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Tailored care by diabetes nurses is not enough to overcome disparities in the regulation of type 2 diabetes between Dutch natives and ethnic minority groups

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Abstract

***Background*:** Differences in diabetes regulation between patients from different ethnic background have been described. This may be reduced by regular visits to a diabetes nurse (RVDN) with the same mother tongue. We explored whether equal access to diabetes-related care, including RVDN with the same mother tongue, may result in similar diabetes regulation among ethnic minorities and Dutch natives.

***Methods*:** Patients with type 2 diabetes and an annual comprehensive diabetes evaluation were included in this study. For the analysis, we emphasized on the data of patients with RVDN and used descriptive statistics and nonparametric tests for between group comparisons.

***Results*:** From a total of 983 patients, 581 patients had RVDN of whom 266 (46%) Dutch natives, 199 (34%) Turks/Moroccans, and 116 (20%) patients from other ethnicities. Within the group of patients with RVDN, Turks/Moroccans had higher median fasting plasma glucose levels as compared with Dutch natives and other ethnic minorities (8.4 vs 7.9 and 7.3 mmol/L, $P < 0.001$), and a higher HbA1c level was found for both the Turks/Moroccans and other ethnic minorities, as compared to Dutch natives (62 vs 55 mmol/mol, $P < 0.001$). In addition, only 22% of Turks/Moroccans and 26% of other minorities achieved the American Diabetes Association/European Association for the Study of Diabetes (ADA/EASD)-recommended HbA1c target ≤53 mmol/mol, compared to 39% in Dutch natives.

***Conclusions*:** In patients with RVDN with the same mother tongue, we still found disparities in HbA1c levels between Dutch natives, Turks/Moroccans and other ethnic minorities. Other factors beyond Dutch language skills are likely to interfere.

Keywords: *Type 2 diabetes mellitus; glycemic control; glycated hemoglobin A1c (HbA1c); ethnic (minority) groups; ethnic disparities*

To access the supplementary material, please visit the article landing page

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In the Netherlands, the responsibility for the treatment and management of type 2 diabetes is primarily the task of general practitioners (GPs). A substantial part of this 'primary care' is carried out by GPs' practice (diabetes) nurses. Referral indications to secondary care diabetes clinics include among others inadequate HbA1c levels despite intensive insulin use, severe hyperglycemia, and the presence of (advanced) complications, which has been estimated to be twice as high in secondary care compared to primary care.[1,2]

However, many GPs struggle with difficulties to ensure patients' compliance and to provide optimal care to patients from ethnic minority backgrounds, because of cultural differences and insufficient language skills. On the other hand, it has been shown that a structured intervention, tailored to ethnic minority groups – integrating

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elements of culture, religion, language and health literacy skills – can yield positive impacts on various patient-centric diabetes-related outcomes.[3,4]

Formerly situated at MC Slotervaart, the diabetes outpatient clinic served a low- to middle-income urban population of approximately 140,000 residents, with around 50% representing ethnic minorities, predominantly from Moroccan and Turkish origins. Since 1999, diabetes nurses of Moroccan and Turkish descent were employed (and still during our study period) at a secondary care diabetes clinic. These nurses were primarily entrusted with the guidance of Turkish and Moroccan patients with insufficient Dutch language skills. In addition, they also provided care to all patients – both Dutch natives and other ethnic minorities – with suboptimal glycemic control, particularly those under insulin treatment. Over a 5-year period (1999–2004), the average HbA1c-level of 100 Moroccan patients decreased from 64 to 60 mmol/mol (unpublished data). We optimistically assumed that the improvements in communication in the broadest sense contributed to better glycemic regulation.

With this in mind, we hypothesized that within a setting of equal access to diabetes-related healthcare, where all patients with type 2 diabetes could communicate in their own mother tongue, the level of glycemic control should be comparable between ethnic minority groups and the native Dutch population. In the present study, we explored whether disparities indeed exist in diabetes regulation, including adequate glucose, blood pressure and lipid control. The specific focus lies on patients of Turkish and Moroccan descent, as well as patients from other ethnic minorities, compared to native Dutch patients.

Methods

Population and setting

The diabetes outpatient clinic at MC Slotervaart in Amsterdam, the Netherlands, served a population of around 1,300 patients. These patients had three or four routine check-ups per year, depending on referrals between primary to secondary care, and had a comprehensive diabetes evaluation every year. Roughly 15% of patients had this evaluation less often for various reasons (e.g. incompliance, intercurrent illness, or logistical challenges).

Between May 2009 and December 2010, consecutive patients with diabetes mellitus were recruited preceding their annual comprehensive diabetes evaluation for participation in a study cohort. These patients were asked for written consent to collect clinical information and storing (extra) blood and urine samples for future study purposes. Local ethics committee approval was obtained for the study protocol.

