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Primary prevention efforts are poorly developed in people at high cardiovascular risk: A report from the European Society of Cardiology EURObservational Research Programme EUROASPIRE V survey in 16 European countries

Kornelia Kotseva[1,2], Guy De Backer[2], Dirk De Bacquer[3], Lars Rydén[4], Arno Hoes[5], Diederick Grobbee[5], Aldo Maggioni[6,7], Pedro Marques-Vidal[8], Catriona Jennings[2], Ana Abreu[9], Carlos Aguiar[10], Jolita Badariene[11,12], Jan Bruthans[13], Renata Cifkova[13], Kairat Davletov[14], Mirza Dilic[15], Maryna Dolzhenko[16], Dan Gaita[17], Nina Gotcheva[18], Hosam Hasan-Ali[19], Piotr Jankowski[20], Christos Lionis[21], Silvia Mancas[17], Davor Milićić[22], Erkin Mirrakhimov[23,24], Rafael Oganov[25], Nana Pogosova[26], Željko Reiner[27], Duško Vulić[28] and David Wood[2]; on behalf of the EUROASPIRE V Investigators*

Abstract

Background: European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) V in primary care was carried out by the European Society of Cardiology EURObservational Research Programme in 2016–2018. The main objective was to determine whether the 2016 Joint European Societies' guidelines on cardiovascular disease prevention in people at high cardiovascular risk have been implemented in clinical practice.

[1]St Mary's Hospital, Imperial College Healthcare NHS Trust, London, UK
[2]National Institute for Prevention and Cardiovascular Health, National University of Ireland-Galway, Republic of Ireland
[3]Department of Public Health and Primary Care, Ghent University, Belgium
[4]Department of Medicine Solna, Karolinska Institutet, Sweden
[5]Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, The Netherlands
[6]Maria Cecilia Hospital, GVMCare & Research Cotignola, Italy
[7]EURObservational Research Programme, European Society of Cardiology, France
[8]Department of Medicine, Lausanne University Hospital, Switzerland
[9]Hospital Santa Marta, Centro Hospitalar de Lisboa Central, Portugal
[10]Hospital Santa Cruz, Centro Hospitalar de Lisboa Ocidental, Portugal
[11]Clinic of Cardiac and Vascular Diseases, Vilnius University, Lithuania
[12]Centre of Cardiology and Angiology, Vilnius University Hospital Santaros Klinikos, Lithuania
[13]Center for Cardiovascular Prevention, Charles University in Prague, Czech Republic
[14]Health Research Institute, Al-Farabi Kazakh National University, Kazakhstan
[15]Medical Faculty, University of Sarajevo, Bosnia and Herzegovina
[16]Supyk National Medical Academy of Postgraduate Education, Ukraine
[17]Clinica de Recuperare Cardiovasculara, Universitatea de Medicina si Farmacie Victor Babes, Romania
[18]Department of Cardiology, National Heart Hospital, Bulgaria
[19]Cardiovascular Medicine Department, Assiut University, Egypt
[20]I Department of Cardiology, Interventional Electro-cardiology and Hypertension, Jagiellonian University Medical College, Poland
[21]Clinic of Social and Family Medicine, University of Crete, Greece
[22]School of Medicine, University of Zagreb, Croatia
[23]Kyrgyz State Medical Academy, Kyrgyzstan
[24]National Center of Cardiology and Internal Medicine named after academician Mirrakhimov MM, Kyrgyzstan
[25]National Research Center for Preventive Medicine, Russia
[26]National Medical Research Center of Cardiology, Ministry of Healthcare of the Russian Federation, Russia
[27]University Hospital Centre Zagreb, University of Zagreb, Croatia
[28]Faculty of Medicine, University of Banja Luka, Bosnia and Herzegovina

*Listed in Appendix 1

Corresponding author:
Kornelia Kotseva, National Institute for Prevention and Cardiovascular Health, Croi Heart and Stroke Centre, Moyola Lane, Newcastle, Galway, Republic of Ireland.
Email: kkotseva.imperial@gmail.com

Methods: The method used was a cross-sectional survey in 78 centres from 16 European countries. Patients without a history of atherosclerotic cardiovascular disease either started on blood pressure and/or lipid and/or glucose lowering treatments were identified and interviewed ≥ 6 months after the start of medication.
Results: A total of 3562 medical records were reviewed and 2759 patients (57.6% women; mean age 59.0 ± 11.6 years) interviewed (interview rate 70.0%). The risk factor control was poor with 18.1% of patients being smokers, 43.5% obese (body mass index ≥ 30 kg/m^2) and 63.8% centrally obese (waist circumference ≥ 88 cm for women, ≥ 102 cm for men). Of patients on blood pressure lowering medication 47.0% reached the target of $<140/90$ mm Hg ($<140/85$ mm Hg in people with diabetes). Among treated dyslipidaemic patients only 46.9% attained low density lipoprotein-cholesterol target of <2.6 mmol/l. Among people treated for type 2 diabetes mellitus, 65.2% achieved the HbA1c target of $<7.0\%$.
Conclusion: The primary care arm of the EUROASPIRE V survey revealed that large proportions of people at high cardiovascular disease risk have unhealthy lifestyles and inadequate control of blood pressure, lipids and diabetes. Thus, the potential to reduce the risk of future cardiovascular disease throughout Europe by improved preventive cardiology programmes is substantial.

Keywords
Primary prevention, guideline implementation, EUROASPIRE, cardiovascular risk factors

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Introduction

The main objectives of cardiovascular disease (CVD) prevention are to reduce morbidity and mortality, improve quality of life and increase life expectancy.[1] The Joint European Societies (JES) guidelines on CVD prevention have been regularly updated since 1994[1–6] and their implementation evaluated with five cross-sectional surveys called EUROASPIRE (European Action on Secondary and Primary Prevention by Intervention to Reduce Events) from 1995–1996 to 2016–2018 through the European Society of Cardiology (ESC) EURObservational Research Programme (EORP).[7–17]

Primary prevention of atherosclerotic CVD remains a major challenge. Observational studies and randomised controlled trials verify that healthy lifestyles and the control of arterial hypertension, dyslipidaemia and diabetes prevent CVD events in people free from such disease.[18–25] The aim of the primary care arm of EUROASPIRE V was to determine to what extent the 2016 JES guidelines on CVD prevention had been implemented in clinical practice in people at high risk of developing CVD.

