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Lifestyle and risk factor management in people at high risk of cardiovascular disease. A report from the European Society of Cardiology European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) IV cross-sectional survey in 14 European regions

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Abstract

Background: European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) IV in primary care was a cross-sectional survey carried out by the European Society of Cardiology, EURObservational Research Programme in 2014–2015 in 71 centres from 14 European countries. The main objective was to determine whether the 2012 Joint European Societies' guidelines on cardiovascular disease (CVD) prevention in people at high CVD risk have been followed in clinical practice.

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Methods: Patients without a history of atherosclerotic disease started on either blood pressure and/or lipid and/or glucose-lowering treatments were identified and interviewed at least six months after the start of medication.
Results: Medical notes of 6700 patients were reviewed, and 4579 patients (58.7% women; mean age 58.8 (standard deviation (SD) 11.3) years) interviewed (interview rate 68.3%). Overall, 16.6% were smokers, 39.9% were overweight (body mass index (BMI)$\geq$25 and $<$30 kg/m^2), 43.5% obese (BMI $\geq$30 kg/m^2) and 63.9% centrally obese (waist circumference of $\geq$88 cm for women, $\geq$102 cm for men). The medical risk factor control was very poor, with less than half (42.8%) of the patients on blood pressure lowering medication reaching the target of $<$140/90 mm Hg ($<$140/80 mm Hg in people with self-reported diabetes). Among treated dyslipidaemic patients only 32.7% attained the low-density lipoprotein (LDL)-cholesterol target of $<$2.5 mmol/l. Among people treated for type 2 diabetes mellitus, 58.5% achieved the glycated haemoglobin (HbA1c) target of $<$7.0%.
Conclusion: The EUROASPIRE IV survey shows that large proportions of patients at high CVD risk have unhealthy lifestyle habits and uncontrolled blood pressure, lipids and diabetes. The present data make it clear that more efforts must be taken to improve cardiovascular prevention in people at high CVD risk.

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

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Introduction

The main objectives of cardiovascular disease (CVD) prevention are to reduce morbidity and premature mortality, improve quality of life and increase longevity.[1] The European Society of Cardiology (ESC) together with other partner societies has engaged in a comprehensive programme of CVD prevention in clinical practice for many years.[2] Guidelines on this important topic have been developed and updated at regular intervals over the last 20 years: 1994, 1998, 2003, 2007 and 2012.[1,3–6] It is emphasised that the highest clinical priority for prevention should be directed towards patients with coronary or other atherosclerotic disease, and those at high risk of developing CVD. Guideline implementation in daily practice has been evaluated with four cross-sectional surveys called European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) conducted under the auspices of ESC Euro Heart Survey programme in patients with coronary heart disease in 1995–1996, 1999–2000, 2006–2008 and in 2013–2015 through the EURObservational Research Programme.[7–15] For the first time, the two most recent surveys included individuals free from any manifestations of CVD but living with a high risk of developing CVD because of arterial hypertension, dyslipidaemia or type 2 diabetes.[12] The aim of the primary care arm of EUROASPIRE IV was to determine whether the 2012 Joint European Societies (JES) guidelines on CVD prevention in people at high cardiovascular risk are being followed in clinical practice.

Study population and methods

Study design

The primary care arm of EUROASPIRE IV was a cross-sectional survey carried out from January 2014–April 2015 in 71 primary care centres in Bosnia and Herzegovina, Bulgaria, Croatia, Kazakhstan, Lithuania, Poland, Portugal, Romania, Russian Federation, Serbia, Spain, Sweden, Ukraine and the UK. Within each country one or more geographical areas with a defined population were selected and a sample of one or more general practices or health centres serving that population were identified according to the structure of the local health services. Not all countries that participated in the hospital arm of EUROASPIRE IV were able to join the primary care study due to logistics issues and differences in the organisation of primary care.

Study population

Within each general practice men and women $\geq$18 to $<$80 years at the time of identification, without a history of coronary or other atherosclerotic disease, who had been prescribed one or more of the following treatments: (a) blood pressure lowering drugs and/or (b) lipid-lowering drugs and/or (c) glucose-lowering (diet and/or oral drugs and/or insulin), $\geq$6 months to $<$3 years prior to the date of interview, were identified retrospectively from practice records. Patients sampled by each of these treatments might have been using one or more of the other drug therapies.

Data collection

Centrally trained research staff undertook data collection using standardised methods and the same instruments in all centres. They reviewed patient medical notes and interviewed and examined the patients at the general practice or home at least six months after the prescription of blood pressure, lipid or glucose-lowering therapy.

