ORIGINAL ARTICLE

Prevalence of Cardiovascular Risk Factors in the Spanish Working Population

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Introduction and objectives. The routine medical check-up provides a good opportunity for screening workers early for cardiovascular risk factors. The aim of the present study was to investigate the prevalence of cardiovascular risk factors in the Spanish working population.

Methods. The study included 216 914 working people (mean age 36.4 years, range 16-74 years, 73.1% male) undergoing routine medical check-up, which involved a structured questionnaire, physical examination, and standard serum biochemical analysis.

Results. Cardiovascular disease had been diagnosed previously in 0.7% of workers, hypertension in 6.2%, diabetes in 1.2%, and dyslipidemia in 8.9%. Routine check-up showed that 49.3% (51.3% of males and 43.8% of females) were smokers, 22.1% (27.0% of males and 8.8% of females) had high blood pressure (≥140/90 mm Hg), 15.5% (18.3% of males and 13.3% of females) were obese (body mass index ≥30), 6.2% (7.8% of males and 1.9% of females) were hyperglycemic (blood glucose >110 mg/dL), and 64.2% had dyslipidemia (total cholesterol ≥200 mg/dL, LDL cholesterol ≥160 mg/dL, triglycerides ≥200 mg/dL, or HDL cholesterol <40 mg/dL in males or <50 mg/dL in females). When compared with workers in the service sector and after adjustment for potential confounders, workers in manufacturing, and particularly those in construction, had higher prevalences of both high blood pressure and smoking.

Conclusions. The prevalence of cardiovascular risk factors in the Spanish working population is high, particularly in males and in certain types of employment.

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A list of the investigators and participants in the Ibermutuamur Cardiovascular Risk Prevention Plan is provided at the end of the article.

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Prevalencia de factores de riesgo vascular en la población laboral española

Introducción y objetivos. Los reconocimientos de la salud de los trabajadores constituyen una oportunidad de detección precoz de factores de riesgo vascular. El presente estudio investiga la prevalencia de factores de riesgo vascular en la población laboral española.

Métodos. Se incluyó a 216.914 trabajadores (edad media, 36,4 años; intervalo, 16-74 años; el 73,1% eran varones) en los que se realizó un reconocimiento en una mutua laboral, que incluyó un cuestionario estructurado, una exploración física y determinaciones bioquímicas.

Resultados. Tenían diagnóstico previo de enfermedad cardiovascular el 0,7%, de hipertensión arterial el 6,2%, de diabetes el 1,2% y de dislipidemia el 8,9%. Durante el reconocimiento se detectó la presencia de tabaquismo en el 49,3% (el 51,3% varones y el 43,8% mujeres), presión arterial elevada (≥ 140/90 mmHg) en el 22,1% (el 27,0% varones y el 8,8% mujeres), obesidad (índice de masa corporal ≥ 30) en el 15,5% (el 18,3% varones y el 13,3% mujeres), hiperglucemia (> 110 mg/dl) en el 6,2% (el 7,8% varones y el 1,9% mujeres) y alguna forma de dislipidemia (colesterol total ≥ 200 mg/dl, cLDL ≥ 160 mg/dl, triglicéridos ≥ 200 mg/dl o cHDL < 40 mg/dl en varones o < 50 mg/dl en mujeres) en el 64,2%. Con respecto al sector «servicios», y tras ajustar por factores de confusión, los trabajadores del sector industria y sobre todo de la construcción mostraron una mayor prevalencia de elevación de la presión arterial y, especialmente, de tabaquismo.

Conclusiones. Hay una alta prevalencia de factores de riesgo en la población laboral española, especialmente en varones y en determinados sectores de actividad.

Palabras clave: *Diabetes mellitus. Factores de riesgo. Hipercolesterolemia. Hiperlipoproteinemia. Hipertensión arterial sistémica. Tabaquismo.*

ABBREVIATIONS

CRF: cardiovascular risk factors.
BMI: body mass index.
BP: blood pressure.
DBP: diastolic blood pressure.
SBP: systolic blood pressure.
SEA: Spanish Atherosclerosis Society.
SEQC: Spanish Society of Clinical Biochemistry and Molecular Pathology.

INTRODUCTION

The high prevalence of cardiovascular risk factors (CRF) in the population makes it essential to implement programs to prevent what could be a real epidemic of cardiovascular diseases.[1,2] It is generally agreed that there is a need to begin prevention of atherosclerosis early,[3] particularly as regards encouraging healthier lifestyles.[4] The routine medical check-up provides a good opportunity for screening workers early for cardiovascular risk factors.