Methods

Study design

The primary care arm of EUROASPIRE V was carried out in 78 primary care centres in 16 countries (Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Egypt, Greece, Kazakhstan, Kyrgyzstan, Lithuania, Poland, Portugal, Romania, Russia, Sweden, Ukraine and the United Kingdom) during 2017–2018. Within each country one or more areas with a defined population were selected and a sample of ≥ 2 general practices serving that population were identified.

Study population

Men and women, ≥ 18–<80 years, free from any atherosclerotic disease, who had been prescribed one or more of the following: (a) blood pressure lowering drugs and/or (b) lipid-lowering drugs and/or (c) glucose-lowering (diet and/or oral drugs and/or insulin) ≥ 6 months to <2 years prior to the interview, were retrospectively identified from the medical records. The sampling principle was that patients treated for hypertension, dyslipidaemia or diabetes had an approximately equal chance of being included. Patients on each of these treatments might have one or more of the other drug therapies.

Data collection

Data collection was undertaken by trained research staff, who reviewed the medical notes and invited the patients to an interview and examination at least six months after the prescription of the blood pressure, lipid-lowering and diabetes therapy. Fasting (at least 12 h) blood samples were obtained at the same time.

Smoking was defined as self-reported smoking, and/or a breath carbon monoxide exceeding 10 ppm using a Smokerlyzer (Bedfont Scientific, Model Micro+).

Height and weight were measured in light indoor clothes without shoes using SECA scales 701 and

measuring stick model 220 (SECA Medical Measuring Systems and Scales, Birmingham, UK). Overweight was defined as a body mass index (BMI) $\geq$25–<30 kg/m^2 and obesity as BMI $\geq$ 30 kg/m^2.

Waist circumference was measured using a metal tape horizontally in the mid-axillary line midway between the lowest rim of the rib cage and tip of the hip bone with the patient standing. Abdominal overweight was defined as a waist circumference of $\geq$80–<88 cm for women and $\geq$94–<102 cm for men and central obesity as a waist circumference of $\geq$88 cm for women and $\geq$102 cm for men.

Blood pressure was measured twice on the right upper arm in a sitting position with an automatic digital Omron Comfort M6 sphygmomanometers (OMRON Corporation, Kyoto, Japan) and the mean was used for the analyses. This sphygmomanometer has a specially designed Intelli Wrap Cuff Technology to give more accurate measurements as the unique preformed Comfort cuff adjusts to suit a variety of arm sizes and shapes. Raised blood pressure was defined as systolic blood pressure (SBP) $\geq$140 mm Hg and/or diastolic blood pressure (DBP) $\geq$90 mm Hg ($\geq$140/85 mm Hg in patients with diabetes)

The physical activity target was defined by the following question 'Do you take regular physical activity of at least 30 minutes duration on average five times a week?'

Blood samples were analysed in the Central Laboratory (Laboratory in the National Institute for Health and Welfare, Helsinki, Finland), accredited by the Finnish Accreditation Service and fulfilling requirements of the standard SFS-EN ISO/IEC 17025:2005. During the course of the study the coefficient of variation (mean $\pm$ standard deviation (SD)) and systematic error (mean $\pm$ SD) were 1.2% $\pm$ 0.1 and 0.0% $\pm$ 1.0 for total cholesterol, 1.9% $\pm$ 0.5 and –0.1% $\pm$ 2.4 for high density lipoprotein-cholesterol (HDL-C), 1.3% $\pm$ 0.2 and –1.8% $\pm$ 2.0 for triglycerides and 0.9% $\pm$ 0.1 and –2.1% $\pm$ 3.4 for glycated haemoglobin (HbA1c), respectively. Total cholesterol, HDL-C and triglycerides were analysed in serum, and HbA1c in whole blood by enzymatic methods for total cholesterol, triglycerides and HbA1c and a homogenous method for direct measurement of HDL-C (reagents from Abbott Laboratories, Abbott Park, Illinois, USA). The level of low density lipoprotein-cholesterol (LDL-C) was calculated by Friedewald's formula when the triglycerides level was <4.5 mmol/l.[26] Elevated LDL-C concentration was defined as $\geq$2.6 mmol/l ($\geq$100 mg/dl).

Plasma glucose was analysed locally with a point-of-care technique (Glucose 201RT, HemoCue, Ängelholm, Sweden).[27] Elevated fasting glucose among patients with diabetes was defined as $\geq$6.0 mmol/l ($\geq$110 mg/dl) and elevated HbA1c as $\geq$7.0% (International Federation of Clinical Chemistry (IFCC) $\geq$ 53 mmol/mol).

Data management

Data were submitted online to the data management centre (EORP, European Heart House, Sophia Antipolis, France). They were checked for completeness, internal consistency and accuracy and stored under the provisions of the National Data Protection Regulations.

Statistical analyses

Descriptive statistics were used to estimate the prevalence rates of risk factors and medication use at interview. Patients' demographics, risk factor profiles and use of medication were described according to unweighted means, SDs and proportions. Prevalences were compared between gender and age groups according to Fisher's exact test. All statistical analyses were undertaken using SAS statistical software (release 9.4, SAS Institute, Cary, North Carolina, USA) in the Department of Public Health, Ghent University, Belgium.

Ethical approval

National coordinators were responsible for obtaining local ethics committee approvals. Written, informed consent was obtained from each participant and stored in the patient file.

