Coronary disease mortality, incidence, and clinical presentation vary greatly over time. In many countries with a high prevalence of coronary heart disease, mortality is now falling rapidly. Concomitantly, there is evidence that acute myocardial infarctions (AMIs) are becoming smaller, and unstable angina pectoris, a less lethal form of the acute coronary syndromes (ACS), now accounts for a substantial proportion of all admissions. Additionally, the mortality from ACS is decreasing more than the incidence, with important decreases also in out-of-hospital deaths. Changes in mortality and incidence have been attributed to changes in coronary care and secondary prevention. Changes in risk factors may also have a role, with falling rates of smoking and more obesity in many areas of the world.

Among patients with AMI, those who present with ST elevation develop larger infarctions, have more in-hospital complications, and have higher short term mortality than patients without ST elevation. Pathophysiologically, patients with ST elevation who progress to Q wave AMI are characterised by occlusive thrombus in the vast majority of cases, whereas total occlusion is infrequently observed in the early hours of non-Q wave AMI. Thus, different pathophysiological processes may be involved. We hypothesised that different risk factors, such as smoking and factors associated with obesity (hypertension and diabetes mellitus), may be differently related to different forms of ACS. To this end, we investigated correlates of ST elevation ACS in a large sample of consecutively enrolled patients with ACS.

PATIENTS AND METHODS

Euro heart survey of acute coronary syndromes

The details of the Euro heart survey of ACS have been previously described in detail. The survey was performed in clusters composed of academic and non-academic hospitals and hospitals with and without cardiac catheterisation laboratories and cardiac surgery facilities. During the enrolment period lasting from 4 September 2000 to 15 May 2001, 14 271 patients in 25 countries with suspected ACS were screened, of whom 10 484 finally had a diagnosis of either AMI or unstable angina pectoris. The locally appointed ethics committees approved the study protocol. Informed consent was obtained from participants if required by the ethics committee, and the study complied with the Declaration of Helsinki. For 231 patients data were missing on either age or sex, leaving 10 253 who formed the study population for the present analysis.

For all patients, the tentative initial diagnosis made by the attending physicians was recorded based on the initial ECG pattern: ACS with ST elevation, ACS without ST elevation, and ACS with an undetermined ECG pattern. The full case report form was filled out for patients with a confirmed diagnosis of unstable angina or AMI and categorised according to the discharge diagnosis as either unstable angina, non-Q wave AMI, or Q wave AMI. The survey was conducted through a period when the new definition of AMI had not been uniformly implemented and unstable angina was therefore diagnosed among some patients with slightly increased markers of myocardial necrosis. For the present study, ST elevation ACS was defined as any presentation with ST elevation.

The case report form detailed the demographic, clinical, and ECG characteristics of the patient, the diagnostic and treatment modalities, the in-hospital complications, and the...
discharge status. Hyperlipidaemia was defined as previously diagnosed by a physician, receiving lipid lowering drugs, or either total cholesterol > 5 mmol/l or serum triglyceride > 2 mmol/l. Hypertension was defined as previously diagnosed by a physician, receiving medication to lower blood pressure, or known blood pressure ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic on two or more occasions. Diabetes mellitus was defined as previously diagnosed by a physician. Information on weight and height for the calculation of body mass index (BMI) was taken from patients’ records. Current smoking was defined as smoking up to one month before admission. Patients were defined as having no, one, two, or three or more risk factors, based on smoking, diabetes, hypertension, or hyperlipidaemia. Chronic angina was defined as having had angina before at least 30 days before admission. Coronary angiography was done in 5437 (53%) patients.