To date, studies of the prevalence of CRFs in the Spanish working population[5-12] have concentrated on a small number of businesses, sectors, and/or regions. The objective of the present study was to investigate the prevalence of CRFs in a very large sample of the Spanish working population. The prevalence of CRFs by geographic areas and type of employment was also analyzed for possible differences.

METHODS

Study Design and Setting

This was an analytic study of the prevalence of CRF in workers covered by Ibermutuamur, a mutual insurance fund run by the Social Security which provides occupational health care and safety services and which has offices in all of the autonomous regions in Spain. Ibermutuamur provides coverage to over 1 100 000 workers, and carries out more than 400 000 medical check-ups annually. The present study forms part of Ibermutuamur's Cardiovascular Risk Prevention Plan which was initiated in 2004 and is systematically applied to all workers attending any of Ibermutuamur's regional offices. In the first phase of the Plan, workers receive a medical check-up which includes anamnesis using a structured questionnaire, a standard physical examination, and laboratory tests. The present paper reports on the prevalence of CRF based on the results of check-up standard.

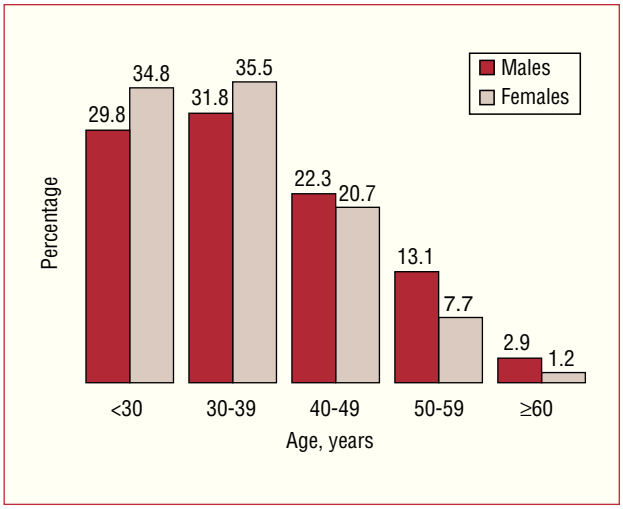

Figure. Distribution of the study population by sex and age group. Percentages represent the proportion of subjects by sex within each age group.

Study Population

A total of 321 308 workers who received a check-up between 3 May 2004 and 31 March 2005 were initially included. Of those, 216 914 workers for whom complete information was available to assess cardiovascular risk were included in the analysis. Cases with missing data or atypical values which could not be checked were excluded. The mean age of subjects included was 36.4 years (37.0 years in males and 34.9 years in females), with a range of 16 to 74 years. Two-thirds of subjects were under 40 years of age. Figure 1 shows the distribution of the study population by age and sex, and Table 1 shows the main demographic and employment characteristics of the study population in comparison with the Spanish working population as a whole.[13] In the present study, subjects were also stratified by geographical region defined according to age-adjusted cardiovascular mortality rates obtained from the Spanish Atherosclerosis Society's (SEA) 2003 report[1]: low mortality (<175 cases per 100 000 person/years: Aragon, Cantabria, Castille-Leon, Catalonia, La Rioja, Madrid Autonomous Region, Navarre Autonomous Region, and the Basque Country); intermediate mortality (175-200 cases per 100 000 person/years: Asturias, Extremadura, Castille-La Mancha, and Galicia), and high mortality (>200 cases per 100 000 person/years: Andalusia, Balearic Islands, Canary Islands, Valencian Autonomous Region, and Murcia). To minimize possible differences with the general working population, data are stratified or adjusted by the principal variables, particularly sex. Table 1 shows data for included and excluded individuals. No differences were observed between these 2 groups.

TABLE 1. **Demographic and Employment Data for Subjects Included and Excluded From the Analysis and in Comparison With the Spanish Working Population***

	Spanish Working Population† (n=17 116 660)	Present Study (Included Subjects) (n=216 914)	Present Study (Excluded Subjects) (n=104 394)
Age, mean±SD, y	38.6±9.0	36.4±10.9	36.4±10.9
Sex, males	10 403 300 (60.8%)	158 593 (73.1%)	75 635 (73.1%)
Type of employment			
Services	11 040 100 (64.5%)	115 257 (53.1%)	53 679 (51.4%)
Manufacturing	3 098 100 (18.1%)	43 129 (19.9%)	24 647 (26.6%)
Construction	2 058 700 (12.0%)	54 326 (25.0%)	23 604 (22.6%)
Agriculture	919 700 (5.4%)	4 202 (1.9%)	2 464 (2.36%)
Areas defined by cardiovascular mortality‡			
Low mortality	8 291 200 (48.4%)	96 918 (44 7%)	44 653 (42.8%)
Intermediate mortality	2 567 700 (15.0%)	35 541 (16.4%)	15 575 (14.9%)
High mortality	6 257 800 (36.6%)	84 455 (38.9%)	44 166 (42.3%)