Outcome measures

The main outcome measures were the proportions of high CVD risk people achieving the lifestyle and risk factor targets as defined in the 2016 JES guidelines on CVD prevention: not smoking, healthy food choices and being physically active; a BMI < 25 kg/m^2; blood pressure <140/90 mm Hg (<140/85 mm Hg in patients with diabetes), LDL-C < 2.6 mmol/l (<100 mg/dl), HbA1c as <7.0% (IFCC < 53 mmol/mol) and appropriate use of cardioprotective drug therapies for treatment of elevated blood pressure, lipids and glucose.[1]

Results

Characteristics of the study population

A total of 3562 medical records were reviewed and 2759 patients attended the interview which, excluding patients who died, moved away and had a change in medical condition, corresponds to a participation rate of 70%.

Table 1. Patients' lifestyle characteristics by age and gender.

Lifestyle characteristics	All $n=2759$ %	Gender		Age	
		Men $n=1170$ %	Women $n=1589$ %	<60 years $n=1344$ %	≥60 years $n=1415$ %
Smoking	18.1	24.6	13.3[a]	24.9	11.7[a]
Current smokers not having been offered professional advice to quit in past 3 years	18.6	15.5	23.0[b]	18.8	18.4
Current smokers not having attempted to quit smoking in past 3 years	81.4	79.3	84.3	80.4	83.4
Current smokers not having the intention to quit within the next 6 months	58.5	54.3	64.5[b]	55.9	64.1
Overweight and obesity	80.7	83.3	78.8[a]	79.6	81.8
Obesity	43.5	41.7	44.9	43.0	44.0
Central obesity	63.8	53.8	71.0[a]	60.4	67.0
Obese patients never been told to be overweight	18.6	17.1	19.6	18.9	18.2
Obese patients not having attempted actively to lose weight in last month	49.2	51.4	47.7	47.2	51.0
Obese patients not seriously considering weight loss in next 6 months	37.0	37.7	36.6	31.0	42.5[a]
Obese patients not being aware of their weight target	37.6	29.9	42.8[a]	39.7	35.7
Obese patients not having been advised to follow dietary guidelines	36.8	36.5	37.1	34.3	39.1
Regular physical activity ≥30 minutes on average 5 times a week	36.4	39.8	33.8[a]	36.0	36.8
Vigorous physical activity for ≥20 minutes 3 or more times a week	16.1	20.7	12.7[a]	18.8	13.6[a]
Performing planned physical activity to increase physical fitness	31.6	35.5	28.6[a]	34.3	29.0[a]
Not performing planned physical activity and no intention to do so in next 6 months	39.1	35.3	42.1[a]	30.9	47.2[a]
Not having received personal advice to do more general everyday activities	55.2	52.6	57.1[b]	54.4	55.9

ACE : Angiotensin converting enzyme; BMI: body mass index; LLD: lipid-lowering drugs.
Smoking: self-reported smoking or >10 ppm carbon monoxide in breath; persistent smoking: self-reported smoking or >10 ppm carbon monoxide in breath in patients reporting to have been smoking in the month prior to the index event; overweight: BMI 25–30 kg/m^2; obesity: BMI ≥ 30 kg/m^2; central obesity: waist circumference ≥88 cm for women and ≥102 cm for men.
[a]$p < 0.01$; [b]$p < 0.05$.

The distribution of study population attending interview by country, age and gender is presented in Supplementary Material Table 1. The mean (SD) age at interview was 59.0 (11.6) years and 57.6% were women.

Reasons for not being interviewed were: refusal to attend (62%), no response to the invitation letter (36%) and miscellaneous (2%). Women were significantly more likely to attend the interview (74% vs 66% in men).

Study outcomes

Lifestyle. The prevalence of smoking, obesity and central obesity are presented in Tables 1 and 2, Figure 1 and Supplementary Material Table 2.

The overall prevalence of smoking was 18.1% (men 24.6%, women 13.3%), higher in patients <60 years. In the past three years 18.6% of current smokers had not been offered professional advice to quit and 58.5% reported no intention to stop within the next six months. Of the persistent smokers, 1.9% attended smoking-cessation clinics and nicotine-replacement and varenicline were used by 4.5% and 1.1% respectively.

Overall, 37.2% of patients (men 41.6%, women 33.9%) were overweight and 43.5% (men 41.7%, women 44.9%) were obese. The prevalence of central obesity was 63.8% (men 53.8%, women 71%). Of obese patients, 18.6% had never been informed that they were overweight, 37.6% were unaware of their weight target

Table 2. Reported lifestyle changes taken by patients to reduce their risk of heart disease within the last three years by age and gender.

		Gender		Age	
	All $n = 2759$ %	Men $n = 1170$ %	Women $n = 1589$ %	<60 years $n = 1344$ %	≥60 years $n = 1415$ %
Smoking[a]					
Abstinence	15.1	17.2	12.2	16.3	12.6
Reduction	37.4	39.2	35.0	39.7	32.7
Smoking cessation clinic	1.9	1.5	2.5	2.2	1.3
Nicotine replacement therapy	4.5	4.7	4.1	4.4	4.6
Bupropion	0.6	0.7	0.5	0.3	1.3
Varenicline	1.1	1.5	0.5	0.9	1.3
In patients with BMI ≥ 30 kg/m^2					
Reduction of fat	71.8	69.3	73.5	74.2	69.7
Reduction of calories	62.0	60.8	62.9	65.7	58.7[b]
Participating in regular physical activity	39.3	44.1	36.1[c]	42.0	36.8
In patients using BP-lowering medication					
Special diet[d]	53.9	51.9	55.2	51.0	56.3[b]
Reduction of salt	71.4	68.2	73.6[c]	69.8	72.7
Increased everyday physical activity	40.0	42.4	38.3	42.2	38.1
In patients using lipid-lowering medications					
Special diet[d]	56.0	52.8	58.7	54.2	57.1
Reduction of fat	70.4	67.1	73.3[b]	69.7	70.9
More fruit and vegetables	76.0	74.8	77.0	74.7	76.8
More fish	60.1	60.7	59.5	58.6	61.0
Increased everyday physical activity	40.5	46.3	35.5[c]	39.9	40.9
In patients with diabetes					
Reduction of fat	76.5	72.3	79.9[c]	78.6	75.1
More fruit and vegetables	77.5	77.5	77.4	76.7	78.0
Less sugar	80.8	81.3	80.5	84.3	78.5[b]
Less alcohol	51.3	53.1	49.9	54.7	49.2
Increased everyday physical activity	51.4	57.6	46.4[c]	49.7	52.5