For the present study, we initially recruited a population (n = 1,063) individuals. From this group, we selected 983 patients who had been diagnosed with type 2 diabetes mellitus, according to ADA/EASD criteria.[5] Eighty patients with type 1 diabetes were excluded based on factors such as their initial clinical presentation, Body Mass Index (BMI), c-peptide levels at the disease onset (if available), and the presence of diabetes-related autoantibodies. We divided the patients with type 2 diabetes into two groups: one group with regular visits to a diabetes nurse (RVDN), defined as a minimum of two visits per year in addition to the routine check-ups by the internist, and another group that did not have regular visits. For the further analysis, we focused on the data of the patients with RVDN and performed comparisons between ethnic groups on various clinical parameters important for diabetes-related care, including glucose, blood pressure and lipid regulation.

Data collection and measurements

Clinical data (Table 1) were evaluated and recorded in a standardized way using electronic case record forms. The procedure for measuring blood pressure and details regarding the routine analysis of blood samples, obtained after a 10-h overnight fast, for lipid profiles, glucose, HbA1c, high-sensitivity C-reactive protein (hs-CRP), and (micro) albuminuria, are described elsewhere.[6] Alongside HbA1c assessment, screening for prevalent hemoglobinopathies was performed using an automated high-performance liquid chromatography analyzer (Menarini Adams™ HA-8160; Arkray Inc., Kyoto, Japan). Renal function was determined by estimating the glomerular filtration rate (GFR), using the Chronic Kidney Disease-Epidemiology Collaboration (CKD-EPI) formula.[7]

Clinical definitions

Ethnicity was categorized based on the patient's or their parents' country of birth (indicating first and second-generation migrants) and analyzed through last name assessment.[8] The following ethnic groups were considered: native Dutch, Turks, Moroccans, Hindustani (of Surinamese or Indian heritage), Black Africans (with origins in Suriname, the Netherlands Antilles, or West Africa), and a group encompassing individuals of other ethnic backgrounds. Obesity was defined as a BMI ≥ 30 kg/m^2. Dutch language skills were scored for patients of non-Dutch origin as: good, adequate, moderate, or poor, as assigned by the physician during the annual diabetes evaluation. The clinical definitions for diabetes-related microvascular complications (nephropathy, retinopathy, and neuropathy) and macrovascular complications are described elsewhere.[6]

Statistical analysis

Categorical data were presented as absolute numbers with percentages. Continuous variables, due to non-normal distribution (Kolmogorov-Smirnov and Shapiro and Wilk, $P < 0.05$), were presented as medians with

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Table 1. Population characteristics and measurements, for all patients, and according to care provided by a diabetes nurse (RVDN)

Characteristics	All patients¶			With RVDN			Without RVDN			*P*-value*
	n = 983			*n* = 581			*n* = 402			
	n	%	IQR	*n*	%	IQR	*n*	%	IQR	
Demographics										
Male gender, *n* (%)	511	52		271	47		240	60		**<0.001**
Age, year; median (IQR)	63		55–71	63		55–70	64		56–73	0.177
Diabetes duration, year; median (IQR)	11		6–16	11		6–17	11		6–16	0.658
Obesity, *n* (%)	525	53		349	60		186	46		**<0.001**
Hemoglobinopathy, *n* (%)	31	3		19	3		12	3		0.801
Smoking										
Current	188	19		108	19		80	20		0.613
Previous	332	34		180	31		152	38		**0.027**
Never	455	46		288	50		167	42		**0.012**
Alcohol use										
Current	336	34		175	30		161	40		**0.001**
Ethnicity										
Dutch	504	51		266	46		238	59		**<0.001**
Turkish	81	8		57	10		24	6		**0.031**
Moroccan	185	19		142	24		43	11		**<0.001**
Hindustani	61	6		34	6		27	7		0.581
Black African	56	6		30	5		26	7		0.386
Other	96	10		52	9		46	11		0.300
Dutch language skills										
Good/adequate	–			405	70		349	87		**<0.001**
Moderate/poor	–			175	30		50	12		**<0.001**
Diabetes complications, *n* (%)										
Nephropathy	497	51		288	50		213	53		0.278
Retinopathy	265	27		193	33		72	18		**<0.001**
Neuropathy	236	24		159	27		77	19		**0.003**
Macrovascular disease	304	31		172	30		132	33		0.274
Any complication	746	76		448	77		298	74		0.414
Measurements – median (IQR)										
Systolic BP, mm Hg	127		116–138	127		116–138	127		116–139	0.941
Diastolic BP, mm Hg	74		68–80	74		67–80	75		69–81	**0.018**
BMI, kg/m^2	30.5		27.5–34.6	31.2		28.1–35.4	29.7		26.4–33.3	**<0.001**
Hs-CRP, mg/L	2.49		1.10–5.21	2.84		1.35–5.55	2.04		0.87–4.79	**<0.001**
Hemoglobin, mg/L	8.5		7.9–9.2	8.5		7.9–9.2	8.6		7.9–9.2	0.225
Fasting glucose, mmol/L	7.9		6.6–9.6	8.4		6.9–10.2	7.3		6.4–8.6	**<0.001**
HbA1c, mmol/mol	54		46–63	57		51–68	50		44–55	**<0.001**
HbA1c, %	7.1		6.4–7.9	7.4		6.8–8.4	6.7		6.2–7.2	**<0.001**
Cholesterol, mmol/L	4.11		3.55–4.82	4.14		3.53–4.80	4.08		3.56–4.83	0.864
HDLc, mmol/L	1.03		0.85–1.25	1.02		0.85–1.44	1.04		0.86–1.26	0.254
Triglycerides, mmol/L	1.46		1.05–2.15	1.47		1.08–2.25	1.40		1.02–2.07	0.057
LDLc, mmol/L	2.27		1.83–2.83	2.27		1.83–2.78	2.27		1.83–2.88	0.702
eGFR (CKD-EPI), ml/min	77		60–93	78		61–95	75		59–91	0.118
Microalbuminuria (mg/24h)	16		7–49	15		7–48	16		7–50	0.779

