

# The EUROASPIRE surveys: lessons learned in cardiovascular disease prevention

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**Abstract:** The Joint European Societies (JES) guidelines on cardiovascular disease (CVD) prevention published in 1994, 1998, 2003, 2007, 2012 and 2016 defined lifestyle and risk factors targets for patients with coronary or other atherosclerotic disease and people at high risk of developing CVD. Guideline implementation in Europe has been evaluated with four cross-sectional EUROASPIRE surveys starting in mid-1990s. The results showed poor lifestyle and risk factor management in patients with CHD and in high CVD risk people with high prevalences of smoking, obesity, central obesity and diabetes. The control of blood pressure, lipids and glucose was far from optimal. A comparison across the recent three surveys provided a unique description of time trends for secondary prevention over a period of 14 years. The results showed adverse lifestyle trends, a substantial increase in obesity, central obesity and diabetes. Despite significant improvement of blood pressure and lipid control many patients were not reaching the risk factor goals and there was no change in glucose control. Comparing the most recent two surveys, there were no major differences in lifestyle and risk factor management in people at high risk of developing CVD. A new approach to CVD prevention integrating primary and secondary prevention into a modern preventive cardiology programme, focusing on lifestyle and risk factor management is required, in order to reduce the risk of CVD events and improve quality of life in patients with CHD and those at high risk of developing CVD.

**Keywords:** Cardiovascular prevention; guidelines implementation; audit; EUROASPIRE

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## Introduction

Cardiovascular disease (CVD) is the leading cause of death in Europe. Despite recent decreases in mortality rates in many countries, CVD is responsible for over 4 million deaths per year, with coronary heart disease (CHD) accounting for almost 1.8 million deaths in Europe annually. The proportion of all deaths attributable to CVD is greater among women (49%) than in men (40%), with large geographic inequalities between countries (1).

The main objectives of CVD prevention are to reduce morbidity and mortality and increase the chances of a longer life expectancy. There is a wealth of scientific evidence from observational studies and randomized controlled trials demonstrating that lifestyle interventions

in relation to smoking, diet and exercise, treatment of hypertension, hyperlipidaemia, and diabetes, and the use of prophylactic drug therapies can reduce morbidity and mortality and improve quality of life in people with CHD and those at high risk of developing CVD.

The Joint European Societies (JES) guidelines on CVD prevention published in 1994, 1998, 2003, 2007, 2012 and 2016 defined lifestyle and risk factor goals for both patients with CHD and those at high risk of developing CVD (2-7). The 2012 JES' guidelines defined the lifestyle and risk factor targets for patients with CHD and those at high risk of developing CVD: stop smoking, make healthy food choices and be physically active; a body mass index (BMI) less than 25 kg/m<sup>2</sup>; blood pressure <140/90 mmHg (<140/80 mmHg in patients with diabetes mellitus); low-density lipoprotein

(LDL) cholesterol <1.8 mmol/L (<70 mg/dL) or at least 50% reduction (patients with proven vascular disease and other very high risk subjects) and <2.5 mmol/L (<100 mg/dL) in high CVD risk individuals, glycated hemoglobin (HbA1c) <7.0 mmol/L (<53 mmol/mol) in people with diabetes mellitus, and appropriate use of medication for treatment of elevated blood pressure, lipids and glucose. In addition, in coronary patients, the appropriate use of cardioprotective drug therapies is recommended: aspirin or other platelet-active drugs, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors/angiotensin II receptor blockers (ARBs) and antithrombotic drugs (6).

Audits of clinical practice provide an objective assessment of clinical outcomes and quantify the extent to which the standards set in the guidelines on CVD prevention are being implemented in every day clinical practice. Guideline implementation in Europe was evaluated in four cross sectional surveys called EUROASPIRE (European Action on Secondary and Primary Prevention by Intervention to Reduce Events) starting in 1995–1996 in nine countries under the auspices of the Working Group on Epidemiology and Prevention, followed by a second and third surveys in 1999–2000 in 15 countries, 2006–2008 in 22 countries through the Euro Heart Survey programme and in 2012–2014 in 26 countries under the auspices of the European Society of Cardiology, EURObservational Research Programme (8–19). The two most recent surveys included for the first time individuals free from any manifestations of but at high risk of developing CVD because of arterial hypertension, dyslipidemia or type 2 diabetes. The aim of EUROASPIRE surveys was to describe lifestyle and risk factors management in coronary patients and people at high risk of developing CVD, and to see whether the practice of preventive cardiology had improved by comparison with the previous surveys. The fourth EUROASPIRE IV survey on Cardiovascular Disease prevention and Diabetes merged with the EuroHeart Survey on Diabetes Mellitus (20,21) and incorporated an assessment of dysglycaemia in all patients.

