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Multifactorial influence of type 2 diabetes on cardiovascular risk assessed by SCORE2-OP in the age group 70–89 years

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Abstract

Introduction and Objective. People over 70 years of age have an especially high rate of morbidity through circulatory system diseases. One of the factors increasing cardiovasular risk (CV) is diabetes. Therefore, CV risk should be assessed to limit morbidity in older age and effectively reduce risk factors. The aim of the study is to assess the impact of type 2 diabetes mellitus (T2DM) on cardiovascular risk in people aged 70–89 years, based on the SCORE2-OP scale, taking into account other risk factors.

Materials and Method. The study was conducted among 514 people aged 70–89 with diabetes (T2DM(+); n=148) and without (T2DM(-); n=366). The appropriate SCORE2 – OP algorithm was used to assess CV risk. The created regression model indicated factors significantly affecting CV risk in this group of respondents.

Results. The mean CV risk is significantly increased in the T2DM(+) group by 2.7% compared with the non-DM group – T2DM(-) (p=0.010). Intergroup analyses confirmed a significantly higher CV risk in single individuals (31.2±12.7) compared to married individuals (25.6±10.2), at the threshold of statistical significance. The model fit (0.91) indicated that age (1.0), smoking (1.0), systolic blood pressure (0.99), non-HDL cholesterol (0.65) and HR (0.52) increased CV risk.

Conclusions. Non-modifiable risk factors such as age increase CV risk and their impact cannot be significantly reduced, but modifying factors such as non-HDL, HR, systolic blood pressure or smoking can significantly reduce CV risk.

Key words

cardiovascular risk, SCORE2–OP, risk factor, diabetes

INTRODUCTION

Type 2 diabetes mellitus (T2DM), referred to as insulin-dependent diabetes mellitus, is a chronic metabolic disease with a complex course. It usually affects the elderly and is the most common form of diabetes (occurring in approximately 90% of patients with T2DM), although there are a number of studies assessing CV risk in younger patients [1]. Clinically, it is characterised by hyperglycaemia, caused by both a reduction in insulin action (insulin resistance) and insufficient in relation to necessary secretion of insulin by the pancreas.

Diabetes is one of the significant risk factors for the development and progression of atherosclerosis and, consequently, with an increased incidence of cardiovascular complications and death. Studies also indicate a reduction in health-related quality of life [2, 3]. As the number of patients with diabetes increases, so does the number of patients with atherosclerosis. Endothelial damage occurs in the elderly as a result of atherosclerotic plaque formation, which is a cause of acute coronary events and strokes. This is supported by the results of studies showing that people with diabetes have more advanced atherosclerosis of the carotid arteries than people without diabetes [4, 5]. Stiffening of the vasculature of the renal vascular bed leads to an increase in arterial pressure amplitude, subsequent myocardial workload, and changes in perfusion during the diastolic period. The consequence is progressive functional impairment, ischaemia, heart failure, hypertension and arrhythmia. Isolated systolic hypertension and heart failure with preserved ejection fraction are more frequently observed in the elderly. In addition, progressive changes in myocytes, endothelial cells, pacemaker cells, and heart valves are an additional cause of increased cardiovascular risk (CV) [6].

Changing demographics in developed countries, characterized an increase in the proportion of older people, have resulted in a significant increase in the population aged 60 and over. The World Health Organization (WHO) divides the elderly population into distinct categories: those aged 60–74 are classified as the elderly, those aged 75–90 and over 90 as the old. According to WHO data, the ageing of the population today is happening much faster than in the past. Between 2015 – 2050, the proportion of the world's population aged over 60 will increase from 12% to 22%.

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In contrast, research indicates that by 2030, 1 in 6 people worldwide will be aged 60 years or older. By 2050, the global population of people aged 60 and older will double and the number of people aged 80 and older will triple, to reach 426 million [7]. The increasing proportion of older people will significantly increase the burden of chronic disease on the healthcare system, signalling the need for greater attention to chronic disease prevention in this population [8].

