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Original Scientific Paper

Trends in cardiovascular risk factor prevalence (1995–2000–2005) in northeastern Spain

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Background **High prevalence of cardiovascular risk factors has been observed in Spain along with low incidence of acute myocardial infarction. Our objective was to determine the trends of cardiovascular risk factor prevalence between 1995 and 2005 in the 35–74-year-old population of Gerona, Spain.**

Design **Comparison of cross-sectional studies were conducted in random population samples in 1995, 2000, and 2005 at Gerona, Spain.**

Methods **An electrocardiogram was obtained, along with standardized measurements of body mass index, lipid profile, systolic and diastolic blood pressure, glycaemia, energy expenditure in physical activity, smoking, use of lipid-lowering and antihypertensive medications, and cardiovascular risk. Prevalence of diabetes, hypertension, and obesity was calculated and standardized for age.**

Results **A total of 7571 individuals (52.0% women) were included (response rate 72%). Low-density lipoprotein cholesterol >3.4 mmol/l (130 mg/dl) (49.7%) and hypertension (39.1%) were the most prevalent cardiovascular risk factors. In 1995, 2000 and 2005, low-density lipoprotein cholesterol decreased in both men and women: 4.05–3.91–3.55 mmol/l (156–151–137 mg/dl) and 3.84–3.81–3.40 mmol/l (148–147–131 mg/dl), respectively. Increases were observed in lipid-lowering drug use (5.7–6.3–9.6% in men and 4.0–5.8–8.0% in women), controlled hypertension (14.8–35.4–37.7% in men and 21.3–36.9–45.0% in women); (all *P*-trends <0.01), and obesity (greatest for men: 17.5–26.0–22.7%, *P*-trends = 0.020). Prevalence of myocardial infarction or possibly abnormal Q waves in electrocardiogram also increased significantly (3.9–4.7–6.4%, *P*-trends = 0.018).**

Conclusions **The cardiovascular risk factor prevalence change in Gerona was marked in this decade by a shift of total cholesterol and low-density lipoprotein cholesterol distributions to the left, independent of the increase in lipid-lowering drug use, and better hypertension control with increased use of antihypertensive drugs. *Eur J Cardiovasc Prev Rehabil* 14:653–659 © 2007 The European Society of Cardiology**

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Introduction

Coronary heart disease (CHD) is the primary cause of population mortality and morbidity in industrialized countries [1,2], but geographical variability is substantial;

France and Spain show particularly low rates. Several coronary risk factors (CRF) have been identified in recent decades [3,4] and most of them are causally associated with CHD. Therefore, the goal for CHD prevention at the population level is to lower the mean level of CRFs and shift the whole distribution of exposure in a favorable direction [5]. In this context, it is important to collect valid information about the prevalence of CRFs and their time trends in the population.

Estimations of the prevalence of classic CRF in Spain have been made in population samples from various communities and groups of workers [6–8]. Analyses of trends in CRF prevalence, however, are seldom done [9]. Knowledge of the trends in prevalence and control of CRF, and of the impact on CHD population incidence and mortality, when changes occur is essential to design and implement preventive public health interventions.

The aim of this study was to analyze the trends of CRF prevalence and distribution in 1995, 2000, and 2005 in the same Spanish population.

Methods

Population

Population-based cross-sectional studies were conducted in the province of Gerona, in north-eastern Spain, in 1995, 2000, and 2005. The reference population was approximately 600 000 inhabitants [10].

We selected participants aged 35–74 years stratified by 10-year age and sex groups for the present analysis. A two-stage sampling method was used in 1995 and 2000: 33 and 17 towns, respectively, were randomly selected in the first stage. Half of the towns were urban ($>10\,000$ inhabitants) and half were rural (500–10 000 inhabitants). In both studies, the second sampling stage consisted of randomly recruiting the same number of women and men participants, stratifying by 10-year age groups from the closest census. The survey of 2005 was conducted on a random sample of participants from the city of Gerona (approximately 70 000 inhabitants) and three surrounding rural towns. In all three surveys, selected participants were contacted by a letter informing them of the aims of the study and the tests to be performed. Participants were requested to fast for at least 10 h before their appointment at the health examination site; a telephone number for inquiries was also supplied. Participants who provided a phone number were contacted 1 week before the examination to confirm attendance.

