

# Lifestyle and risk factor management and use of drug therapies in coronary patients from 15 countries

## Principal results from EUROASPIRE II Euro Heart Survey Programme

EUROASPIRE II Study Group\*

**Aims** The principal aim of the second EUROASPIRE survey was to determine in patients with established coronary heart disease whether the Joint European Societies' recommendations on coronary prevention are being followed in clinical practice.

**Methods** This survey was undertaken in 1999–2000 in 15 European countries: Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Slovenia, Sweden, Spain and the U.K., in selected geographical areas and 47 centres. Consecutive patients, men and women  $\leq 70$  years were identified retrospectively with the following diagnoses: coronary artery bypass graft, percutaneous transluminal coronary angioplasty, acute myocardial infarction and myocardial ischaemia. Data collection was based on a review of medical records and interview and risk assessment at least 6 months after hospital admission.

**Results** 8181 medical records (25% women) were reviewed and 5556 patients (adjusted participation rate 76%) interviewed. Recording of risk factor history and risk factor measurement in hospital notes was incomplete, particularly for discharge documents. At interview (median time 1.4 years after hospital discharge), 21% of patients smoked cigarettes, 31% were obese, 50% had raised blood pressure (systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg), 58% had elevated serum total cholesterol (total cholesterol  $\geq 5$  mmol  $\cdot$  l $^{-1}$ ) and 20%

reported a medical history of diabetes. Glucose control in these diabetic patients was poor with 87% having plasma glucose  $>6.0$  mmol  $\cdot$  l $^{-1}$  and 72%  $\geq 7.0$  mmol  $\cdot$  l $^{-1}$ . Among the patients interviewed the use of prophylactic drug therapies on admission, at discharge and at interview was as follows: aspirin or other antiplatelet drugs 47%, 90% and 86%; beta-blockers 44%, 66% and 63%; ACE inhibitors 24%, 38% and 38%; and lipid-lowering drugs 26%, 43% and 61%, respectively. With the exception of antiplatelet drugs, wide variations in the use of prophylactic drug therapies exist between countries.

**Conclusions** This European survey of coronary patients shows a high prevalence of unhealthy lifestyles, modifiable risk factors and inadequate use of drug therapies to achieve blood pressure and lipid goals. There is considerable potential throughout Europe to raise the standard of preventive cardiology through more effective lifestyle intervention, control of other risk factors and optimal use of prophylactic drug therapies in order to reduce coronary morbidity and mortality.

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**Key Words:** EUROASPIRE, Euro Heart Survey, preventive cardiology, guidelines.

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\*Investigators and participating centres are listed in the Appendix at the end of the paper.

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## Introduction

Cardiovascular diseases, of which coronary heart disease is the most common, are the main cause of death in middle-aged and older adults in most European countries<sup>[1]</sup>. Coronary heart disease remains the leading cause of mortality in men over 45 years, and in women over 65 years throughout Europe, but there are significant differences in mortality between and within

countries over time. Despite falling coronary heart disease mortality rates in Western European countries the number of coronary heart disease patients may actually be increasing because of ageing populations, and the improving prognosis of coronary patients due to more effective treatments for acute coronary heart disease, revascularization and use of prophylactic drug therapies<sup>[2]</sup>. All these factors are contributing to an enlarging pool of coronary patients, who are at high risk of myocardial reinfarction and heart failure.

The major European Scientific Societies in the field of cardiovascular medicine (European Society of Cardiology (ESC), European Atherosclerosis Society (EAS) and the European Society of Hypertension (ESH)) published recommendations on prevention of coronary heart disease in clinical practice in 1994<sup>[3]</sup>. The main objectives of coronary heart disease prevention are to reduce morbidity and mortality, improve quality of life, and increase the chances of a longer life expectancy<sup>[4]</sup>. There is substantial scientific evidence showing that lifestyle interventions and risk factor modification can reduce cardiovascular morbidity and mortality. The priority for preventive cardiology is patients with established coronary heart disease or other atherosclerotic disease and selected high-risk individuals from the general population. In coronary patients lifestyle interventions (smoking cessation, healthy food choices and increased physical activity), control of blood pressure, cholesterol and diabetes, and the selective use of prophylactic drug therapies (aspirin, beta-blockers, ACE inhibitors, lipid-lowering drugs and anticoagulants) will reduce the risk of recurrent non-fatal and fatal disease and improve survival.

In 1994–1995, a survey assessing risk factor recording and management in patients with coronary heart disease, called ASPIRE (Action on Secondary Prevention through Intervention to Reduce Events) was carried out in the United Kingdom at the initiative of the British Cardiac Society<sup>[5]</sup>. The ASPIRE study revealed that risk factor recording in the medical records of coronary patients was incomplete and risk factor control, particularly cholesterol, was inadequate. In 1995–1996 a European survey (EUROASPIRE I), based on the U.K. ASPIRE study, was undertaken by the ESC in nine European countries: the Czech Republic, Finland, France, Germany, Hungary, Italy, the Netherlands, Slovenia and Spain<sup>[6]</sup>. This survey also showed a high prevalence of modifiable risk factors in coronary heart disease patients, with wide variations in medical practice between countries, and hence a real potential to further reduce coronary heart disease morbidity and mortality and improve survival chances.

In 1998 a Second Joint European Societies Task Force on coronary prevention was convened by the same three Societies, and also included representatives from the International Society of Behavioural Medicine, the European Society of General Practice/Family Medicine and the European Heart Network<sup>[7]</sup>. The recommendations of this Task Force reinforced the priorities given in the 1994 recommendations:

1. Patients with established coronary heart disease or other atherosclerotic disease.
2. Healthy individuals at high risk because of hypertension, hyperlipidaemia, diabetes, or a combination of these or other coronary heart disease risk factors.
3. Close (first-degree) blood relatives of both patients with early onset coronary heart disease or other atherosclerotic disease, and of healthy individuals at particularly high risk.

Common lifestyle and risk factor goals were set for coronary patients and high risk individuals, reinforcing the recommendations made in 1994, and a new goal for cholesterol ( $<5 \text{ mmol} \cdot \text{l}^{-1}$ ) and LDL-cholesterol ( $<3.0 \text{ mmol} \cdot \text{l}^{-1}$ ) was established. The appropriate use of prophylactic drug therapies in coronary patients was also reinforced. Screening of close blood relatives of patients with early onset coronary heart disease was also advised again.

A second EUROASPIRE survey (EUROASPIRE II) has now been conducted in 15 European countries — Belgium, the Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Slovenia, Sweden, Spain and the U.K. in 1999–2000, under the auspices of the Euro Heart Survey programme. The overall aim of this programme is to provide systematic information on patient management in Europe. A cardiovascular survey system has been developed in order to: verify the applicability of European guidelines on the investigation, treatment and prevention of cardiovascular diseases to facilitate their implementation; investigate the applicability of the results of clinical trials in everyday practice; analyse the outcome of different disease management strategies; and foster the implementation of evidence-based medicine.

### *Objectives of EUROASPIRE II*

The objectives of EUROASPIRE II were:

1. To determine in patients with established coronary heart disease (acute myocardial infarction and ischaemia and patients following revascularization by angioplasty or coronary artery surgery) whether the European recommendations on secondary prevention of coronary heart disease are being followed.
2. To determine whether the practice of preventive cardiology in patients with established coronary disease has improved in those centres which took part in EUROASPIRE I.
3. To determine in the families (first degree blood relatives) of patients with premature coronary heart disease (men under 55 years and women under 65 years) whether screening for risk factors has occurred and, if so, to describe their management by lifestyle and drug therapies.

In this paper, the principal results of EUROASPIRE II as presented are based on the analysis of hospital medical records, discharge documents, and patient interviews and examinations. The comparison of EUROASPIRE I and II surveys in those nine countries

which took part in both surveys is reported elsewhere<sup>[8]</sup>. The results of the survey of first-degree blood relatives will also be the subject of a separate report.