*P-value for patients with versus patients without (i.e. no) RVDN, using the χ^2 test (for categorical data) or M-W test (for continuous data). ¶Missing data: BMI (*n* = 25), Smoking (*n* = 8), Dutch language skills (*n* = 4), Systolic and diastolic BP (*n* = 47), hs-CRP (*n* = 13), Fasting glucose (*n* = 12), HbA1c (*n* = 2), cholesterol (*n* = 3), and eGFR (*n* = 1). RVDN: regular visits to a diabetes nurse; hs-CRP: high-sensitivity C-reactive protein; GFR: glomerular filtration rate; IQR: interquartile range.
Statistical significance was defined as $p < 0.05$ (bold values).

interquartile range (IQR). Between-group comparisons utilized Pearson chi-square (χ^2) test for categorical trend analysis, and Mann–Whitney U (M-W) or Kruskal–Wallis (K-W) test for continuous variables based on group number (see Table legends). Differences in achieving the target HbA1c below 53 mmol/mol between native and non-native-Dutch patients, adjusted for confounders, were evaluated through odds ratios (ORs) with 95% confidence intervals (CIs) using multiple logistic regression. Native Dutch patients were the reference. Statistical analysis was performed using SPSS version 28.0 software package (SPSS Inc., Chicago, IL, USA).

Results

Population characteristics and clinical measurements for all 983 patients with type 2 diabetes, as well as those with (n = 581) and without RVDN (n = 402), are summarized in Table 1. Within the entire cohort, 49% were of non-native Dutch origin (19% Moroccans, 8% Turkish, 6% Hindustani, 6% Black Africans, and 10% persons of 'other' ethnicities) of whom 45% had moderate or poor Dutch language skills, with the highest prevalence among Turks and Moroccans (both combined 72%). A translator, typically a friend or relative of the patient, was present during the comprehensive annual diabetes evaluation for 41 and 37% of the Turks and Moroccans, respectively. Among patients from other ethnicities, 15% had moderate or poor language skills.

We observed a difference in characteristics between patients without or with RVDN (Table 1). Compared to those with RVDN, among patients without RVDN, there were more males (60 vs 47%), a greater prevalence of native Dutch origin (59 vs 46%), and a reduced prevalence of inadequate Dutch language skills (12 vs 30%; all P < 0.001). In addition, they had a significant lower prevalence of retinopathy and neuropathy (18 vs 33%, P < 0.001 and 19 vs 27%, P = 0.003, respectively), a lower median BMI (29.7 vs 31.2 kg/m^2, P < 0.001), and more adequate levels of glycemic control (median HbA1c 50 vs 57 mmol/mol, P < 0.001).

Patients with RVDN: characteristics

Patients with RVDN (n = 581) were further divided into three groups: Dutch natives (n = 266), Turks and Moroccans (n = 199; 29% Turks and 71% Moroccans), and other ethnic minorities (n = 116; of whom 29% Hindustani and 26% Black Africans). Table 2 shows their clinical characteristics and measurements and Table 3 their medication use. Statistical significant between-group differences (all with $P \leq 0.001$) were found for median age (67 years for native Dutch patients vs 59 years for both Turks/Moroccans and other ethnicities, Table 2), for current smoking and use of alcohol (smoking 10% vs 21 and 24%; alcohol: 5% vs 31 and 49% for Turks and Moroccans vs. other ethnicities and native Dutch, respectively), and for the prevalence of retinopathy (40% for both Turks/Moroccans and other ethnicities vs. 25% for native Dutch) and macrovascular disease (39, 25, and 20% for native Dutch, other ethnicities and Turks/Moroccans, respectively).

