



Demographic features of patients with type 2 diabetes treated in primary care are associated with glycemia control. GPs should take into consideration patients' demographic characteristics, especially being a younger men, when planning treatment of type 2 diabetes.

Demographic features of type 2 diabetes patients are associated with diabetes control in terms of primary health care

Karolina Kłoda¹, Karina Sznabel¹, Bogna Wyżykowska¹, Joanna Iskra¹, Ewa Marcjan², Bartosz Guźmiński¹, Artur Mierzecki¹

1. Independent Laboratory of Family Physician Education, Pomeranian Medical University in Szczecin, Poland.

2. Clinical Department on Nephrology, Transplantation and Internal Medicine, Pomeranian Medical University in Szczecin, Poland.

¹K. Kłoda – MD, PhD, assistant; K. Sznabel – MD; B. Wyżykowska – MD; J. Iskra – MD, PhD, family medicine resident; B. Guźmiński – MD, family medicine resident, A. Mierzecki – MD, PhD, Assoc. Prof., ³E. Marcjan – MD

#Corresponding author: dr hab. n. med. Artur Mierzecki, Samodzielna Pracownia Kształcenia Lekarza Rodzinnego PUM w Szczecinie ul. Rybacka 1, 70-204 Szczecin, tel.: +48-914-800-872, wikarla@gazeta.pl

RUNNING TITLE Demographic features of type 2 diabetes patients are associated with diabetes control in terms of primary health care

KEYWORDS diabetes, HbA1c, general practitioner

WORD COUNT 1 462

CONFLICT OF INTERESTS no conflicts of interest

ABSTRACT

Aim. The aim of this study was to evaluate the association between selected demographic features of type 2 diabetes (T2D) patients and glycemia control expressed as the percentage of glycosylated hemoglobin (HbA1c) in the period of publishing the first diabetes treatment guidelines for general practitioners (GPs). **Material and method.** Medical records of 209 patients with type 2 diabetes (84 men and 125 women) aged from 22 to 87 years (mean age 65.8 years) from two general practitioners' (GPs) practices in 2009 and 2010 were retrospectively assessed. Analysis of HbA1c was performed using high performance liquid chromatography (HPLC). **Results.** In regard to 2010 significantly higher mean percentage of HbA1c was found: in men compared to women (7.9±1.9% vs 7.1±1.1%); in patients <70 years of age compared to ≥70 years of age (7.7±1.8% vs 7.0±0.9%); in the population <70 years of age - in men compared to women (8.2±2.0% vs 7.2±1.3%) and in the group of men <70 years of age compared with ≥70 years of age (8.2±2.0% vs 7.0±1.1%). Among the 66 patients analyzed in both years, lower mean percentage of HbA1c was demonstrated in the group <70 years of age in 2009 compared to 2010 (7.3 ± 1.1% vs 7.8 ± 1.5%). By contrast, regarding 2010 patients <70 years of age had a higher HbA1c than those ≥70 years of age (7.8 ± 1.5% vs 7.1 ± 0.9%). **Discussion and conclusions.** Demographic features of patients with type 2 diabetes treated in primary care are associated with glycemia control. GPs should take into consideration patients' demographic characteristics, especially being a younger men, when planning treatment of type 2 diabetes.

INTRODUCTION

Glycated hemoglobin (HbA1c) is the product of non-enzymatic attachment of the glucose molecules to the free amino group of one or both of N-terminal valine residues of hemoglobin β chain¹. HbA1c percentage is influenced by many factors such as: age, nutritional status of the patient or ethnicity²⁻⁶. In studies regarding diabetes diagnosis and control, important role of HbA1c as the indicator of blood glucose concentrations for the last 2-3 months has been described^{5,7}. Kowall et al. considered the introduction of HbA1c percentage values as the diagnostic criteria for diabetes. They compared the ability to diagnose prediabetic state and diabetes through fasting blood glucose concentrations, oral glucose tolerance test (OGTT) and HbA1c percentage evaluation. With the assumption of HbA1c $\geq 6.5\%$ for the diagnosis of diabetes, they noticed that at this level patients have had already developed macrovascular complications. Therefore, they suggested the use of lower thresholds of HbA1c for diagnosis of diabetes to prevent late diagnosis of disease and its complications². In recent years researchers draw their attention to the gradual improvement of glyce-mic control values expressed as the percentage of HbA1c in patients with diabetes. This improvement may be the result of earlier diabetes diagnosis and better cooperation between physicians and patients. Thus, a trend of HbA1c decrease has been observed especially in women and elderly population^{8,9}. Type 2 diabetes (T2D) patients in Poland are treated not only by diabetologists but also GPs. Therefore in 2009 first guidelines of diabetes treatment in primary health care have been published by the College of Family Physicians in Poland and Polish Diabetes Association.