## Study population and methods

### *Geographical area and hospital sampling frame*

Within each country one or more geographical areas with a defined population (greater than half a million people) was selected and all hospitals serving this population were identified. The area included at least one hospital offering interventional cardiology and cardiac surgery, and one or more hospitals receiving patients with acute myocardial infarction and ischaemia. A sample of one or more hospitals, or all hospitals, was taken so that any patient presenting within the area with acute symptoms of coronary disease, or requiring revascularization in the form of balloon angioplasty or coronary artery surgery, had an approximately equal chance of being included. Patients admitted to a hospital outside this geographical area were not included in the sample. Geographical areas and participating centres for each country are given in [Table 1](#).

Within each hospital, consecutive patients, men and women  $\leq 70$  years of age at the time of the index event or procedure, with the following diagnoses or treatments for coronary disease (see below) were identified from diagnostic registers, hospital discharge lists or other sources:

1. Coronary artery bypass graft (CABG)  
Consecutive patients having their first elective or emergency CABG operation, including emergency CABG for acute myocardial infarction, were identified from the hospital surgical registers or other sources. All first operations for coronary artery disease were included. When coronary artery surgery was performed in the context of valve replacement or when the primary diagnosis was not coronary artery disease, patients were excluded.
2. Percutaneous transluminal coronary angioplasty (PTCA)  
Consecutive patients following their first elective or emergency PTCA, including emergency PTCA for acute myocardial infarction were identified from the catheter laboratory registers or other sources. The term PTCA included all first procedures as well as the use of stents and other devices. Patients with a history of CABG were excluded.
3. Acute myocardial infarction (AMI: ICD-9 410)  
Consecutive patients with a hospital diagnosis of first or recurrent acute myocardial infarction but no history of CABG or PTCA were identified from the cardiac care unit admission or hospital discharge books, death returns, or other sources.
4. Acute myocardial ischaemia (ischaemia: ICD-9 411, 413)

Consecutive patients with a hospital diagnosis of first or recurrent myocardial ischaemia but no evidence of infarction, and no history of CABG, PTCA or a previous acute myocardial infarction were identified from the cardiac care unit admission or hospital discharge books, death returns, or other sources.

Consecutive patients were identified retrospectively, including those who died during their surgical procedure or in-hospital stay, but no earlier than 1 January 1997. Although some hospital diagnoses for acute myocardial infarction and myocardial ischaemia might not always meet the standard diagnostic criteria used by WHO, all cases with these diagnostic labels were included as all these patients should be appropriately managed in relation to lifestyle intervention, management of other risk factors and use of prophylactic drug therapies.

### *Sample size and data collection*

The data collection took place at least 6 months after the date of acute hospital admission or procedure and was based on a review of medical records and an interview and examination of the patients. Within each country the objective was to obtain information from a minimum of 400 living patients attending for an interview: 100 CABG, 100 PTCA, 100 acute myocardial infarction, and 100 myocardial ischaemia. In order to allow for deaths and non-response to invitation for interview, a sample of at least 525 consecutive patients had to be drawn: 150 for acute myocardial infarction (which has a larger number of in-hospital deaths than the other categories) and 125 in each of the other three diagnostic groups.

A description of the study population by centres and diagnostic categories is presented in [Table 2](#).

The data collection was conducted by trained research staff who reviewed patient medical records and interviewed and examined the patients at the hospital or their home using standardized methods and instruments.

### *Review of patient medical records*

The following information was obtained from the hospital medical records both prior to and following the date of acute hospital admission or procedure:

- (a) Personal and demographic details.
- (b) Personal cardiac history.
- (c) Risk factor recordings:
  - i. Medical history of cigarette smoking, hypertension, hyperlipidaemia, diabetes and, for women, use of oral contraceptives and hormone replacement therapy.
  - ii. Recorded measurements of smoking status, blood pressure, lipids, and diabetes.
- (d) Medication.

### *Patient interview and examination*

The following information was obtained at least 6 months after the acute admission or procedure:

**Table 1 Participating centres**

Country	Centres
Belgium (BEL/GHE)	GHENT Universitair Ziekenhuis A.Z. Maria Middelaers-Sint Jozef A.Z. Sint Lucas A.Z. Volkskliniek Jan Palfijn, Algemeen Ziekenhuis
Czech Republic (CZE/PP)	PILSEN Charles University Hospital PRAGUE Institute of Clinical Experimental Medicine
Finland (FIN/KUO)	KUOPIO Kuopio University Hospital
France (FRA/LLRT)	LILLE Hôpital Cardiologique Universitaire, Lille Hôpital Saint-Philibert, Lomme Hôpital Victor Provo, Roubaix Hôpital Gustave Dron, Tourcoing
Germany (GER/MÜNS)	MÜNSTER Medizinische Klinik und Poliklinik für Kardiologie und Angiologie, Universität Münster Klinik und Poliklinik für Thorax-, Herz- und Gefäßchirurgie, Universität Münster St. Franziskus Hospital
Greece (GRE/ATCI)	ATHENS Onassis Cardiac Surgery Centre Hippokratio Hospital, University of Athens Tzanio Hospital of Pireus THESSALONIKI A.H.E.P.A. Hospital, University of Thessaloniki General Hospital of Kavala CRETE University P.E.P.A.G.N.I. Hospital, Heraklion Crete IOANNINA University General Hospital of Ioannina Peripheral General Hospital of Ioannina Hatzikosta
Hungary (HUN/BUD)	BUDAPEST Hungarian Institute of Cardiology Szt. János Municipal Teaching Hospital
Ireland (IRE/DUB)	DUBLIN Adelaide and Meath Hospital, Tallaght St. James's Hospital
Italy (ITA/TV)	TREVISO Ca' Foncello Hospital VERONA Borgo Trento Hospital
The Netherlands (NET/ROT)	RIJNMOND (Rotterdam & Surroundings) Thorax Centre of the Academic Hospital "Dijkzigt" Sint Franciscus Gasthuis Zuiderziekenhuis
Poland (POL/CRA)	CRACOW PROVINCE Collegium Medicum, Jagiellonian University Ludwik Rydygier District Hospital Józef Dietl Hospital Gabriel Narutowicz Memorial General Hospital
Slovenia (SLO/LJU)	LJUBLJANA University Medical Centre
Spain (SPA/BAR)	BARCELONA AND PROVINCE Hospital Clinic i Provincial, Barcelona Hospital de la Santa Creu i Sant Pau, Barcelona Corporació Sanitària Parc Tauli, Sabadell
Sweden (SWE/MAL)	MALMÖ Malmö University Hospital
U.K. (U.K./HL)	HULL Castle Hill Hospital Hull Royal Infirmary LONDON Charing Cross Hospital Hammersmith Hospital Central Middlesex Hospital West Middlesex Hospital

Table 2 Study population (number) enrolled from medical records and patient interviews by centres and diagnostic categories

Diagnostic category	BEL/GHE	CZE/PP	FIN/KUO	FRA/LLRT	GER/MÜNS	GREATCI	HUN/BUD	IRE/DUB	ITA/TV	NET/ROT	POL/CRA	SLO/LJU	SPA/BAR	SWE/MAL	U.K./HL	Total
CABG																
Patients records	152	125	125	138	142	132	123	144	62	130	126	160	124	122	170	1975
Patients interviews	102	100	100	99	101	95	101	99	25	95	101	117	89	99	100	1423
PTCA																
Patients records	151	125	125	165	205	158	128	138	125	129	127	154	134	128	183	2175
Patients interviews	98	110	102	124	103	113	102	102	82	96	116	109	107	101	95	1560
AMI																
Patients records	104	150	157	165	167	157	133	127	158	167	160	195	152	132	225	2349
Patients interviews	51	100	99	88	98	108	82	98	94	98	115	118	113	101	99	1462
Ischaemia																
Patients records	19	125	74	79	170	127	132	65	96	110	127	139	126	127	166	1682
Patients interviews	9	100	47	54	100	75	104	46	57	68	95	102	95	91	68	1111
All categories																
Patients records	426	525	481	547	684	574	516	474	441	536	540	648	536	509	744	8181
Patients interviews	260	410	348	365	402	391	389	345	258	357	427	446	404	392	362	5556
Participation rate at interview (%)	65.2	83.2	89.2	79.4	66.6	70.6	80.4	77.1	66.3	72.7	85.9	77.4	88.2	79.8	58.0	75.6

- (a) Personal and demographic details.
- (b) Personal cardiac history.
- (c) Other medical history, including hypertension, hyperlipidaemia and diabetes.
- (d) Reported lifestyle in relation to smoking, diet (including weight reduction) and exercise.
- (e) Medication (generic and commercial name and total daily dose).
- (f) For women: exposure to oral contraceptives, date of menopause and hormone replacement therapy.