Patients with RVDN: glucose regulation

As depicted in Table 2, Turks and Moroccans had higher median fasting plasma glucose levels compared to Dutch natives and patients from other ethnic minorities (8.4 vs 7.9 and 7.3 mmol/L, P < 0.001). Similarly, significant higher HbA1c levels were observed in both the Turks/Moroccans and other ethnic groups in comparison to native Dutch patients (62 and 62 vs 55 mmol/mol, P < 0.001). Only 22% of Turks/Moroccans achieved the ADA/EASD recommended HbA1c target below 53 mmol/mol, while this proportion was 26% in patients of other ethnicities and 39% in Dutch natives (unadjusted ORs for Turks/Moroccans 0.44 (95%CI: 0.29–0.66) and for other ethnic minorities 0.55 (95%CI: 0.34–0.90), compared to the native Dutch reference). After adjustments for confounding factors, including age, BMI, presence of haemoglobinopathy, smoking and alcohol use, and daily insulin dose, the disparity persisted for Turks/Moroccans (OR 0.49; 95%CI: 0.27–0.88), but not for patients from other ethnic minorities (OR 0.68; 95%CI: 0.37–1.23).

In addition, there were differences in treatment modalities for achieving glycemic control among ethnic groups (Table 3). Metformin as add-on therapy to insulin was more prevalent in non-native Dutch groups, compared to Dutch natives (88 and 91% in Turks/Moroccans and other ethnicities, vs. 82% in Dutch natives), with no significant difference in median daily dose. There was no difference in the proportion of patients who used insulin therapy, Turks and Moroccans were more frequently treated with twice-daily regimens (44 vs. 32 and 31% in native Dutch and other ethnicities, respectively), required more units of insulin per day (76 vs. 67 and 70 units) and only 1% of them was treated with insulin pump therapy (compared to 4% among other ethnicities and 8% among Dutch natives).

Patients with RVDN: blood pressure and lipids

Patients from other ethnic minorities had the lowest median systolic blood pressure (SBP) levels and conversely, the highest median diastolic blood pressure (DBP) levels, in contrast to the relatively balanced SBP and DBP levels seen in Dutch natives and Turks/Moroccans (Table 2). Turks and Moroccans were more successful in achieving the ADA/EASD-recommended target for DBP below 80 mmHg and had a lower prescription rate for all types of blood pressure-lowering medication, except for Angiotensin-Converting Enzyme (ACE) inhibitors (Table 3).

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Table 2. Characteristics and measurements of patients with RVDN, according to ethnicity.

Characteristics	Dutch natives			Turks and Moroccans			Other ethnic minorities			*P*-value*
	n = 266			*n* = 199			*n* = 116			
	n	%	IQR	n	%	IQR	*n*	%	IQR	
Demographics										
Male gender, *n* (%)	135	51		87	44		49	42		0.183
Age, median year (IQR)	67		60–74	59		51–67	59		52–65	**<0.001**
Diabetes duration, median year (IQR)	11		7–17	10		6–16	11		7–18	0.361
Obesity, *n* (%)	153	58		131	66		65	56		**<0.001**
Current smoking, *n* (%)	64	24		20	10		24	21		**<0.001**
Current alcohol use, *n* (%)	130	49		10	5		35	31		**<0.001**
Hemoglobinopathy, *n* (%)	1	0		4	2		14	12		**<0.001**
Diabetes complications, *n* (%)										
Nephropathy	118	44		104	52		64	55		0.066
Retinopathy	67	25		80	40		46	40		**0.001**
Neuropathy	84	32		48	24		27	23		0.114
Macrovascular disease	103	39		40	20		29	25		**<0.001**
Measurements – median (IQR)										
Systolic BP, mm Hg	128		118–140	126		114–136	125		118–136	**0.039**
Diastolic BP, mm Hg	73		66–81	72		67–78	76		71–82	**0.001**
BMI, Kg/m^2	30.9		27.8–34.8	32.5		28.8–35.9	30.9		27.1–35.4	**0.044**
Hs-CRP, mg/L	2.46		1.28–4.99	3.47		1.66–6.03	2.37		0.97–5.17	**0.013**
Hemoglobin, mg/L	8.6		8.1–9.3	8.3		7.6–8.9	8.2		7.6–8.9	**<0.001**
Fasting glucose, mmol/L	8.2		6.9–9.9	8.8		6.9–10.7	8.2		6.8–10.6	0.295
HbA1c, mmol/mol	55		49–85	62		54–72	62		52–70	**<0.001**
HbA1c, %	7.2		6.6–9.9	7.8		7.1–8.7	7.8		6.9–8.6	**<0.001**
Cholesterol, mmol/L	4.14		3.57–4.85	4.13		3.52–4.80	4.16		3.59–4.79	0.990
HDLc, mmol/L	1.03		0.88–1.24	0.98		0.83–1.19	1.06		0.84–1.32	**0.049**
Triglycerides, mmol/L	1.67		1.18–2.34	1.48		1.09–2.29	1.21		0.89–1.78	**<0.001**
LDLc, mmol/L	2.22		1.80–2.74	2.34		1.82–2.87	2.37		1.88–2.84	0.201
ADA/EASD-targets, *n* (%)										
HbA1c < 53 mmol/mol	103	39		43	22		30	26		**<0.001**
Systolic BP < 130 mm Hg	129	49		114	57		68	59		0.080
Diastolic BP < 80 mm Hg	175	66		154	77		71	61		**0.001**
HDLc > 1.0 mmol/L	148	56		91	46		65	56		0.071
Triglycerides < 1.7 mmol/L	138	52		122	61		82	71		**0.002**
LDLc < 2.6 mmol/L	181	68		119	60		77	66		0.257