Statistical methods
All analyses were calculated with SAS software version 8e (SAS Institute, Cary, North Carolina, USA). All tests were two sided and p < 0.05 were considered significant. The trend for the association between presenting with ST elevation and categorical risk factors was tested with Fisher’s exact tests or the Cochran-Armitage trend test. Pearson tests were used for continuous variables. Because BMI data were missing for 1413 patients, many of whom died early, a separate variable was created for missing values for BMI and likewise for patients with no information on smoking (n = 975). BMI was categorised into four groups: 0, missing data; 1, < 25 kg/m²; 2, 25–30 kg/m²; and 3, ≥ 30 kg/m². Smoking was categorised into three groups: 0, missing data; 1, non-smokers (including former smokers); and 2, current smokers. For smoking categories 1 to 2, differences in proportions were tested with Fisher’s exact tests and with t tests for continuous variables. The trend for the association between categorical risk factors and BMI categories 1–3 was tested with the Cochran-Armitage trend test. Pearson tests were used for continuous variables. Age adjusted odds ratios (ORs), with 95% confidence intervals (CIs), were calculated by logistic regression with ST elevation ACS as the dependent variable and categories of risk factors as independent variables. We did not adjust for multiple statistical testing because many of the variables that were tested were intercorrelated and to do so would have increased the likelihood of type II error. However, CIs are presented for all main findings. To estimate the independent contribution of each of the variables to the risk of ST elevation ACS, multiple logistic regression models were used; Hyperlipidaemia was not entered into the models because of probable low precision. In a first step, dependent variables that were related to ST elevation in univariate analysis were entered: age, sex, and smoking; prior AMI, chronic angina, and revascularisation; and medication with aspirin or β blockers on admission. Because obesity is strongly causally related to hypertension and diabetes they were added only in a second model to investigate the effect of obesity without these intermediary factors. Use of statins was consistently not significant (p > 0.15 in all models) and was not included. In addition, separate models were created for men and women. Possible interactions between sex and smoking were tested with logistic regression, with the interaction term (sex*smoking) introduced in the logistic regression model with ST elevation as the dependent variable. We also included, separately, similar interaction terms for other variables where a possible interaction was detected.

RESULTS
Of the patients enrolled in the survey, 43% presented with ST elevation (table 1). Of patients with ST elevation, 65% were discharged with a diagnosis of Q wave MI and 13% with unstable angina. Fifty seven per cent presented without ST elevation; of these 9% were discharged with a diagnosis of Q wave MI and 64% with unstable angina.

Table 2 shows baseline risk factors and prior disease for all patients in the study and separated for patients with and without ST elevation. Overall, the prevalence of risk factors was high, with only 12% of the total study population not having any of the predefined risk factors (smoking, hypertension, hyperlipidaemia, or diabetes mellitus). Twenty four per cent had known diabetes mellitus, 58% had hypertension, 47% had hyperlipidaemia, and 30% were smokers. BMI was not recorded in 14%; of the remainder, 68% were overweight or obese. Patients with ST elevation were younger and more were men and current smokers. They had a lower prevalence of other risk factors, less prior disease, and fewer medications.

In subsequent analyses, categories of risk factors and prior disease were compared for the proportion of patients with ST elevation (table 3). The proportion of patients with ST elevation was higher among current smokers than non-smokers (OR 1.84, 95% CI 1.67 to 2.02). The OR associated with smoking was higher in women than in men, with a formal test for interaction significant (p for interaction 0.0098). Obesity (OR 0.76, 95% CI 0.67 to 0.85 for BMI > 30 kg/m²) and hypertension (OR 0.65, 95% CI 0.60 to 0.70) were associated with less risk of presenting with ST elevation. Diabetes mellitus carried less risk of presenting with ST elevation among men but not among women (p for interaction 0.0004). There was also a significant interaction between sex and BMI (p = 0.015), with a stronger effect among women than among men. Prior AMI, revascularisation, or chronic angina and treatment with aspirin, β blockers, or statins before hospitalisation were all associated with lower risk of presenting with ST elevation in both men and women.

Of the smokers in the study population, 73% were below 65 years and 18% were women compared with 35% and 40%, respectively, among the non-smokers (table 4). Smokers had lower BMI but, although significant, the absolute difference was small. They also had less diabetes mellitus, hypertension, prior disease, and medication on admission. Compared with patients with normal weight (BMI < 25 kg/m²), slightly more of the obese patients were women. Obese patients were also younger and had more hypertension, diabetes mellitus, and hyperlipidaemia (table 5). The prevalence of prior AMI, chronic angina, and revascularisation was by and large similar, regardless of BMI category, but obese patients tended to take more medications.