The following measurements were performed:

- (a) Height and weight were measured in light indoor clothes without shoes (SECA scales and measuring stick, model number 707). The scales were calibrated at the start of the survey to ensure comparability of results between centres.
- (b) Blood pressure was measured twice in a sitting position on the right upper arm (Omron 711 automatic digital sphygmomanometer) and the mean of the two measurements was used in data analyses.
- (c) Breath carbon monoxide was measured in ppm (Smokerlyser, Bedfont Scientific, Model EC 50 Micro III).
- (d) Measurement of serum total cholesterol, HDL cholesterol and triglycerides, and plasma glucose.

The Central Laboratory at the Department of Medicine, University of Manchester, United Kingdom, performed all biochemical analyses. The laboratory is standardized to Randox International Quality Control Scheme which has the values of its reference material from the Center for Disease Control—NHLBI Lipid Standardization Program. At interview, venous blood samples (with recorded time of the last meal) were drawn into three different tubes (Vacutainer, Beckton Dickinson). Six ml of blood was taken into a tube containing clot activator, 6 ml into a lithium–heparin tube, and 10 ml in a potassium EDTA tube. Samples were allowed to stand for 30 min at 4 °C and then centrifuged at 3000 rpm at 4 °C for 15 min. Serum, EDTA–plasma and lithium–heparin plasma were aliquoted into pre-labelled tubes (Eppendorf, Germany), sealed and stored at a minimum of –20 °C at the local centres until they were shipped, in solid CO<sub>2</sub> by overnight courier to the central laboratory, where they were stored at –80 °C until used. Serum was used for the measurement of total cholesterol, HDL cholesterol and triglycerides using Unimate 7 cholesterol, Unimate HDL Direct and Unimate triglyceride reagents (Roche Diagnostics) on a Cobas Mira S Autoanalyser (Roche Diagnostics). During the course of the study, the coefficient of variation for total cholesterol was 1.2%, for HDL cholesterol 9.4% and for triglycerides 2.1%. Plasma glucose was measured from lithium–heparin samples using the hexokinase method (Bayer) on a Bayer Axon analyser. Coefficient of variation for glucose measurements was 2.8%.

### *Quality assurance*

To ensure standardization of measurements, all equipment was calibrated and serviced according to the manufacturer's recommendations. All research staff were trained in making all of the above measurements in the Co-ordinating Centre, Cardiac Medicine, Clinical Epidemiology Group, National Heart and Lung Institute, Imperial College School of Medicine, University of London, U.K. Each Principal Investigator audited medical records in the following way:

- (i) The first 10 medical records abstracted by each member of research staff were audited and all discrepancies discussed and corrected.
- (ii) A random sample of 10 medical records for each diagnostic category was audited in the same way throughout the duration of the study.

### *Data management*

All data were stored electronically onto notebook computers using a unique identification number for country, centre and individual. Computer discs were sent on a weekly basis by each country to the Co-ordinating Centre where they were checked for completeness, internal consistency and accuracy. All data were stored under the provisions of the United Kingdom Data Protection Act.

### *Statistical analyses*

All statistical analyses were undertaken using SAS statistical software in the Department of Public Health, Ghent University, Belgium. Descriptive statistics were used to estimate the prevalence of risk factor recording and management by diagnostic category within and between countries. In order to assess prevalence of risk factors, it was calculated that a sample of 400 patients, who attended for interview, was sufficient to estimate prevalences with precision of at least 5%, and with a confidence interval of 95%. As this was a descriptive survey, with emphasis on estimation of prevalences, no formal hypothesis testing was done.

## **Results**

### *Patients and their characteristics*

8181 medical records were reviewed and 5556 patients interviewed at least 6 months after hospitalization for a coronary event. The size of the study population enrolled from medical records and the numbers of patient interviews by centres and diagnostic categories are presented in [Table 2](#).

The number of available records by centre varied between 426 (Belgium) and 744 (U.K.). The distribution

of diagnostic categories was: CABG 24.1% (1975), PTCA 26.6% (2175), acute myocardial infarction 28.7% (2349), and ischaemia 20.6% (1682). The proportion of CABG was highest in Belgium, 35.7% (152/426) and lowest in Italy, 14.1% (62/441). The highest proportion of PTCA was in Belgium, 35.4% (151/426) and the lowest in the Czech Republic, 23.8% (125/525). The proportions of acute myocardial infarction ranged from 24.4% in Belgium (104/426) and Germany (167/684) to 35.8% (158/441) in Italy. The proportion of myocardial ischaemia was highest in Hungary, 25.6% (132/516) and the lowest in Belgium, 4.5% (19/426).

A total of 24.7% (2019) were women — the highest in Hungary, 33.9% (175/516) and the lowest in France, 19.9% (109/547). As to the gender distribution by diagnostic categories, the proportion of women in the first three groups ranged from 17% to 23%, while in the ischaemia group 39.4% of the patients were females.

21.7% (1775) of patients were <51 years, 34.3% (2807) between 51 and 60 years and 44.0% (3599) between 61 and 70 years. The proportions of women for the same age groups were 19.4% (344/1775), 21.3% (597/2807) and 29.9% (1078/3599) respectively.

### *Risk factors and measurements recorded in the medical records and discharge documents*

The available information recorded in the medical records at the time of the index event in relation to smoking status, and the history of hypertension, hyperlipidaemia and diabetes, and recorded risk factor measurements are presented in Table 3. Available information on cardiovascular risk factors at discharge was taken from the hospital discharge letter, or from any other relevant written material; the results are shown in Table 4.

### *Reported lifestyle advice and risk factor status at interview*

Information on lifestyle advice given to patients to reduce their coronary risk and to follow a cardiac rehabilitation programme was collected at interview and is described in Table 5. The distribution of quantitative coronary risk factors (medians) at interview is given in Table 6. Table 7 shows the prevalence of coronary risk factors at interview. Among patients with self reported diabetes, 87% had a fasting plasma glucose >6.0 mmol.l<sup>-1</sup> and 72% had a fasting plasma glucose ≥7.0 mmol.l<sup>-1</sup>. The therapeutic control of blood pressure and serum cholesterol at interview is shown in Table 8.

Patient interviews were conducted on 67.9% (5556/8181) of the patients (Table 2). The median time between index event and interview was 1.44 years (interquartile range 1.12–1.93 years). The median time between index event and interview ranged from 0.96

years in Poland to 1.95 years in Sweden. Reasons for not being interviewed were: refused to participate or no response 22.0%, and dead or not contacted 10.1%. The adjusted participation rate, defined as those who were contacted and found alive, was 75.6% and ranged from 58.0% in the U.K. to 89.2% in Finland. The proportion of interviewed patients in all other centres except the U.K. was >65%. The response rate by diagnostic category ranged from 72.6% in the ischaemia group to 77.6% in the CABG group. The proportion of women attending interview was 23.7% (1319) and ranged from 17.4% (68/391) in Greece to 35.7% (139/389) in Hungary. By diagnostic category, the proportion of females was 16.1% (229/1423) with CABG, 20.8% (325/1560) with PTCA, 21.4% (313/1462) with acute myocardial infarction and 40.7% (452/1111) with myocardial ischaemia. A blood sample was drawn from 5462 patients, of whom 4769 (87.3%) had been fasting for at least 6 h. The proportion of fasting blood samples varied widely between centres, ranging from 3.5% in Italy to 99.8% in Poland. Except for Italy (3.5%), Hungary (40.9%), the Netherlands (82.2%), the U.K. (87.0%) and Greece (88.6%), the proportion of fasting blood samples was >90.0%.

