Original paper

Trend analysis of selected classical cardiovascular risk factors in patients with ischemic heart disease in Poland. 10 years' data of National Registry of Invasive Cardiology Procedures (ORPKI)

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Abstract

Introduction: Distribution of cardiovascular risk factors can change depending on lifestyle changes.
Aim of the research: To analyze changes in the prevalence of risk factors over a 10-year period.
Material and methods: The study included 1,993,262 patients with ischemic heart disease, including 1,035,562 with acute coronary syndrome (ACS) and 959,328 with chronic coronary syndrome (CCS).
Results: In both groups, there was an increase in male patients undergoing procedures and patients with prior percutaneous coronary intervention (PCI), decrease in the prevalence of diabetes, prior stroke, and prior coronary artery bypass grafting (CABG). In the CCS group, there was an increase in prevalence of previous myocardial infarction (MI), kidney disease, and chronic obstructive pulmonary disease (COPD). In the ACS group, there was an increase in active smokers, patients with prior PCI, and those with COPD. Compared to men, women undergoing these procedures had a higher prevalence of hypertension, diabetes, and kidney disease, but were less likely to be active smokers or had prior stroke, MI, PCI, CABG, psoriasis, or COPD. With advancing age, the prevalence of hypertension, diabetes, kidney disease, COPD, and prior stroke, myocardial infarction, PCI, and CABG increased, while the frequency of active smoking, psoriasis, the proportion of male patients, and body weight decreased.
Conclusions: Over the past decade the prevalence of risk factors changed significantly. Frequency of previous PCI increased and frequency of previous CABG decreased. Among those undergoing PCI, women more frequently suffered from hypertension and diabetes than men. As age increases, diseases and previous procedures that are risk factors for atherosclerosis accumulated.

Introduction

Despite advances in cardiovascular research, classical risk factors for cardiovascular diseases still play a crucial role in risk stratification in the European Society of Cardiology (ESC) guidelines [1]. Numerous observational, epidemiological, and genetic studies have confirmed that elevated systemic blood pressure is a major cause of cardiovascular diseases and heart failure. It contributes to 9.4 million deaths annually worldwide and significantly increases disability [2]. Many studies have also shown that high blood pressure is a significant risk factor for the development of ischemic heart disease, heart failure, cerebrovascular disease, peripheral artery disease, chronic kidney disease, and atrial fibrillation. There is a clear linear increase in mortality risk with elevated blood pressure values, starting from 90 mm Hg systolic and 75 mm Hg diastolic [3, 4]. The second significant risk factor for cardiovascular diseases is diabetes [5–7]. Both diabetes alone and diabetes coexisting with obesity are associated with insulin resistance, higher glycated hemoglobin levels, and an increased cardiometabolic risk as well as atherosclerosis [8–14]. Numerous studies emphasize the significant impact of hypertension and dyslipidemia occurring together, which substantially increase cardiovascular risk [15]. Another very important risk factor for cardiovascular diseases is chronic kidney disease. Cardiovascular diseases are predominant among patients with chronic kidney failure, being the leading cause of morbidity and mortality [16]. The risk of death significantly increases in patients with coexisting kidney diseases, even when other risk factors such as diabetes and hypertension are effectively managed [17]. Kidney failure and chronic kidney disease significantly increase the risk of cardiovascular diseases and modify their symptoms [18]. Patients with moderate to mild COPD have an 8–10 times higher likelihood of dying from cardiovascular diseases than from respiratory failure. They also have a significantly higher rate of hospitalizations and deaths due to cardiovascular conditions, including stroke and heart failure [19, 20].

Aim of this research

The aim of this study is to analyze changes in the prevalence of classical risk factors over a 10-year period and to compare the distribution of these factors by sex and age decades based on data from the National Registry of Invasive Cardiology Procedures (ORPKI).