Height and weight (scales 701 and measuring stick model 220; SECA Medical Measuring Systems and Scales, Birmingham, UK) and waist circumference[16] (metal tape applied horizontally at the point midway in the mid-axillary line between the lowest rim of the rib cage and the superior iliac crest) were recorded. Being overweight was defined as a body mass index (BMI)$\geq$25 to $<$30 kg/m^2 and obesity as BMI$\geq$30 kg/m^2. Abdominal overweight was defined as a waist circumference $\geq$94 cm in men, $\geq$80 cm in women 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 using an automatic digital sphygmomanometer (Omron M6; OMRON Corporation, Kyoto, Japan) and the mean was used for the analyses. 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$140/80 mm Hg in patients with diabetes).

Breath carbon monoxide (CO) was measured in ppm using a smokerlyser (Model Micro+ Bedfont Scientific, Harrietsham, UK). Smoking was defined as self-reported smoking, and/or a breath CO exceeding 10 ppm.[17]

Habitual physical activity was assessed with the following question:

> Which of the following four alternatives describes your level of activity outside work in the best way?
>
> a. No physical activity weekly,
> b. Only light physical activity in most weeks,
> c. Vigorous physical activity at least 20 minutes once or twice a week,
> d. Vigorous physical activity for at least 20 minutes three or more times a week.

Fasting (10 h) venous blood samples were taken in the sitting position with light stasis into a tube containing clot activator (Venosafe, Terumo Europe, Leuven, Belgium) for lipid assays and into a potassium Ethylenediaminetetraacetic acid (EDTA) tube (Venosafe) for glycated haemoglobin (HbA1c) assay. Serum was separated by centrifuging at 2000 g for 10 min at room temperature and aliquoted into two bar-code-labelled tubes that were stored locally together with whole EDTA blood tubes at a minimum of –70°C for subsequent transportation to the central laboratory at the Disease Risk Unit, National Institute for Health and Welfare, Helsinki, Finland where all measurements were performed on a clinical chemistry analyser (Architect c8000; Abbott Laboratories, Abbott Park, Illinois, USA). The laboratory has been accredited by the Finnish Accreditation Service and fulfils the requirements of the standard SFS-EN ISO/IEC 17025:2005.

Total and high density lipoprotein cholesterol (HDL-C) and triglycerides were analysed in serum, and HbA1c in whole blood with the following methods: enzymatic method for total cholesterol, a homogenous method for direct measurement of HDL-C, an enzymatic glycerol phosphate oxidase method for triglycerides, and an immunoturbidimetric method for HbA1c. LDL cholesterol (LDL-C) was calculated according to Friedewald's formula.[18] Elevated LDL-C concentration was defined as $\geq$2.5 mmol/l. Elevated HbA1c was defined as $\geq$7.0% (Diabetes Control and Complications Trial (DCCT)).

The laboratory takes part in the Lipid Standardization Program organized by Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA and External Quality Assessment Schemes organized by Labquality, Helsinki, Finland. During the course of the study, comprising two months in 2013, the coefficient of variation (mean$\pm$standard deviation (SD)) and systematic error (bias) (mean $\pm$ SD) were 1.3% $\pm$ 0.2 and 1.7% $\pm$ 1.1 for total cholesterol, 1.6% $\pm$ 0.5 and –1.5% $\pm$ 1.6 for HDL-C, 2.3% $\pm$ 0.1 and –1.2% $\pm$ 2.6 for triglycerides, and 1.9% $\pm$ 0.1 and 1.4% $\pm$ 0.2 for HbA1c, respectively.

Data management

The EURObservational Research Programme at the European Heart House (Nice, France) was in charge of data management. All data were collected electronically through web-based data entry using a unique identification number for country, centre and individual. The data were submitted via the Internet to the data management centre where checks for completeness, internal consistency and accuracy were run. All data were stored under the provisions of the National Data Protection Regulations.

Statistical analyses

Sample size calculations indicated that a sample of 400 patients attending interview was sufficient to estimate prevalence of risk factors with precision of at least 5% and with a confidence interval of 95%. Descriptive

Table 1. Distribution of study population by country, age and gender.