CV risk factors, together with ageing and comorbidities, play a key role in the development of heart disease. Older people with multimorbidity are under-represented in primary and secondary prevention trials designed to assess common CV risk factors, such as hypercholesterolaemia, diabetes and hypertension. In addition, there are concerns about the optimal intensity of treatment, taking into account tolerability and risk of drug interactions in the elderly [9].

Cardiovascular disease (CVD) is a major contributor to morbidity and mortality among older people. The incidence of CV events increases significantly after 65 years of age in men and after 75 years of age in women. Several CV factors, including blood glucose levels and systolic blood pressure, show a progressive increase with age. In contrast, other factors, such as body weight, cholesterol levels, diastolic pressure and heart rate, tend to decrease. In addition, older people, especially those who are frail with multimorbidity, are under-represented in primary and secondary prevention studies designed to address cardiovascular risk factors such as hypercholesterolaemia, diabetes and hypertension [9]. For this reason, among older people with T2DM, it is very important to individualise management in terms of monitoring the risk of cardiovascular complications, effective and optimal diabetes therapy and education in health-promoting lifestyles.

The aim of this study is to analyse and evaluate the multifactorial impact of type 2 diabetes on CV risk in a group of people aged 70 – 89 assessed by SCORE2–OP.

MATERIALS AND METHOD

Organization of the study. The study was conducted in primary care units in south-eastern Poland. Prior to the survey, consent was obtained from the heads of medical units to conduct the survey at the unit, and to inspect the patients' medical records. The inclusion criteria for the study were: no history of CVD, such as myocardial infarction, overt coronary heart disease, history of stroke, severe renal failure and diabetes with complications.

The study was anonymous and voluntary for the study participant. The subject gave voluntary consent to participate in the study prior to entering the study. Prior to entering the study, the study participant was informed about the purpose and course of the study, anonymit, and the possibility of withdrawing from the study at any stage of the study.

The study was based on a self-administered questionnaire survey including questions about socio-demographic data, CV risk factors (such as smoking, alcohol consumption and physical activity), and measurements of blood pressure, heart rate, BMI and abdominal circumference. Blood pressure measurements were performed in accordance with the Guidelines of the European Society of Cardiology and the European Society of Hypertension [10]. Blood parameters, such as total cholesterol (TC), concentration of LDL, HDL and non-HDL fractions, triglycerides (TGs), and other factors were also analysed. Parameters measured within the last six months were considered to be current. The SCORE2-OP algorithm, applicable to this group, was used to assess CV risk in the study group of people between 70–89 years.

The study was carried out in accordance with the Helsinki Declaration (WMA Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects) [11]. The study involved no risk for the participants and had no impact on treatment.

Consent to perform the study was obtained from the Bioethics Committee of the Academy of Zamość (Approval No. KBAZ/2U/2025).

Study group. The study was conducted in a group of 514 respondents (F – 60.1; M – 39.9), of whom 148 were diagnosed with T2DM(+). Mean age of the study group – 76.9±5.5 years. Characteristics of the study group in terms of socio-demographic data and risk factors are shown in Table 1.

Table 1. Characteristics of the study group. Categorical and continuous variables

Variable	N (%)		
	T2DM(–) (n – 366)	T2DM(+) (n – 148)	Total (n – 514)
Gender:			
female	215 (58.7)	94 (63.5)	309 (60.1)
male	151 (41.3)	54 (36.5)	205 (39.9)
Place of residence:			
city	144 (39.3)	62 (41.9)	206 (40.1)
village	222 (60.6)	86 (58.1)	308 (59.9)
Marital status:			
mariagge	171 (46.7)	64 (43.2)	235 (45.7)
single	195 (53.3)	84 (56.8)	279 (54.3)
Education:			
elementary	175 (47.8)	59 (39.9)	234 (45.5)
secondary	163 (44.5)	74 (50.0)	237 (46.1)
higher	28 (7.6)	15 (10.1)	43 (8.4)
Profession:			
white collar worker	97 (26.5)	36 (24.3)	133 (25.9)
worker	121 (33.1)	56 (37.8)	177 (34.4)
farmer	128 (35.0)	51 (34.6)	179 (34.8)
without a profession	20 (5.5)	5 (3.4)	25 (4.9)
Employment status:			
disability person	34 (9.3)	23 (15.5)	57 (11.1)
retirement	332 (90.7)	122 (82.4)	454 (88.3)
worker		3 (2.0)	3 (0.6)
Smoking:			
yes	76 (20.8)	35 (23.6)	111 (21.6)
no	290 (79.2)	113 (76.3)	403 (78.4)
Alcohol consumption:			
yes	239 (62.6)	111 (75.0)	350 (68.1)
no	127 (34.7)	37 (25.0)	164 (31.9)
Physical activity (n- 365):			
yes	104 (28.4)	57 (38.5)	161 (31.3)
no/occasionally	261 (71.3)	90 (60.8)	351 (68.3)
Activity – intensivity:			
high	8 (7.7)	2 (3.5)	89 (55.3)
middle	40 (38.5)	22 (38.6)	62 (38.5)
low	56 (53.8)	33 (57.9)	10 (6.2)