*P-value for differences across the ethnic groups, using χ^2 test for trend (categorical data) or K-W test (continuous data). RVDN: regular visits to a diabetes nurse; hs-CRP: high-sensitivity C-reactive protein; IQR: interquartile range.
Level of significance for the bold values ($p < 0.05$) is provided in the methods section.

Lipid profiles, in general, were comparable between native Dutch patients and those from ethnic minority groups (Table 2). Only the level of triglycerides was significantly higher for Dutch natives as compared to Turks/Moroccans and other ethnicities (1.67 vs 1.48 and 1.21 mmol/L, $P = 0.002$) and had the lowest proportion of patients who achieved the ADA/EASD-recommended targets of a triglyceride level below 1.7 mmol/L. Except for ezetimibe (which had the highest number of prescriptions among Dutch natives), there was no significant difference in the use of statins and fibrates across the groups (Table 3).

Patients without RVDN: glucose regulation, blood pressure and lipids

Among the patients without RVDN Turks and Moroccans had significantly higher median HbA1c levels as compared to Dutch natives and other ethnic minorities (53 vs.

Table 3. Medication use of patients with RVDN, according to ethnicity

Characteristics	Dutch natives			Turks and Moroccans			Other ethnic minorities			*P*-value*
	n = 266			*n* = 199			*n* = 116			
	n	%	IQR	*n*	%	IQR	*n*	%	IQR	
Diabetes treatment, *n* (%)										
Metformin	217	82		175	88		105	91		**0.015**
Monotherapy	9	3		5	3		3	3		0.834
Other BG lowering drugs	21	7		9	5		7	6		0.333
Insulin	238	90		186	93		109	94		0.188
Twice daily regimen	85	32		87	44		36	31		**0.022**
Intensive regimen	149	56		100	50		70	60		0.123
Pump therapy	22	8		2	1		5	4		**0.001**
Daily doses, median (IQR)										
Metformin, grams	2.0		1.0–2.0	2.0		1.5–2.55	1.7		1.0–2.0	**0.003**
Insulin, units	67		44–118	76		52–118	70		43–115	0.305
Hypertension treatment, *n* (%)										
ACEi	125	47		97	49		47	41		0.352
ARBs	79	30		45	23		50	43		**0.001**
Beta blockers	124	47		57	29		40	35		**<0.001**
Calcium antagonists	61	23		35	18		40	35		**0.003**
Diuretics	107	40		54	27		39	34		**0.013**
Other BP lowering drugs	66	25		22	11		21	18		**0.034**
Number of tablets										
0	43	16		54	27		14	12		**0.001**
1–2	108	41		95	48		63	54		**0.037**
3–4	97	36		44	22		28	24		**0.001**
≥5	18	7		6	3		11	9		0.053
Lipid treatment, *n* (%)										
Statins	167	63		139	70		78	67		0.269
Fibrates	26	10		14	7		9	8		0.551
Ezetimibe	28	11		4	2		5	4		**0.001**

*P-value for differences across the ethnic groups, using χ^2 test for trend (for categorical data) or K-W test (for continuous data). RVDN: regular visits to a diabetes nurse; IQR: interquartile range; ARB: Angiotensin Receptor Blockers.
Level of significance for the bold values ($p < 0.05$) is provided in the methods section.