BMI: body mass index; BP: blood pressure.
[a]Change during the last three years reported by smokers; [b]$p < 0.05$; [c]$p < 0.01$; [d]prescribed by a doctor or other health professional.

and 36.8% had not been advised to follow dietary guidelines.

Regular physical activity (≥30 min on average five times/week) was undertaken by 36.4% of the patients (men 39.8%, women 33.8%) while 39.1% did not perform any planned physical activity and had no intention to do so the next six months and 55.2% had not received any advice to increase their physical activities

Blood pressure, lipids and diabetes. The management of blood pressure, LDL-C and self-reported diabetes is presented in Tables 3 and 4 and Supplementary Material Tables 3 and 4.

Overall, 75.4% of patients were on antihypertensive medication but 53% (men 56.6%, women 50.5%) had blood pressure ≥140/90 mm Hg (≥140/85 mm Hg in people with diabetes). A total of 84.2% on blood pressure therapy were aware of their blood pressure level and 69.2% knew their recommended target. The most common medications were inhibitors of renin-angiotensin systems (ACE inhibitors/angiotensin receptor blockers (ARBs); 78.9%), followed by beta-blockers (37.9%), diuretics (35.6%) and calcium channel blockers (32%) with 42.2% on one, 34% on two, 17.7% on three and 6.1% on ≥4 blood pressure lowering drugs. Two-thirds of patients (64.9%) reported complete adherence with the intake of their blood pressure lowering drugs. Furthermore, blood pressure was elevated in 43.2% of patients not using antihypertensive medication. Of those being treated for hypertension 31.0%

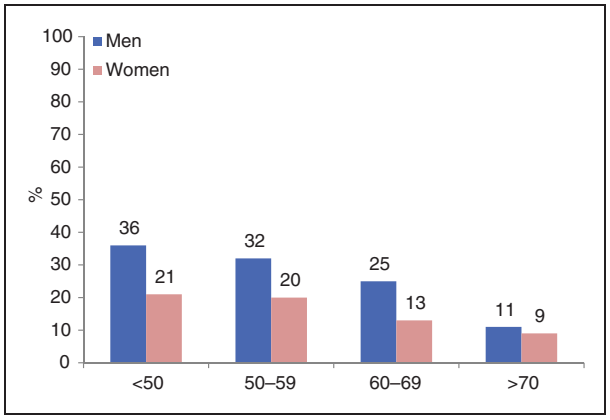

Figure 1. Prevalence (%) of smoking[a] by age and sex.[b]
[a]Self-reported or >10 ppm CO in breath.
[b]Significance of gender differences in smoking prevalences by age: age <50 years: $p = 0.0002$; age 50–59 years: $p = 0.0003$; age 60–69 years: $p < 0.0001$; age ≥70 years: $p = 0.45$.

were also on lipid-lowering medication and 50.4% had an LDL-C ≥ 2.6 mmol/l. Of those with hypertension not on lipid-lowering medication 80.8% had an LDL-C ≥ 2.6 mmol/l.

Lipid-lowering medication was prescribed in 34.1% and in this group 97.3% were on statins, 2.9% on fibrates and 0.3% on other lipid-lowering drugs. Overall, 61.3% reported 100% adherence with lipid-lowering drugs. Still, 53.1% of these patients (men 45.2%, women 59.9%) had LDL-C ≥ 2.6 mmol/l. Of these, 45.3% had been informed of their cholesterol levels and only 29.9% were aware of their target. Of patients on no lipid-lowering medication 81% had a LDL-C ≥ 2.6 mmol/l (men 77.5%, women 83.3%). Of those being treated for dyslipidaemia, 70.8% were also on anti-hypertensive medication and 48.9% had a blood pressure above the recommended target. Of dyslipidaemic patients not on anti-hypertensive medication, 35.6% had a blood pressure above the target.

The prevalence of self-reported diabetes at interview was 35.8% (men 37.2%, women 34.7%) and 34.8% of people in this group had a HbA1c ≥ 7.0%. The majority (79.2%) were on oral glucose-lowering drugs, 14.5% on insulin and 57.2% on diet; 76.5% reported 100% adherence with glucose-lowering drugs. In patients with known diabetes, ACE inhibitors/ARBs were prescribed in 56.0%, statins in 38.0% and both statins and ACE/ARBs in 26.0%. Of those with diabetes, 69.8% were on anti-hypertensive medication and 64.8% had a blood pressure ≥ 140/85 mm Hg. Of those with diabetes not on anti-hypertensive medication, 55.1% had a blood pressure ≥140/85 mm Hg. A total of 39.5% were on lipid-lowering medication but 41.9% had an LDL-C ≥ 2.6 mmol/l. Of those with diabetes not on lipid-lowering medication, 74.5% had an LDL-C ≥ 2.6 mmol/l.

Discussion

Principal findings

The EUROASPIRE V survey in primary care clearly demonstrates that a large majority of patients at high CVD risk fail to achieve lifestyle, blood pressure, lipid and glycaemic targets as defined in the 2016 JES guidelines on CVD prevention in clinical practice. A wide gap still exists between the evidence-based guidelines and everyday clinical practice.