Material and methods

ORPKI was launched in 2004 by the Association of Cardiovascular Interventions of the Polish Society of Cardiology. ORPKI is a national percutaneous coronary intervention (PCI) registry to which all patients in PCI hospitals are enrolled. Currently, the registry is coordinated by the Jagiellonian University Medical College in Cracow. The data used in the statistical analysis for the presented study was accessed on July 20th, 2024. All consecutive patients who underwent coronary angiography or coronary angiography with possible PCI at 188 interventional cardiology centers in Poland between 2014 and 2023 were included in the retrospective analysis. Patients with incomplete data on baseline characteristics were excluded. No methods were used to impute missing data. Signed informed consent for PCI hospitalization contains consent for data transfer to ORPKI registry. Since this is a mandatory and central national registry, ethics committee approval was waived. The study complied with the ethical principles of clinical research based on the Declaration of Helsinki, as amended. The authors had access to information that could identify individual participants during or after data collection, and this information is used only for long-term observation, which does not apply to the current study. No external funding was used to support this registry.

Statistical analysis

Continuous variables were summarized using median with the first and the third quartile whereas nominal variables were summarized as counts and percentages. Comparison of continuous variables across groups was performed using Mann-Whitney *U* test (2 groups) or Kruskal-Wallis test (> 2 groups). Nominal variables were compared using Pearson χ^2 test or test for trend in proportions for year and age groups (due to ordinal scale of measurement). Trends in age and weight were analyzed using linear regression. Analyses were performed in R version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria, 2024).

Results

The study included 1,993,262 patients with ischemic heart disease, including 1,035,562 with acute coronary syndrome (ACS) and 959,328 with chronic coronary syndrome (CCS). In the CCS group, there was a significant increase in patient age (from 65 (59–73) to 69 (63–75)), body weight (from 80 (70–90) to 80 (72–90)), and the male gender percentages (from 61% to 65%). The proportion of active smokers decreased (from 16% to 12%), as so did the incidence of diabetes (from 23% to 20%), history of stroke (from 2.9% to 2.5%), and prior coronary artery bypass grafting (CABG) (from 5.8% to 4.4%). There was an increase in patients with previous PCI (from 27% to 35%), myocardial infarction (MI) (from 23% to 27%), kidney disease (from 4.9% to 6.8%), and chronic obstructive pulmonary disease (COPD) (from 0.1% to 3.7%). All these changes showed a significant trend ($p < 0.001$), except for arterial hypertension, which remained between 69% and 71%; although the differences were statistically significant, no trend was observed (Table 1). In the ACS group, there was a significant increase in patient age (from 66 (59–75) to 68 (61–75)), body weight (from 80 (70–90) to 80 (70–90)), and the male gender percentages undergoing procedures also increased (from 63% to 65%). There was a decrease in the prevalence of diabetes (from 24% to 20%), arterial hypertension (from 72% to 65%), history of stroke (from 3.4% to 2.4%), prior MI (from 26% to 23%), prior CABG (from 6.0% to 4.2%), and kidney disease (from 5.8% to 4.6%). There was an increase in the proportion of active smokers (from 18% to 19%), patients with previous PCI (from 27% to 30%), and those with COPD (from 0.1% to 3.3%). All these changes followed a significant trend, except for psoriasis, which showed significant fluctuations over the years but no clear trend. The incidence of each type of ACS has varied significantly over the decade (Table 2). Selected key risk factors for CCS and ACS are shown in Figures 1 and 2. A comparison of risk factors by gender showed that women undergoing coronary angiography and/or PCI were older and had lower body weight than men. Women were more likely to have diabetes, hypertension, and kidney disease, while they were less likely to be active smokers or have psoriasis, COPD, a history of stroke, MI, PCI, or CABG (Table 3). An analysis of risk factor changes by age decades showed that patients undergoing coronary angiography and/or PCI in older age decades had lower body weight and were less likely to be male or active smokers. With increasing age, these patients were more likely to have diabetes, hypertension, kidney disease, COPD, and a history of stroke, MI, PCI, and CABG (Table 4).