The sample size in each survey was designed to allow (i) at least an 80% chance to detect as statistically significant ($P < 0.05$) differences of at least 15, 11 and 10% units in a categorical variable, with a point estimate of 50% between any two strata in the surveys of 1995, 2000 and 2005, respectively, and (ii) a statistical power $>85\%$ to detect differences greater than 6% units among the three surveys in each sex at a P value of 0.05.

All participants were duly informed and signed their consent to participate in the studies. The studies were approved by the local ethics committee and the results of the examination were sent to participants.

Measurements

Examinations were performed by a team of trained nurses and interviewers who used the same standard questionnaires and measurement methods in all three surveys [11].

A precision scale of easy calibration was used for weight measurement with participants in underwear. Height was also measured. Body mass index (BMI) was determined as weight divided by squared height (kg/m^2).

Blood pressure was measured with a periodically calibrated mercury sphygmomanometer. A cuff adapted to upper arm perimeter (young, adult, obese) was selected for each participant. Measurements were performed after a 5-min rest. Two measurements were taken, at least 20 min apart, and the lower value was recorded for the study. The cut-off points for blood pressure followed the criteria in the Seventh Report of the Joint National Committee [12].

The following rates were calculated regarding hypertension and its treatment and control (i) history of hypertension: when participants reported a previous diagnosis or treatment for hypertension; (ii) real hypertension: systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg in previously nondiagnosed and nontreated participants; (iii) treated hypertension: patients with history of hypertension under drug treatment but not satisfactorily controlled; and (iv) controlled hypertension: SBP <140 and DBP <90 mmHg in participants with treated hypertension. SBP and DBP reference values were 130/85 mmHg for population with diabetes.

A standard 12-lead electrocardiogram (ECG) recording was obtained for each participant and interpreted by the same senior cardiologist in all three surveys. We present the proportion of participants with possibly abnormal Q waves, left ventricular hypertrophy by ECG Minnesota code [13], complete right or left branch block, and rhythm disorders, which includes ventricular extrasystolia, and atrial fibrillation or flutter. Participants were asked to disclose previous diagnosis of acute myocardial infarction (AMI); we present the combined information of history of AMI or possibly abnormal Q waves in ECG.

Blood was withdrawn after 10–14 h fasting, with less than 60-s duration. Serum sample aliquots were stored at

–80°C. Total cholesterol and triglyceride concentrations were determined enzymatically (Roche Diagnostics, Basel, Switzerland). High-density lipoprotein cholesterol (HDL-c) was measured as cholesterol after precipitation of apoprotein B-containing lipoproteins with phosphotungstic-Mg^{2+} (Boehringer, Mannheim, Germany). Analyses were performed in a Cobas Mira Plus autoanalyzer (Roche Diagnostics, Basel, Switzerland). Quality control was performed with External Quality Assessment – WHO Lipid Program (WHO, Prague, Czech Republic) and Monitrol-Quality Control Program (Baxter Diagnostics, Dudingen, Switzerland). Interassay coefficients of variation were 2.5, 4.5, and 3.2% for total cholesterol, HDL-c, and triglycerides, respectively. Low-density lipoprotein cholesterol (LDL-c) was calculated by the Friedewald equation whenever triglycerides were < 3.4 mmol/l (300 mg/dl).

Glucose metabolism alterations were classified as follows (i) history of diabetes: participants already diagnosed by a physician; (ii) impaired fasting glycaemia: fasting glycaemia 6.1–6.9 mmol/l (110–125 mg/dl) in participants not diagnosed previously with diabetes; and (iii) real diabetes: participants with history of diabetes or with a fasting glycaemia > 6.9 mmol/l (125 mg/dl). Insulin and oral antidiabetic treatments were also recorded.

Cardiovascular risk in participants free of CHD symptoms was calculated by the REGICOR (*Registre Gironí del Cor*) function adapted from the original Framingham function and validated for Spain [14,15].

The Minnesota leisure-time physical activity questionnaire validated for the Spanish population was used to assess the amount of leisure time physical activity performed during the previous year [11,16,17]. This questionnaire allows us to estimate the average daily energy expenditure in physical activity in the last year.