A major concern is that nearly one-fifth of high CVD risk patients were smokers with a prevalence higher in men than women and in patients <50 years. Moreover, two-fifths of current smokers did not intend to quit smoking within the next six months. Despite the evidence that stopping smoking is the most cost-effective strategy for prevention of CVD,[1,28] only a small minority of patients attended smoking cessation clinics or were prescribed pharmacological support. There is a failure of the primary care system to provide professional support for smoking cessation, including prescription of evidence based medications like varenicline and buproprion, and to address all aspects of lifestyle including recommending physical activity, especially in older groups. These poor outcomes on smoking and physical activity management in such high risk patients could be seen as professional negligence.

A large majority of high CVD risk patients were overweight or obese and nearly two-thirds were centrally obese with the highest prevalence in women. Of concern is that one-fifth of obese patients were never told that they were overweight, and that more than a third were unaware of their weight target and without any dietary recommendations. Healthy diet and weight reduction in overweight and obese patients are recommended in order to reduce the blood pressure, lipids and the risk of diabetes mellitus type 2.[1,29] In this survey, the majority of obese patients reported reducing fat and calorie intake but only two-fifths participated in regular physical activity.

There is a wealth of scientific evidence that control of blood pressure, lipids and glucose can reduce the risk of future CV events in high risk patients.[21–25] However, blood pressure management was poor with less than half of patients on blood pressure lowering medication achieving the guideline targets, slightly better in women than men. Although a majority of patients were aware of their blood pressure level and the target to be achieved only 65% reported complete adherence with their treatment. Of note is that more than two-fifths of high CVD risk patients, because of dyslipidaemia and/or diabetes, had elevated blood pressure without being prescribed any antihypertensive therapy. The management of LDL-C was surprisingly poor, with less than

Table 3. Cardiovascular risk factor management by age and gender.

Risk factor	All $n = 2759$ %	Gender		Age	
		Men $n = 1170$ %	Women $n = 1589$ %	<60 years $n = 1344$ %	≥60 years $n = 1415$ %
BP ≥ 140/90 mm Hg (≥140/85 if diabetes) in patients using antihypertensive drugs	53.0	56.6	50.5[a]	50.4	55.2[b]
BP ≥ 140/90 mm Hg (≥140/85 if diabetes) in patients not using antihypertensive drugs	43.2	48.7	38.7[b]	36.6	52.5[a]
Awareness of BP level in patients using antihypertensive drugs	84.2	83.0	85.0	83.4	84.8
Awareness of BP target in patients using antihypertensive drugs	69.2	69.4	69.0	67.7	70.5
Reporting 100% adherence with BP lowering drugs	64.9	62.5	66.5	61.2	67.9[a]
If blood pressure raised, never been told by a doctor to have high BP	13.0	15.3	11.0	13.8	12.3
BP ≥ 140/90 mm Hg (≥140/85 if diabetes) in obese patients using antihypertensive drugs	60.5	61.5	59.8	61.4	59.7
B ≥ 140/90 mm Hg (≥140/85 if diabetes) in centrally obese patients using antihypertensive drugs	57.0	60.1	55.4	56.7	57.3
BP ≥ 140/90 mm Hg (≥140/85 if diabetes) in obese patients using lipid-lowering drugs	52.7	56.9	48.7	52.0	53.1
BP ≥ 140/90 mm Hg (≥140/85 if diabetes) in centrally obese patients using lipid-lowering drugs	48.0	54.2	43.8[b]	42.5	51.2[b]
LDL-C ≥ 2.6 mmol/l in patients using lipid-lowering drugs	53.1	45.2	59.9[a]	62.2	47.3[a]
LDL-C ≥ 2.6 mmol/l in patients not using lipid-lowering drugs	81.0	77.5	83.3[a]	81.9	79.9
Awareness of total cholesterol level in patients using lipid-lowering drugs	45.3	44.6	45.8	45.8	44.9
Awareness of total cholesterol target in patients using lipid-lowering drugs	29.9	31.4	28.7	32.2	28.5
Reporting 100% adherence with lipid-lowering drugs	61.3	65.3	58.1[b]	54.3	66.1[a]
If LDL-C ≥ 2.6 mmol/l, never been told to have high cholesterol	44.4	46.3	43.2	49.1	39.2[a]
Self-reported previous diabetes	35.8	37.2	34.7	29.2	42.0
In patients with self-reported diabetes, HbA1c ≥ 7.0%	34.8	32.5	36.6	37.0	33.4
Awareness of glucose level in patients with self-reported diabetes	62.9	62.3	63.4	56.0	67.5[a]
Awareness of glucose target in patients with self-reported diabetes	48.0	49.4	46.9	40.5	53.0[a]
Self-monitoring	72.4	72.3	72.5	66.6	76.2
Reporting 100% adherence with glucose-lowering drugs	76.5	75.	77.4	76.2	76.7

BP: blood pressure; LDL-C: low density lipoprotein-cholesterol.
[a]$p < 0.01$; [b]$p < 0.05$.

half of patients on lipid-lowering medication achieving the recommended target. Lipid control was better in men than women. Surprisingly, less than half of patients on lipid-lowering medication were aware of their cholesterol levels and less than a third knew their cholesterol target. However, over three-fifths of patients reported 100% adherence with lipid-lowering drugs. Similar to blood pressure, the majority of patients selected as being at high risk, because of treated hypertension and/or diabetes, had elevated LDL-C but without any prescription of lipid-lowering therapy. More than two-fifths of patients with elevated LDL-C had never been told they had high cholesterol. In this survey, blood pressure was better controlled in women than men and the reverse was true for LDL-C, with similar observations reported in previous EUROASPIRE III and IV surveys in primary care.[14–16]

There may be several explanations for the poor blood pressure and lipid management, such as low-dose prescriptions, not up-titrating doses to achieve

Table 4. Use of blood pressure (BP) lowering, lipid-lowering and antidiabetic therapies.

