2 (32.7–33.6)	29.1 (29.0–29.2)	< 0.001
High vocational education (%)	11.3 (11.1–11.5)	10.1 (10.0–10.1)	< 0.001
Low vocational education (%)	56.1 (55.6–56.5)	58.6 (58.5–58.7)	< 0.001
No vocational education (%)	14.2 (14.1–14.4)	14.6 (14.6–14.7)	< 0.001
Foreign nationality (%)	10.2 (9.9–10.5)	8.6 (8.5–8.6)	< 0.001
Population density (persons per m^2)	1,222 (1,343)	759.5 (957.7)	< 0.001
Income (Euros per year and person)	18,597 (2,234)	19,327 (2,243)	< 0.001
Welfare recipients (%)	0.394 (0.386–0.402)	0.353 (0.351–0.356)	< 0.001
Living space (m^2 per person)	40.8 (3.3)	42.1 (3.6)	< 0.001
Unemployed (%)	9.1 (8.9–9.2)	7.6 (7.5–7.6)	< 0.001
Pump therapy (%)	22.8 (20.8–24.8)	31.8 (31.1–32.4)	< 0.001

Data are mean (SD) or mean (95% confidence interval) values as indicated.
[a]Kruskal–Wallis or χ^2 test, with Bonferroni–Holm adjustment.
BMI-SDS, body mass index SD score; HbA1c, glycated hemoglobin.

Table 2. Odds Ratios of Insulin Pump Treatment in Pediatric Patients with Type 1 Diabetes, 0–19 Years Old, for Treatment Year 2009, Categorized as Patients of Turkish Origin and Those Without Migration Background

	Prevalence odds ratios				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5 (full model)*
Migration background (no vs. Turkish)	0.50 (0.42–0.58)	0.49 (0.42–0.57)	0.47 (0.40–0.55)	0.53 (0.44–0.62)	0.51 (0.43–0.60)
Sex (male vs. female)	0.80 (0.75–0.85)	1.06 (1.02–1.10)	0.80 (0.75–0.85)	0.80 (0.75–0.86)	0.81 (0.76–0.87)
Age in 2009 (per year increase)	0.88 (0.87–0.89)	0.88 (0.87–0.89)	0.89 (0.88–0.89)	0.92 (0.91–0.93)	0.93 (0.92–0.93)
Diabetes duration (per year increase)	1.17 (1.16–1.18)	1.17 (1.16–1.18)	1.17 (1.16–1.18)	1.17 (1.16–1.18)	1.17 (1.16–1.19)
BMI-SDS (per 1 BMI-SDS increase)		0.80 (0.75–0.85)			1.07 (1.03–1.12)
Number of outpatient visits (per 1 visit increase)			1.12 (1.10–1.14)		1.08 (1.06–1.10)
Number of daily blood glucose measurements (per 1 unit increase)				1.24 (1.21–1.26)	1.30 (1.22–1.27)

Glycated hemoglobin and socioeconomic status variables were not significantly associated when added to Model 1. BMI-SDS, body mass index SD score.

Results

We included 1,695 pediatric patients with diabetes of Turkish background and 19,802 patients without migration background. Table 1 shows the characteristics of the two patient groups. Age and sex distribution were comparable between the two groups. Patients with Turkish origin had shorter diabetes duration, higher BMI-SDS, and higher HbA1c values, more outpatient visits, and fewer blood glucose self-measured controls. They lived in more socially deprived areas. However, although statistically significant, most differences were small.

The crude prevalence of insulin pump treatment among patients of Turkish origin was 22.8%, compared with 31.8% among patients without migration background. Adjusted for age, sex, and diabetes duration, respective figures were 17.5% and 29.9% (prevalence odds ratio 0.50, 95% confidence interval 0.42–0.58, $P < 0.001$) (Tables 2 and 3). Inclusion of BMI-SDS, outpatient visits, and blood glucose self-measured control, which were significantly associated with pump therapy in separate models, changed the results only marginally. The fully adjusted respective prevalences were 18.5% and 30.9% (odds ratio 0.51, 95% confidence interval 0.43–0.60, $P < 0.001$) (Tables 2 and 3).