The prevalence of prior AMI, chronic angina, and revascularisation was by and large similar, regardless of BMI category, but obese patients tended to take more medications. To investigate the relative contribution of risk factors adjusted for age, prior disease, and medication of admission, multiple logistic regression analyses were done with ST elevation as the dependent variable (table 6). In a first analysis we considered only smoking, BMI, and prior disease and medication, but not hypertension or diabetes because obesity is strongly causally related to these factors.
Risk factors and clinical presentation in ACS

In this large survey of patients with ACS from Europe and the Mediterranean area, where only a small proportion of patients had no conventional risk factors, we found that presenting with ST elevation was strongly associated with smoking but inversely related to BMI and hypertension. Prior manifestations of coronary disease, with concomitant treatment, were associated with less ST elevation, but the associations between presenting with ST elevation and risk factors were independent of prior disease and medication. Thus, shifts in coronary risk factor pattern, with reduced smoking rates and an increase in the prevalence of obesity and obesity-related disorders such as hypertension, may be contributing to a shift in the clinical presentation in ACS and perhaps to improved outcomes.

Several studies have reported decreasing severity of AMI and ACS.\textsuperscript{5-7} In a study from Finland, the proportion of patients who had an AMI with definite ECG findings decreased by about one third between 1983 and 1993,\textsuperscript{22} together with a significant decrease in the incidence of increased cardiac enzymes. In the US based ARIC (atherosclerosis risk in the communities) study, mean peak creatine kinase concentration decreased 5% per year between 1987 and 1994 among patients with ACS; however, at the same time the proportion with ST elevation increased, providing mixed support for decreases in the severity of AMI.\textsuperscript{6} Nonetheless, two other population-based studies from the USA have indicated decreased disease severity in AMI. One study showed that the proportion of Q wave AMIs, as part of all AMIs, decreased from about one half to one third from the mid-1980s to the mid-1990s.\textsuperscript{7} The other study, from Olmsted County, Minnesota, examined several indicators of AMI severity between 1983 and 1994. The proportion of patients presenting with ST elevation declined, as well as the occurrence of Q waves and peak creatine kinase concentrations, independently of time to presentation and differences in reperfusion treatment.\textsuperscript{8}

Contributing to the evidence of less severe AMIs are the numerous studies that report decreasing mortality from

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**Table 2** Baseline risk factors and prior disease by presence or absence of ST elevation in the Euro heart survey of ACS