	Female, % (*n*)	Age, mean (SD)	Age≥60 years, % (*n*)
Centre			
Bosnia and Herzegovina[d]	53.2 (118/222)	62.3 (8.9)	58.1 (129/222)
Bulgaria	49.5 (93/188)	60.0 (12.2)	60.6 (114/188)
Croatia	57.9 (232/401)	62.7 (10.1)	64.1 (257/401)
Kazakhstan	68.3 (285/417)	57.2 (9.1)	39.8 (166/417)
Lithuania	55.8 (223/400)	54.0 (9.1)	28.3 (113/400)
Poland	55.8 (261/468)	56.8 (10.5)	42.9 (201/468)
Portugal	53.8 (211/392)	65.9 (9.4)	75.5 (296/392)
Romania	60.2 (239/397)	55.5 (12.5)	39.5 (157/397)
Russian Federation	71.6 (290/405)	56.0 (10.1)	30.4 (123/405)
Serbia	57.2 (103/180)	51.0 (14.2)	30.6 (55/180)
Spain	46.6 (75/161)	66.9 (8.9)	76.4 (123/161)
Sweden	51.3 (77/150)	64.9 (9.0)	72.7 (109/150)
Ukraine	64.1 (263/410)	56.8 (11.4)	43.4 (178/410)
United Kingdom	45.6 (177/388)	61.0 (11.5)	55.9 (217/388)
Reasons for inclusion			
Blood pressure lowering therapy	59.2 (1920/3243)	58.9 (11.0)	48.5 (1574/3243)
Lipid-lowering therapy	57.0 (676/1186)	60.8 (10.7)	56.2 (667/1186)
Glucose-lowering therapy	52.1 (570/1094)	59.7 (11.7)	52.7 (577/1094)
All	57.8 (2647/4579)	58.8 (11.3)	48.9 (2238/4579)

SD: standard deviation.

statistics were used to estimate the prevalence of risk factors and medication use by country, gender and age at interview. All statistical analyses were undertaken using SAS statistical software (release 9.4) in the Department of Public Health, Ghent University, Belgium.

Ethical procedures

The local ethics committees of all participating countries approved the EUROASPIRE IV protocol. Written, informed consent was obtained from each participant.

Outcome measures

The main outcome measures were the proportions of high CVD risk individuals achieving the lifestyle and risk factor targets defined in the 2012 JES guidelines on CVD prevention in clinical practice: not smoking, healthy food choices and be physically active; a BMI<25 kg/m^2; blood pressure<140/90 mm Hg (<140/80 mm Hg in patients with diabetes), LDL-C<2.5 mmol/l, and appropriate use of cardioprotective drug therapies for treatment of elevated blood pressure, lipids and glucose.

Results

Patient characteristics

A total of 6700 medical notes were reviewed and 4579 patients interviewed after the start of drug treatment (interview rate 68.3%). The comparison of patients interviewed with those who were not, showed that women and patients older than 60 years were significantly more likely to attend the interview. Of those interviewed, the mean (SD) age was 58.8 (11.3) years and 2647 (57.8%) were women (Table 1).

Study outcomes

Lifestyle. The prevalence of smoking, obesity and central obesity is presented in Table 2. The overall prevalence of smoking (self-reported and/or CO in breath >10 ppm) was 16.6% (men 22.0%, women 12.7%) and higher in patients <60 years of age. Less than half of current smokers (42.2%) reported having the intention to quit smoking within the next six months. Although the majority of smokers had been offered personal advice by a health professional to stop smoking (73.5%), only 11.1% had been referred to smoking cessation clinic. Advice to use nicotine replacement therapy (NRT) had been given to 11.6% of the smokers

Table 2. Prevalence of smoking, obesity and central obesity by country, age and gender.

	Smoking[a]% (*n*)		Obesity[b] % (*n*)		Central obesity[c] % (*n*)	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Centre						
Bosnia and Herzegovina	20.2 (21/104)	5.9 (7/118)	14.5 (12/83)	20.2 (20/99)	18.3 (11/60)	73.5 (61/83)
Bulgaria	29.5 (28/95)	15.1 (14/93)	60.0 (57/95)	39.8 (37/93)	82.1 (78/95)	89.2 (83/93)
Croatia	20.7 (35/169)	21.1 (49/232)	45.0 (76/169)	44.4 (103/232)	57.4 (97/169)	69.8 (162/232)
Kazakhstan	33.3 (44/132)	14.0 (40/285)	45.5 (60/132)	44.2 (126/285)	56.8 (75/132)	79.9 (227/284)
Lithuania	26.0 (46/177)	10.8 (24/223)	54.2 (96/177)	55.5 (122/220)	65.5 (116/177)	74.1 (163/220)
Poland	26.1 (54/207)	19.2 (50/261)	42.7 (88/206)	37.5 (98/261)	46.4 (96/207)	68.2 (178/261)
Portugal	12.7 (23/181)	7.6 (16/211)	33.5 (60/179)	42.2 (89/211)	57.9 (103/178)	76.3 (161/211)
Romania	13.9 (22/158)	5.9 (14/239)	40.5 (64/158)	51.9 (124/239)	39.9 (63/158)	71.1 (170/239)
Russian Federation	31.3 (36/115)	12.4 (36/290)	48.7 (56/115)	59.6 (171/287)	44.1 (49/111)	70.6 (199/282)
Serbia	46.8 (36/77)	34.0 (35/103)	24.3 (17/70)	22.5 (23/102)	48.5 (16/33)	62.7 (37/59)
Spain	12.8 (11/86)	16.0 (12/75)	40.7 (35/86)	64.0 (48/75)	70.9 (61/86)	80.0 (60/75)
Sweden	12.3 (9/73)	6.5 (5/77)	35.6 (26/73)	29.9 (23/77)	57.5 (42/73)	63.6 (49/77)
Ukraine	25.9 (38/147)	4.2 (11/263)	36.1 (53/147)	54.0 (142/263)	41.5 (61/147)	68.4 (180/263)
United Kingdom	10.9 (23/211)	13.0 (23/177)	32.2 (68/211)	40.7 (72/177)	44.1 (93/211)	65.9 (116/176)
Age						
<60 years	29.5 (305/1035)	17.5 (228/1306)	42.9 (440/1026)	44.7 (581/1299)	51.0 (503/986)	70.4 (884/1255)
≥60 years	13.5 (121/897)	8.1 (108/1341)	37.5 (328/875)	46.7 (617/1322)	53.8 (458/851)	74.0 (962/1300)
All	22.0 (426/1932)	12.7 (336/2647)	40.4 (768/1901)	45.7 (1198/2621)	52.3 (961/1837)	72.3 (1846/2555)