Statistical analysis

Prevalence is presented by sex and is standardized for the world age distribution. Continuous variables are presented as mean and standard deviation or median and interquartile range when their distribution departs from normal (e.g. glycaemia, triglycerides, and energy expenditure in physical activity), and categorical variables as proportions.

Analysis of variance and Kruskall–Wallis tests were used as appropriate to compare means and medians of continuous variables, respectively. Chi-squared test was used to compare proportions. To assess the linear trend of variables, analysis of variance and chi-squared tests were used. Standardization for age was done using the world standard population [18].

Statistical analysis was done with *R* Statistical Package (*R* Foundation for Statistical Computing, Vienna, Austria; Version 2.0).

Results

We included 7571 individuals aged 35–74 years: 1480 individuals (52.1% women) from 1995, 2540 (51.1% women) from 2000, and 3551 (52.7% women) from 2005. The response rates in these three surveys were 72.4, 70.0, and 73.8%, respectively.

Table 1 shows the lipid profile by sex, observed in the three surveys. Total cholesterol and LDL-c decreased steeply and significantly for both sexes, resulting in a shift of the entire population distribution curve of 2005 to the left as compared with those of 2000 and 1995 (Fig. 1a). On the contrary, the HDL-c mean showed no significant change (Fig. 1a). A significant increase in the percentage of participants under lipid-lowering treatment was observed. A sensitivity analysis, however, showed that the LDL-c trends held after excluding participants with lipid-lowering drugs: values were 4.02 (1.00), 3.91 (0.97), and 3.57 (1.01) mmol/l [155 (39), 151 (37), and 138 (39) mg/dl], *P*-trends < 0.001, for men; and 3.83 (1.06), 3.81 (1.00), and 3.41 (1.07) [148 (41), 147 (39), and 132 (42) mg/dl], *P* trends < 0.001, for women.

SBP significantly decreased in both sexes (Tables 2 and 3). Awareness of hypertension tended to increase together with the percentage of participants with hypertension and with participants with controlled hypertension in both sexes.

Glycaemia and the proportion of participants with impaired fasting glycaemia values decreased in both sexes (Tables 2 and 3). History of diabetes increased in men, but not in women; BMI tended to increase among men, although reported physical activity also increased over the studied period in both sexes.

The percentage of smokers significantly decreased, although this continued to be over 30% in men and actually increased in women to 21% in 2005. The percentage of ex-smokers increased for both sexes. The mean of 10-year cardiovascular risk remained unchanged over these 10 years for men, and decreased a little, but significantly, for women (Tables 2 and 3).

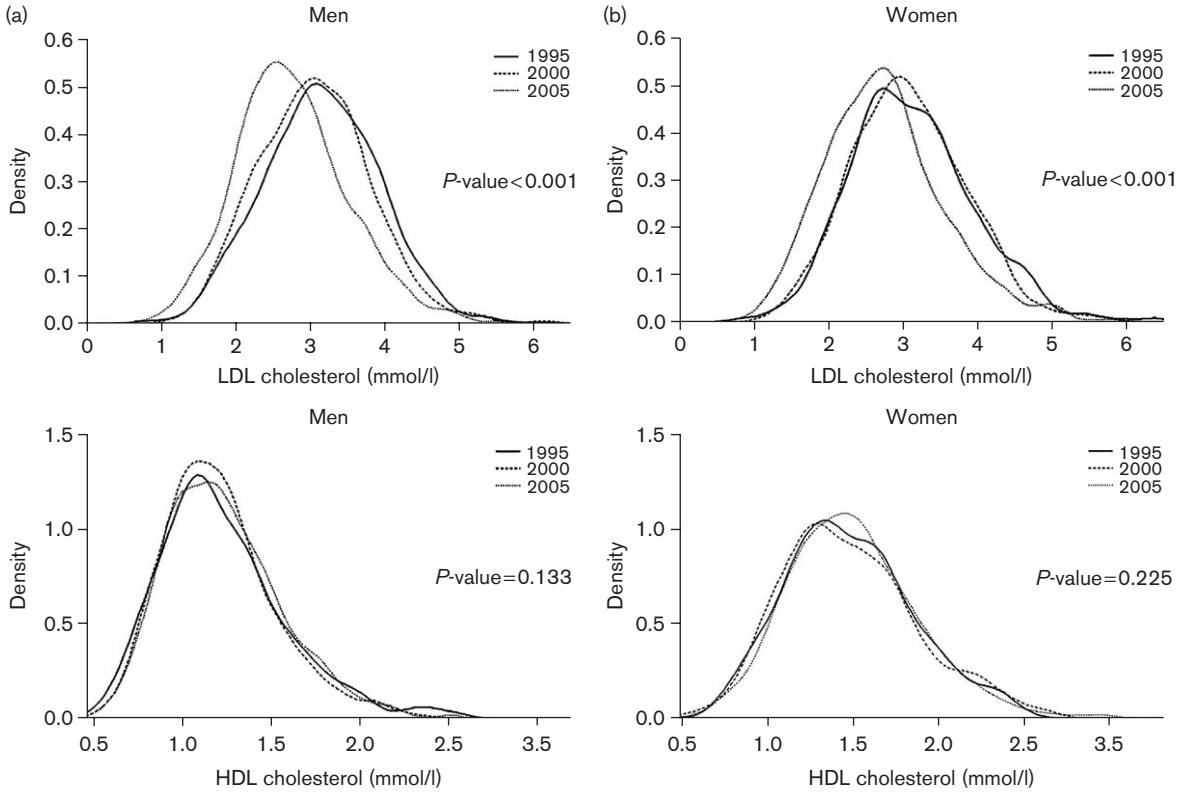
The prevalence of several ECG disorders is shown by sex in Table 4. Intraventricular conduction disorders were by far the more prevalent ECG finding in both sexes. The percentage of men with ECG signs of left ventricular hypertrophy and definite or possible AMI increased a little, but significantly.