## Methods

In the hospital arm, coronary patients, men and women ( $\geq 18$  and <80 years of age at the time of their index event or procedure), with the following first or recurrent clinical diagnoses or treatments for CHD were retrospectively identified from hospital discharge lists or other sources: (I) elective or emergency CABG; (II) elective or emergency

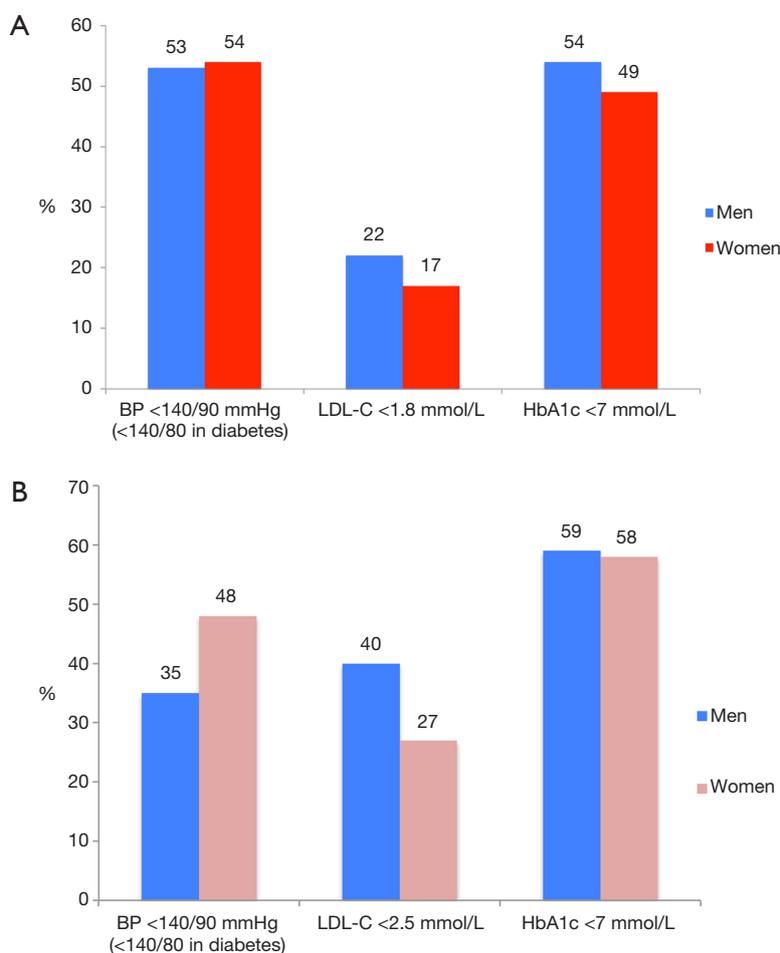
percutaneous coronary intervention (PCI); (III) acute myocardial infarction; and (IV) unstable angina. In the primary care arm, men and women ( $\geq 18$  and <80 years at the time of identification, without a history of coronary or other atherosclerotic disease, who had been prescribed one or more of the following treatments: (I) blood pressure lowering drugs and/or (II) lipid lowering drugs and/or (III) glucose lowering (diet and/or oral drugs and/or insulin), were identified retrospectively from general practice records.

Data collection was based on a review of patient's medical notes and a prospective interview and examination at least six months after acute coronary event or procedure (coronary patients) or start of blood pressure and/or lipid-lowering and/or glucose lowering therapy (high risk individuals), using standardized methods and instruments. The methodology used in EUROASPIRE I was duplicated in the second, third and fourth surveys with standardized interviews and measurements and a central laboratory for lipid and glucose analyses, so that time trends between surveys could be described.