The aim of this study was to evaluate the association between selected demographic features T2D patients and glycemia control expressed as the percentage of HbA1c in the period of publishing the first diabetes treatment guidelines for GPs.

MATERIAL AND METHOD

The medical records of 209 T2D patients (84 men and 125 women) aged from 22 to 87 years (mean age 65.8 years) from two GP practices were retrospectively assessed. Analysis included 2009 and 2010. The patients enrolled were divided into two age groups: below 70 years of age (in 2009 - 83 individuals, in 2010 - 69) and ≥ 70 years of age (in 2009 - 70 individuals, in 2010 - 52). From among 209 patients, 66 were examined in both 2009 and 2010 (27 men and 39 women). The study included patients with T2D-confirmed in accordance with the relevant guidelines at the time of diagnosis. Exclusion criteria: age < 18 years, insulin therapy (because patients treated with insulin were under the care of a diabetes specialists), severe illness requiring hospitalization. All patients were treated with combination therapy with oral

drugs: sulfonylureas and metformin. We analyzed the age and sex of the patients. The characteristics of the patients are shown in Table 1. Whole blood was collected during routine monitoring of T2D patients. All tests were performed using high performance liquid chromatography (HPLC). The study did not require approval of the local Bioethics Committee, because it concerned a retrospective analysis of documentation describing HbA1c parameter evaluated by the general practitioners.

STATISTICAL ANALYSIS

The statistical analysis was performed using Statistica 10.1. We considered the statistically significant values as $p < 0.05$. In order to assess the normal distribution for variables the W-Shapiro-Wilk test was used. Distribution of variables was not normal, therefore we used non-parametric tests for further analysis: Wilcoxon test (to assess the relationship between the parameters at two time points) and U-Mann Whitney test (non-parametric test for two independent samples). The results for continuous variable (age) are presented as mean value \pm SD (standard deviation).

RESULTS

The Age

Retrospective analysis of mean HbA1c value depending on the age (< 70 years and ≥ 70 years) showed no statistically significant differences ($p = 0.77$) regarding 2009. However, statistically significant differences were found ($p = 0.049$) regarding 2010 (Table 2). Mean HbA1c values were lower among older population.

Sex

Comparison of the mean HbA1c value between males and females showed differences on the border of statistical significance ($p = 0.088$) regarding 2009, whereas statistically significant differences ($p = 0.034$) were shown for 2010 (Table 2). Mean HbA1c values were lower among females.

Age and sex

After comparing the mean value of HbA1c among patients < 70 years of age, depending on gender (men vs. women), no statistically significant differences ($p = 0.21$) regarding 2009 were found. However, for 2010 statistically significant differences ($p = 0.029$) were demonstrated. Mean HbA1c values were lower among females (Table 3). Comparison of patients ≥ 70 years, depending on sex, did not show statistically significant differences ($p = 0.26$ and $p = 0.86$ for 2009 and 2010 respectively) (Table 3). Comparison of mean HbA1c values among men < 70 vs. ≥ 70 years of age showed no statistically significant differences ($p = 0.88$) regarding 2009. The same comparison for 2010 showed statistically significant differences ($p = 0.04$). Comparison of mean HbA1c among women < 70 vs. ≥ 70 years of age showed no statistically significant differences ($p = 0.86$ and $p = 0.78$ for 2009

and 2010 respectively (Table 4). A group of 66 individuals was assessed both, in 2009 and 2010. The difference in mean HbA1c values measured in the same population in subsequent years was not statistically significant (7.3 ± 1.3 vs. 7.5 ± 1.3 ; $p=0.62$).