	Medication use (drug classes) % (*n*)		
	All (range between centres)	Men	Women
In people on BP lowering medication			
Beta-blockers	37.9 (8.9 to 58.1)	33.4	41.1[a]
ACE inhibitors	51.7 (25.0 to 76.8)	52.8	50.8
ARBs	27.2 (8.7 to 49.1)	27.1	27.3
Calcium channel blockers	32.0 (12.6 to 57.1)	37.6	28.1[a]
Diuretics	35.6 (7.4 to 53.8)	35.0	36.0
Other BP lowering drugs	4.4 (0.0 to 12.1)	4.3	4.6
Number of BP lowering drugs:			
1 BP lowering drug	42.2 (26.5 to 74.2)	41.6	42.6
2 BP lowering drugs	34.0 (21.0 to 41.8)	33.9	34.1
3 BP lowering drugs	17.7 (3.2 to 30.3)	17.7	17.8
$\geq$4 BP lowering drugs	6.1 (0.0 to 16.3)	6.8	5.6
In people on lipid-lowering medication			
Statins	97.4 (92.3 to 100)	97.3	97.4
Fibrates	2.9 (0.0 to 15.2)	3.9	2.0
Other LLD	0.3 (0.0 to 3.6)	0.2	0.4
Fixed-dose combination LLD	2.0 (0.0 to 8.4)	2.3	1.8
In people with self-reported diabetes			
Diet	57.2 (21.6 to 95.1)	56.4	57.9
Oral antidiabetic drugs	79.2 (33.3 to 100)	77.4	80.6
Insulin	14.5 (0.0 to 35.2)	14.3	14.7

ARBs: angiotensin receptor blockers; LLD: lipid-lowering drugs; ACE: angiotensin converting enzyme.
[a]$p < 0.01$.

targets, using monotherapy, poor patient adherence and physician inertia to treat patients to targets according to the most recent guidelines. Large clinical trials demonstrate that most patients with hypertension can achieve and sustain adequate blood pressure control, however only with the use of two or more blood pressure lowering drugs. In this survey, more than two-fifths of patients on anti-hypertensive therapy were on only one, while one-third were on two and just one-fourth on three or more blood pressure lowering drugs.

According to the JES guidelines, people with diabetes mellitus type 2 should be considered and managed as high CVD risk and prescribed cardioprotective medications including ACE inhibitors/ARBs and statins.[1] However, in this survey more than a third of patients with known diabetes had HbA1c above the recommended target of <7%. Overall, nearly three-fifths were on ACE inhibitors/ARBs and only just over one-third on statins.

One important finding of this survey is that a large majority of patients identified on the basis of being on blood pressure and/or lipid-lowering medications and/or having diabetes, were found to have more than one of these risk factors. Counting the number of uncontrolled cardiovascular risk factors (current smoking, elevated blood pressure, elevated LDL-C or uncontrolled diabetes), 38.7% had one, 40.1% had two, 10.8% had three and 0.6% had four of them inadequately managed. This underlines the importance of multifactorial cardiovascular risk factor management as the total CVD risk is a consequence of the interaction of many risk factors and modest increases of several risk factors can be more harmful than a high level of a single risk factor. Treating single risk factors in isolation is less effective than screening for and managing all CVD risk factors, and where one risk factor is detected it is essential to screen for and manage all the others.

Comparison with other surveys

The results of EUROASPIRE V are in accordance with other earlier surveys of primary prevention in Europe, USA and other parts of the world.[30–34] Most of them focused on the control of a single risk factor while the information on management of multiple CVD risk factors in patients at high CVD risk is limited. By comparison with the EURIKA study on 7641 patients from 12 European countries free of clinical CVD, and with at least one major CVD risk factor, blood pressure and LDL-C control in EUROASPIRE V was slightly better.[30] Among patients with treated hypertension,

39% of patients in EURIKA achieved the blood pressure target compared to 47% of patients in EUROASPIRE V. Among treated patients with dyslipidaemia, 41% of patients in EURIKA attained an LDL-C of <3 mmol/l, compared to 47% achieving LDL-C of <2.6 mmol/l in EUROASPIRE V. In another European study, 32% of high CVD risk patients were smokers, 36% were obese, 49% had blood pressure >140/90 mm Hg, 64% total cholesterol ≥5 mmol/l and 14% a fasting glucose levels >6.1 mmol/l.[31] Predictors of risk factor control were medication adherence and health-related quality of life. Being single and having a lower educational level was associated with poorer risk factor control. The International ChoLesterol management Practice Study (ICLPS) investigated achievement of LDL-C targets in patients at high or very high CVD risk receiving lipid-modifying therapy in countries outside Western Europe.[32] The proportion of patients achieving guideline-specified treatment targets was 44% for LDL-C, 55% for blood pressure and 39% for diabetes.

Strengths and limitations

A major strength is that data were collected using face-to-face interviews with standardised methods and equipment, including central laboratory analyses, rather than data from general practice medical records where the risk factor recording is usually incomplete. A limitation may be the way that patients were identified, through prescription of blood pressure and/or lipid-lowering and/or diabetes therapies, rather than screening to detect those at highest multifactorial CVD risk. High CVD risk screening would have been labour-intensive requiring assessment of a large number of people to detect those at highest risk, while selecting those already at high medical risk because they were being treated with drug therapies was easier. The majority of these selected patients had more than one risk factor which puts them at high multifactorial risk for CVD requiring a comprehensive approach to risk factor reduction. The reason for choosing three geographical regions with a minimum of two general practices in each area in each country was to increase the representativeness of the study.