Discussion

Numerous studies indicate that classic risk factors remain critical in cardiovascular diseases. These

Table 1. Trends in chronic coronary syndromes

Variable	Total, N = 959,328	2014, N = 92,561	2015, N = 95,439	2016, N = 105,494	2017, N = 105,622	2018, N = 105,393	2019, N = 101,544	2020, N = 72,235	2021, N = 84,187	2022, N = 95,037	2023, N = 101,816	*P*-value	*P*-value for trend	Trend direction
Age[1] [years]	67 (61–74)	65 (59–73)	66 (60–73)	66 (60–74)	67 (60–74)	67 (61–74)	68 (61–74)	68 (61–74)	68 (62–74)	69 (62–74)	69 (63–75)	< 0,001	< 0,001	↑
Male gender, *n* (%)	602,557 (63)	56,013 (61)	58,506 (62)	64,753 (62)	66,440 (63)	66,173 (63)	63,982 (63)	46,472 (65)	54,265 (65)	60,801 (64)	65,152 (65)	< 0,001	< 0,001	↑
Weight[1] [kg]	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70-90)	80 (70–90)	80 (71–90)	80 (72–90)	80 (71–90)	80 (70–90)	< 0,001	< 0,001	↑
Diabetes, *n* (%)	207,045 (22)	20,256 (22)	20,271 (21)	22,826 (22)	23,033 (22)	22,829 (22)	22,396 (22)	16,383 (23)	18,145 (22)	20,304 (21)	20,602 (20)	< 0,001	< 0,001	↓
Previous stroke, *n* (%)	26,113 (2.7)	2,608 (2.8)	2,538 (2.7)	2,921 (2.8)	2,957 (2.8)	3,055 (2.9)	2,893 (2.8)	2,010 (2.8)	2,099 (2.5)	2,490 (2.6)	2,542 (2.5)	< 0,001	< 0,001	↓
Previous MI, *n* (%)	241,857 (25)	20,948 (23)	22,851 (24)	27,422 (26)	27,608 (26)	27,003 (26)	26,830 (26)	19,749 (27)	22,227 (26)	23,985 (25)	23,234 (23)	< 0,001	< 0,001	↑
Previous PCI, *n* (%)	312,206 (33)	25,139 (27)	28,140 (29)	34,572 (33)	35,386 (34)	35,143 (33)	34,569 (34)	25,614 (35)	28,937 (34)	32,045 (34)	32,661 (32)	< 0,001	< 0,001	↑
Previous CABG, *n* (%)	51,996 (5.4)	5,396 (5.8)	5,514 (5.8)	5,900 (5.6)	5,987 (5.7)	6,060 (5.7)	5,724 (5.6)	3,899 (5.4)	4,492 (5.3)	4,548 (4.8)	4,476 (4.4)	< 0,001	< 0,001	↓
Active smoking status, *n* (%)	135,688 (14)	13,133 (14)	12,575 (13)	14,727 (14)	15,119 (14)	15,638 (15)	16,082 (16)	11,403 (16)	12,413 (15)	12,485 (13)	12,113 (12)	< 0,001	< 0,001	↓
Psoriasis, *n* (%)	3,111 (0.3)	343 (0.4)	292 (0.3)	349 (0.3)	351 (0.3)	355 (0.3)	302 (0.3)	259 (0.4)	251 (0.3)	305 (0.3)	304 (0.3)	0,052	0,02	↓
Arterial hypertension, *n* (%)	675,788 (70)	66,062 (71)	66,557 (70)	73,832 (70)	74,385 (70)	73,137 (69)	73,090 (72)	50,837 (70)	58,771 (70)	67,810 (71)	71,307 (70)	< 0,001	0,266	↑
Kidney disease, *n* (%)	53,663 (5.6)	4,492 (4.9)	4,677 (4.9)	5,443 (5.2)	5,690 (5.4)	5,955 (5.7)	6,870 (6.8)	4,486 (6.2)	4,685 (5.6)	5,498 (5.8)	5,867 (5.8)	< 0,001	< 0,001	↑
COPD, *n* (%)	26,248 (2.7)	107 (0.1)	2,411 (2.5)	2,860 (2.7)	3,031 (2.9)	3,428 (3.3)	3,576 (3.5)	2,642 (3.7)	2,495 (3.0)	2,784 (2.9)	2,914 (2.9)	< 0,001	< 0,001	↑