[a]Self-reported smoking or carbon monoxide (CO) in breath >10 ppm; [b]body mass index ≥30 kg/m^2; [c]waist circumference ≥88/102 cm for women/men; [d]the percentage of missing values in waist circumference in Bosnia and Herzegovina makes gender comparisons difficult.

and bupropion and varenicline had been prescribed to 2.6% and 2.9% of them, respectively.

Overall, 39.9% of patients (men 45.6%, women 35.9%) were overweight and 43.5% (men 40.4%, women 45.7%) were obese. The prevalence of abdominal overweight was 84.9%, higher in women (89.8%) than in men (78.1%) and 63.9% (men 52.3%, women 72.3%) were centrally obese. One in five of obese patients (20.1%) have never been told by a health professional that they were overweight and just over half (52.2%) planned to lose weight in the next month. About two-thirds (65.2%) of obese patients had received a personal dietary recommendation by a health professional and 59.0% were advised to participate in regular physical activity but less than half of them took steps to lose weight by increasing physical activity (39.3%). In this survey, less than a fifth (18.4%) of patients (men 23.6%, women 13.0%) performed vigorous physical activity during at least 20 min on three or more times/week. In addition, less than one in five patients (14.1%) had been advised to attend some form of CVD prevention programme. The reported lifestyle changes are presented in Table 3.

Blood pressure. Just over half of patients not using blood pressure lowering medication had a normal blood pressure (total 53.8%, men 44.0%, women 62.0%). Overall, 82.7% of patients were on blood pressure lowering medication at the time of interview. However, less than half (42.8%, men 35.0%, women 48.4%) reached the target of <140/90 mm Hg (<140/80 mm Hg in people with diabetes) (Table 4). Four of five patients (85.4%) on blood pressure lowering medication were aware of their blood pressure level and 67.9% of the recommended blood pressure target. The most commonly prescribed medication were inhibitors of renin angiotensin systems (angiotensin-converting-enzyme (ACE) inhibitors/ angiotensin receptor blockers (ARBs); 79.8%), followed by beta-blockers (36.8%), diuretics (38.3%) and calcium channel blockers (29.1%).

Lipids. One third of the patients (35.6%) were on lipid-lowering drug therapy. Of these patients 96.1% were on statins, 4.6% on fibrates, 1.4% on ezetimibe and 0.4% on other lipid-lowering drugs. Only a minority of those prescribed lipid-lowering drugs reached the LDL-C target of <2.5 mmol/l (total 32.7%, men 39.9%, women 27.0%) (Table 5). Less than half (47.1%) of patients on lipid-lowering medication had been informed of their cholesterol levels and 38.7% were aware of their target. Only one in 10 (10.7%) of the patients without any lipid-lowering medication had a LDL-C<2.5 mmol/l (men 12.3%, women 9.6%).

Table 3. Reported lifestyle changes taken by patients to reduce their risk of heart disease within the last three years by gender.