### *Prophylactic drug therapy*

Reported medical treatment at interview is presented in Table 9, and for comparison recorded medication in the medical records of those interviewed is shown in the same table. Recorded information in the medical records of all patients at the time of admission and discharge did not differ significantly from that recorded only from those interviewed. The proportion of patients overall taking a statin was 55.3%, ranging from 30.7% to 75.1%. The Netherlands (75.1%), Sweden (73.5%) and the U.K. (67.6%) had the largest proportion of statin use and Greece (30.7%), Poland (34.7%) and the Czech Republic (38.8%), the lowest use.

## **Discussion**

This second European survey on the clinical practice of coronary prevention shows a high prevalence of adverse lifestyle characteristics, other risk factors and underuse of prophylactic drug therapies in patients with coronary heart disease. There is considerable variation between European countries in patient lifestyles, especially for smoking, and in the use of some prophylactic drug therapies. The lifestyle, risk factor and therapeutic goals set by the Joint European Societies recommendations on prevention of coronary heart disease in clinical practice are not being realized in a majority of patients throughout Europe<sup>3,7</sup>. The documentation and management of risk factors in coronary patients, particularly in the hospital discharge communication, is not acceptable. There is real potential through more effective

**Table 3 Available information (%) on risk factor history and measurements of weight, height, blood pressure and lipids on admission from medical records, by centre and diagnostic category**

	Available information on risk factor history on admission				Available information on risk factor measurements on admission					
	Smoking (%)	Hypertension (%)	Hyperlipidaemia (%)	Diabetes (%)	Weight (%)	Height (%)	Blood pressure (%)	Total cholesterol (%)	HDL-cholesterol (%)	Triglycerides (%)
<b>By centre</b>										
BEL/GHE	70.4	56.6	51.6	43.2	48.6	54.9	81.2	69.3	60.3	66.2
CZE/PP	83.1	90.5	79.4	84.8	85.0	81.9	98.7	82.3	47.1	78.5
FIN/KUO	81.9	93.8	89.2	92.5	85.7	81.1	93.8	78.6	77.6	78.8
FRA/LLRT	95.6	98.7	98.2	98.9	89.4	88.9	92.5	56.1	13.4	54.1
GER/MÜNS	92.0	80.3	67.1	69.7	96.5	95.3	95.6	80.4	61.6	78.4
GRE/ATCI	90.9	93.7	90.8	93.0	43.9	36.2	90.8	77.9	51.4	75.4
HUN/BUD	66.5	100	98.8	100	74.4	70.7	99.0	91.3	33.3	86.6
IRE/DUB	98.5	99.6	90.7	97.1	49.2	37.6	93.5	73.6	58.9	64.4
ITA/TV	83.9	96.4	94.8	97.5	84.6	76.0	98.2	68.7	30.8	61.0
NET/ROT	91.6	78.0	56.9	88.8	92.2	92.0	93.5	64.7	32.1	43.7
POL/CRA	89.8	85.4	20.2	61.7	80.2	60.0	94.3	44.1	40.4	43.7
SLO/LJU	78.6	98.6	95.5	99.7	90.4	81.0	99.4	66.1	64.4	65.4
SPA/BAR	94.4	92.4	86.9	88.8	82.1	86.4	99.6	10.1	4.5	10.1
SWE/MAL	94.3	95.1	75.4	95.3	96.7	95.5	97.3	79.8	75.6	79.2
U.K./HL	97.2	87.9	69.2	87.8	71.4	47.7	98.0	65.1	22.6	48.7
<b>By diagnostic category</b>										
CABG	88.9	93.3	86.0	90.4	94.4	93.2	93.8	64.5	46.3	59.1
PTCA	87.8	88.6	78.9	85.2	80.7	77.2	93.1	71.7	49.1	66.7
AMI	87.5	88.8	71.7	86.2	68.5	58.2	97.2	67.9	41.9	62.1
Ischaemia	86.7	89.5	73.8	85.7	71.5	61.6	97.3	63.0	40.0	59.1
<b>Total</b>	87.7	89.9	77.5	86.8	78.6	72.4	95.3	67.1	44.5	62.0

**Table 4 Available information (%) on coronary risk factors and measurements of weight, blood pressure and cholesterol in hospital discharge documents, by centre and diagnostic category**

	Risk factors recorded					Measurements recorded		
	Smoking (%)	Obesity (%)	Hypertension (%)	Hyperlipidaemia (%)	Diabetes (%)	Weight (%)	Blood pressure (%)	Cholesterol (%)
By centre								
BEL/GHE	48.8	31.2	32.2	39.7	18.3	39.7	39.7	11.7
CZE/PP	83.4	82.1	95.1	94.5	94.7	34.3	53.1	59.8
FIN/KUO	46.4	10.8	69.0	66.5	61.3	5.6	10.8	38.9
FRA/LLRT	76.2	81.4	80.6	79.3	81.2	11.0	20.7	35.1
GER/MÜNS	42.0	47.7	50.4	67.0	17.4	50.3	41.5	50.0
GRE/ATCI	61.8	26.3	68.0	72.7	64.1	9.8	39.6	51.1
HUN/BUD	41.9	98.1	99.2	98.6	99.2	41.3	94.2	80.4
IRE/DUB	81.9	85.2	94.1	90.1	88.6	41.6	66.7	34.0
ITA/TV	71.4	90.7	88.2	90.7	93.2	26.8	52.4	26.5
NET/ROT	31.0	10.5	31.3	29.1	23.3	13.6	56.3	26.7
POL/CRA	58.0	53.1	78.7	68.3	56.7	14.1	74.8	79.4
SLO/LJU	82.4	86.0	99.7	95.8	99.7	90.0	99.1	65.4
SPA/BAR	70.9	8.6	60.1	57.8	43.8	0.4	56.7	45.3
SWE/MAL	93.1	78.8	96.3	88.4	94.7	1.0	3.5	6.9
U.K./HL	31.9	6.7	26.3	28.4	17.7	12.0	30.9	16.8
By diagnostic category								
CABG	55.4	47.9	68.5	69.2	58.9	23.5	36.7	19.2
PTCA	58.3	53.7	67.1	69.2	59.8	28.4	47.0	44.1
AMI	66.8	52.0	71.1	71.7	64.8	27.5	57.6	52.6
Ischaemia	60.5	54.2	74.6	70.8	64.4	27.6	56.8	53.4
Total	60.5	51.9	70.1	70.3	62.0	26.8	49.6	42.4

organization of medical care, to raise the standards of preventive cardiology in order to reduce the risk of recurrent non-fatal and fatal coronary heart disease. A comparison of these results with those from the first EUROASPIRE survey in nine countries is reported elsewhere<sup>[8]</sup>.

A picture resembling the inadequate risk factor management of coronary patients in Europe is also reported from other parts of the world. The American College of Cardiology Evaluation of Preventive Therapeutics (ACCEPT) project, quantified the treatment gap in coronary heart disease patients in the United States and is identifying the barriers playing the greatest role in limiting the optimal care of coronary patients<sup>[9-11]</sup>. The overall objective of ACCEPT was to describe cardiovascular risk factor assessment and management in consecutive patients  $\leq 70$  years of age, admitted to hospitals in the United States with the diagnosis of coronary heart disease in 1996: first CABG, first PTCA, acute myocardial infarction or myocardial ischaemia. 1797 medical records were reviewed and 818 patients interviewed and examined 6 months after their discharge. Prevalence of risk factor recording in the medical notes was also incomplete. At interview a quarter were smoking cigarettes but a large majority (74%) had achieved the blood pressure target (systolic blood pressure  $< 140$  mmHg) unlike patients in Europe. However, only 24% had reached the U.S. target for LDL-cholesterol  $< 100$  mg  $\cdot$  dl<sup>-1</sup> (2.6 mmol  $\cdot$  l<sup>-1</sup>). Aspirin use (87%) was similar to the EUROASPIRE II survey, but both beta-blockers (63% of patients) and lipid-lowering medication

(59% of patients) were more commonly prescribed in the U.S.A. In the Far East the ASPAC (Asia-Pacific) study determined the prevalence and management of cardiovascular risk factors in coronary heart disease patients in more than 180 randomly selected hospitals from nine countries in the Asia-Pacific region<sup>[12-14]</sup>. Information was collected only from medical records of 4112 patients admitted with myocardial infarction or unstable angina over a period of 6 months. Compared to Europe there is even greater heterogeneity in risk factor recording and management between countries.