<table>
<thead>
<tr>
<th>Baseline risk factors</th>
<th>ACS with ST elevation (n = 4361)</th>
<th>ACS without ST elevation (n = 5892)</th>
<th>p Value</th>
<th>All (n = 10 253)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt; 65</td>
<td>2280 (52%)</td>
<td>2439 (41%)</td>
<td>&lt;0.0001</td>
<td>4719 (46%)</td>
</tr>
<tr>
<td>Women</td>
<td>1239 (28%)</td>
<td>2090 (35%)</td>
<td>&lt;0.0001</td>
<td>3329 (32%)</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not recorded</td>
<td>472 (11%)</td>
<td>941 (16%)</td>
<td>1413 (14%)</td>
<td></td>
</tr>
<tr>
<td>Normal (&lt;25)</td>
<td>1294 (30%)</td>
<td>1502 (25%)</td>
<td>2796 (27%)</td>
<td></td>
</tr>
<tr>
<td>Overweight (25-30)</td>
<td>1807 (41%)</td>
<td>2322 (39%)</td>
<td>4129 (40%)</td>
<td></td>
</tr>
<tr>
<td>Obese (&gt;30)</td>
<td>788 (18%)</td>
<td>1127 (19%)</td>
<td>1915 (19%)</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>969 (22%)</td>
<td>1470 (25%)</td>
<td>2439 (24%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>2215 (51%)</td>
<td>3710 (63%)</td>
<td>5925 (58%)</td>
<td></td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>1859 (43%)</td>
<td>2997 (51%)</td>
<td>4856 (47%)</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not recorded</td>
<td>423 (10%)</td>
<td>552 (9%)</td>
<td>975 (10%)</td>
<td></td>
</tr>
<tr>
<td>Non-smoker\textsuperscript{t}</td>
<td>2252 (52%)</td>
<td>3933 (67%)</td>
<td>&lt;0.0001</td>
<td>6185 (60%)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>1686 (39%)</td>
<td>1407 (24%)</td>
<td>3093 (30%)</td>
<td></td>
</tr>
<tr>
<td>Number of risk factors\textsuperscript{t, s}</td>
<td>1</td>
<td>580 (13%)</td>
<td>699 (12%)</td>
<td>1279 (12%)</td>
</tr>
<tr>
<td>2</td>
<td>1644 (38%)</td>
<td>1980 (34%)</td>
<td>3624 (35%)</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>1471 (34%)</td>
<td>2177 (37%)</td>
<td>3648 (36%)</td>
<td></td>
</tr>
<tr>
<td>Prior diseases and medication before admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>962 (22%)</td>
<td>2142 (36%)</td>
<td>&lt;0.0001</td>
<td>3104 (30%)</td>
</tr>
<tr>
<td>Chronic angina</td>
<td>921 (21%)</td>
<td>2193 (37%)</td>
<td>&lt;0.0001</td>
<td>3114 (30%)</td>
</tr>
<tr>
<td>Revascularisation</td>
<td>414 (9%)</td>
<td>1308 (22%)</td>
<td>&lt;0.0001</td>
<td>1722 (17%)</td>
</tr>
<tr>
<td>Aspirin</td>
<td>1320 (30%)</td>
<td>2978 (51%)</td>
<td>4298 (42%)</td>
<td></td>
</tr>
<tr>
<td>β Blocker</td>
<td>1089 (23%)</td>
<td>2292 (39%)</td>
<td>3381 (33%)</td>
<td></td>
</tr>
<tr>
<td>Statin</td>
<td>656 (15%)</td>
<td>1424 (24%)</td>
<td>2080 (20%)</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{t}Trend test, only among patients with recorded height and weight.
\textsuperscript{†}Includes former smokers.
\textsuperscript{s}Only among patients with complete data for smoking.
\textsuperscript{t}Risk factors: smoking, hypertension, diabetes, hyperlipidaemia.

BMI, body mass index.
coronary disease in the USA, Australia, and in large parts of Europe and reports of decreasing case fatality. In studies investigating trends in fatal and non-fatal AMI, several studies have found that mortality decreased more than the incidence. Trends in out-of-hospital coronary mortality probably reflect changes in cardiovascular risk factors, whereas in-hospital mortality is more tied to medical care. However, judging from the results of the present study, and because ST elevation has the most adverse short term prognosis, it is possible that in-hospital mortality is also influenced by risk factor pattern.

### Table 3 Age adjusted odds ratios for risk factors and prior disease associated with ST elevation among men and women in the Euro heart survey of ACS