Conclusions

Many European patients at high CVD risk have unhealthy lifestyles including sedentary behaviour and high prevalence of smoking, overweight, obesity and central obesity. The control of blood pressure, lipids and diabetes is poor with the majority of patients not achieving guideline-recommended targets for CVD prevention. There were considerable variations between countries in lifestyle and risk factor management that may be explained by the differences in drug prescribing and local healthcare policies. The results demonstrate that both patients and physicians pay insufficient attention to lifestyle risk factors which can unfavourably impact on the control of blood pressure, lipids and diabetes. Thus, there is considerable potential to raise the standards of preventive cardiology through modern preventive cardiology programmes[35] addressing all aspects of lifestyle, multifactorial risk factor management supported by comprehensive pharmacological therapy in order to reduce the risk of future CVD.

Author contribution

KK contributed to conception and design, data acquisition, analysis and interpretation, drafted and critically revised the manuscript. GDB, DDB, LR, AH, DG, AM, PMV, CJ and DW contributed to conception and design, data acquisition, analysis and interpretation, and critically revised the manuscript. AA, CA, JBa, JBr, RC, KD, MDi, MDo, DG, NG, HHA, PJ, CL, SM, DM, EM, RO, NP, ZR and DV, contributed to conception and design, data acquisition and critically revised the manuscript. All authors gave final approval and agreed to be accountable for all aspects of work ensuring integrity and accuracy.

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Appendix 1

EUROASPIRE V registry (EAV) Primary care

EORP Oversight Committee

Christopher P. Gale, GB (Chair); Branko Beleslin, RS; Andrzej Budaj, PL; Ovidiu Chioncel, RO; Nikolaos Dagres, DE; Nicolas Danchin, FR; David Erlinge, SE; Jonathan Emberson, GB; Michael Glikson, IL; Alastair Gray, GB; Meral Kayikcioglu, TR; Aldo P. Maggioni, IT; Klaudia Vivien Nagy, HU; Aleksandr Nedoshivin, RU; Anna-Sonia Petronio, IT; Jolien Roos-Hesselink, NL; Lars Wallentin, SE; Uwe Zeymer, DE

Steering Committee (Executive Committee and National Coordinators)

I Executive Committee

Kornelia Kotseva, GB (Chair EUROASPIRE V Steering Committee); Guy De Backer, BE (Chair EUROASPIRE V Executive Committee); Dirk De Bacquer, BE; Herve Druais, FR; Diederick E. Grobbee, NL; Arno W. Hoes, NL; Aldo P. Maggioni, IT; Pedro Marques-Vidal, CH; Lars Rydén, SE; David A. Wood, GB

II National Coordinators

Ana Abreu, PT; Carlos Aguiar, PT; Jolita Badariene, LT; Jan Bruthans, CZ; Almudena Castro Conde, ES; Renata Cifkova, CZ; Jim Crowley, IE; Kairat Davletov, KZ; Delphine De Smedt, BE; Johan De Sutter, BE; Jaap W. Deckers, NL; Mirza Dilic, BA; Vilnis Dzerve, LV; Maryna Dolzhenko, UA; Andrejs Ērglis, LV; Zlatko Fras, SI; Dan Gaita, RO; Nina Gotcheva, BG; Hosam Hasan-Ali, EG; Peter Heuschmann, DE; Piotr Jankowski, PL; Nebojsa Lalic, SRB; Seppo Lehto, FI; Christos Lionis, GR;

Dragan Lovic, SRB; Aldo P. Maggioni, IT; Silvia Mancas, RO; Davor Miličić, HR; Erkin Mirrakhimov, KG; Rafael Oganov, RU; Nana Pogosova, RU; Željko Reiner, HR; Lars Ryden, SE; Stefan Störk, DE; Lale Tokgözoğlu, TU; Konstantinos Tsioufis, GR; Dusko Vulic, BA; David A. Wood, GB.

Coordinating centre
Agnieszka Adamska, GB; Sabina Adamska, GB; Catriona Jennings, GB; Kornelia Kotseva, GB; David A. Wood GB;

Diabetes centre
Viveca Gyberg, SE; Linda Mellbin, SE; Oliver Schnell, DE; Lars Rydén, SE; Jaakko Tuomilehto, FI;