In patients with diabetes onset in Turkey ($n = 153$, 9.0% of all patients with Turkish origin), the prevalence of insulin pump therapy was markedly lower than in patients with Turkish origin who were living in Germany when diabetes was diagnosed (fully adjusted prevalences: 12.0% vs. 18.8%, odds ratio 0.59, 95% confidence interval 0.34–1.01).

Discussion

We found that the prevalence of insulin pump therapy is roughly half among pediatric patients with type 1 diabetes and Turkish background compared with patients without migration background. The prevalence was particularly low in patients who came to Germany after diabetes onset.

This finding could not be explained by differences in sex, age, diabetes duration, HbA1c, BMI-SDS, variables indicating healthcare seeking (blood glucose self-measured control, outpatient visits), and area sociodemographic conditions. It is interesting that healthcare seeking did not differ substantially between patients with Turkish origin and those without migration background. This may be explained by a highly standardized diabetes care. In contrast, it has been found that patients with Turkish origin have a lower participation in prevention and screening programs.[5,7,11]

In several studies, area-level sociodemographic conditions have been found to be associated with diabetes healthcare and outcomes.[1,2] We could not find an association between insulin pump therapy and these variables. Area-level sociodemographic conditions for patients with Turkish origin were worse compared with patients without migration background; however, differences were small or moderate. Perhaps the level of districts is too crude to find important differences. On the other hand, in Germany, social inequality may be lower than in other countries, in particular compared with the United States. Nevertheless, inclusion of socioeconomic status variables did not seriously affect the association

Table 3. Adjusted Prevalences of Insulin Pump Treatment in Pediatric Patients with Type 1 Diabetes, 0–19 Years Old, for Treatment Year 2009, Categorized as Patients of Turkish Origin and Those Without Migration Background

	Pump therapy [adjusted means (%)]				
Patients	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5 (full model)*
With Turkish origin	17.5 (1.4)	17.8 (1.4)	17.7 (1.4)	18.8 (1.5)	18.5 (1.5)
Without migration background	29.9 (1.1)	20.6 (1.1)	31.4 (1.2)	30.5 (1.2)	30.9 (1.2)

Data are mean (SE) values.

between migration background and pump use. Thus, there seems to be only little confounding.

Other reasons may explain our finding. Language barriers may play a role. In the DPV documentation, for 15% of the families with Turkish background, language problems were documented. There may be a different understanding of disease or health beliefs.[5,15] Unfortunately, we have no respective data in our study population. On the other hand, factors within the healthcare system may contribute to our finding as well. Because pump therapy is costly and requires intensive education, the statutory health insurance decides individually whether costs of insulin pump therapy are reimbursed. For pediatric patients with Turkish background, allowance might be more difficult to obtain. People with Turkish background are in part poorly integrated in the German society, and discrimination is obvious.[5] We cannot support these hypotheses with our data. This has to be done in further research (e.g., detailed interviews with patients and parents with Turkish background), considering social position and health beliefs.

Our study has several limitations. First, there may be some misclassification regarding Turkish background. However, the country of birth is available for the majority of patients, and the name-based algorithm has been found to have a high sensitivity and specificity.[11–13] Second, we could not consider individual socioeconomic status. Socioeconomic status has been found to explain a large part of differences between children with and without migration background.[2,5,16] However, we adjusted for several environmental residence-based socioeconomic conditions without any change of our main finding. Ecological bias may be present with respect to ecological variables. However, several studies have used area-level sociodemographic variables (for example, Keenan et al.[17]).

Insulin pump therapy has been shown to reduce the risk of severe hypoglycemia, to improve quality of life, and probably HbA1c values.[8,9] As a general goal, all pediatric patients should have the opportunity to receive optimized therapy. Thereby, it might be useful to improve cultural perspectives of interventions for diabetes in children and adolescents from ethnic minority groups (e.g., by introducing Turkish staff members to diabetes care teams).[15]

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Author Disclosure Statement

No competing financial interests exist.

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