DISCUSSION

This study found that mean HbA1c percentage was significantly higher among men and in younger age group. Indeed, the highest mean HbA1c was observed in men <70 years of age (8.2 ± 2.0). Ford et al. indicated a similar trend, resulting from differences between the sexes⁸. The possible cause of this observation may be non-compliance involving failure to fulfill the treatment. López-Sanroman et al. have shown that non-compliance applies especially to men who, in general, adhere less to medical recommendations (taking the prescribed medication, keeping the diet, changing the lifestyle) than women, who attach more attention to their health¹⁰. The differences in compliance to treatment depend not only on sex, but also age, education, marital status, coexistence of cigarette smoking, overweight/obesity, as well as the patient's personality¹¹⁻¹³. Therefore Ford et al. draw a conclusion that individuals, who don't conform to the recommendations optimally, should be paid special attention⁸.

Jimenez-Quevedo et al. demonstrated that higher value of HbA1c in patients with T2D is an independent factor influencing atherosclerotic plaque formation, resulting in ischemic heart disease and in addition, it worsens the prognosis of these patients. It was also confirmed that effective diabetes control among elderly, decreases the risk of developing chronic kidney disease¹⁴. This observation is very important, because age is one of the risk factors of poorer glycemia control in T2D patients. Our findings are consistent with the Rothenbacher study, which examined 869 patients with T2D and demonstrated higher HbA1c values in younger population⁹. Moreover, Camara et al. indicated that being <65 years of age is a strong predictor of poorer glycemia control¹⁵. Hsieh et al. observed that younger patients had had higher HbA1c at the time of the diabetes diagnosis in comparison to older individuals¹⁶. Fox et al. reported that despite oral hypoglycemic agents for T2D treatment, values of HbA1c remain high only in younger population¹⁷. Inverse results have been also published. Chan et al. analyzed data of 11,799 diabetic patients in Latin America and Asia. They observed that older age of patients was significantly associated with poor glycemia control. But what's more important, there was no evidence of such relationship in Europe and other parts of the world¹⁸. Differences may be related to the diverse education of patients, cultural and demographic characteristics of the study groups, as well as differences in health care systems and poverty level.

Diabetes control has a chance to improve due to standardized guidelines implementation in many

countries. Many of these recommendations scope on holistic patient care delivered by general practitioners, nurses, dietitians, lifestyle consultants, social workers and also psychologists, including patients' self-management¹⁹. Guidelines implementation is meeting many barriers, such as lack of awareness of novel recommendations among GPs²⁰. Den Engelsen et al. studied the effects of the introduction of co-operation between nurses and GPs, as well as changes to the guidelines in the diagnosis and management of diabetes. They observed significant lowering of HbA1c values after introducing nursing care to the process of treatment and monitoring of diabetic patients²¹. Although College of Family Physicians in Poland and the Polish Diabetes Association diabetes treatment guidelines had been published in 2009, there were no statistically significant differences in comparison of the HbA1c values between 2009 (pre-guidelines period) and 2010 in our study. This result may be related to the small sample or short time that has elapsed since the implementation of the new guidelines. What's more, despite the fact that GPs included in this study declared familiarization with the guidelines, it was not verified through their knowledge assessment.

CONCLUSIONS

Demographic features of patients with type 2 diabetes treated in primary care are associated with glycemia control. GPs should take into consideration patients' demographic characteristics, especially being a younger men, when planning treatment of type 2 diabetes.