## Results

### Hospital arm

The most recent EUROASPIRE IV survey was undertaken in 78 centres from 24 European countries. A total of 7,998 coronary patients (24% women) were interviewed on average 1.3 years following their index event (14,15). A total of 16% of patients smoked cigarettes, with only one in two (51%) of those who smoked before the index event had stopped. Little or no physical activity was reported by 60%. The prevalence rates of overweight and obesity were alarming in all countries with 38% being obese (BMI  $\geq 30$  kg/m<sup>2</sup>) and 58% centrally obese (waist circumference  $\geq 102$  cm in men or  $\geq 88$  cm in women). Blood pressure, lipids and glucose control was very poor (*Figure 1A*). Overall, 43% had blood pressure  $\geq 140/90$  mmHg ( $\geq 140/80$  mmHg in people with diabetes); 81% had LDL-cholesterol  $\geq 1.8$  mmol/L ( $>70$  mg/dL) and 27% reported having diabetes. The therapeutic control of blood pressure was poor, with only half of patients on blood pressure lowering medication (53%) being controlled (BP <140/90 mmHg; <140/80 mmHg for patients with diabetes). In those on lipid-lowering medication just over one fifth (21%) had reached the LDL cholesterol goal of <1.8 mmol/L. Only 53% of patients with self-reported diabetes had HbA1c <7.0 mmol/L. The use of



**Figure 1** Therapeutic control of blood pressure, LDL-cholesterol and glucose in people on blood pressure, lipids and glucose-lowering treatments, respectively. (A) Coronary patients; (B) people at high CVD risk. LDL, low-density lipoprotein; CVD, cardiovascular disease.

cardioprotective medication was as follows: anti-platelets 94%; beta-blockers 83%; ACE inhibitors/ARBs 75%, and statins 86%. Furthermore, only half of coronary patients (51%) were advised to participate in a CVD prevention and rehabilitation programme and 81% of those advised attended at least half of the sessions.

A comparison across the most recent three surveys provided a unique description of time trends for secondary prevention in the same countries, geographic areas and hospitals over a period of 14 years (16,17). The results showed adverse lifestyle trends, a substantial increase in obesity, central obesity and diabetes, and high prevalences of persistent smoking among younger patients and especially women. The prevalence of smoking was virtually unchanged over the three surveys with about one in five patients still smoking at the time of interview. The prevalence of

obesity and central obesity increased significantly by 7% and 6%, respectively. These adverse trends in body weight and distribution most probably contribute to the poor control of other risk factors such as raised blood pressure, dyslipidemia and diabetes. Although blood pressure and lipid management improved these risk factors were still not optimally controlled. The proportions of patients with raised blood pressure and elevated LDL cholesterol decreased significantly by 9% and by 21%, respectively. However, many patients on antihypertensive and lipid-lowering medication had not reached the blood pressure and LDL-cholesterol goal. The prevalence of diabetes increased by 9% over 14 years reflecting most probably the rising prevalence of obesity and central obesity. The glucose control in patients with self-reported diabetes remained unchanged across the three surveys with only a minority of

patients achieving the target of fasting glucose  $<7.0$  mmol/L. There appeared to be an apparent ceiling to prescribing cardioprotective medication. Although the frequency of cardioprotective drug use had substantially increased between the EUROASPIRE II and III surveys, no further significant change was observed between the third and fourth surveys. However, there was a two-fold increase in the proportion of patients on high intensity statins between the III and IV surveys.

### *Primary care arm*

In the primary care arm, the gap between evidence based guidelines and clinical practice was even greater than that seen for coronary patients (18,19). A total of 4,579 patients (59% women) in EUROASPIRE IV considered to be at high cardiovascular risk were interviewed at least 6 months after the start of blood pressure, lipid-lowering or glucose treatment (18). Overall, 17% smoked cigarettes, 44% were obese and 64% centrally obese. The risk factor control was inadequate, with only 43% of the patients on blood pressure lowering medication reaching the target of  $<140/90$  mmHg ( $<140/80$  mmHg in people with self-reported diabetes) and a third (33%) of those on lipid-lowering medication achieving the LDL-cholesterol target of  $<2.5$  mmol/L (*Figure 1B*) Glucose control among people with diabetes was unsatisfactory, with less than two thirds (59%) achieving the HbA1c target of  $<7.0\%$ . In addition many patients without any blood pressure and/or lipid lowering therapy had elevated blood pressure (46%) and elevated LDL-cholesterol (89%).