48 and 51 mmol/mol, $P = 0.003$) and consequently achieved less frequently ADA/EASD-recommended HbA1c targets (49% vs. 71 and 63%, $P = 0.003$; Table S1). However, patients of native Dutch origin were compared to Turks and Moroccans and other ethnic groups more frequently treated with intensive insulin regimens (22% vs. 9 and 11%; Table S2).

No significant differences were observed in the achievement of blood pressure targets between the three groups (Table S1). However, 31% of the Turks and Moroccans did not use any blood pressure lowering therapy, as compared to 12% of Dutch natives and 19% of persons from other ethnic minorities (Table S2). Median Low-Density Lipoprotein (LDL)-cholesterol levels were comparable between the ethnic groups, and no differences in the achievement of an LDL-target < 2.6 mmol/L, nor in the use of statins was observed. Turks and Moroccans had the lowest proportion of patients with an HDL-cholesterol > 1.0 mmol/L (39% vs. 58% for Dutch natives and 61% for other ethnicities), while Dutch natives had the lowest proportion of patients with a triglyceride level < 1.7 mmol/L (56% vs. 72% for other ethnicities and 78% for Turks and Moroccans). There was no difference in the use of fibrates across the ethnic groups (Table S1–S2).

Discussion

Our study reveals significant poorer glycemic regulation among patients from ethnic minority groups compared to native Dutch patients, despite equal access to diabetes-related care. This difference remained statistically significant for Turks/Moroccans even after adjusting for various confounding factors. Interestingly, RVDN from the same

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ethnic background and with the same mother tongue, to overcome the barrier for Dutch language and cultural differences, did not result in equal HbA1c levels for native Dutch and Turkish/Moroccan patients. The differences were not smaller than among the patients who did not regularly visit a diabetes nurse.

Our finding of higher HbA1c levels among non-native Dutch patients, as compared to Dutch natives, has also been observed in another study involving multi-ethnic outpatients with diabetes in Amsterdam. In this study, which was not primarily designed to explore differences in glycemic regulation, patients excluded because of language difficulties had higher HbA1c levels compared to respondents without such difficulties.[9] In our study, the HbA1c level did not differ between Turks/Moroccans and other ethnic minorities. However, within the latter group only 18% of the patients had inadequate Dutch language skills. This implicates that factors beyond language barriers contribute to the observed HbA1c difference. Based on our data and limited literature on our specific study population, we discuss several potential factors.

Differences in treatment modalities

Among our findings, Turks/Moroccans were less frequently treated with intensive insulin regimens including pump therapy, despite having higher HbA1c levels. Possible explanations include patients' unwillingness to switch to more intensive regimens and doctors' concerns about potential noncompliance with more intensive regimens. However, a more plausible explanation could be that 77% of Turks/Moroccans lacked adequate Dutch language skills, which may have acted as a barrier to the initiation of intensive insulin therapy or the conversion from a twice-daily insulin regimen to a more intensive one. From daily practice, we have examples of patients who cannot read or write numbers and are entirely dependent on a close family member or caregiver for insulin therapy. It is therefore conceivable that the treating internist opts for a twice-daily schedule, where the chance of errors or the burden on the caregiver is kept as minimal as possible. Insulin pump therapy demands acceptable reading abilities and ability to communicate with manufacturer or internist on call in case of pump dysfunction. As a result, poor language skills, illiteracy in particular, may be considered a barrier for intensive insulin therapy, even with a diabetes nurse with the same mother tongue present during week days.

Adherence to lifestyle recommendations

Adherence to healthy diets and physical activity likely plays an important role. In the HELIUS study, an epidemiological study in the same region focusing on differences between ethnic groups, comparable dietary patterns were described across ethnic groups without diabetes, however, differences in food constituents were associated with both HbA1c and fasting glucose levels.[10] As for exercise behavior, data from the Amsterdam Health Monitor Survey of 2012 revealed that fewer Moroccans (49%) and Turks (44%) achieved the Dutch norms for physical activity compared to Dutch natives (over 70%).[11] Similar trends were evident in the HELIUS study.[10] In a focus group study on lifestyle behavior conducted in another city (the Hague), cultural backgrounds and social norms emerged as barriers for adopting lifestyle changes among Moroccan, Turkish and Hindustani-Surinamese patients.[12]

Health literacy

Functional health literacy, defined as an individual's capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions,[13] could be another important factor. In a study involving 189 parents of chronically ill children from Moroccan, Turkish, Surinamese, and other ethnic minority backgrounds, functional health literacy was sufficient for 88% of the parents, and 58% possessed adequate Dutch language skills. Sufficient knowledge of disease and sense of disease severity were 59 and 67%, respectively. Interestingly, decreased adherence to healthcare advice was best predicted by low functional health literacy, limited disease knowledge, and limited perception of disease severity and not by inadequate Dutch language skills.[14]