Table 1 Lipid profile and lipid-lowering treatment in population of Gerona aged 35–74 years from 1995 to 2005

	1995	2000	2005	*P* value	*P* for trends
Men	*N*=709	*N*=1243	*N*=1681		
Total cholesterol (mmol/l)[a]	5.91 (1.12)	5.76 (1.09)	5.47 (1.09)	<0.001	<0.001
Total cholesterol>6.5 mmol/l (250 mg/dl)[b]	196 (30.0)	262 (23.5)	279 (17.1)	<0.001	<0.001
HDL-c (mmol/l)[a]	1.24 (0.38)	1.21 (0.32)	1.23 (0.33)	0.133	–
HDL-c<1.0 mmol/l (40 mg/dl)[b]	207 (30.8)	350 (31.3)	478 (28.4)	0.162	–
LDL-c (mmol/l)[a]	4.05 (1.02)	3.91 (0.98)	3.55 (1.00)	<0.001	<0.001
LDL-c>3.4 mmol/l (130 mg/dl)[b]	473 (74.6)	751 (70.3)	852 (53.1)	<0.001	<0.001
Triglycerides (mmol/l)[c]	1.20 (0.85–1.70)	1.22 (0.89–1.67)	1.23 (0.89–1.74)	0.291	–
Triglycerides>2.3 mmol/l (200 mg/dl)[b]	79 (12.6)	99 (9.28)	212 (13.6)	0.012	0.148
Lipid-lowering treatment[b]	51 (5.70)	94 (6.28)	211 (9.58)	<0.001	<0.001
Women	*N*=771	*N*=1297	*N*=1870		
Total cholesterol (mmol/l)[a]	5.79 (1.17)	5.79 (1.15)	5.43 (1.21)	<0.001	<0.001
Total cholesterol>6.5 mmol/l (250 mg/dl)[b]	210 (25.0)	329 (25.4)	360 (16.7)	<0.001	<0.001
HDL-c (mmol/l)[a]	1.49 (0.37)	1.48 (0.40)	1.51 (0.38)	0.225	–
HDL-c<1.2 mmol/l (46 mg/dl)[b]	238 (32.5)	413 (36.5)	552 (28.5)	<0.001	0.010
LDL-c (mmol/l)[a]	3.84 (1.06)	3.81 (1.01)	3.40 (1.06)	<0.001	<0.001
LDL-c>3.4 mmol/l (130 mg/dl)[b]	474 (64.2)	767 (65.1)	951 (47.2)	<0.001	<0.001
Triglycerides (mmol/l)[c]	0.92 (0.69–1.26)	0.92 (0.70–1.25)	0.94 (0.69–1.32)	0.248	–
Triglycerides>2.3 mmol/l (200 mg/dl)[b]	30 (3.48)	40 (3.07)	101 (4.56)	0.036	0.053
Lipid-lowering treatment[b]	43 (3.95)	98 (5.78)	202 (7.98)	<0.001	<0.001