	Lifestyle changes % (*n*)		
	Men	Women	All
Smoking[a]			
Abstinence	19.2 (77/401)	21.8 (68/312)	20.3 (145/713)
Reduction	46.6 (190/408)	49.8 (158/317)	48.0 (348/725)
Smoking cessation clinic	2.7 (11/407)	3.8 (12/315)	3.2 (23/722)
NRT	6.1 (25/408)	6.6 (21/316)	6.4 (46/724)
Bupropion	1.0 (4/405)	1.0 (3/314)	1.0 (7/719)
Varenicline	1.0 (4/405)	1.6 (5/314)	1.3 (9/719)
In patients with BMI $\geq$30 kg/m^2			
Reduction of fat	74.9 (747/997)	74.5 (689/925)	74.7 (1436/1922)
Reduction of calories	63.8 (627/982)	61.1 (557/911)	62.5 (1184/1893)
Increased everyday physical activity	40.2 (400/995)	38.4 (358/932)	39.3 (758/1927)
In patients using BP lowering medication			
Special diet	46.0 (699/1520)	47.3 (1025/2165)	46.8 (1724/3685)
Reduction of salt	70.6 (1080/1530)	75.2 (1640/2180)	73.3 (2720/3710)
Increased everyday physical activity	41.4 (635/1535)	41.0 (892/2178)	41.1 (1527/3713)
In patients using lipid-lowering medications			
Special diet[b]	54.6 (388/710)	64.9 (569/877)	60.3 (957/1587)
Reduction of fat	72.8 (525/721)	78.9 (697/883)	76.2 (1222/1604)
More fruit and vegetables	79.6 (575/722)	80.9 (711/879)	80.3 (1286/1601)
More fish	64.4 (462/717)	64.8 (568/876)	64.7 (1030/1593)
Increased everyday physical activity	44.7 (322/720)	42.7 (376/880)	43.6 (698/1600)
In patients with diabetes			
Reduction of fat	73.9 (442/598)	80.0 (509/636)	77.1 (951/1234)
More fruit and vegetables	79.1 (446/589)	83.0 (526/634)	81.1 (992/1223)
Less sugar	83.7 (503/601)	83.8 (538/642)	83.7 (1041/1243)
Less alcohol	62.4 (369/591)	52.6 (332/631)	57.4 (701/1222)
Increased everyday physical activity	45.7(274/600)	47.9(307/641)	46.8 (581/1241)

BMI: body mass index; BP: blood pressure; NRT: nicotine replacement therapy.
[a]Change during the last three years reported by smokers; [b]prescribed by a doctor or other health professional.

Diabetes. The proportion of study patients with self-reported diabetes at interview was 27.7%, higher in men (31.9%) than in women (24.7%). The majority (75.1%) were on oral glucose-lowering drugs while 18.3% had been prescribed insulin and 8.6% diet only. Somewhat more than half (58.5%) had a HbA1c<7.0% (Table 6), and a minority (24.3%) had been informed of their HbA1c target. In people with diabetes, statins were prescribed in 40.8% and inhibitors of the renin angiotensin system in 63.4%.

Discussion

Principal findings

There is a wealth of scientific evidence that lifestyle adaptations and CVD risk factor management can reduce the risk of future atherosclerotic events in people at high CVD risk.[1,19–24] Still, as shown by EUROASPIRE IV, the implementation of evidence-based CVD prevention guidelines in general practice is far from optimal. A large majority of high CVD risk patients in Europe are failing to achieve their lifestyle, blood pressure, lipids and diabetes goals. This is true even considering the large variation between countries in lifestyle and risk factor management and in the use of cardioprotective therapies. The high prevalences of smoking, obesity and central obesity are major causes for concern. Only a small minority of high-risk patients were advised to participate in a CVD prevention programme and the majority of those on blood pressure and lipid-lowering medication did not achieve the targets defined in the Fifth Joint European Societies' guidelines on CVD prevention. Moreover many of the patients were not informed on their treatment targets. Thus there is a substantial gap between

Table 4. Control of blood pressure by country, age and gender.

	Blood pressure at goal[a] (%) *n*			
	No BP lowering medication[b]		On BP lowering medication[b]	
	Men	*Women*	*Men*	*Women*
Centre				
Bosnia and Herzegovina	0.0 (0/3)	100 (4/4)	39.6 (40/101)	41.2 (47/114)
Bulgaria			32.6 (31/95)	37.6 (35/93)
Croatia	37.5 (6/16)	66.7 (18/27)	26.8 (41/153)	40.2 (82/204)
Kazakhstan	46.7 (7/15)	72.0 (18/25)	39.3 (46/117)	55.4 (144/260)
Lithuania	29.0 (9/31)	58.8 (20/34)	32.9 (47/143)	45.7 (85/186)
Poland	31.1 (23/74)	60.9 (53/87)	29.2 (38/130)	41.0 (71/173)
Portugal	52.4 (11/21)	52.9 (9/17)	27.7 (44/159)	44.8 (87/194)
Romania	50.0 (26/52)	57.4 (39/68)	22.6 (24/106)	32.2 (55/171)
Russian Federation	69.2 (9/13)	76.5 (13/17)	58.6 (58/99)	71.8 (188/262)
Serbia	56.7 (17/30)	67.6 (25/37)	62.2 (28/45)	69.2 (45/65)
Spain	50.0 (4/8)	59.1 (13/22)	37.2 (29/78)	32.1 (17/53)
Sweden	0.0 (0/2)	40.0 (4/10)	30.9 (21/68)	57.6 (38/66)
Ukraine	33.3 (5/15)	50.0 (9/18)	38.2 (50/131)	47.3 (116/245)
United Kingdom	51.9 (42/81)	65.5 (38/58)	36.0 (45/125)	47.9 (57/119)
Age				
<60 years	46.0 (120/261)	65.2 (165/253)	39.9 (305/764)	54.7 (568/1039)
≥60 years	39.0 (39/100)	57.3 (98/171)	30.2 (237/786)	42.8 (499/1166)
All	44.0 (159/361)	62.0 (263/424)	35.0 (542/1550)	48.4 (1067/2205)