[1]*Median (IQR); CABG – coronary artery bypass grafting, COPD – chronic obstructive pulmonary disease, MI – myocardial infarction, PCI – percutaneous coronary intervention.*

Table 2. Trends in risk factors in acute coronary syndromes

Variable	Total, *N* = 1,035,562	2014, *N* = 135,410	2015, *N* = 129,203	2016, *N* = 124,830	2017, *N* = 120,862	2018, *N* = 105,443	2019, *N* = 97,686	2020, *N* = 78,689	2021. *N* = 81,909	2022. *N* = 81.450	2023. *N* = 80,080	*P*-value	*P*-value for treNd	Trend direction
Age[1] [years]	67 (60–75)	66 (59–75)	67 (59–75)	67 (60–75)	67 (60–75)	67 (60–75)	68 (60–75)	67 (60–74)	68 (61–74)	68 (61–75)	68 (61–75)	< 0,001	< 0,001	↑
Male gender, *n* (%)	657,790 (64)	86,612 (64)	82,257 (64)	77,813 (63)	76,549 (63)	66,644 (63)	61,953 (64)	50,704 (65)	52,795 (65)	51,957 (64)	50,506 (64)	< 0,001	< 0,001	↑
Weight[1] [kg]	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	80 (70–90)	< 0,001	< 0,001	↑
Diabetes, *n* (%)	225,485 (22)	32,715 (24)	29,129 (23)	26,976 (22)	25,836 (21)	22,167 (21)	21,431 (22)	17,204 (22)	17,167 (21)	16,966 (21)	15,894 (20)	< 0,001	< 0,001	↓
Previous stroke, *n* (%)	31,286 (3.0)	4,629 (3.4)	4,189 (3.2)	3,897 (3.1)	3,666 (3.0)	3,132 (3.0)	2,995 (3.1)	2,400 (3.0)	2,211 (2.7)	2,223 (2.7)	1,944 (2.4)	< 0,001	< 0,001	↓
Previous MI, *n* (%)	251,654 (24)	35,068 (26)	32,685 (25)	28,578 (23)	27,958 (23)	23,794 (23)	23,370 (24)	19,918 (25)	20,570 (25)	20,442 (25)	19,271 (24)	< 0,001	0,015	↓
Previous PCI, *n* (%)	290,978 (28)	38,141 (28)	36,035 (28)	33,096 (27)	33,625 (28)	28,607 (27)	27,737 (28)	23,332 (30)	23,810 (29)	23,704 (29)	22,891 (29)	< 0,001	< 0,001	↑
Previous CABG, *n* (%)	55,903 (5.4)	8,053 (5.9)	7,754 (6.0)	7,210 (5.8)	6,871 (5.7)	5,817 (5.5)	5,239 (5.4)	3,972 (5.0)	3,983 (4.9)	3,645 (4.5)	3,359 (4.2)	< 0,001	< 0,001	↓
Active smoking status, *n* (%)	201,787 (19)	25,994 (19)	24,160 (19)	23,425 (19)	23,279 (19)	20,857 (20)	20,707 (21)	16,880 (21)	16,583 (20)	15,555 (19)	14,347 (18)	< 0,001	< 0,001	↑
Psoriasis. *n* (%)	4,046 (0.4)	570 (0.4)	456 (0.4)	492 (0.4)	464 (0.4)	357 (0.3)	355 (0.4)	424 (0.5)	324 (0.4)	296 (0.4)	308 (0.4)	< 0,001	0,315	↑
Arterial hypertension, *n* (%)	706,632 (68)	97,688 (72)	90,194 (70)	85,735 (69)	82,928 (69)	70,056 (66)	65,875 (67)	52,579 (67)	54,952 (67)	54,229 (67)	52,396 (65)	< 0,001	< 0,001	↓
Kidney disease, *n* (%)	53,849 (5.2)	7,442 (5.5)	6,800 (5.3)	6,310 (5.1)	6,084 (5.0)	5,633 (5.3)	5,638 (5.8)	4,301 (5.5)	4,038 (4.9)	3,917 (4.8)	3,686 (4.6)	< 0,001	< 0,001	↓
COPD, *n* (%)	25,040 (2.4)	158 (0.1)	3,231 (2.5)	3,292 (2.6)	3,087 (2.6)	3,086 (2.9)	3,184 (3.3)	2,614 (3.3)	2,215 (2.7)	2,159 (2.7)	2,014 (2.5)	< 0,001	< 0,001	↑
NSTEMI, *n* (%)	231,583 (22.4)	33,867 (25.1)	30,206 (23.4)	27,877 (22.3)	26,941 (22.3)	28,079 (26.6)	27,109 (27.8)	22,372 (28.4)	22,021 (26.9)	21,638 (26.6)	21,382 (26.7)	< 0,001	NA	NA
STEMI, *n* (%)	261,492 (25.3)	39,682 (29.3)	32,006 (24.8)	24,145 (19.3)	23,684 (19.6)	21,822 (20.7)	20,719 (21.2)	17,989 (22.9)	18,112 (22.1)	17,166 (21.1)	16,258 (20.3)			
UA, *n* (%)	542,487 (52.3)	61,861 (45.7)	66,991 (51.9)	72,808 (58.3)	70,237 (58.1)	55,542 (52.7)	49,858 (51.1)	38,328 (48.7)	41,776 (51)	42,646 (52.4)	42,440 (53)			