Variable	M	SD	Me	Q1	Q3	Min	Max
Age (n – 514)	76.9	5.5	76.0	72.0	81.0	70.0	90.0
Age T2DM(–) (n – 366)	76.5	5.5	75.0	72.0	81.0	70.0	90.0
Age T2DM(+) (n – 148)	77.8	5.3	78.0	73.0	81.5	70.0	89.0

N – number of observations; % – percent; M – mean; SD – standard deviation; Me – median; Q1 – lower quartile; Q3 – upper quartile; Min – minimum; Max – maximum.

Questionaire. The study used and analysed the SCORE2-OP algorithm to assess 10-year cardiovascular risk in the group of people aged 70 – 89 years.

SCORE2–OP (Older Persons) [12]. The risk of CVD increases with age, as does the risk of mortality from causes other than CVD, and remaining life expectancy decreases with age. In this population, where life expectancy is limited, the important benefits of treatment are different because older people tend to be at high risk of adverse reactions to drugs and their side-effects. CVD risk prediction models can be used to identify those at higher risk of CVD as well as patients who would potentially benefit most from treatments. The prediction models can also assist in making patient-centred clinical decisions, taking into account other patient characteristics, such as biological age and patient preferences. However, for several reasons, most 10-year CV risk prediction models generally show poor performance in older people, mainly because the association between traditional risk factors and CVD weakens with age, and traditional risk prediction models do not take into account the competing risks of non-CVD mortality. This leads to an over-estimation of CV risk and a consequent over-estimation of the potential benefits of risk factor treatment in older people. In turn, the over-estimation can lead to unnecessary treatment, polypragmasy, increased risk of drug interactions, adverse events, reduced quality of life, and unnecessary costs. Consequently, an elderly-specific risk score should be used to assess risk.

Previously developed risk models for older people estimate the risk of cardiovascular mortality, while non-fatal events, e.g. stroke and heart failure (HF), are also relevant. Previous models, however, have not been extensively validated externally and have not been shown to be useful in different geographical regions of risk where risk levels vary.

SCORE2-OP estimates a CV risk event in people aged 70 – 89 years. The SCORE2-OP algorithm is designed for potentially healthy patients without CVD, diabetes, chronic kidney disease, hypercholesterolaemia, or hypertension. The SCORE2-OP system illustrates the distribution of 10-year CV risk of completed and/or non-fatal CVD over 10 years in older people. The algorithm is profiled for countries at low, moderate, high and very high risk of CVD – Poland is classified as a high-risk country. The following parameters are used to estimate the risk in the SCORE2-OP scale: gender, age (years), smoking, non-HDL cholesterol concentration (mg/dl) in blood, and systolic blood pressure value (mmHg). Once the data have been estimated, the degree of CV risk is determined according to the SCORE2-OP risk chart [12]. The SCORE2-OP algorithm is now suggested by the European Society of Cardiology and the Society of Hypertension in their guidelines for the treatment of hypertension in older people [13]. The SCORE2-OP algorithm takes into account CV risk factors relevant in older age groups, while eliminating the problem of referencing test results attributed to the younger group – the elderly.