Unfortunately, we have no data on functional health literacy in our cohort. However, we may speculate that the sense of disease severity to some extent is present among various ethnic groups. Most patients had undergone annual check-ups over the years, focusing on the presence of complications. For Turkish and Moroccan patients, there seems to be an understanding of the link between symptoms and glucose levels, and counselling sessions on participating in Ramadan fasting also reveal awareness of illness severity and understanding. In addition, we speculate that medication compliance may be sufficient in our study population. This assumption is based on the absence of ethnic disparities in achieving the ADA/EASD recommended blood pressure and LDL-cholesterol targets. Nevertheless, it is worth noting that these targets are likely easier to achieve with structured diabetes care than precise glucose regulation.

Genetic factors

Several single nucleotide polymorphisms (SNPs) have been linked to HbA1c, and roughly half of them operate through 'non-glycemic' mechanisms associated with red cell biology.[15,16] Additionally, other SNPs have been associated with the glycemic response to metformin and/or other oral blood glucose-lowering agents.[17] However, it

is still necessary to determine the distribution of these SNPs across different ethnic groups. In a subset of our study population, we observed variations in the prevalence of several genetic variants of the glucocorticoid receptor among different ethnic groups. Nevertheless, these SNPs could not account for the differences in glycemic control levels.[18]

Strengths and limitations

Some aspects of our study warrant further comment. To the best of our knowledge, there have been no previous Dutch studies exploring ethnic disparities in diabetes regulation in secondary care diabetes practice. In contrast to a limited number of studies in Dutch primary care,[19,20] we utilized multifaceted data with detailed information on diabetes-related variables and therapy extracted from the patients' medical files, instead of relying solely on self-reports, thereby minimizing missing data.

However, there are notable limitations to our study: First, the cross-sectional design of our study precludes us from drawing conclusions about causality. Second, our emphasis on data from patients with regular diabetes nurse visits resulted in a relatively low number of Turkish, Hindustani, and Black African individuals, leading to a reduction in statistical power. This necessitated the combination of data from the Turkish and Moroccan groups, as well as from Hindustani, Black Africans, and individuals from other ethnic minorities. Third, information regarding the socio-economic position (including education level, reading abilities in the mother language and numeracy) of the included patients was unavailable (not systematically collected). This aspect may be important, especially considering that immigrant populations often belong to lower socio-economic classes. The impact of socio-economic position on health status, health-related behaviors (such as adherence to lifestyle advice), and the quality of care for patients with type 2 diabetes has been extensively documented.[21,22] Finally, given the specific organization of diabetes-related care at our outpatient clinic, it is debatable whether the observed differences in diabetes regulation for Turks and Moroccans are generalizable to other secondary care clinical practices in the Netherlands.

Conclusion

In summary, we have demonstrated a clinically significant difference in HbA1c levels between ethnic minority groups and native Dutch patients with type 2 diabetes, even in minority groups that were treated by diabetes nurses in the own mother tongue. We believe that culturally tailored diabetes educational interventions targeting improvements in health literacy, language skills, and lifestyle modifications could prove beneficial. Barriers to access and participation in such educational programs must be identified and further evaluations of their effectiveness is crucial. Furthermore, a systematic exploration for the potential role of genetic factors and their distribution across ethnic groups is needed.

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References

1. Rutten GE, de Grauw WJ, Nijpels G, Goudswaard AN, Uitewaal PJ, van der Does FE, et al. [NHG-guideline diabetes mellitus type 2]. Huisarts Wetenschap 2006; 49(3): 137–52.
2. van't Riet E, Schram MT, Abbink EJ, Admiraal WM, Dijk-Schaap MW, Holleman F, et al. The diabetes pearl: diabetes biobanking in the Netherlands. BMC Public Health 2012; 12: 949. doi: 10.1186/1471-2458-12-949
3. Creamer J, Attridge M, Ramsden M, Cannings-John R, Hawthorne K. Culturally appropriate health education for Type 2 diabetes in ethnic minority groups: an updated Cochrane review of randomized controlled trials. Diabet Med 2016; 33(2): 169–83. doi: 10.1111/dme.12865
4. Zeh P, Sandhu HK, Cannaby AM, Sturt JA. The impact of culturally competent diabetes care interventions for improving diabetes-related outcomes in ethnic minority groups: a systematic review. Diabet Med 2012; 29(10): 1237–52. doi: 10.1111/j.1464-5491.2012.03701.x
5. ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. 2. Classification and diagnosis of diabetes: standards of care in diabetes-2023. Diabetes Care 2023; 46(Suppl 1): S19–40. doi: 10.2337/dc23-S002
6. Ahdi M, Gerdes VE, Graaff R, Kuipers S, Smit AJ, Meesters EW. Skin autofluorescence and complications of diabetes: does ethnic background or skin color matter? Diabetes Technol Ther 2015; 17(2): 88–95. doi: 10.1089/dia.2013.0374
7. Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, 3rd, Feldman HI, et al. A new equation to estimate glomerular filtration rate. Ann Intern Med 2009; 150(9): 604–12. doi: 10.7326/0003-4819-150-9-200905050-00006
8. Senior PA, Bhopal R. Ethnicity as a variable in epidemiological research. BMJ 1994; 309(6950): 327–30. doi: 10.1136/bmj.309.6950.327
9. Schmidt CB, Potter van Loon BJ, Torensma B, Snoek FJ, Honig A. Ethnic minorities with diabetes differ in depressive and anxiety symptoms and diabetes-distress. J Diabetes Res 2017; 2017: 1204237. doi: 10.1155/2017/1204237
10. Dekker LH, van Dam RM, Snijder MB, Peters RJ, Dekker JM, de Vries JH, et al. Comparable dietary patterns describe dietary behavior across ethnic groups in the Netherlands, but different