[1]*Median (IQR); CABG – coronary artery bypass grafting, COPD – chronic obstructive pulmonary disease, MI – myocardial infarction, NSTEMI – non-ST elevation myocardial infarction, PCI – percutaneous coronary intervention, STEMI – ST elevation myocardial infarction, UA – unstable angina.*

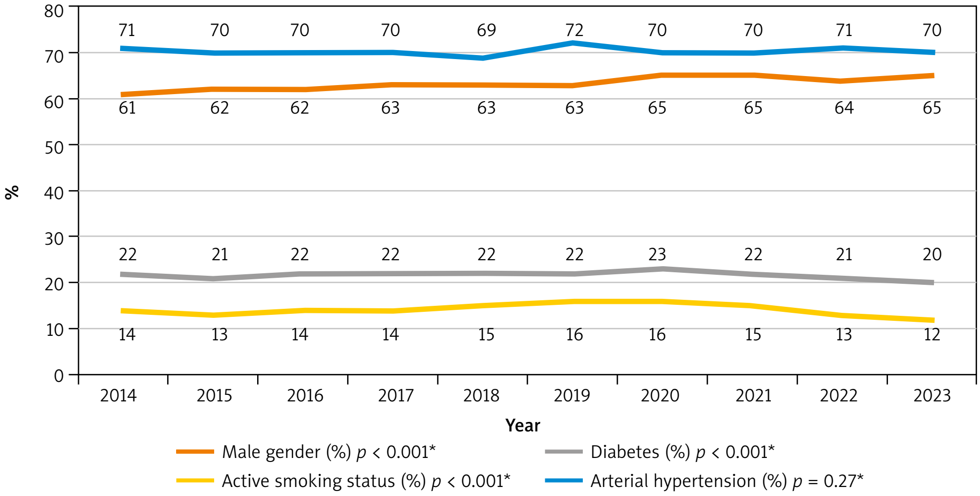

Figure 1. Trends for main atherosclerosis risk factors in the chronic coronary syndromes. *p-value for trend $p < 0.001$ for differences of all variables