Statistical Analysis. The resulting cardiovascular risk scores were calculated and recorded using percentages. Qualitative data were presented by number and percentage, measurable data by mean, standard deviation, median, upper quartile, lower quartile, minimum and maximum value.

The study analysed risk factors such as smoking, alcohol consumption and physical activity. The primary questions about these risk factors were dichotomous variables with two levels of 'yes'-'no' responses. A study participant was considered to be a smoker if he or she had smoked at least one cigarette every day in the past 12 months. Similarly, for alcohol consumption. A 'yes' response was recorded for each person who showed alcohol consumption of at least 1g/week.

In order to apply proper statistical inference, the W Shapiro Wilk test was used to verify the conformity of the distribution of the measurable variable with the normal distribution and the equality of variance using the Leven test. The absence of a normal distribution conditioned the use of non-parametric statistics. The analysis of correlations for two independent groups was performed using the Mann Whitney U test, and for >2 groups using the Kruskal Wallis test. A linear correlation analysis was performed for the two measurable variables using the linear correlation coefficient r -Perason. This coefficient takes values in the range [-1;1]. Negative correlations mean that an increase in one variable determines a decrease in the other; positive correlations indicate an increase in the values of both analysed variables. Values of $r<0.3$ indicate weak correlation, 0.3 – 0.5 sufficient correlation, 0.6 – 0.7 moderate correlation, 0.8 – 0.9 very strong correlation, and $r=1$ indicates perfect correlation.

A logistic regression model was created to assess the influence of risk factors on CV risk assessed by the SCORE2-OP algorithm. The model allowed for the impact of individual risk factors and groups of risk factors significantly affecting CV risk to be assessed.

Statistical analysis was performed using Statistica 13.0PL. Statistically significant relationships were considered to be those with a significance level of $p\geq0.05$.

RESULTS

Analysis of the mean SCORE2-OP algorithm value in the T2DM(+) and T2DM(-) groups was performed. The mean CV risk is higher in the T2DM(+) group. The mean CV risk is significantly increased in the T2DM(+) group by 2.7% compared with the non-DM group – T2DM(-) (p=0.010) (Tab. 2)

Table 2. Influence of T2DM on 10-years risk of fatal or nonfatal cardiovascular events

SCORE	T2DM(–)		T2DM(+)		Risk difference	p
	M	SD	M	SD	[%]	
SCORE2–OP, % of 10-year risk of CV event (fatal or nonfatal), (n – 514)	26.1	10.2	28.8	12.0	+ 2.7	0.010

T2DM– type 2 diabetes mellitus; T2DM(–) – patient without DM; T2DM(+) – patient with DM; CV – cardiovascular diseases, M – mean, SD – standard deviation; p – p value, test U Mann Whitney

The presence of diabetes increased CV risk as assessed by the SCORE2-OP algorithm. Individuals with T2DM(+) who were working, single, receiving a salary, had a middle level of education, consumed alcohol and were non-smokers, had a significantly higher CV risk compared with T2DM(-) individuals. Among T2DM(-) subjects, significantly higher CV risk was observed among men (27.6±8.6) compared to women (25.1±11.1). Singles with T2DM(+) had a significantly higher CV risk (+3.0) compared with T2DM(-) subjects (p=0.049). Intra-group analysis showed that singles with

T2DM(+)(31.2±12.7) and without T2DM(-)(28.2±10.4) had significantly higher CV risk compared with married individuals (25.6±10.2, 23.7±9.5, respectively). Among those with secondary education, there was a significantly higher CV risk in the T2DM(+) group (29.0±12.7). In addition, those with T2DM(+) who were working had a significantly higher CV risk (28.3±11.6), compared to the T2DM(-) group (24.5±9.4) (0.024), as well as retirees with T2DM(+) (28.4±11.9) (0.037).

On analysing risk factors, an intra-group analysis showed that in the T2DM(-) group, smokers had a significantly higher CV risk (29.9±6.3) compared to non-smokers (25.1±10.8), while those who were not physically active (26.8±10.5) had a significantly higher CV risk compared to those who were physically active (24.2±9.4). Alcohol consumption significantly increased CV risk in the T2DM(+) group (29.4±12.2) compared with the T2DM(-) group (25.8±10.3; 0.008) (Tab. 3).