So the problem of documenting and effectively managing risk factors for coronary heart disease is common to many parts of the world, and other national multicentre surveys have shown similar results to EUROASPIRE II<sup>[15-23]</sup>. However, the practice of preventive cardiology can improve as shown by the PREVESE studies, the first conducted in Spain in 1994 and then again in 1998 in patients following myocardial infarction<sup>[24-26]</sup>. The first survey on 1242 patients from 39 hospitals, and the second on 2054 patients from 74 hospitals, included 36 out of 39 hospitals which had participated in the first survey. Significant changes in the use of drug therapies were shown at the time of hospital discharge; an increased use of beta blockers from 33% to 45% and ACE inhibitors from 33% to 47% and a striking sixfold increase in the use of statins from 5% to 29% over this period. However, it is not just a question of increasing the use of drug therapies. Lifestyle changes are the first and most important step and, in addition, the appropriate use of drug therapies in selected patients

**Table 5** Reported lifestyle advice (%) given to patients to reduce their risk of coronary heart disease and to participate in a cardiac rehabilitation programme at interview, by centre and diagnostic category

	Stop smoking <sup>1</sup> (%)	Lose weight <sup>2</sup> (%)	Special diet to lower blood pressure <sup>3</sup> (%)	Special diet to lower blood cholesterol <sup>4</sup> (%)	Exercise <sup>5</sup> (%)	Cardiac rehabilitation programme <sup>5</sup> (%)
By centre						
BEL/GHE	86.4	52.7	24.0	63.4	48.5	62.7
CZE/PP	84.8	50.7	45.1	75.8	47.9	55.5
FIN/KUO	96.0	51.6	35.3	76.4	78.2	17.5
FRA/LLRT	80.7	64.5	14.5	47.4	74.5	37.4
GER/MÜNS	71.9	56.8	22.8	69.6	72.0	59.3
GRE/ATCI	96.9	70.4	41.7	65.1	76.9	19.7
HUN/BUD	88.7	60.3	39.6	65.4	66.3	44.1
IRE/DUB	91.2	60.0	16.2	73.7	75.7	54.2
ITA/TV	91.9	48.6	8.8	52.6	67.4	17.4
NET/ROT	78.2	36.3	9.1	20.9	47.6	60.5
POL/CRA	96.0	57.9	46.2	63.7	54.6	35.4
SLO/LJU	96.9	62.3	63.6	75.6	86.6	70.9
SPA/BAR	98.6	66.8	75.1	79.9	91.1	4.0
SWE/MAL	96.3	58.3	19.0	63.4	68.6	66.6
U.K./HL	63.5	50.3	8.6	32.7	34.3	35.4
By diagnosis						
CABG	81.1	61.1	32.4	62.0	72.7	67.0
PTCA	90.7	57.0	29.8	66.6	68.4	34.6
AMI	89.2	55.2	32.7	61.9	69.3	49.1
Ischaemia	81.2	54.1	39.1	56.5	52.7	16.6
Total	88.0	57.0	33.3	62.2	66.6	43.1

<sup>1</sup>For subgroup of smokers; <sup>2</sup>for subgroup with overweight; <sup>3</sup>for subgroup with reported history of hypertension; <sup>4</sup>for subgroup with reported history of hyperlipidaemia; <sup>5</sup>for the total group.

can ensure risk factor goals are achieved and the risk of recurrent disease reduced.

EUROASPIRE II has demonstrated substantial deficiencies in the medical records of coronary heart disease patients in all countries. Risk factor recording in medical notes is incomplete and discharge documents even more so. When the patient's history is taken it is probable that information on lifestyle, history of hypertension, dyslipidaemia and so on is elicited by the physician, but incompletely recorded. The coronary risk factor history and risk factor measurements should be systematically entered into the patient's medical record, as this will inform subsequent investigations and management. Communication between secondary and primary care is a major factor in implementing evidence based medicine and it is of particular concern that discharge documents are worse than medical records. One reason for this may be the perception of cardiologists that their role is primarily to treat the acute event. The failure of cardiologists to ensure patients receive adequate risk factor advice and treatment before they leave hospital is then perpetuated in primary care. Primary-care physicians may perceive this lack of a hospital treatment plan to mean that the cardiologist does not endorse risk-lowering strategies. The primary-care physicians are strongly influenced by hospital recommendations. They are more likely to continue with therapy prescribed by cardiologists, than to initiate treatment themselves. Cardiologists must play a leadership role: they do not have sole responsibility, but they can have a significant

positive impact on the management of coronary heart disease risk factors over the long term. As a minimum standard, all discharge communications for coronary patients should contain the risk factor history, risk factor measurements, risk factor goals and drug therapies including actual and optimal doses. In this way the physician then responsible for the patient's long-term care will have a clinical framework for managing and following up risk factors to defined goals.

There is substantial evidence that modification of lifestyle reduces the risk of coronary events in patients with established coronary heart disease. Smoking cessation, healthy food choices and appropriate aerobic exercise all reduce the risk of further non-fatal and fatal events and improve the chances of survival.

The favourable effect of smoking cessation on prognosis of coronary disease is well documented<sup>[27]</sup>. Almost one third (32%) of patients with coronary disease in this study were current smokers at the time of admission, and this had fallen to 21% of all patients at interview; an absolute reduction of a third. At least a twofold difference in smoking prevalence exists between centres, reflecting the smoking habits of the populations in these countries. An interesting equality of smoking by gender in coronary patients was observed in about half the countries, and in Ireland and the U.K. more women were smoking. Smoking was lowest among coronary surgery patients; they seem to have a better perception of the severity of their disease, combined with selection through survival (those who stop smoking are more

Table 6 Quantitative coronary heart disease risk factors (medians) at interview, by centre and diagnostic category

By centre	Body mass index ( $\text{kg} \cdot \text{m}^{-2}$ , median)	Systolic BP (mmHg, median)	Diastolic BP (mmHg, median)	Serum total cholesterol ( $\text{mmol} \cdot \text{l}^{-1}$ , median)	Serum HDL-cholesterol ( $\text{mmol} \cdot \text{l}^{-1}$ , median)	Serum triglycerides* ( $\text{mmol} \cdot \text{l}^{-1}$ , median)	Plasma glucose* ( $\text{mmol} \cdot \text{l}^{-1}$ , median)
BEL/GHE	28.0	135.2	79.0	5.65	1.19	1.40	5.7
CZE/PP	29.0	134.0	80.0	5.59	1.19	1.50	6.2
FIN/KUO	28.1	136.8	81.0	4.77	1.17	1.40	5.9
FRA/LLRT	28.4	139.2	83.0	5.31	1.25	1.42	6.1
GER/MÜNS	28.1	142.5	87.5	5.43	1.24	1.46	5.7
GRE/ATCI	27.7	137.0	82.5	5.44	1.11	1.60	5.9
HUN/BUD	28.5	130.0	78.5	5.35	1.31	2.00	5.8
IRE/DUB	27.7	136.0	83.0	5.11	1.22	1.76	5.5
ITA/TV	27.3	136.0	80.0	5.16	1.13	1.58	5.0
NET/ROT	27.5	137.5	83.5	4.86	1.12	1.32	5.7
POL/CRA	28.0	137.0	84.5	5.43	1.11	1.75	6.1
SLO/LJU	27.8	142.5	83.0	5.54	1.12	1.74	6.1
SPA/BAR	28.1	134.5	78.0	5.08	1.14	1.20	6.0
SWE/MAL	27.3	144.5	84.0	4.73	1.25	1.44	6.1
U.K./HL	28.4	141.0	81.0	5.10	1.33	1.60	5.5
By diagnosis							
CABG	27.9	139.5	82.5	5.18	1.15	1.52	5.9
PTCA	28.0	135.5	81.0	5.16	1.19	1.48	5.9
AMI	27.8	135.5	82.0	5.18	1.17	1.55	5.9
Ischaemia	28.3	141.0	83.0	5.49	1.26	1.55	5.9
Total	28.0	137.5	82.0	5.23	1.19	1.52	5.9

\*For patients fasting  $\geq 6$  h (87.3% of all patients).