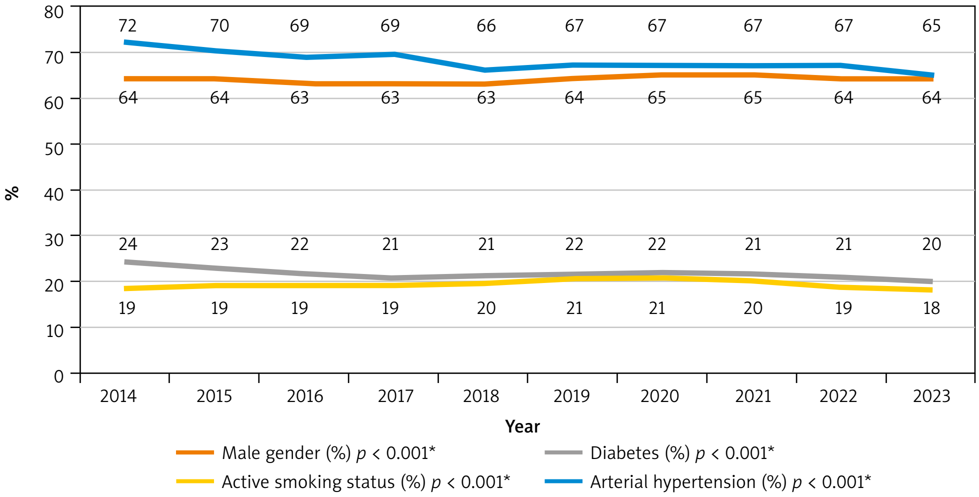

Figure 2. Trends for main atherosclerosis risk factors in the acute coronary syndromes. *p-value for trend $p < 0.001$ for differences of all variables

Table 3. Distribution of risk factors among patients by gender (aggregated 10-year data)

Variable	Total, N = 1,983,636	Male, N = 1,260,347	Female, N = 723,289	P-value[2]
Age[1] [years]	67 (60–74)	66 (59–73)	70 (63–77)	< 0.001
Weight[1] [kg]	80 (70–90)	84 (75–93)	73 (65–82)	< 0.001
Diabetes, *n* (%)	430.844 (22)	258,811 (21)	172,033 (24)	< 0.001
Previous stroke, *n* (%)	57.243 (2.9)	37,225 (3.0)	20,018 (2.8)	< 0.001
Previous MI, *n* (%)	491.744 (25)	354,905 (28)	136,839 (19)	< 0.001
Previous PCI, *n* (%)	601.144 (30)	425,792 (34)	175,352 (24)	< 0.001
Previous CABG, *n* (%)	107.723 (5.4)	82,286 (6.5)	25,437 (3.5)	< 0.001
Active smoking status, *n* (%)	336.002 (17)	252,940 (20)	83,062 (11)	< 0.001
Psoriasis, *n* (%)	7.145 (0.4)	4,960 (0.4)	2,185 (0.3)	< 0.001
Arterial hypertension, *n* (%)	1.378.813 (70)	859,338 (68)	519,475 (72)	< 0.001
Kidney disease, *n* (%)	107,104 (5.4)	66,751 (5.3)	40,353 (5.6)	< 0.001
COPD, *n* (%)	51,149 (2.6)	34,959 (2.8)	16,190 (2.2)	< 0.001

[1]Median (IQR); [2]Wilcoxon rank sum test; Pearson's χ^2 test. CABG – coronary artery bypass grafting, COPD – chronic obstructive pulmonary disease, MI – myocardial infarction, PCI – percutaneous coronary intervention.

Table 4. Distribution of risk factors among patients according to decades of age (aggregated 10-year data)