Table 3. Influence of sociodemographic and risk factors on CV risk among patients aged 70–89 years

Variable	SCORE2–OP (%)		Risk differences T2DM(–) vs. T2DM(+)	p
	T2DM(–) (n–366)	T2DM(+) (n–148)		
	M (SD)	M (SD)		
Gender:	**	*		
female	25.1 (11.1)	28.1 (13.0)	+3.0	0.064
male	27.6 (8.6)	30.0 (9.9)	+2.4	0.137
Place of residence:	*	*		
city	26.3 (10.9)	29.3 (11.4)	+3.0	0.059
village	26.0 (9.8)	28.4 (12.4)	+2.4	0.179
Marital status:	***	**		
mariagge	23.7 (9.5)	25.6 (10.2)	+1.9	0.255
single	28.2 (10.4)	31.2 (12.7)	+3.0	0.049
Education:	*	*		
elementary	27.5 (10.5)	29.7 (11.4)	+2.2	0.105
secondary	24.9 (10.3)	29.0 (12.7)	+4.1	0.030
higher	24.7 (7.0)	23.8 (9.1)	–0.9	0.592
Profession:	*	*		
white collar worker	27.1 (10.5)	28.0 (12.3)	+0.9	0.861
worker	24.5 (9.4)	28.3 (11.6)	+3.8	0.024
farmer	26.6 (10.2)	29.5 (12.4)	+2.9	0.177
without a profession	27.4 (12.8)	–	–	–
Employment status:	*	*		–
working	22.7 (1.5)	22.7 (1.5)	0.0	0.489
disability person	28.6 (8.9)	31.7 (12.4)	+3.1	0.037
retirement	25.8 (10.3)	28.4 (11.9)	+2.6	–
does not work	27.4 (12.8)	–	–	
Smoking:	***	*		
yes	29.9 (6.3)	29.6 (11.1)	–0.3	0.657
no	25.1 (10.8)	28.5 (12.2)	+3.4	0.010
Alcohol consumption:	*	*		
yes	25.8 (10.3)	29.4 (12.2)	+3.6	0.008
no	26.7 (10.2)	27.3 (11.0)	+0.6	0.793
Activity:	**	*		
yes	24.2 (9.4)	28.0 (12.0)	+3.8	0.077
no/occasionally	26.8 (10.5)	29.1 (11.8)	+2.3	0.089
Activity – intensivity:	*	*		
high	22.9 (9.3)	23.5 (2.1)	+0.6	0.601
middle	23.0 (9.5)	27.6 (10.5)	+4.6	0.089
low	25.2 (9.4)	28.5 (13.4)	+3.3	0.447

T2DM – type 2 diabetes mellitus; T2DM(–) – patient without DM; T2DM(+) – patient with DM; M – mean; SD – standard deviation; * (intragroup analysis)-p≥0.05; **(intragroup analysis) – p<0.05; ***(intragroup analysis) – p<0.001; N – number of observations; % – percent; p – analysis between T2DM(–) and T2DM(+) [2 groups – U Mann Whitney test; >2 groups – Kruskal Wallis test]

In the study population the risk of disease and/or death in the next 10 years due to cardiovascular causes, calculated using the SCORE2-OP scale, was estimated in 514 examined persons aged 70–89 years. There was a significant linear relationship between the presence of diabetes and the SCORE2-OP scale values in persons >70 years of age (p<0.001). In the group of persons burdened with diabetes, significantly more often there was a high and very high risk of disease and/or death due to cardiovascular causes, compared to the group of unburdened persons. In the latter group, in over 50%, cardiovascular risk was more often low (30.3%) or moderate (25.4%) (Tab. 4).