Table 7 Prevalence (%) of coronary heart disease risk factors at interview, by centre and diagnostic category

	Current smoking <sup>1</sup> (%)		Over-weight <sup>2</sup> (%)	Obesity <sup>3</sup> (%)	Increased waist circumference <sup>4</sup> (%)	Raised blood pressure <sup>5</sup> (%)	Lipids (%)			Diabetes mellitus (%)			Family history of CHD (%)		
	Men	Women					Total	Elevated TC <sup>6</sup>	Decreased HDL <sup>7</sup>	Elevated TG <sup>8</sup>	Self-reported diabetes	Drug treated <sup>9</sup>	Diabetes <sup>10</sup>	Any age	Premature <sup>11</sup>
By centre															
BEL/GHE	25.0	14.3	22.7	79.6	27.3	80.0	44.2	76.6	22.8	25.0	14.2	12.0	18.5	46.6	22.0
CZE/PP	19.3	19.4	19.3	87.0	40.1	79.2	41.8	72.5	24.6	29.2	21.5	12.2	29.6	53.2	27.2
FIN/KUO	24.5	12.6	21.6	78.5	33.6	74.7	49.7	42.6	24.1	21.7	18.7	13.2	25.1	70.1	34.2
FRA/LLRT	27.0	11.8	24.2	79.7	37.5	83.9	54.7	60.2	16.0	29.6	27.5	23.6	38.1	43.8	23.5
GER/MÜNS	17.2	15.0	16.8	82.5	30.6	81.1	63.0	66.3	19.6	26.7	13.5	11.3	16.6	50.2	20.0
GRE/ATCI	26.0	20.9	25.1	79.2	28.0	87.5	47.8	64.5	31.2	31.0	21.3	14.4	30.0	50.4	20.7
HUN/BUD	35.2	20.9	30.1	79.2	36.8	82.0	37.3	60.2	20.3	50.0	21.1	12.9	35.2	64.1	41.6
IRE/DUB	25.6	29.6	26.4	75.4	26.7	70.7	47.5	53.7	19.8	38.4	8.7	7.0	11.7	65.6	40.1
ITA/TV	15.0	15.5	15.1	71.7	23.6	81.0	49.2	56.9	26.4	33.3	21.8	17.5	—	37.3	18.7
NET/ROT	28.5	27.7	28.3	78.5	27.7	84.9	52.1	44.3	30.2	25.1	13.2	11.5	21.9	66.0	38.8
POL/CRA	18.7	15.6	17.8	78.5	27.2	72.8	47.5	64.2	28.2	36.1	15.2	13.4	30.0	59.4	42.0
SLO/LJU	15.4	12.3	14.6	78.5	28.0	81.6	61.9	68.3	32.6	38.2	23.8	16.6	34.5	42.7	17.8
SPA/BAR	21.0	5.9	17.8	85.2	34.1	83.9	42.6	53.0	27.0	13.9	35.2	23.2	39.2	45.0	19.3
SWE/MAL	20.8	20.2	20.7	74.0	27.0	75.8	61.5	40.4	13.3	24.7	14.0	13.0	26.2	63.2	29.3
U.K./HL	16.8	20.7	17.7	81.9	38.4	77.8	52.4	53.5	13.3	33.8	21.0	18.8	35.0	53.8	30.8
By diagnosis															
CABG	16.9	12.7	16.2	79.2	29.6	77.4	54.0	56.4	27.5	28.4	23.4	18.9	31.6	54.9	30.6
PTCA	22.9	21.3	22.6	80.6	29.7	80.7	46.4	55.9	22.6	28.7	16.6	11.4	25.7	56.5	28.9
AMI	26.3	23.4	25.7	77.1	30.3	78.4	46.5	56.4	24.7	29.6	19.0	15.2	27.4	52.4	25.8
Ischaemia	23.5	13.3	19.4	81.5	37.1	83.5	56.8	66.7	17.0	31.3	19.6	13.4	27.4	55.4	30.3
Total	22.2	17.6	21.1	79.5	31.3	79.8	50.5	58.3	23.3	29.4	19.6	14.7	28.0	54.8	28.8

<sup>1</sup>Self-reported and/or CO in breath >10 ppm; <sup>2</sup>body mass index  $\geq 25 \text{ kg} \cdot \text{m}^{-2}$ ; <sup>3</sup>body mass index  $\geq 30 \text{ kg} \cdot \text{m}^{-2}$ ; <sup>4</sup>waist circumference  $\geq 94 \text{ cm}$  for men and  $\geq 80 \text{ cm}$  for women; <sup>5</sup>systolic blood pressure  $\geq 140 \text{ mmHg}$  and/or diastolic blood pressure  $\geq 90 \text{ mmHg}$ ; <sup>6</sup>serum total cholesterol  $\geq 5 \text{ mmol} \cdot \text{l}^{-1}$ ; <sup>7</sup>serum HDL cholesterol  $< 1 \text{ mmol} \cdot \text{l}^{-1}$ ; <sup>8</sup>serum triglycerides  $> 2 \text{ mmol} \cdot \text{l}^{-1}$ ; <sup>9</sup>oral hypoglycaemic drugs or/and insulin; <sup>10</sup>glucose  $\geq 7.0 \text{ mmol} \cdot \text{l}^{-1}$  and/or history of diabetes (in patients fasting  $\geq 6 \text{ h}$ ); <sup>11</sup>men  $< 55$  years and women  $< 65$  years. CHD=coronary heart disease; TC=total cholesterol; HDL=high-density lipoprotein; TG=triglycerides.

**Table 8 Therapeutic control of blood pressure and serum cholesterol at interview, by centre and diagnostic category; goal for blood pressure: systolic blood pressure (BP) <140 and diastolic BP <90 mmHg; goal for cholesterol: serum total cholesterol (TC) <5.0 mmol.l<sup>-1</sup>**

	No BP lowering medication*		BP lowering medication*		All patients		No lipid-lowering medication		Lipid-lowering medication		All patients	
	n	Reaching goal (%)	n	Reaching goal (%)	n	Reaching goal (%)	n	Reaching goal (%)	n	Reaching goal (%)	n	Reaching goal (%)
<b>By centre</b>												
BEL/GHE	31	61.3	229	55.0	260	55.8	122	9.0	109	39.4	231	23.4
CZE/PP	40	65.0	369	57.4	409	58.2	172	22.7	231	31.2	403	27.5
FIN/KUO	23	60.9	325	49.5	348	50.3	124	34.7	221	70.1	345	57.4
FRA/LLRT	34	61.8	330	43.6	364	45.3	113	30.1	248	44.0	362	39.8
GER/MÜNS	46	41.3	354	36.4	400	37.0	123	17.9	263	41.1	386	33.7
GRE/ATCI	57	50.9	332	52.4	389	52.2	200	30.0	166	42.2	366	35.5
HUN/BUD	11	45.4	378	63.2	389	62.7	169	30.2	188	48.4	357	39.8
IRE/DUB	87	58.6	258	50.4	345	52.5	130	32.3	209	55.0	339	46.3
ITA/TV	15	53.3	243	50.6	258	50.8	64	34.4	103	48.5	167	43.1
NET/ROT	79	45.6	276	48.6	355	47.9	83	24.1	265	65.7	348	55.7
POL/CRA	47	55.3	380	52.1	427	52.5	234	26.9	163	48.5	397	35.8
SLO/LJU	31	41.9	415	37.8	446	38.1	171	19.3	227	41.0	398	31.7
SPA/BAR	61	68.8	338	55.3	399	57.4	142	38.7	254	51.6	396	47.0
SWE/MAL	74	50.0	318	35.8	392	38.5	92	43.5	299	64.6	391	59.6
U.K./HL	89	42.7	269	49.1	359	47.6	105	29.5	234	54.3	340	46.5
<b>By diagnosis</b>												
CABG	239	43.9	1181	46.4	1420	46.0	477	28.5	877	51.8	1354	43.6
PTCA	171	58.5	1382	53.0	1554	53.6	452	29.6	992	50.7	1445	44.1
AMI	137	65.7	1323	52.2	1460	53.5	541	28.3	842	53.3	1384	43.6
Ischaemia	178	50.0	928	41.9	1106	43.2	574	24.9	469	43.5	1043	33.3
Total	725	53.0	4814	49.0	5540	49.6	2044	27.7	3180	50.6	5226	41.7

\*BP lowering medication: beta-blocker, calcium antagonist, ACE inhibitor, angiotensin II-receptor blocker, diuretic or other antihypertensive drug.