The comparison between EUROASPIRE III and IV demonstrated that there were no major differences between the two surveys in lifestyle and risk factor management in people at high risk of developing CVD (19). The prevalence of smoking was similar in both surveys. However the proportion of smokers who did not intend to quit was significantly greater in EUROASPIRE IV compared with EUROASPIRE III. The prevalence of overweight or obesity was high and identical in both surveys. No significant differences were observed in physical activity. In subjects with known arterial hypertension blood pressure was at or below guideline recommended targets in 28% in the third and 35% in the fourth survey. In people on lipid lowering drugs the LDL-C was  $<2.5$  mmol/L in 28% and 37%, respectively. In participants with known diabetes HbA1c was  $<7.0\%$  in 62% in the third and 60% in the fourth survey.

## **Discussion**

The EUROASPIRE results showed that implementation of evidence-based guidelines on CVD prevention is far from optimal. A large majority of coronary and high CVD patients in Europe did not achieve the guideline standards set by the 2012 JES' guidelines on CVD prevention in clinical practice, with high prevalences of persistent smoking, overweight, obesity and diabetes. Although, most patients were receiving cardioprotective drugs, blood pressure, lipids and diabetes control was inadequate. There was considerable variation between European countries in patients' lifestyle, risk factor prevalences and use of cardioprotective medication.

There is a wealth of scientific evidence that cardiac rehabilitation is an effective treatment for patients with CHD and reduces both cardiac and total mortality (22-24). A systematic review of 47 studies including 10,794 patients randomized to exercise-based cardiac rehabilitation or usual care demonstrated that exercise-based cardiac rehabilitation was effective in reducing total and cardiovascular mortality in medium to longer term studies by 13% and 26%, respectively, and hospital admissions in shorter term studies by 31% (23). The contribution of secondary prevention programs with or without exercise was evaluated in a meta-analysis of 63 randomized controlled trials including 21,295 patients with CHD (24). Secondary prevention programs reduced all-cause mortality by 15%, and for recurrent myocardial infarction by 17%. The effects on mortality and myocardial infarction were similar for programs without exercise, programs with exercise and exercise only programs.

The results of EUROASPIRE survey showed that despite the wealth of scientific evidence only half of patients were referred to attend a cardiac rehabilitation programme and only two-fifths participated in such a programme. So, there is considerable potential to further reduce the risk of CVD in existing cardiac rehabilitation programs. Recent studies, such as EUROACTION and Global Secondary Prevention Strategies to Limit (GOSPEL) studies, provided scientific evidence for the beneficial effect and improved prognosis in patients with CHD (25,26). A health economics analysis from EUROASPIRE III showed favorable results with an average incremental cost-effectiveness ratio (ICER) of Euro12,484 per quality-adjusted life year (QALY) (27).

Lifestyle modifications (smoking cessation, healthy eating and becoming physically active), together with effective management of blood pressure and lipids can also

reduce the risk of coronary or other atherosclerotic disease in people at high CVD risk. Yet, despite the scientific evidence, it is surprising that people living with high risk for, but still no manifestations of CVD get such unsatisfactory protection from future illness. The EUROASPIRE results strongly underlines that intense efforts must be taken not only to issue and update guidelines on cardiovascular prevention but also to enhance their implementation. Therefore, all high CVD risk patients should be offered a structured, multidisciplinary prevention program that gives an opportunity for a comprehensive evaluation and cardiovascular risk reduction.

Optimal control of CVD risk factors is one of the most effective methods for reducing vascular events in patients with CHD and in people at high CVD risk. All of them should receive professional advice on stopping smoking, healthy diet and how to increase their physical activity. The risk of future CVD can be further reduced by optimizing the prescription of cardioprotective medication, combining different drugs and up-titrating them to the doses showing efficacy and safety in clinical trials. Improving treatment adherence is a very important step in optimizing cardiovascular risk factor management. In clinical practice, physicians should always assess treatment adherence and identify reasons for non-adherence.

## Conclusions

Preventive cardiology needs a systematic, comprehensive, multidisciplinary approach, which addresses lifestyle and risk factor management by cardiologists, general practitioners, nurses and other allied health professionals, and a health care system which invests in prevention. What is required is a comprehensive risk reduction approach to lifestyle, risk factor and therapeutic management to reduce total cardiovascular risk. A modern cardiovascular prevention program could be created by integrating 'cardiac rehabilitation' and 'secondary prevention' to deliver one comprehensive risk reduction service. All coronary and high CVD risk people require a comprehensive preventive cardiology programme, combining a professional lifestyle intervention with effective risk factor management to achieve better risk factor control and adherence with cardioprotective medications, and to reduce the risk of future cardiovascular events.

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## Footnote

*Conflicts of Interest:* The author declared research contracts with the European Society of Cardiology.

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