Characteristic	Overall, *N* = 1,993,262	(< 20), *N* = 457	(21–30), *N* = 2,600	(31–40), *N* = 17,902	(41–50), *N* = 92,078	(51–60), *N* = 328,829	(61–70), *N* = 727,799	(71–80), *N* = 577,673	(81–90), *N* = 229,888	(> 90), *N* = 16,036	*P*-value[2]
Weight[1] [kg]	80 (70–90)	74 (65–83)	80 (70–90)	85 (75–98)	85 (75–98)	83 (74–95)	80 (72–90)	80 (70–88)	75 (65–82)	70 (60–80)	0,010
Male gender, *n* (%)	1,260,305 (64)	330 (74)	2,292 (89)	15,017 (84)	72,434 (79)	241,452 (74)	481,936 (67)	327,253 (57)	112,435 (49)	7,156 (45)	< 0,001
Diabetes, *n* (%)	432,301 (22)	40 (8.8)	76 (2.9)	1,145 (6.4)	9,809 (11)	52,792 (16)	159,836 (22)	148,659 (26)	56,910 (25)	3,034 (19)	< 0,001
Previous stroke, *n* (%)	57,363 (2.9)	5 (1.1)	12 (0.5)	130 (0.7)	986 (1.1)	5,754 (1.7)	19,878 (2.7)	20,489 (3.5)	9,457 (4.1)	652 (4.1)	< 0,001
Previous MI, *n* (%)	493,062 (25)	44 (9.6)	106 (4.1)	2,003 (11)	17,212 (19)	76,614 (23)	181,524 (25)	147,809 (26)	63,702 (28)	4,048 (25)	< 0,001
Previous PCI, *n* (%)	602,655 (30)	61 (13)	95 (3.7)	2,103 (12)	19,823 (22)	93,564 (28)	226,405 (31)	184,269 (32)	72,340 (31)	3,995 (25)	< 0,001
Previous CABG, *n* (%)	107,866 (5.4)	16 (3.5)	8 (0.3)	94 (0.5)	1,027 (1.1)	10,144 (3.1)	39,445 (5.4)	40,945 (7.1)	15,651 (6.8)	536 (3.3)	< 0,001
Active smoking status, *n* (%)	337,340 (17)	59 (13)	458 (18)	5,027 (28)	28,227 (31)	87,826 (27)	139,743 (19)	62,837 (11)	12,483 (5.4)	680 (4.2)	< 0,001
Psoriasis, *n* (%)	7,156 (0.4)	1 (0.2)	7 (0.3)	87 (0.5)	444 (0.5)	1,591 (0.5)	2,823 (0.4)	1,675 (0.3)	497 (0.2)	31 (0.2)	< 0,001
Arterial hypertension, *n* (%)	1,381,785 (69)	159 (35)	383 (15)	6,345 (35)	48,361 (53)	212,604 (65)	511,276 (70)	423,769 (73)	168,083 (73)	10,805 (67)	< 0,001
Kidney disease, *n* (%)	107,445 (5.4)	13 (2.8)	46 (1.8)	512 (2.9)	2,126 (2.3)	7,950 (2.4)	28,048 (3.9)	39,125 (6.8)	27,368 (12)	2,257 (14)	< 0,001
COPD, *n* (%)	51,269 (2.6)	4 (0.9)	0 (0)	34 (0.2)	563 (0.6)	4,874 (1.5)	19,297 (2.7)	18,995 (3.3)	7,080 (3.1)	422 (2.6)	< 0,001

[1]Median (IQR); χ^2 Test for Trend in Proportions. CABG – coronary artery bypass grafting, COPD – chronic obstructive pulmonary disease, MI – myocardial infarction, PCI – percutaneous coronary intervention.