CITE THIS AS

MEDtube Science 2015, Jun 4(3), 12 - 16

LIST OF THE TABLES

- Tab. 1. Characteristics of patients
- Tab. 2. Comparison of mean HbA1c values depending on age and sex separately
- Tab. 3. Comparison of mean HbA1c values in patients <70 and ≥ 70 years depending on sex
- Tab. 4. Comparison of the mean HbA1c values in men and women depending on age

TAB. 1. CHARACTERISTICS OF PATIENTS

Analyzed year	N	Men (n = 111)		N	Women (n = 163)		Total
		<70 y	≥70 y		<70 y	≥70 y	
2009	62	45	17	91	38	53	153
2010	49	34	15	72	35	37	121

y- years of age

TAB. 2. COMPARISON OF MEAN HBA1C VALUES DEPENDING ON AGE AND SEX SEPARATELY

Analyzed year	N	HbA1c [%]		N	Range	Medium±SD	p
		Range	Medium±SD				
		<70 y			≥70 y		
2009	83	4.7-12.2	7.2±1.5	70	4.8-11.1	7.1±1.4	0.77
2010	69	4.7-13.6	7.7±1.8	52	5.3- 8.9	7.0±0.9	0.049
		Men			Women		
2009	62	5.0-12.2	7.4±1.6	91	4.7-11.1	7.0±1.3	0.088
2010	49	5.1-13.6	7.9±1.9	72	4.7-10.6	7.1±1.1	0.034

y- years of age

TAB. 3. COMPARISON OF MEAN HBA1C VALUES IN PATIENTS <70 AND ≥ 70 YEARS DEPENDING ON SEX

Analyzed year	N	HbA1c [%]		N	Range	Medium±SD	p
		Range	Medium±SD				
		Men <70 y			Women <70 y		
2009	45	5.0-12.2	7.5±1.7	38	4.7-9.8	6.9±1.3	0.21
2010	34	5.1-13.6	8.2±2.0	35	4.7-10.6	7.2±1.3	0.029
		Men ≥70 y			Women ≥70 y		
2009	17	5.2-9.9	7.4±1.4	53	4.8-11.1	7.1±1.4	0.26
2010	15	5.5-8.9	6.97±1.1	37	5.3-8.6	7.0±0.8	0.86

y- years of

TAB. 4. COMPARISON OF THE MEAN HBA1C VALUES IN MEN AND WOMEN DEPENDING ON AGE

Analyzed year	N	HbA1c [%]		N	Range	Medium±SD	p
		Range	Medium±SD				
		Men <70 y			Men ≥70 y		
2009	45	5.0-12.2	7.5±1.7	17	5.2-9.9	7.4±1.4	0.88
2010	35	5.1-13.6	8.2±2.0	15	5.5-8.9	6.97±1.1	0.04
		Women <70 y			Women ≥70 y		
2009	38	4.7-9.8	6.9±1.3	53	4.8-11.1	7.1±1.4	0.86
2010	35	4.7-10.6	7.2±1.3	37	5.3-8.6	7.0±0.8	0.78