Statistical analysis centre
Dirk De Bacquer,BE; Guy De Backer, BE

Central laboratory
Laura Raman, FI; Jouko Sundvall, FI

Investigators
Bosnia & Herzegovina: *Sarajevo*: A. Begic, M. Dilic, Z. Jatic , A. Keco, A. Osmanagic, N. Trifunovic, Banja Luka: D. Vulic, *Banja Luka*: D. Djekic, *Banja Luka*: M.Popovic, G.Tesanovic, *Banja Luka*: N.Todorovic, *Banja Luka*: K.Stanetic, *Banja Luka*: V. Petrovic, *Banja Luka*: N. Pilipovic-Broceta, *Banja Luka*: B. Djukic, *Banja Luka*: B. Milankovic, *Banja Luka*: S. Savic; **Bulgaria:** *Sofia*: B. Georgiev, N. Manova, N. Gotcheva, A. Terziev, G. Vladimirov, *Sofia*: T. Doychinova, M. Nikolova, *Varna:* S. Doncheva, S. Ivanova, B. Kanazirev, S. Nikolaeva, D. Tonkova, M. Vetkova; **Croatia** *Zagreb*: D. Milicic, Z. Reiner, J. Samardzic; *Zagreb:* V. Cerovecki, I. Kermc, *Zagreb*: Z. Ozvacic Adzic, *Zagreb:* G. Petricek, *Zagreb*: M. Hanzevacki, *Zagreb:* K. Kranjcevic, *Zagreb:* I. Jukic-Vojnic, *Zagreb*: I. Pecek, *Zagreb:* N. Buljan, *Zagreb:* V. Bralic Lang; **Czech Republic:** *Prague*: J. Bruthans, R. Cífková, Z. Petržílková, P. Šulc, *Prague*: P. Herle, *Prague*: M Kerner; **Egypt:** *Assiut*: K. Elmaghraby, H. B. Hamed, H. Hasan-Ali, N. Mohamed, E. Mosad *Aswan*: A. Ibrahim, M. A. Elsharef, E. F. Kholef**,** *Cairo*: A. Elamragy, A. Youssef, *Zagazig*: T. M. Moustafa, M. S. Sobieh; **Greece:** *Heraklion Crete*: C. Lionis, *Heraklion Crete*: T. Vasilopoulos, D. Vasilakis, I. Trachanatzi, *Heraklion Crete*: F. Anastasiou, G. Duijker, K. Moschou, M. Titaki, **Kazakhstan**: *Almaty*: B. Assembekov, B. Amirov, S. Berkinbaev, Y. Chernokurova, K. Davletov, F. Ibragimova**,** *Almaty*: N. Ermekkyzy, N. Chektikbaeva, G. Aldibekova**,** *Almaty*: Z. Ayekeshov**,** *Almaty*: A. Smagulova, S. Kenebaeva, F. Zaureshbekova**,** *Almaty*: F. Umarova, M. Zhumakun, K. Erlanova**,** *Almaty*: K. Aitkazina**,** *Almaty*: G. Nurmagambetova; **Kyrgyzstan**: *Bishkek*: E. Hodzhiboboev, E. Mirrakhimov, K. Neronova, U. Zakirov, *Bishkek*: S. Abilova, E. Bektasheva, J. Esenbekova, A. Turusbekova**,** *Osh:* A. Kerimkulova, J. Turganbaeva, U. Toktomamatov, A. Asanbaev, R. Arapova, *Osh*: O. Lunegova, K. Ergeshova, N. Asanaliev, N. Mamasydykova; **Lithuania**: *Vilnius*: J. Badarienė, L. Vencevičienė, I. Eitaviciute, K. Vencevicius, *Kaunas:* G. Urbonas, I. Valciukaite, L. Petrauskas, J. Karpaviciene, G. Lazarenkiene; **Poland**: *Krakow*: D. Czarnecka, P. Jankowski, *Bydgoszcz*: A. Andruszkiewicz, K. Buczkowski, A. Kubica, A. Kosobucka, P. Michalski, Ł. Pietrzykowski, *Bydgoszcz*: D. Borowska, P. Michalski, Ł. Pietrzykowski, *Łódź*: A. Kubica, P. Michalski M. Timler; **Portugal***:* *Lisboa Norte*: A. Abreu, *Lisboa Ocidental*: C. Aguiar, *Sacavém*: P. Brás, A. Castelo, M. Cruz, V. Ferreira, A. Gonçalves, T. Mano, T. Mendonça, L. Morais, R. Moreira, J. Pereira, R. Pires, J. Reis, I. Rodrigues, J. Sanches, C. Silva, H. Tiny, *Oeiras*: C. Brízido, A. Félix de Oliveira, F. Fernandes da Gama, M. Gonçalves, G. Mendes, M. H. Febra, A. S. Figueira, M. Chen, A. Oliveira, C. Ferreira, J. Sanches, R. Sanches; **Romania**: *Timisoara*: D. Baibata, L. Bizau, O. Cosor, L. Craciun, L. Gaita, D. Gaita, S. Mosteoru, *Iasi:* F. Mitu, R. S. Gavril, O. Mitu; **Russian Federation**: *Moscow*: A. Arutyunov, A. Ausheva, T. Gusarova, S. Isakova, A. Karpova, I. Lelchuk, N. Pogosova, A. Salbieva, O. Sokolova, Y. Yufereva, *Moscow*: A. Allenov, S. Strelkova, Moscow: I. Polunina, *Moscow:* O. Krasilnikova, I. Korzhenevskaya, *Moscow:* E. Kasparova, M. Shebzukhova, *Barnaul*: I. Osipova, O. Antropova, L. Borisova, N. Pyrikova, I. Polyakova; **Sweden:** *Stockholm*: V. Gyberg, L. Rydén, S. Smetana, V. Boström-Nilsson**,** *Stockholm*: P. Papachristou, *Lindingo*: L. Forsell, *Danderyd*: V. Gyberg, *Vallentuna*: M. Murén; *Stockholm*: S. Skeppholm, *Hasselby:* P. Löf; **Ukraine:** Kiev: M. Dolzhenko, C. Faradj, L. Grybyak, L. Konoplyanik, N. Kozhuhareva, L. Lobach, T. Mostepan, O. Nudchenko, T. Simagina, V. Tkachenko, L. Yakovenko, *Kharkiv:* S. Serik, T. Ovrakh**;** *Lviv*: A. Bazylevych, M. Bazylevych**,** *Kryvyj Rig*: V. Potabashniy, V. Fesenko, V. Asarenko**,** *Dnipro*: T. Kolesnyk, H. Kosova, A. Nadiuk, *Zaporizhzhya:* O. Shershnyova, L. Panchenko;

United Kingdom*: London*: A. Adamska, S. Adamska; C. Jennings, K. Kotseva, D. Wood, *London*: F. Doyle, S. Shillito, M. Zerominska**,** Harrow: I. Khan, R. Coles,

N. Coote, P. Griffiths, O. Hussein, B. Joseph**,** *West Midlands*: A. Ballintine, A. Isaew, S. Spannuth, J. Timmins, S. Uddin; *Birmingham*: J. Taylor; *Stirchley*: N. Chauhan, *West Midlands*: A. Agasou, L. Andrew, R. Hibbell, S. Hollishead, J. Howell, S. Hunt, S. Jones, S. Mazilu-Wood, M. Oakley, L. Rosenberg, J. Simm, C. Thornley, J. Wilson, *Oswetry*: M. Arthur, *Oswetry*: T. Nyguyen**,** *Oswetry:* C. Bell, *West Midlands*: C. Brown, J. Davies, N. Ghuman, C. Talbot, *Kenilworth*: R. Crowe, *Worcester:* C. Jones, *East Midlands*: J. Beecham, S. Bosel-Doyle, K. Duff, *Bourne*: L. S. Taylor, T. Mason, *Gainsborough:* S. Taylor, P. Steadman