BP: blood pressure; DBP: diastolic BP; SBP: systolic BP.
[a]SBP/DBP<140/90 mm Hg (<140/80 mm Hg in patients with diabetes); [b]BP lowering medication: angiotensin-converting-enzyme (ACE) inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers, diuretics, alpha-blockers.

evidence-based guidelines and everyday clinical practice.

In the primary care arm of EUROASPIRE IV, nearly one-fifth of high-risk patients were smokers at the time of interview. Of worry is that the prevalence of smoking was higher in younger patients and that a large majority of those smoking at the time of identification as at high CVD risk still smoked at the interview. Stopping smoking is the most cost-effective strategy for CVD prevention.[1,19] Yet, only a minority of smokers attended smoking cessation clinic and/or were prescribed pharmacotherapy. Despite being labelled as high CVD risk, only two-fifths of smokers intended to quit smoking within the next six months following interview.

Healthy diet and weight reduction in overweight and obese people is recommended in order to reduce blood pressure, lipids and risk of type 2 diabetes mellitus.[1,20] A large majority of the patients in EUROASPIRE IV were overweight or obese and two-thirds centrally obese. Although a majority had attempted dietary amendments to lose weight less than half reported on increasing everyday physical activity. Indeed less than 20% of the patients reported performing vigorous physical activity for at least 20 minutes three or more times a week.

Good blood pressure, lipid and glycaemic control reduce the risk of CVD. [1,21–25] In this survey, the management of blood pressure was poor with less than half of patients on blood pressure lowering medication achieving recommended targets. Importantly, a large proportion of patients selected as at high risk because of treated hyperlipidaemia and/or diabetes had elevated blood pressure without any prescription of blood pressure reducing therapy. The control of LDL-C in patients on lipid-lowering medication was inadequate, with only 30% of patients achieving the target. Considerable gender differences were observed in lipid and blood pressure goal achievement, with a better control of lipids in men and blood pressure in women. Similarly to blood pressure, many patients identified as at high risk because of treated hypertension and/or diabetes had elevated LDL-C without any lipid-lowering medication. Accordingly many of the EUROASPIRE IV patients with high blood pressure and/or high cholesterol seemed to be unaware of or indeed not diagnosed as having hypertension and/or dyslipidaemia. An explanation may be that general

Table 5. Control of low-density lipoprotein (LDL) cholesterol by country, age and gender.

	LDL cholesterol at goal[a] (%) *n*			
	No lipid-lowering medication[b]		On lipid-lowering medication[b]	
	Men	*Women*	*Men*	*Women*
Centre				
Bosnia and Herzegovina	16.3 (8/49)	10.9 (7/64)	29.0 (9/31)	22.2 (8/36)
Bulgaria	12.2 (6/49)	11.1 (6/54)	42.1 (8/19)	13.6 (3/22)
Croatia	10.3 (9/87)	4.8 (7/145)	41.8 (23/55)	34.8 (24/69)
Kazakhstan	11.0 (13/118)	7.1 (19/268)	50.0 (2/4)	25.0 (2/8)
Lithuania	5.9 (6/102)	4.2 (6/143)	13.5 (5/37)	17.4 (12/69)
Poland	5.6 (7/126)	6.8 (10/148)	33.8 (23/68)	26.2 (28/107)
Portugal	8.5 (6/71)	8.0 (7/87)	32.7 (33/101)	17.3 (19/110)
Romania	15.7 (14/89)	19.5 (26/133)	37.9 (22/58)	33.3 (33/99)
Russian Federation	9.1 (7/77)	8.7 (18/206)	53.3 (8/15)	17.4 (8/46)
Serbia	25.0 (10/40)	17.5 (11/63)	33.3 (5/15)	25.0 (5/20)
Spain	26.3 (5/19)	23.5 (4/17)	49.1 (27/55)	28.6 (14/49)
Sweden	4.8 (2/42)	2.0 (1/49)	44.4 (12/27)	33.3 (9/27)
Ukraine	18.5 (17/92)	13.6 (24/176)	46.2 (18/39)	27.8 (20/72)
United Kingdom	22.7 (17/75)	13.8 (12/87)	51.6 (63/122)	43.2 (35/81)
Age				
<60 years	11.2 (70/627)	10.8 (98/909)	34.0 (87/256)	26.1 (78/299)
≥60 years	13.9 (57/409)	8.2 (60/731)	43.8 (171/390)	27.5 (142/516)
All	12.3 (127/1036)	9.6 (158/1640)	39.9 (258/646)	27.0 (220/815)