**Table 9** Reported medication (%) at time of interview (I), and recorded medication in the medical records on admission (A) and discharge (D) of those interviewed, by centre and diagnostic category

	Antiplatelets (%)			Beta-blockers (%)			ACE inhibitors (%)			Lipid-lowering drugs (%)			Anti-coagulants (%)		
	A	D	I	A	D	I	A	D	I	A	D	I	A	D	I
By centre															
BEL/GHE	52.6	87.8	89.6	55.9	77.2	76.9	20.8	31.9	29.6	18.0	15.0	48.9	22.8	6.3	3.1
CZE/PP	36.0	88.2	87.6	39.7	73.5	73.7	22.2	37.0	47.1	19.3	27.0	57.3	2.1	5.9	3.7
FIN/KUO	56.5	85.6	81.9	62.4	94.2	87.9	20.7	25.4	24.4	31.1	47.0	64.4	5.9	13.0	10.9
FRA/LLRT	36.5	92.9	85.7	39.1	68.7	60.4	24.1	42.6	38.5	36.2	46.4	68.1	2.4	21.4	3.3
GER/MÜNS	48.9	96.3	86.3	40.7	67.4	68.1	33.8	49.3	44.6	29.3	48.0	67.6	8.2	35.3	5.0
GRE/ATCI	48.9	94.8	91.8	43.0	61.4	55.2	17.3	31.9	32.0	17.3	35.9	46.6	2.2	8.6	3.8
HUN/BUD	57.2	76.9	75.1	62.2	84.4	84.3	40.9	60.0	56.8	29.0	36.6	51.4	18.0	15.3	10.8
IRE/DUB	56.3	93.5	92.5	33.3	47.8	47.3	13.6	19.5	26.7	21.8	40.7	61.5	3.5	4.1	4.1
ITA/TV	27.0	94.9	91.5	21.4	62.8	61.2	21.9	51.4	51.9	10.1	45.5	59.7	0.6	3.5	1.2
NET/ROT	32.2	86.7	81.0	43.3	53.0	48.2	19.7	37.7	38.1	26.8	47.0	76.2	15.4	21.8	16.0
POL/CRA	35.3	91.5	87.1	31.4	61.9	61.6	38.5	51.3	47.8	9.5	42.8	41.9	3.6	5.4	6.3
SLO/LJU	46.2	87.9	82.3	39.5	64.0	65.7	33.7	60.5	59.4	26.6	42.7	58.3	4.8	7.0	9.0
SPA/BAR	47.7	91.4	85.6	40.6	52.6	47.3	24.8	16.2	21.8	29.5	39.1	64.6	8.1	8.6	6.2
SWE/MAL	53.1	94.7	92.1	48.0	71.3	63.5	13.3	14.6	18.9	33.6	56.9	76.5	10.8	16.2	8.7
U.K./HL	55.1	94.0	80.9	47.5	50.6	43.8	17.0	24.1	27.4	37.0	64.5	69.0	4.2	7.2	4.2
By diagnosis															
CABG	73.1	87.9	88.0	72.6	54.8	59.4	36.4	30.0	37.8	47.9	38.7	64.8	12.5	20.6	7.8
PTCA	57.1	97.6	92.1	47.3	70.4	67.0	22.8	38.4	36.2	27.4	50.8	68.4	9.0	8.2	4.9
AMI	17.5	90.5	86.5	20.0	74.4	68.4	15.2	48.7	45.1	10.0	42.3	60.4	2.9	12.6	8.4
Ischaemia	33.9	83.2	73.6	30.7	63.4	54.3	20.3	31.3	31.5	15.0	37.2	45.5	4.2	7.9	5.0
Total	46.6	90.3	85.9	43.9	66.2	62.9	24.1	37.6	38.0	26.1	42.7	60.8	7.4	12.4	6.6

likely to survive). Registration of smoking status at discharge from hospital was poor and lower than at admission, but some form of personal advice to stop smoking had been given to the vast majority of smokers. Patients should be professionally encouraged and supported to stop smoking. There is a strong dose-response relationship between the intensity of tobacco dependence counselling and its effectiveness<sup>[28]</sup>. Five first-line pharmacotherapies for tobacco dependence — nicotine replacement therapies in the form of nicotine gum, nicotine inhaler, nicotine nasal spray, and nicotine patch and more recently sustained-release bupropion hydrochloride — are effective, and to begin with, nicotine replacement therapy should be prescribed in the absence of contraindications<sup>[29]</sup>. Nicotine chewing gum and transdermal nicotine patches can be helpful in the initial weeks or months of smoking cessation. The use of nicotine patches is reported to be safe and without adverse effects in coronary patients. Caution, however, is still required and it is imperative that patients should not smoke while using nicotine replacement therapy.

Obesity (body mass index  $\geq 30 \text{ kg} \cdot \text{m}^{-2}$ ) is associated with an increase in all-cause mortality and cardiovascular mortality in particular, and has an adverse effect on cardiovascular risk factors such as blood pressure, plasma LDL-cholesterol, HDL-cholesterol, triglycerides and glucose tolerance. Central adiposity with an increased intra-abdominal fat mass is also adversely related to these risk factors and is associated with insulin resistance. In EUROASPIRE II, information on body height and weight was available in almost three-quarters of patients at admission. However, weight was only

recorded in one forth of the discharge letters, and only 14% of patients were noted to be obese at discharge. In contrast, obesity was found in approximately one third of patients at interview. This is partly a function of physicians relying mainly on patients' self-reported height and weight<sup>[30]</sup>. Like the results for smoking, the prevalence of obesity was lower in the revascularized and acute myocardial infarction groups, as compared to the myocardial ischaemia group. Overweight (body mass index  $\geq 25 \text{ kg} \cdot \text{m}^{-2}$ ) and increased waist circumferences ( $\geq 94 \text{ cm}$  in men and  $\geq 80 \text{ cm}$  in women) were recorded in four out of five patients. Obesity management in this clinical context is suboptimal and is dominated by the prevalence of obesity in these societies<sup>[31]</sup>. According to the Joint European recommendations on coronary prevention, the food composition should be modified so that the total dietary intake of fat is reduced to 30% or less of the total energy intake, and the intake of cholesterol to less than  $300 \text{ mg} \cdot \text{day}^{-1}$ , with an increase of monounsaturated and polyunsaturated fats from vegetables and fish, and carbohydrates from fresh fruits, cereals and vegetables. Waist circumferences  $\geq 94 \text{ cm}$  in men and  $\geq 80 \text{ cm}$  in women are an indication to lose weight and increase physical activity, while subjects with waist circumferences  $\geq 102 \text{ cm}$  in men and  $\geq 88 \text{ cm}$  in women should seek advice from health professionals for weight reduction. In this study, just over half of overweight patients received advice to lose weight and about two-thirds were recommended to increase physical activity.

Elevated blood pressure following myocardial infarction is associated with an increased risk of reinfarction

and coronary death<sup>[32]</sup>, as well as an increased risk of stroke. Almost half the patients in this study had a recorded history of hypertension on admission, and blood pressure measurements were available in almost all patients. The presence of hypertension was recorded in two-fifths of the patients in their discharge documents. Yet at interview, less than half of all patients had a blood pressure <140/90 mmHg, and of those on blood pressure lowering medication just under one half had reached this blood pressure goal. As blood pressure was only measured twice, the proportion of patients who actually require antihypertensive therapy on the basis of repeated blood pressure recordings, will be lower. However, there is still a considerable gap in the control of elevated blood pressure and about one half of all coronary patients require more intensive lifestyle advice, repeat blood pressure measurements and, where appropriate, antihypertensive medication. Whilst there is no evidence from randomized controlled trials on antihypertensive treatment in patients with CABG, PTCA and myocardial ischaemia, two classes of antihypertensive agents (beta-blockers and ACE-inhibitors) have provided secondary protection in patients following myocardial infarction. Therefore, the treatment of elevated blood pressure in patients with established coronary disease should follow the same guidelines for primary prevention, but blood pressure lowering should be dealt with carefully. The goal for coronary patients should be a blood pressure consistently below 140/90 mmHg<sup>[6]</sup>.