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>All (4361)</th>
<th>Men (3122)</th>
<th>Women (1239)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ST elevation ACS OR (95% CI)</td>
<td>ST elevation ACS OR (95% CI)</td>
<td>ST elevation ACS OR (95% CI)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;65</td>
<td>4719 (51%)</td>
<td>1.00</td>
<td>1887 (51%)</td>
</tr>
<tr>
<td>≥65</td>
<td>5534 (38%)</td>
<td>0.65 (0.60 to 0.70)</td>
<td>1235 (38%)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25 kg/m²</td>
<td>1413 (33%)</td>
<td>0.62 (0.55 to 0.71)</td>
<td>310 (37%)</td>
</tr>
<tr>
<td>25–30 kg/m²</td>
<td>2796 (46%)</td>
<td>1.00</td>
<td>880 (47%)</td>
</tr>
<tr>
<td>&gt;30 kg/m²</td>
<td>4129 (44%)</td>
<td>0.87 (0.78 to 0.95)</td>
<td>1399 (46%)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing data</td>
<td>975 (43%)</td>
<td>1.37 (1.20 to 1.57)</td>
<td>290 (45%)</td>
</tr>
<tr>
<td>No</td>
<td>6185 (36%)</td>
<td>1.00</td>
<td>1452 (39%)</td>
</tr>
<tr>
<td>Yes</td>
<td>3093 (55%)</td>
<td>0.97 (0.96 to 0.98)</td>
<td>1280 (54%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4328 (30%)</td>
<td>1.00</td>
<td>1664 (51%)</td>
</tr>
<tr>
<td>Yes</td>
<td>5925 (37%)</td>
<td>0.65 (0.60 to 0.70)</td>
<td>1458 (40%)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7814 (43%)</td>
<td>1.00</td>
<td>2529 (46%)</td>
</tr>
<tr>
<td>Yes</td>
<td>2439 (40%)</td>
<td>0.92 (0.83 to 1.01)</td>
<td>593 (40%)</td>
</tr>
<tr>
<td>Prior MI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7149 (49%)</td>
<td>1.00</td>
<td>2420 (51%)</td>
</tr>
<tr>
<td>Yes</td>
<td>3104 (43%)</td>
<td>0.97 (0.96 to 0.98)</td>
<td>1280 (54%)</td>
</tr>
<tr>
<td>Chronic angina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7139 (48%)</td>
<td>1.00</td>
<td>2487 (50%)</td>
</tr>
<tr>
<td>Yes</td>
<td>3114 (30%)</td>
<td>0.47 (0.43 to 0.52)</td>
<td>635 (32%)</td>
</tr>
<tr>
<td>Prior revascularisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8531 (47%)</td>
<td>1.00</td>
<td>2804 (50%)</td>
</tr>
<tr>
<td>Yes</td>
<td>1722 (44%)</td>
<td>0.56 (0.52 to 0.60)</td>
<td>318 (24%)</td>
</tr>
<tr>
<td>ASA before admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5955 (51%)</td>
<td>1.00</td>
<td>2188 (54%)</td>
</tr>
<tr>
<td>Yes</td>
<td>4298 (31%)</td>
<td>0.45 (0.41 to 0.49)</td>
<td>934 (33%)</td>
</tr>
<tr>
<td>β Blocker before admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6872 (47%)</td>
<td>1.00</td>
<td>2352 (50%)</td>
</tr>
<tr>
<td>Yes</td>
<td>3381 (32%)</td>
<td>0.53 (0.49 to 0.58)</td>
<td>770 (32%)</td>
</tr>
<tr>
<td>Statin before admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8173 (45%)</td>
<td>1.00</td>
<td>2659 (48%)</td>
</tr>
<tr>
<td>Yes</td>
<td>2080 (65%)</td>
<td>0.54 (0.49 to 0.60)</td>
<td>463 (32%)</td>
</tr>
</tbody>
</table>

*Only in patients with recorded weight and height.

### Table 4 Baseline risk factors and prior disease in smokers and non-smokers in the Euro heart survey of ACS

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Smokers (n = 3093)</th>
<th>Non-smokers (n = 6185)</th>
<th>p Value</th>
<th>No data (n = 975)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>558 (18%)</td>
<td>2445 (40%)</td>
<td>&lt;0.0001</td>
<td>326 (33%)</td>
</tr>
<tr>
<td>Age ≤65</td>
<td>57 (11.4%)</td>
<td>68.0 (11.3)</td>
<td>&lt;0.0001</td>
<td>70.0 (11.7)</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.9 (4.3)</td>
<td>27.3 (4.2)</td>
<td>&lt;0.0001</td>
<td>27.1 (4.0)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>510 (16%)</td>
<td>1665 (27%)</td>
<td>&lt;0.0001</td>
<td>264 (27%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1404 (45%)</td>
<td>3962 (64%)</td>
<td>&lt;0.0001</td>
<td>559 (57%)</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>1465 (47%)</td>
<td>3031 (49%)</td>
<td>&lt;0.0001</td>
<td>360 (37%)</td>
</tr>
<tr>
<td>Prior diseases and medication before admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>672 (22%)</td>
<td>2080 (34%)</td>
<td>&lt;0.0001</td>
<td>352 (36%)</td>
</tr>
<tr>
<td>Chronic angina</td>
<td>676 (22%)</td>
<td>2103 (34%)</td>
<td>&lt;0.0001</td>
<td>335 (34%)</td>
</tr>
<tr>
<td>Revascularisation</td>
<td>337 (11%)</td>
<td>1199 (19%)</td>
<td>&lt;0.0001</td>
<td>186 (19%)</td>
</tr>
<tr>
<td>ASA</td>
<td>930 (31%)</td>
<td>2887 (47%)</td>
<td>&lt;0.0001</td>
<td>471 (48%)</td>
</tr>
<tr>
<td>β Blocker</td>
<td>781 (25%)</td>
<td>2197 (36%)</td>
<td>&lt;0.0001</td>
<td>403 (41%)</td>
</tr>
<tr>
<td>Statin</td>
<td>507 (16%)</td>
<td>1365 (22%)</td>
<td>&lt;0.0001</td>
<td>208 (21%)</td>
</tr>
</tbody>
</table>