[a]LDL cholesterol<2.5 mmol/l; [b]lipid-lowering medication: statins, fibrates, bile acid sequestrants (anion exchange resins), nicotinic acid and its derivates, cholesterol absorption inhibitors.

practitioners still have an unifactorial approach to CVD risk based on the old fashioned medical paradigm seeing single risk factors as a disease instead of calculating the total CVD risk as recommended in the prevention guidelines. It underlines that further efforts are needed to underline the importance of screening for other CVD risk factors and estimate the global CVD risk in each patient with an already diagnosed CVD risk factor. A multifactorial risk approach is important because the CVD risk results from interaction of many risk factors, with modest increases in multiple risk factors more harmful than a significantly raised level of a single risk factor and that the concept of continuous risk should replace the dichotomous classification of risk factors. Looking at the number of risk factors (smoking, elevated blood pressure or cholesterol and diabetes) only 8.2% of patients in EUROASPIRE IV had only one risk factor, while 58.0% had two, 30.6% three and 3.2% four risk factors. Thus a substantial proportion of patients on blood pressure and/or lipid-lowering medication should have been considered as at high CVD risk. It underlines the importance to always look at the total CVD risk while treating individual risk factors since the benefits of preventive measures are greatest in people at the highest absolute CVD risk. Such approach will also avoid treatment of single risk factors in people at low multifactorial risk.

There are several explanations for the poor blood pressure and lipid control, including low-dose prescriptions, inadequate up-titration, poor patients adherence or therapeutic inertia defined as the failure of physicians to initiate or intensify therapy when therapeutic targets are not reached. In addition, monotherapy is usually insufficient for treating hypertension and many patients would require combination of two or more blood pressure lowering medications. The majority of patients in the survey (85%) reported that they took their medication 'nearly all of the time (90%)' or 'all of the time (100%)'. In such setting further possibilities to reduce recurrent cardiovascular events would be to optimise the dose of evidence-based medication and to, use combination therapies combining e.g. several blood pressure lowering compounds in one tablet.

According to the guidelines, people with type 2 diabetes should be managed as at high CVD risk. The importance of glucose control in patients with diabetes has been debated as regards protection from macrovascular but is still valid for the avoidance of microvascular complications. There are, however, reasons to believe that glucose control is of particular value in

Table 6. Control of diabetes by country, age and gender.

	HbA1c<7.0%, % (*n*)		
	Men	Women	All
Centre			
Bosnia and Herzegovina	38.9 (14/36)	35.5 (11/31)	37.3 (25/67)
Bulgaria	56.2 (9/16)	73.3 (11/15)	64.5 (20/31)
Croatia	48.3 (28/58)	48.6 (34/70)	48.4 (62/128)
Kazakhstan	28.6 (8/28)	55.6 (20/36)	43.8 (28/64)
Lithuania	77.3 (58/75)	79.3 (65/82)	78.3 (123/157)
Poland	80.0 (28/35)	75.8 (25/33)	77.9 (53/68)
Portugal	63.1 (53/84)	60.6 (40/66)	62.0 (93/150)
Romania	62.5 (10/16)	68.8 (33/48)	67.2 (43/64)
Russian Federation	60.0 (18/30)	67.5 (27/40)	64.3 (45/70)
Serbia	56.0 (14/25)	43.6 (17/39)	48.4 (31/64)
Spain	71.8 (28/39)	70.6 (24/34)	71.2 (52/73)
Sweden	50.0 (12/24)	70.6 (12/17)	58.5 (24/41)
Ukraine	33.3 (11/33)	28.8 (17/59)	30.4 (28/92)
United Kingdom	62.7 (42/67)	48.8 (20/41)	57.4 (62/108)
Age			
<60 years	57.4 (148/258)	57.8 (144/249)	57.6 (292/507)
≥60 years	60.1 (185/308)	58.6 (212/362)	59.3 (397/670)
All	58.8 (333/566)	58.3 (356/611)	58.5 (689/1177)

HbA1c: glycated haemoglobin.

patients with short diabetes duration and still without any CVD manifestations.[25] It is therefore unsatisfactory that less than 60% of patients with self-reported diabetes achieved the target of HbA1c (<7.0%). The cardioprotective medications recommended in patients with diabetes mellitus include ACE inhibitors/ARBs to reduce blood pressure to target and statins to reduce CVD risk. In this survey less than 30% of patients with known diabetes were on ACE inhibitors/ARBs and only 40% on statins.