Table 4. Impact of diabetes on the 10-year risk of cardiovascular disease and/or death in the study group aged 70-89 years, according to SCORE2-OP [*qualitative analysis*]

SCORE2 – OP	T2DM(–)		T2DM(+)		Total		p
	n	%	n	%	n	%	
< 19	111	30.3	35	23.6	146	28.4	
19–25	93	25.4	31	21.0	124	24.1	
25–34	79	21.6	41	27.7	120	23.4	<0.001
>34	83	22.7	41	27.7	124	24.1	
Total	366	100.0	148	100.0	514	100.0	

*p – p – value, Chi^2 Pearson test

The strongest significant correlation in the SCORE2-OP scale was indicated with respect to age, both in the T2DM(+) group (r=0.81) and in the T2DM(–) group (r=0.74) (p<0.001). In the T2DM(+) group, significant correlations were noted for total cholesterol (r=0.32), HDL fraction (r=0.23) and LDL (r=0.21), non–HDL (r=0.23), systolic blood pressure (r=0.31), diastolic blood pressure (r=0.27), and heart rate, both in people with diabetes (r=0.30) and those not diagnosed with the disease (r=0.17). However, the correlation coefficient was higher in each measurement in patients with T2DM(+) (Tab. 5).

A regression model was created to assess the effect of individual factors on CV risk as determined by the SCORE2-OP algorithm. The strongest effects on SCORE2-OP values were age (1.0), non-HDL fraction (0.65), systolic blood pressure (0.99), heart rate (0.52) and smoking (1.0). The fit of the model was satisfactory (R=0.91) (Tab. 6).

DISCUSSION

Type 2 diabetes develops slowly, often asymptomatically, in the first phase of the disease, and sometimes the diagnosis is made only after the occurrence of cardiovascular complications. However, cardiovascular complications occurring in older people – apart from health consequences – generate increasing socio-economic costs [5, 14].

The incidence of cardiovascular diseases increases significantly with age, primarily due to the complex process of aging, weakening of homeostasis and immune mechanisms, as well as to prolonged exposure to factors damaging the circulatory system and the coexistence of numerous diseases, including diabetes [9, 15]. The author's studies highlight a very important and significant role of age in CV risk assessment: age increases the risk not only in patients with T2DM(+), but also in those without diabetes.

Table 5. Correlation coefficient (r) between variable value and CV risk according to the presence of T2DM

Variable	SCORE2 – OP (r; p)	
	T2DM(–)	T2DM(+)
Age [years]	0.74 <0.001	0.81 <0.001
Average weekly recreational activity [min/week]	0.03 0.726	-0.23 0.087
Alcohol consumption [g/week]	-0.06 0.319	-0.11 0.268
Height [m]	0.02 0.638	0.02 0.807
Body weight [kg]	0.015 0.779	-0.03 0.695
BMI [kg/m^2]	-0.02 0.683	-0.04 0.583
Waist circumference [cm]	0.04 0.439	-0.02 0.789
TC – total cholesterol [mg/dL]	0.10 0.046	0.32 <0.001
HDL – cholesterol fraction [mg/dL]	0.12 0.016	0.23 0.004
LDL – cholesterol fraction [mg/dL]	0.08 0.114	0.21 0.012
TGs – triglycerides [mg/dL]	0.05 0.324	0.13 0.115
Non HDL fraction [mg/dL]	0.13 0.016	0.23 0.005
Systolic blood pressure [mmHg]	0.22 <0.001	0.31 <0.001
Diastolic blood pressure [mmHg]	0.22 <0.001	0.27 0.001
Heart rate [HR] [beats/min]	0.17 0.001	0.30 <0.001

r – correlation coefficient; p – p value, correlation rPearson

Table 6. Levels of risk factors affecting CV risk.