*Data are mean (SD).
et al, in relation to the various manifestations of ACS. Although Khot et al.18 probably underestimated because some patients with diabetes, hyperlipidaemia, or hypertension may be unaware of these conditions. Few studies have investigated risk factors in selected. Even so, the proportion with no risk factors is probably underestimated because some patients with diabetes, hyperlipidaemia, or hypertension may be unaware of these conditions. Few studies have investigated risk factors in relation to the various manifestations of ACS. Although Khot et al.24 did not comment on this, in their study current smoking was more prevalent among patients with ST elevation AMI than among patients with non-ST elevation AMI or unstable angina, particularly among women, whereas hypertension was more common among patients with non-ST elevation AMI. In a recent study of women hospitalised with AMI or unstable angina, current cigarette smoking (OR 1.60) and diabetes mellitus (OR 1.44) predicted AMI, whereas prior coronary disease (OR 0.70) independently predicted unstable angina.25 Other studies have also found smoking to be more prevalent among patients with ST elevation AMI.26 27 Paradoxically, smoking has been found to be associated with lower short term mortality among patients admitted with AMI, particularly after thrombolysis.28 30

This is a lower proportion than in the dataset from 14 international randomised controlled trials reported by Khot et al,18 probably in part because patients taking part in trials are selected. Even so, the proportion with no risk factors is probably underestimated because some patients with diabetes, hyperlipidaemia, or hypertension may be unaware of these conditions. Few studies have investigated risk factors in relation to the various manifestations of ACS. Although Khot et al.24 did not comment on this, in their study current smoking was more prevalent among patients with ST elevation AMI than among patients with non-ST elevation AMI or unstable angina, particularly among women, whereas hypertension was more common among patients with non-ST elevation AMI. In a recent study of women hospitalised with AMI or unstable angina, current cigarette smoking (OR 1.60) and diabetes mellitus (OR 1.44) predicted AMI, whereas prior coronary disease (OR 0.70) independently predicted unstable angina.25 Other studies have also found smoking to be more prevalent among patients with ST elevation AMI.26 27 Paradoxically, smoking has been found to be associated with lower short term mortality among patients admitted with AMI, particularly after thrombolysis.28 30

Table 5  Baseline risk factors and prior disease by categories of BMI in the Euro heart survey of ACS