'*P* for trends' have not been computed for those variables whose differences were not significant among the 3 years. To convert total, HDL and LDL cholesterol to mg/dl, multiply by 38.61. To convert triglycerides to mg/dl, multiply by 88.50. HDL-c, High density lipoprotein cholesterol; LDL-c, Low density lipoprotein cholesterol. [a]Mean (standard deviation). [b]*N* (%). [c]Median (25th percentile. 75th percentile).

Fig. 1



(a) Distribution of LDL-c (above) and HDL-c levels (below) in male population aged 35–74 years. (b) Distribution of LDL-c (above) and HDL-c levels (below) in female population aged 35–74. Three measurements over the past decade are presented. HDL-c, high-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol.

Discussion

The most prevalent CRFs in Gerona in the past 10 years were consistently LDL-c >3.4 mmol/l (130 mg/dl) (50.8%) and hypertension (44.8%). A substantial decrease, however, occurred in total and LDL-c mean values, but not in HDL-c, with a shift to the

Table 2 Coronary risk factors in male population of Gerona aged 35–74 from 1995 to 2005

	1995 (*N*=709)	2000 (*N*=1243)	2005 (*N*=1681)	*P* value	*P* for trends
Systolic blood pressure (mmHg)[a]	131 (19)	134 (18)	128 (17)	<0.001	<0.001
Diastolic blood pressure (mmHg)[a]	81 (11)	82 (9)	80 (10)	<0.001	0.166
History of hypertension *N* (%)	168 (19.8)	331 (23.8)	603 (29.6)	<0.001	<0.001
Real hypertension *N* (%)	350 (44.5)	680 (50.6)	854 (43.6)	0.074	–
Treated hypertension *N* (%)[b]	99 (36.8)	152 (32.5)	362 (44.8)	<0.001	0.018
Controlled hypertension *N* (%)[c]	16 (14.8)	20 (35.4)	84 (37.7)	0.008	0.011
History of diabetes *N* (%)	97 (11.5)	140 (9.7)	259 (11.7)	0.004	0.052
Glycaemia (mmol/l); (mg/dl)[d]	5.58 (5.12–6.10)	5.71 (5.25–6.30)	5.27 (4.84–5.89)	<0.001	0.022
Impaired fasting glycaemia *N* (%)[e]	90 (12.6)	154 (15.8)	145 (7.9)	<0.001	<0.001
Real diabetes *N* (%)	125 (15.9)	203 (18.8)	321 (15.3)	0.285	–
Insulin treatment *N* (%)[f]	10 (9.4)	9 (6.7)	35 (19.1)	0.078	–
Oral diabetes treatment *N* (%)[f]	39 (27.1)	60 (28.2)	125 (48.4)	0.155	–
BMI (kg/m^2)[a]	26.6 (3.8)	27.8 (3.9)	27.6 (4.0)	<0.001	<0.001
Obesity (BMI $\geq$ 30) %	129 (17.5)	347 (26.0)	413 (22.7)	<0.001	0.020
EEPA (kcal/day)[d]	286 (149–557)	283 (138–534)	320 (163–596)	<0.001	0.003
Current smoker *N* (%)	224 (36.2)	386 (35.5)	517 (34.5)	<0.001	<0.001
Former smoker *N* (%)	235 (30.6)	412 (30.5)	697 (38.0)		
Ten-year cardiovascular risk[a]	8.0 (7.8)	8.2 (8.7)	7.3 (7.3)	0.190	–

'*P* for trends' have not been computed for those variables whose differences were not significant among the 3 years. To convert glycaemia to mg/dl, multiply by 18.02. BMI, body mass index; EEPA, energy expenditure in physical activity. [a]Mean (standard deviation). [b]Among participants with history of hypertension. [c]Among participants with treated hypertension. [d]Median (25th percentile. 75th percentile). [e]Glycaemia 6.1–6.9 mmol/l (110–125 mg/dl). [f]Among participants with history of diabetes.