Comparison with other surveys

The slow implementation of primary prevention guidelines in clinical practice has been reported in similar surveys in Europe and the USA.[26–35] However, some studies were focused on the control of a single risk factor (blood pressure or lipids) and there is limited comparable information on management and control of CVD risk factors in patients at high CVD risk across Europe. Blood pressure control in EUROASPIRE IV was slightly better than in the EURIKA study conducted in 2009 selecting 7641 patients from 12 European countries free of clinical CVD and with at least one major CVD risk factor.[26] Among patients with treated hypertension 38.8% achieved a blood pressure of <140/90 mm Hg (<130/90 mm Hg in people with diabetes), which may be compared to 42.8% in EUROASPIRE IV. Among treated patients with dyslipidaemia, 41.2% of patients in EURIKA attained LDL-C of <3 mmol/l, compared to 32.7% achieving LDL-C of <2.5 mmol/l in EUROASPIRE IV. An international cross-sectional observational study conducted in 3723 individuals at high risk of CVD in nine European countries found that 50.6% had elevated blood pressure >140/90 mm Hg, 59.8% had total cholesterol >5 mmol/l, 30.5% were smokers, 31.4% were obese, 76.5% were overweight, and 14.6% had a fasting glucose levels >6.1 mmol/l.[27]

Strengths and limitations

The findings of the EUROASPIRE IV survey should be considered within the context of some limitations. The most important is that patients were identified from selected geographical areas and a convenience sample of general practices according to the structure of local health services. Therefore, the patients are not necessarily representative of all high-risk patients cared for in the primary care setting of each country. Another limitation is the diagnostic characteristics. All patients were already on blood pressure and/or lipid-lowering medication and/or had diabetes mellitus averting the

assessment of the total multifactorial risk by means of SCORE or similar risk calculators. However, a large majority of patients identified on the basis of being on blood pressure and/or lipid-lowering medication and/or having diabetes did indeed have more than one uncontrolled risk factor, which will put them at high risk of developing CVD. The profile of patients in primary care may differ between centres, which for instance can explain differences in age distributions between countries. Since a comparison between countries was not the aim of the EUROASPIRE surveys no formal statistical testing adjusting for age was performed. We believe that our sample reflects a typical European patient population in the age range 18–80 years. The tables show country-specific results just to inform participating countries of their own results.

The main strength of the EUROASPIRE IV survey is that the data are not just based on a review of medical notes from general practices but on face-to-face interviews and standardised examinations, including central laboratory analyses. Patients were interviewed at least six months after starting blood pressure, lipid-lowering or diabetes medication which is sufficient time to achieve guidelines defined targets. Therefore this survey provides relevant information on preventive care in everyday general practice.

Conclusions

The implementation of evidence-based guidelines on primary prevention in everyday clinical practice is poor. Large proportions of patients at high CVD risk have high prevalences of overweight, obesity and central obesity and, in addition, blood pressure, lipids and diabetes levels above the targets defined in the prevention guidelines. There is a large heterogeneity between countries in lifestyle and risk factor management that may be explained by the differences in the characteristics of study populations, drug prescription policies and healthcare systems between countries. It is surprising that people living with high risk for CVD, but still no manifestations of CVD, get such unsatisfactory protection from future illness. The present data strongly underline the need for intense efforts to be taken not only to issue and update guidelines on cardiovascular prevention but also to enhance their implementation. Considering the present results the latter seems to be an issue that should be heavily prioritised. Such efforts should include information on the distribution of knowledge on the guidelines among different parts of the health care providers providing comprehensive risk factors management, in order to reduce the risk of CVD. There is an urgent need for CVD prevention centres to have multidisciplinary teams of health care professionals, focusing on all aspects of lifestyle and risk factor management in order to reduce the risk of CVD and improve the standards in CVD prevention in Europe.

Author contribution

KK drafted the manuscript. KK, DDB, GDB, LR, CJ, VG, AA, CA, ACC, KD, MD[9], MD[10], DG, BG, NG, NL, AL, DL, SM, DM, RO, AP, NP, ZR, DV and DW contributed to the conception or design of the work. KK, DDB, GDB, LR, CJ, VG and DW contributed to the acquisition, analysis, or interpretation of data for the work. KK, DDB, GDB, LR, CJ, VG, AA, CA, ACC, KD, MD[9], MD[10], DG, BG, NG, NL, AL, DL, SM, DM, RO, AP, NP, ZR, DV and DW critically revised the manuscript. All gave final approval and agree to be accountable for all aspects of work ensuring integrity and accuracy.

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