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>&lt;25 (n = 2796)</th>
<th>25–30 (n = 4129)</th>
<th>&gt;30 (n = 1915)</th>
<th>No data (n = 1413)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt;65</td>
<td>937 (34%)</td>
<td>1085 (26%)</td>
<td>724 (38%)</td>
<td>583 (42%)</td>
</tr>
<tr>
<td>Age [years]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>471 (17%)</td>
<td>956 (23%)</td>
<td>643 (34%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1378 (49%)</td>
<td>2422 (59%)</td>
<td>1347 (70%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>1206 (43%)</td>
<td>2046 (50%)</td>
<td>1020 (53%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Missing data for smoking</td>
<td>213 (8%)</td>
<td>301 (7%)</td>
<td>146 (8%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Current smoker</td>
<td>971 (35%)</td>
<td>1278 (31%)</td>
<td>561 (29%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Prior diseases and medication before admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>809 (29%)</td>
<td>1248 (30%)</td>
<td>756 (30%)</td>
<td>0.60</td>
</tr>
<tr>
<td>Chronic angina</td>
<td>799 (29%)</td>
<td>1268 (31%)</td>
<td>590 (31%)</td>
<td>0.072</td>
</tr>
<tr>
<td>Revascularisation</td>
<td>435 (16%)</td>
<td>726 (18%)</td>
<td>328 (17%)</td>
<td>0.074</td>
</tr>
<tr>
<td>ASA</td>
<td>1100 (39%)</td>
<td>1741 (42%)</td>
<td>825 (43%)</td>
<td>0.010</td>
</tr>
<tr>
<td>β Blocker</td>
<td>853 (31%)</td>
<td>1365 (33%)</td>
<td>692 (36%)</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>499 (18%)</td>
<td>884 (21%)</td>
<td>407 (21%)</td>
<td>0.009</td>
</tr>
</tbody>
</table>

*p Value

*Data are mean (SD).

Table 6  Multivariate age adjusted odds ratios (with 95% CI) for risk factors and prior disease associated with ST elevation among men and women in the Euro heart survey of ACS

<table>
<thead>
<tr>
<th>Model</th>
<th>All</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not recorded</td>
<td>0.62 (0.54 to 0.71)</td>
<td>0.71 (0.59 to 0.84)</td>
<td>0.48 (0.38 to 0.60)</td>
</tr>
<tr>
<td>Overweight (25–30)</td>
<td>0.92 (0.83 to 1.02)</td>
<td>0.98 (0.87 to 1.11)</td>
<td>0.83 (0.69 to 1.00)</td>
</tr>
<tr>
<td>Obese (&gt;30)</td>
<td>0.84 (0.75 to 0.96)</td>
<td>0.29 (0.77 to 1.00)</td>
<td>0.77 (0.62 to 0.96)</td>
</tr>
<tr>
<td>Missing data for smoking</td>
<td>1.52 (1.32 to 1.76)</td>
<td>1.46 (1.22 to 1.75)</td>
<td>1.66 (1.29 to 2.13)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>1.53 (1.38 to 1.69)</td>
<td>1.34 (1.20 to 1.50)</td>
<td>2.31 (1.87 to 2.85)</td>
</tr>
<tr>
<td>Prior diseases and medication before admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>0.82 (0.74 to 0.91)</td>
<td>0.78 (0.69 to 0.89)</td>
<td>0.93 (0.77 to 1.12)</td>
</tr>
<tr>
<td>Chronic angina</td>
<td>0.60 (0.55 to 0.66)</td>
<td>0.64 (0.57 to 0.72)</td>
<td>0.55 (0.47 to 0.65)</td>
</tr>
<tr>
<td>Revascularisation</td>
<td>0.56 (0.49 to 0.64)</td>
<td>0.52 (0.44 to 0.60)</td>
<td>0.72 (0.55 to 0.93)</td>
</tr>
<tr>
<td>ASA</td>
<td>0.66 (0.59 to 0.73)</td>
<td>0.67 (0.60 to 0.76)</td>
<td>0.63 (0.53 to 0.74)</td>
</tr>
<tr>
<td>β Blocker</td>
<td>0.83 (0.75 to 0.92)</td>
<td>0.86 (0.76 to 0.97)</td>
<td>0.77 (0.64 to 0.91)</td>
</tr>
</tbody>
</table>

*Data are mean (SD).

In model I the effect of increasing BMI is assessed without intermediary variables (diabetes and hypertension). In model II these variables are added. If BMI was analysed as a continuous variable in model I, among the 8855 patients with recorded weight and height, risk of ST elevation was significantly reduced with increasing BMI overall (p = 0.0001; p = 0.0505 among men; p = 0.0008 among women). Corresponding p values for model II were p = 0.0018 overall, among men p = 0.27, among women p = 0.001.