include male gender, hypertension, smoking, hyperlipidemia, diabetes, and obesity, with no significant regional differences observed across Europe [21, 22]. The identification of these risk factors, along with increased awareness of their elimination and advances in pharmacological treatments, has led to a significant reduction in cardiovascular mortality, reaching up to 80% in some European countries [23, 24]. In addition to these well-known classic risk factors, non-classical factors such as stress and depression also play a crucial role in the pathogenesis of cardiovascular diseases [25, 26]. Notably, Polish research suggests that stress significantly impacts population health from an early age [27]. The present study has demonstrated there has been an observed increase in the proportion of procedures performed in male patients and in the incidence of previous PCI. However, the prevalence of diabetes, prior strokes, and CABG has decreased. Many recent studies have analyzed trends in classic cardiovascular risk factors, both globally and regionally, including in Poland [28, 29]. In Poland, research on the influence of classic risk factors on cardiovascular diseases has been ongoing for many years, primarily through studies such as POL-MONICA, WOBASZ, and the NATPOL series [29]. Extensive research on the prevalence and control of these risk factors has been led by Zdrojewski *et al.* The NATPOL 11 study, which included 2,401 respondents, provided valuable insights into the prevalence of risk factors like gender, age, hypertension, and diabetes. The prevalence of classic risk factors, such as gender, age, hypertension, and diabetes, was analyzed in stable patients in outpatient care [29]. Trzeciak *et al.*, in a study of 932 patients under 40 years of age from the PL-ACS registry, found that women were less likely to smoke, had an older average age, and were less likely to experience ST-segment elevation myocardial infarction (STEMI) compared to men [30]. Similar results were obtained by Piątek *et al.*, using the PL-ACS database in a study of 66,667 patients. They found that women were generally older than men and had more comorbidities, which contributed to higher unadjusted mortality rates. However, long-term prognosis appeared more favorable for women [31]. In another analysis by Piątek *et al.* of 197,192 patients from the PL-ACS registry (2005–2014), the average age of women decreased slightly, while the incidence of diabetes, obesity, hypertension, and smoking increased. In over 1 million patients with ACS, women were more likely to have hypertension, diabetes, and kidney disease, but were less likely to be active smokers [32]. The present study confirms these findings. Studies from the ORPKI registry highlight the significant occurrence of classic coronary risk factors in ACS patients. Dziewierz *et al.*, in a study of 150,782 patients with STEMI, found that 17.5% (26,360 patients) had diabetes, a condition associated with higher risks, longer reperfusion delays, and increased periprocedural mortality (1.1% vs. 1.9%; $p < 0.0001$). Diabetes was identified as an independent predictor of periprocedural death [33]. Additionally, Kringeland *et al.*, in a study of 12,329 participants from the Hordaland Health Study, suggested that hypertension is a stronger risk factor for ACS in midlife in women than in men [34]. Kidney failure is another significant coronary risk factor. An estimated glomerular filtration rate below 60 ml/min/1.73 m^2 is considered the strongest predictor of unfavorable outcomes of ACS in patients with renal failure [35]. Our observations show that with age, the prevalence of hypertension, diabetes, and chronic kidney disease increases. Psoriasis, though a less recognized risk factor until recently, has also been linked to ACS. In the ORPKI study, Siudak *et al.* analyzed 405,078 ACS patients and identified psoriasis as an independent predictor of allergic reactions in these patients [36]. Interesting research on coronary risk factors was presented by Rębak *et al.*, who analyzed a professional group of paramedics (N = 140). Their health assessments included blood pressure measurements, biochemical analysis (fasting lipid profile, glycemia), anthropometric measurements, and a questionnaire. Cardiovascular risk factors were a significant burden in this group of paramedics, showing unfavorable health profiles with abnormal body weight, elevated blood pressure, and an unhealthy lipid profile [37]. The National Cardiovascular Disease Program planned in Poland for 2022–2032 multidirectionally addresses, the promotion of healthy lifestyles among children and adults, improving access to qualified medical staff and modern medical equipment, and investing in scientific research and innovative therapies in cardiology [38]. In parallel, there are nationwide anti-smoking campaigns, campaigns covering overweight and obesity prevention and promoting mental health detailed in the National Health Program [39]. Implemented prevention programs like the Cardiovascular Disease (CVD) prevention program use laboratory tests, a questionnaire for assessing cardiovascular disease risk factors, and health education to reduce cardiovascular morbidity and mortality [40]. "Coordinated care" introduced in Poland 2022 enables early detection of diseases such as hypertension, atrial fibrillation, diabetes, chronic kidney disease or heart failure, and their effective treatment and monitoring through cooperation between a family doctor and a specialist [41].

Despite over 60 years of intense research into classic coronary risk factors, this area continues to generate controversies. New information regarding both classic and lesser-known risk factors, such as psoriasis and stress, continues to emerge.

Conclusions

Over the past decade, among patients with various forms of ischemic heart disease undergoing coronary angiography and PCI, there has been an observed increase in the proportion of procedures performed in male patients and in the incidence of previous PCI. Conversely, the prevalence of diabetes, prior strokes, and CABG has decreased. Compared to men, women undergoing these procedures had a higher prevalence of hypertension, diabetes, and kidney disease, but were less likely to be active smokers or to have a history of stroke, MI, PCI, CABG, psoriasis, or COPD. With advancing age, the prevalence of hypertension, diabetes, kidney disease, COPD, and prior stroke, myocardial infarction, PCI, and CABG increased, while the frequency of active smoking, psoriasis, the proportion of male patients, and body weight decreased.

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Conflict of interest

The authors declare no conflict of interest.

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