Table 3 Coronary risk factors in female population of Gerona aged 35–74 from 1995 to 2005

	1995 (*N*=771)	2000 (*N*=1297)	2005 (*N*=1870)	*P* value	*P* for trends
Systolic blood pressure (mmHg)[a]	126 (20)	125 (21)	122 (20)	<0.001	<0.001
Diastolic blood pressure (mmHg)[a]	76 (12)	77 (10)	77 (11)	0.098	–
History of hypertension *N* (%)	206 (22.0)	373 (24.6)	600 (26.0)	0.008	0.002
Real hypertension *N* (%)	357 (38.8)	576 (38.5)	769 (35.1)	0.073	–
Treated hypertension *N* (%)[b]	129 (47.8)	217 (41.7)	365 (47.1)	0.337	–
Controlled hypertension *N* (%)[c]	28 (21.3)	48 (36.9)	124 (45.0)	<0.001	<0.001
History of diabetes *N* (%)	84 (8.8)	120 (8.1)	221 (10.8)	0.071	–
Glycaemia (mmol/l); (mg/dl)[d]	5 (5–6)	5 (5–6)	5 (5–5)	<0.001	<0.001
Impaired fasting glycaemia *N* (%)[e]	49 (6.1)	115 (10.8)	86 (3.9)	<0.001	<0.001
Real diabetes *N* (%)	104 (11.2)	157 (13.9)	273 (13.4)	0.550	–
Insulin treatment *N* (%)[f]	12 (6.2)	10 (9.7)	24 (6.1)	0.476	–
Oral diabetes treatment *N* (%)[f]	27 (14.0)	48 (30.1)	65 (19.2)	0.102	–
BMI (kg/m^2)[a]	26.4 (4.4)	27.4 (5.1)	26.3 (5.1)	<0.001	0.213
Obesity (BMI $\geq$ 30) %	166 (19.0)	381 (26.5)	453 (21.2)	<0.001	0.756
EEPA (kcal/day)[d]	180 (92–313)	194 (101–327)	241 (127–418)	<0.001	<0.001
Current smoker *N* (%)	97 (17.1)	205 (20.1)	308 (21.5)	<0.001	<0.001
Former smoker *N* (%)	25 (4.2)	81 (7.3)	230 (14.1)		
Ten-year cardiovascular risk[a]	2.8 (3.0)	3.0 (3.1)	2.6 (2.6)	<0.001	0.004

'*P* for trends' have not been computed for those variables whose differences were not significant among the 3 years. To convert glycaemia to mg/dl, multiply by 18.02. BMI, body mass index; EEPA. energy expenditure in physical activity. [a]Mean (standard deviation). [b]Among participants with history of hypertension. [c]Among participants with treated hypertension. [d]Median (25th percentile. 75th percentile). [e]Glycaemia 6.1–6.9 mmol/l (110–125 mg/dl). [f]Among participants with history of diabetes.

Table 4 Electrocardiographic findings in the population of Gerona aged 35–74 years from 1995 to 2005

	1995	2000	2005	*P* value	*P* for trends
Men	*N*=709	*N*=1243	*N*=1681		
Acute myocardial infarction *N* (%)[a]	35 (3.93)	64 (4.73)	125 (6.38)	0.038	0.018
Left ventricular hypertrophy *N* (%)	15 (2.06)	27 (2.06)	62 (3.73)	0.022	0.013
Intraventricular conduction disorders *N* (%)	30 (3.41)	103 (8.00)	120 (6.60)	0.003	0.058
Rhythm disorders *N* (%)	8 (0.72)	19 (1.10)	42 (1.63)	0.040	0.014
Women	*N*=771	*N*=1297	*N*=1870		
Acute myocardial infarction *N* (%)[a]	13 (1.35)	18 (1.18)	45 (1.97)	0.158	–
Left ventricular hypertrophy *N* (%)	5 (0.46)	23 (1.44)	23 (1.12)	0.086	–
Intraventricular conduction disorders *N* (%)	22 (2.09)	53 (4.06)	88 (4.50)	0.094	–
Rhythm disorders *N* (%)	13 (1.25)	10 (0.65)	26 (1.24)	0.141	–

'*P* for trends' have not been computed for those variables whose differences were not significant among the 3 years. [a]History of acute myocardial infarction or possibly abnormal Q waves in electrocardiogram.

left in the population distribution curves. BMI and obesity have dramatically increased over this decade in men. Improvements in hypertension awareness, treatment, and control were also remarkable. Diabetes prevalence remained stable over the studied decade.