y- years of age

BIBLIOGRAPHY

1. Sztefko K. Glycated hemoglobin – analytical problems. *Diagn Lab* 2012;48(3):303–311.
2. Kowall B, Rathmann W, Landgraf R. Is HbA1c a valid and feasible tool for the diagnosis of diabetes? *Diabetes Res Clin Pract* 2011;(93):314–316.
3. Higgins T. HbA1c for screening and diagnosis of diabetes mellitus. *Endocrine* 2013;43:266–273.
4. Schöttker B, Brenner H, Koenig W, Müller H, Rothenbacher D. Prognostic association of HbA1c and fasting plasma glucose with reduced kidney function in subjects with and without diabetes mellitus. Results from a population-based cohort study from Germany. *Prev Med* 2013;57:596–600.
5. Kester LM, Hey H, Hannon TS. Using Hemoglobin A1c for prediabetes and diabetes diagnosis in adolescents: can adult recommendations be upheld for pediatric use? *J Adolesc Health* 2012;50:321–323.
6. Tuomi T, Santoro N, Caprio S, Cai M, Weng J, Groop L. The many faces of diabetes: a disease with increasing heterogeneity. *Lancet* 2014;383:1084–1094.
7. Forouhi NG, Wareham NJ. Epidemiology of diabetes. *Medicine (Abingdon)* 2014;42(12):698–702.
8. Ford ES, Li C, Little RR, Mokdad AH. Trends in A1C concentrations among U.S. adults with diagnosed diabetes from 1999 to 2004. *Diabetes Care* 2008;31(1):102–104.
9. Rothenbacher D, Rüter G, Saam S, Brenner H. Younger patients with type 2 diabetes need better glycaemic control: results of a community-based study describing factors associated with a high HbA1c value. *Br J Gen Pract* 2003;53(490):389–391.
10. López-Sanromán A, Bermejo F. Review article: how to control and improve adherence to therapy in inflammatory bowel disease. *Aliment Pharmacol Ther* 2006;24 Suppl;3:45–49.
11. Salam MA, Siddiqui AF. Socio-demographic determinants of compliance among type 2 diabetic patients in Abha, Saudi Arabia. *J Clin Diagn Res* 2013;7(12):2810–2813.
12. Shamsi A, Khodaifar F, Arzaghi SM, Sarvghadi F, Ghazi A. Is there any relationship between medication compliance and affective temperaments in patients with type 2 diabetes? *J Diabetes Metab Disord* 2014;13(1):96.
13. Wróbel M, Szymborska-Kajaneck A, Strojek K. Przestrzeganie zaleceń lekarskich (compliance) jako element leczenia cukrzycy. *Med Dypł* 2008, Wyd. Spec. 03:13.
14. Jiménez-Quevedo P, Suzuki N, Corros C, Ferrer MC, Angiolillo DJ, Alfonso F, Hernández-Antolín R, Gonzalo N, Bañuelos C, Escaned J, Fernández C, Costa M, Macaya C, Bass T, Sabaté M. Assessment of dynamic coronary plaque changes and the clinical consequences in type II diabetic patients: a serial intracoronary ultrasound study. *Rev Esp Cardiol* 2011;64(7):557–563.
15. Camara A, Baldé NM, Sobngwi-Tambekou J, Kengne AP, Diallo MM, Tchatchoua AP, Kaké A, Sylvie N, Balkau B, Bonnet F, Sobngwi E. Poor glycaemic control in type 2 diabetes in the south of the Sahara: The issue of limited access to an HbA1c test. *Diabetes Res Clin Pract* 2015;108(1):187–192.
16. Hsieh A, Ong PX, Molyneaux L, McGill MJ, Constantino M, Wu T, Wong J, Yue DK, Twigg SM. Age of diabetes diagnosis and diabetes duration associate with glycated haemoglobin. *Diabetes Res Clin Pract* 2014;104:1–4.
17. Fox KM, Gerber Pharmd RA, Bolinder B, Chen J, Kumar S. Prevalence of inadequate glycaemic control among patients with type 2 diabetes in the United Kingdom General Practice Research Database: A Series of retrospective analyses of data from 1998 through 2002. *Clin Ther* 2006;28(3):388–395.
18. Chan JC, Gagliardino JJ, Baik SH, Chantelot JM, Ferreira SR, Hancu N, Ilkova H, Ramachandran A, Aschner P. Multifaceted determinants for achieving glycaemic control: the International Diabetes Management Practice Study (IDMPS). *Diabetes Care* 2009;32(2): 227–233.
19. Bastiaens H, Sunaert P, Wens J, Sabbe B, Jenkins L, Nobels F, Snauwaert B, Van Royen P. Supporting diabetes self-management in primary care: pilot-study of a group-based programme focusing on diet and exercise. *Prim Care Diabetes* 2009;3:103–109.
20. Fürthauer J, Flamm M, Sönnichsen A. Patient and physician related factors of adherence to evidence based guidelines in diabetes mellitus type 2, cardiovascular disease and prevention: a cross sectional study. *BMC Fam Pract* 2013;14:47.
21. den Engelsen C, Soedamah-Muthu SS, Oosterheert NJ, Ballieux MJ, Rutten GE. Improved care of type 2 diabetes patients as a result of the introduction of a practice nurse: 2003–2007. *Prim Care Diabetes* 2009;3:165–171.