elements in the diet are associated with glycated hemoglobin and fasting glucose concentrations. J Nutr 2015; 145(8): 1884–91. doi: 10.3945/jn.114.207472
11. The Amsterdam Health Monitor Survey 2012. Amsterdam: Public Health Service of Amsterdam (GGD Amsterdam); 2013. Available from: http://www.ggd.amsterdam.nl/beleid-onderzoek/gezondheidsmonitors/amsterdamse/ [cited 24 June 2018].
12. Jansen YJ, Uitewaal PJ, Wijsman-Grootendorst A, Geelhoed-Duijvestijn PH. [Social and cultural problems in the compliance with life-style advice in diabetic patients of non-Dutch origin]. Ned Tijdschr Geneeskd 2011; 155: A3117.
13. Nielsen-Bohlman L, Panzer AM, Kindig DA, eds. Health literacy: a prescription to end confusion. National Academies Press (US), Washington, DC; 2004.
14. Dahhan N, Meijssen D, Chegary M, Bosman D, Wolf B. Ethnic diversity outpatient clinic in paediatrics. BMC Health Serv Res 2012; 12: 12. doi: 10.1186/1472-6963-12-12
15. Grimsby JL, Porneala BC, Vassy JL, Yang Q, Florez JC, Dupuis J, et al. Race-ethnic differences in the association of genetic loci with HbA1c levels and mortality in U.S. adults: the third National Health and Nutrition Examination Survey (NHANES III). BMC Med Genet 2012; 13: 30. doi: 10.1186/1471-2350-13-30
16. Herman WH. Are there clinical implications of racial differences in HbA1c? Yes, to not consider can do great harm! Diabetes Care 2016; 39(8): 1458–61. doi: 10.2337/dc15-2686
17. Maruthur NM, Gribble MO, Bennett WL, Bolen S, Wilson LM, Balakrishnan P, et al. The pharmacogenetics of type 2 diabetes: a systematic review. Diabetes Care 2014; 37(3): 876–86. doi: 10.2337/dc13-1276
18. Ahdi M, Gerards MC, Smits PHM, Meesters EW, Brandjes DPM, Nieuwdorp M, et al. Genetic glucocorticoid receptor variants differ between ethnic groups but do not explain variation in age of diabetes onset, metabolic and inflammation parameters in patients with type 2 diabetes. Front Endocrinol 2023; 14: 1200183. doi: 10.3389/fendo.2023.1200183
19. El Fakiri F, Bruijnzeels MA, Foets MM, Hoes AW. Different distribution of cardiovascular risk factors according to ethnicity: a study in a high risk population. J Immigr Minor Health 2008; 10(6): 559–65. doi: 10.1007/s10903-008-9144-4
20. Uitewaal PJ, Goudswaard AN, Ubink-Veltmaat LJ, Bruijnzeels MA, Hoes AW, Thomas S. Cardiovascular risk factors in Turkish immigrants with type 2 diabetes mellitus: comparison with Dutch patients. Eur J Epidemiol 2004; 19(10): 923–9. doi: 10.1007/s10654-004-5193-8
21. Lanting LC, Joung IM, Mackenbach JP, Lamberts SW, Bootsma AH. Ethnic differences in mortality, end-stage complications, and quality of care among diabetic patients: a review. Diabetes Care 2005; 28(9): 2280–8. doi: 10.2337/diacare.28.9.2280
22. Uniken Venema HP, Garretsen HF, van der Maas PJ. Health of migrants and migrant health policy, the Netherlands as an example. Soc Sci Med 1995; 41(6): 809–18. doi: 10.1016/0277-9536(95)00065-F

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