The decrease in total cholesterol and LDL-c population mean level, which has been observed in other European countries and USA [19–23], and the left shift in their population distribution curve might be related either to the increasing use of lipid-lowering drugs or to changes in lifestyle. Lipid-lowering drugs predominantly affect total cholesterol and LDL-c levels. Although the proportion of treated participants increased, particularly between 2000 and 2005, both measures decreased independently of such treatments. HDL-c mean values, which play a key role in lowering CHD risk, remained unchanged over the 10-year period. The intake of vegetables, fruits, fish, red meat, dairy products, pulses, and cereals remained stable between 2000 and 2005 (data not shown). Weekly physical activity equivalent to brisk walking, however, increased from 1995 to 2005 by approximately 40 min in men and 70 min in women.

BMI increased over this period, particularly in men, bringing the percentage of male obesity close to 23% in 2005. Smoking prevalence increased in women and remained steadily high in men over the period, together with a growth in the percentage of former smokers for both sexes, probably related to anti-smoking policies developed in recent years. Concurring with the Spanish National Health Surveys report, the percentage of smokers among women significantly increased [24]. Prevalence of smoking for Spanish men is among the highest for European countries [1].

Hypertension prevalence remained similar in the three studies. Our data show that almost 50% of men and 40% of women were diagnosed with hypertension or had blood pressure measurements beyond the limits of hypertension. These results concur with those by Wolf-Maier *et al.* [25] who found the hypertension prevalence in Spain to be approximately 45% in the general population (35–74 years). This percentage was higher than that observed in USA or Sweden. More individuals were aware of their hypertension in 2005 in our region, which probably results from better hypertension screening and management.

The cardiovascular risk, which was already very low in initially CHD-free women, decreased. In men, however, it remained similar over the decade, despite the decrease in total and LDL-c levels and improved control of hypertension. The shift to the left observed in the population distribution curves of total cholesterol and LDL-c should have an impact on CHD incidence, according to the 'population strategy' theory by Geoffrey Rose [5], although the efficiency of this approach has been called into question recently [26]. The slight but significant increase in the history of AMI or possibly abnormal Q waves in ECG in men may be due to the overall stabilization of AMI incidence accompanied by a significant (−5.4%) decrease in in-hospital AMI case-fatality observed recently in the region among men, 35–74 years of age [27].

Paradoxically, the prevalence of classical CRF is similar or even higher in Mediterranean than in other industrialized countries [7,28]. Therefore, the role of CRF in the development of CHD may differ among populations [28,29]. The absolute CHD risk for different levels of exposure to total cholesterol and SBP varied across populations in the Seven Countries study [30], although the relative risk for these risk factors was similar in all populations.

CHD mortality rates have decreased consistently in most industrialized countries in the past decade [1]. Despite this generalized trend, AMI mortality rates continue to be four times lower in South Mediterranean areas of Europe [1]. This suggests that primary prevention needs to be adapted to local characteristics of prevalence of CRF, AMI mortality and incidence rates, and economic and cultural factors [31]. The achievements in cholesterol levels and hypertension control in our region are likely to be related to 'high risk' or opportunistic intervention rather than a population preventive approach [5]. Our findings suggest that there is room for preventive activity concerning lifestyle in the studied area to decrease cardiovascular risk in the population, particularly increased efforts to promote physical activity, and smoking cessation or reduction.

Participation in the three independent cross-sectional studies considered was consistently around 72%, which guarantees representativeness. The basal age and sex characteristics of responders and nonresponders were similar in all three surveys. History of hypertension, diabetes and dyslipidaemia were also similar in the 2000 and 2005 surveys: in 1995 this information was not collected in nonresponders (data not shown). Although minimal differences are to be expected among regions [7,32], generalization of our results to the rest of Spain should be made with caution.

In conclusion, the prevalence of classic CRF in Gerona is high despite the low AMI incidence and death rates observed in this region. The CRF prevalence change in Gerona has been marked in the last decade by a shift of total cholesterol and LDL-c distributions to the left, independent of the increase in lipid-lowering drug use, and by better hypertension control, accompanied by increased use of antihypertensive drugs.

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