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Smoking is associated with a hypercoagulable state, particularly with respect to increased concentrations of plasma fibrinogen, but the propensity for intracoronary clot formation associated with smoking is also due to effects on platelet activation. Smokers have also been shown to have better outcome in ACS without ST elevation, but this was shown to be due to a more favourable clinical profile.

The role of obesity in ACS is much less clear. Obesity is a risk factor for AMI but is also strongly associated with other factors in the development of coronary disease, such as hypertension, diabetes mellitus, and decreased glucose tolerance, as well as dyslipidaemia and inflammation. We found that BMI was inversely related to the risk of ST elevation but also that this effect was attenuated if correlates of obesity such as hypertension and diabetes (among men) were taken into account, indicating that the association between BMI and ST elevation was partly mediated by these intermediary factors. The effect was significant only among the women in the study. Among patients with stable and unstable coronary disease undergoing coronary angiography, obesity was recently shown to be strongly related to instability, independently of correlated risk factors and markers of inflammation. How this relates to our finding of less ST elevation in obese patients is not clear.

Hypertension is common among patients with AMI and unstable angina, but not many studies have evaluated the role of hypertension in patients with ACS. One recent study showed that more hypertensive patients with ACS were women and that they were older, had more co-morbidities, and slightly less often had AMI diagnosed. Hypertensive patients have also been shown to have more non-Q wave AMI but similar infarct sizes compared with non-hypertensive patients.

The findings from the present study may tentatively help to explain the changes in clinical presentation of ACS in parts of the world. Decreasing rates of smoking, particularly among men, may be resulting in a lower proportion of patients presenting with ST elevation. The worldwide epidemic of overweight and obesity may be counteracting the beneficial effect of the decreasing trends in smoking but may be resulting in milder coronary events, with lower short term mortality. However, despite the increasing trend worldwide of overweight and obesity, blood pressure levels have decreased over the past decades in some countries, illustrating the complexity of these issues.

Limitations
AMI and unstable angina diagnoses were not strictly validated. Even though atherosclerosis is probably the main causative factor for ACS even in patients without an angiographically obvious coronary stenosis, a proportion of the patients with diagnosed unstable angina may have had chest pain of non-cardiac origin. However, among the 5437 patients in the study who underwent a coronary angiography only 5% of these were normal. Only a small minority of patients with a diagnosis of unstable angina and no ST elevation had no prior cardiovascular disease or diabetes. Accordingly, the proportion of patients without any form of coronary disease is likely to be low. Limiting our analysis to patients with confirmed AMI or angiographically confirmed coronary disease would have excluded an important subset of the ACS population.

Conclusions
The main finding of this large survey of patients with ACS from 25 countries in Europe and the Mediterranean basin was that different risk factors were related to different ACS diagnoses. Smoking was related to patients presenting with ST elevation, whereas obesity and hypertension were more common among patients who presented without ST elevation. These differences suggest variations in pathophysiology associated with risk factor pattern, but they may also help to explain some of the temporal trends with respect to disease severity and decreasing mortality from coronary disease in areas where the epidemic of coronary disease seems to be receding.

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Conflict of interest: none

The locally appointed ethics committees approved the study protocol, informed consent was obtained from participants if required by the ethics committee, and the study was done in compliance with the Declaration of Helsinki.

REFERENCES
An unusual case of right ventricular dilatation

A 19 year old woman was admitted with cough, dyspnoea, pleuritic chest pain, tachycardia, and hypoxia 20 weeks after the birth of her first child. Chest x-ray findings were unremarkable. Echocardiography (panel A) revealed pronounced right ventricular dilatation, severe tricuspid regurgitation, and a right ventricular systolic pressure of 70 mm Hg. Initially pulmonary embolism was suspected. Computed tomographic (CT) pulmonary angiography, however, showed no evidence of pulmonary embolism although high resolution CT images revealed diffuse bilateral air space shadowing (panel B). Avian proteins antibodies were strongly positive and on further questioning antibodies were strongly positive and on further questioning bilateral air space shadowing is present with sparing of apical segments.