Factors	SS	MS_{efekt}	F	p	P	R
Age	9584.812	9584.812	413.8592	0.000	1.00	0.91
TC	2.084	2.084	0.0900	0.765	0.06	
HDL	34.400	34.400	1.4854	0.225	0.23	
LDL	34.602	34.602	1.4941	0.224	0.23	
TGs	67.428	67.428	2.9115	0.090	0.40	
Non-HDL	128.224	128.224	5.5365	0.020	0.65	
Systolic blood pressure	473.169	473.169	20.4308	0.000	0.99	
Diastolic blood pressure	14.087	14.087	0.6083	0.437	0.12	
HR	95.887	95.887	4.1403	0.044	0.52	
Gender	37.904	37.904	1.6367	0.203	0.25	
Place of resident	15.791	15.791	0.6818	0.410	0.13	
Marital status	7.324	7.324	0.3162	0.575	0.09	
Education	65.373	32.686	1.4114	0.247	0.30	
Profession	17.149	5.716	0.2468	0.863	0.10	
Employment status	36.447	18.223	0.7869	0.457	0.18	
Smoking	1252.036	1252.036	54.0612	0.000	1.00	
Alcohol consumption	20.857	20.857	0.9006	0.344	0.16	
Physical activity	36.447	18.223	0.7869	0.457	0.18	

* SS – sum of squares; MS – intergroup variance quotient; F – F-test value; p; P – correlation power; R – regression model

Type 2 diabetes is known as the 'silent epidemic' and particularly affects older people. Studies show that people with diabetes have a significantly higher risk of developing heart disease compared to those without the disease. Studies have also shown that diabetes is one of the most important independent factors for cardiovascular events in people over 70 years of age, which confirms the need to monitor and treat diabetes in this age group [16].

One of the most important mechanisms by which diabetes affects CV risk is increased insulin resistance, which leads to lipid abnormalities and elevated blood pressure. Studies have shown that older patients with diabetes have higher triglyceride levels and lower levels of HDL (high-density lipoprotein) [17].

People over 70 years of age often have multiple comorbidities. which further increases CV risk. Frequent heart disease. hypertension and dyslipidaemia may exacerbate CV risk in patients with diabetes. Studies have found that ageing populations of patients with diabetes have higher rates of hospitalisation for cardiovascular disease compared to other age groups [18].

The authors' findings confirmed the results of INTERHEART in which diabetes, dyslipidemia. hypertension. and smoking were significant risk factors for myocardial infarction in the age group over 60 years old [19].

A study of elderly people from Denmark, Italy, Belgium and Norway (age group 65 and older), showed that the average predictable 10-year risk of death in the elderly was higher in men (15.741) compared to women (12.755). In addition, evaluation of the multi-factorial effects on cardiovascular risk confirmed the significant impact of diabetes (F – 2.30, M – 1.84), followed by smoking, total cholesterol, systolic blood pressure and HDL [20].

The prevalence of diabetes in the population over 65 years of age reaches 25–30%. Symptoms of hyperglycaemia in patients over 65 years of age may be less severe than in younger individuals.,which may result in delayed diagnosis of the disease. In patients with diabetes and at an advanced age, the survival time is much shorter, so that when determining treatment it should be borne in mind that prevention of complications developing after several or more years of disease is less important than in younger people [21].

Physical activity is also an important risk factor for cardiovascular disease lowering CV risk [22–25]. The authors' study confirmed a significantly lower CV risk among T2DM(-) subjects, while no significant relationship was found among T2DM(+) subjects, although the risk was slightly lower in those who systematically engaged in recreational physical activity.

Limitations of the study. The study has some limitations. The estimated total CV risk depended on the presence of risk factors not included in the SCORE2-OP risk table, which may affect people aged 70–89, e.g. isolation and low social support, low socio-economic position, depression, anxiety or the presence of comorbidities, e.g. autoimmune diseases (psoriasis. rheumatoid arthritis), periodontitis or obstructive sleep apnea. The presence of these factors may significantly affect the CV risk estimate.

CONCLUSIONS

- People with T2DM(+) who work, are single, receive a salary, have a middle level of education, consume alcohol, and do not smoke, have a significantly higher CV risk compared to those with T2DM(-).
- The study identified a significant relationship between the presence of diabetes and SCORE2-OP scale values in people >70 years of age. High and very high risk of cardiovascular morbidity and/or mortality was recorded more frequently in the diabetic burden group, compared with the non-burdened group. Low or moderate cardiovascular risk was recorded more frequently among unburdened individuals.
- Non-modifiable risk factors such as age increase CV risk, and their impact cannot be significantly reduced, while modifying factors such as non-HDL, HR, systolic blood pressure or smoking, can significantly reduce CV risk.

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