A history of hyperlipidaemia was recorded in over a third of patients and a total cholesterol measurement was available in two thirds of the patients on admission. Less than half had cholesterol measurements recorded in their discharge letters. Between 1994 and 1997, three major trials: 4S<sup>[33]</sup>, CARE<sup>[34]</sup> and LIPID<sup>[35]</sup>, have shown that simvastatin and pravastatin reduce coronary morbidity and mortality and prolong survival in coronary patients. The 1998 Joint European Societies recommendations set goals of total cholesterol <5 mmol.l<sup>-1</sup> (190 mg.dl<sup>-1</sup>) and LDL-cholesterol <3 mmol.l<sup>-1</sup> (115 mg.dl<sup>-1</sup>) for coronary patients. Applying these new lipid goals to the EUROASPIRE II survey, a total cholesterol  $\geq 5$  mmol.l<sup>-1</sup> was measured in three-fifths of patients, and of those on lipid-lowering medication one half had not reached the goal of <5.0 mmol.l<sup>-1</sup>. So, despite the overwhelming evidence of the benefits of lipid-lowering therapy, a large majority of coronary patients are inadequately treated. This is despite the increase in the use of lipid-lowering therapies, from 26% at admission to 43% at discharge and 61% at interview; about half of the patients on lipid-lowering therapy are still not reaching goal.

Diabetes markedly increases the risk of coronary death and non-fatal recurrent coronary events in patients with clinically established coronary disease<sup>[36,37]</sup>. Although it is not yet established whether good glucose control reduces the risk of recurrent coronary events, the DIGAMI study in patients with acute myocardial infarction compared the impact of intensive

glucose control with insulin treatment with conventional treatment over a period of 1 year and reported a significant 52% reduction in mortality in the intensively treated group<sup>[38]</sup>. In EUROASPIRE II, 20% of the coronary patients had previously diagnosed diabetes. Although the information available did not allow classification according to the type of diabetes, evidently the majority of diabetic patients had type 2 (non-insulin-dependent) diabetes. In addition, 11% of the patients without diagnosis of diabetes had fasting plasma glucose levels  $\geq 7.0$  mmol.l<sup>-1</sup> compatible with the diagnosis of diabetes<sup>[39]</sup> and this raises the total prevalence of diabetes among EUROASPIRE II patients to 28%. The glucose control among diabetic patients with previously diagnosed diabetes was poor: 87% of them had a fasting plasma glucose level >6.0 mmol.l<sup>-1</sup> known to be associated with increased arterial disease risk, and 72% had a plasma glucose level  $\geq 7.0$  mmol.l<sup>-1</sup>, with additional risk of microvascular disease<sup>[40]</sup>. Due to their particularly high risk, the lifestyle and risk-factor management and the application of prophylactic drug therapies has to be particularly aggressive in diabetic patients with coronary disease. The comparison of the practice of secondary prevention in diabetic and non-diabetic EUROASPIRE II patients will be the subject of a separate report.

The following prophylactic drug classes, all of which can reduce morbidity and mortality in coronary patients, are recommended by the Joint European Societies: aspirin or other platelet modifying drugs, beta-blockers, ACE inhibitors, lipid-lowering therapies and anticoagulants<sup>[33-35,41-47]</sup>.

Apart from the antiplatelet drugs, which are used in the vast majority of coronary patients in all centres, there are wide differences between centres in prescribing other prophylactic therapies. The use of antiplatelets had nearly doubled by the time of interview. All centres used antiplatelet drugs to a similar extent, with the exception of Hungary, Finland and the Netherlands, but this was counterbalanced by the higher use of anticoagulants in these countries.

Overall, prescriptions of beta-blockers at interview had increased from 44% on admission to 63% at interview. The largest increase was in the acute myocardial infarction group. However, there was still a twofold difference between centres at interview in the use of this drug class, which varied between 44% and 48% in the U.K., Spain, Ireland and the Netherlands, up to 88% in Finland.

The use of ACE inhibitors had increased by 14% at interview, as compared to admission, with almost a third of the patients taking this class of drugs. However, as for beta-blockers, there was wide variation in reported ACE-inhibitor use between centres, ranging from 19% to 22% in Sweden and Spain to nearly 60% in Slovenia and Hungary.

Anticoagulants following myocardial infarction are now recommended for selected patients at increased risk of thromboembolic events. Whilst overall only 7% of patients at interview were taking anticoagulants, there

was also wide variation in the use of this drug class between centres. The highest use of anticoagulants was in the Netherlands, Hungary and Finland.

The results of EUROASPIRE II, and other contemporary studies, show convincingly that integration of coronary heart disease prevention into daily practice is inadequate, reflecting a collective failure of medical practice. This is not due to a lack of professional recommendations on coronary prevention at a European or national level. The most recent recommendations from the Joint Task Force of the ESC/EAS/ESH restate that patients with established coronary heart disease are the top priority for prevention. Yet, risk factor recording and management in coronary patients clearly falls short of these recommendations. Of course, the publication of guidance alone is not sufficient to influence clinical practice. The real task facing cardiovascular medicine is communication and implementation of these guidelines in daily clinical practice and this responsibility lies at a national level and in both hospital and primary care.

There are several barriers to the implementation of evidence based coronary prevention at societal, institutional, professional and patient levels<sup>[48,49]</sup>, and these can differ between European countries. Political and social changes, like those occurring in Eastern and Central European countries, can have a profound impact on the risk of coronary disease and patients with established coronary heart disease are as susceptible to these influences as the rest of the population. Similarly, the economies of some countries in Europe are weak and resources for coronary patients are therefore scarce and this will inevitably limit the impact of secondary prevention. The institutional organization of medical care and regulations for reimbursement of drug therapies will also influence the effectiveness of care. Access to comprehensive cardiac prevention and rehabilitation programmes differs between countries and from one hospital to another within countries. Professional attitudes of cardiologists and other physicians towards prevention and the medical organization of a patients' long-term care will also influence outcomes. So the opportunities for patients to address their lifestyles and receive treatments are not the same, and the patients' attitude towards risk factor reduction will also determine whether lifestyle and risk factor goals are achieved. The HELP study<sup>[50]</sup> found the public had a reasonable knowledge of the risk of coronary heart disease but their attitude was remarkably indifferent; even in post-MI patients, 24% were aware of lipid-lowering treatments, but did not take them, while over a third were not even aware of this form of therapy. Even when patients are treated they may not reach goals for a variety of reasons: severity of risk factors, inappropriate drugs or drug dosages and patient non-compliance. The Joint European Task Force recommendations state that hospital is a good starting point for a cardiac prevention and rehabilitation programme, which then needs to be further extended to the community to provide continuity of risk-factor management and to ensure long-term compliance with evidence-based

therapies. Hospital specialists and general practitioners need to co-ordinate their efforts and, with the support of other health professionals, create an integrated hospital and community based clinical strategy for prevention of coronary heart disease.

EUROASPIRE II shows that too many patients are not receiving adequate lifestyle and therapeutic interventions and as a consequence most are not achieving the recommended goals. There is a wide gap in the implementation of evidence-based medicine in clinical practice in both hospital and primary care. This needs to be urgently addressed, otherwise many patients under our care will suffer unnecessary further morbidity and premature mortality.

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## Appendix

The EUROASPIRE II survey was carried out under the auspices of the European Society of Cardiology, Euro Heart Survey programme. EUROASPIRE was originally an initiative of the ESC Working Group on Epidemiology and Prevention and the first EUROASPIRE survey was undertaken as part of work of the Joint ESC/EAS/ESH Implementation Group on Coronary Prevention. This second survey informs the work of the Joint European Societies Cardiovascular Prevention Committee, a Board Committee of the ESC.

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