*SD indicates standard deviation.
†Data from the 2004 Working Population Survey.[13]
‡Geographic areas defined by age-adjusted cardiovascular mortality based on the 2003 SEA report[1]: low mortality (<175 cases per 100 000 person/years: Aragon, Cantabria, Castille-Leon, Catalonia, La Rioja, Madrid Autonomous Region, Navarre Autonomous Region, and the Basque Country); intermediate mortality (175-200 cases per 100 000 persons/year: Asturias, Extremadura, Castille-La Mancha, and Galicia), and high mortality (>200 cases per 100 000 person/years: Andalusia, Balearic Islands, Canary Islands, Valencian Autonomous Region, and Murcia).

Main Determination

Cardiovascular disease was considered to be present when there was a prior medical diagnosis of heart disease, cerebrovascular disease or peripheral arteriopathy.

Subjects were classified as smokers if, on inclusion in the study, they consumed cigarettes, cigars and/or pipe tobacco, even if only occasionally.[14] Individuals who had given up smoking less than a year previously were also classified as smokers. All other subjects were classified as non-smokers.

Body-mass index (BMI) was calculated by dividing weight (in kg) by height (in meters) squared. Individuals with a BMI between 25 and 29.9 were considered to be overweight and individuals with a BMI of ≥30 were considered obese.[15] Waist circumference was measured while the individual was standing, using the midpoint between the lowest rib and the iliac crest as a reference. A waist circumference of >102 cm (in men) or >88 cm (in women) was considered to indicate abdominal obesity.[16]

As recommended in the 2003 European Society of Hypertension-European Society of Cardiology guidelines,[17] blood pressure (BP) was measured twice on the same arm using a validated automatic measuring system (OMRON M4-I, Omron Electronics, Hoofddorp, Holanda) with an interval of 1-2 min between measurements. Systolic blood pressure (SBP) of ≥140 mm Hg and/or diastolic blood pressure (DBP) of ≥90 mm Hg was considered abnormal. All individuals who were taking antihypertensive treatment or who had a prior diagnosis of hypertension were classified as hypertensive, regardless of the results of blood pressure measurements in the present study.

In all cases, systematic 12 h fasting serum analyses of blood glucose, triglycerides, total cholesterol, high density lipoprotein (HDL) cholesterol, uric acid, and creatinine were performed. Low density lipoprotein (LDL) cholesterol was calculated using Friedewald's formula.[18] Analyses were carried out in reference laboratories using standard protocols.

The following lipid values were considered abnormal: total cholesterol ≥200 mg/dL, HDL cholesterol <40 mg/dL (men) or <50 mg/dL (women), LDL cholesterol ≥160 mg/dL or triglycerides ≥200 mg/dL. All individuals who were taking anti-cholesterol medication or who had a prior diagnosis of dyslipidemia were classified as having dyslipidemia, regardless of the lipid values obtained in the present study.[16]

Fasting blood glucose values of >110 mg/dL were considered abnormal, particularly values of >126 mg/dL (in the diabetes range). Individuals were classified as diabetic if they were taking medication for diabetes or if they had a prior diagnosis of diabetes, regardless of the blood sugar values recorded in the present study.[19]

Data Quality Control

All of the definitions and measurement techniques used to collect data for the employment-related medical record were standardized before the Plan was initiated, and the information was communicated to participating clinicians via instruction booklets and meetings. Data quality was constantly checked by 2 data managers in collaboration with participating health care professionals.

Blood samples were analyzed in central laboratories (95% of the samples in Madrid, Murcia, and Alicante) and in sub-contracted laboratories in Oviedo, Palma de Mallorca, Palencia, Tenerife, and Zamora (the remaining 5%). The Spanish Society of Clinical Biochemistry and Molecular Pathology's (SEQC) quality control recommendations were followed. The variation coefficient for the main serum analyses was within the range accepted by the SEQC.

Statistical Analysis

Data analyses were performed in SAS (SAS Institute Inc., Cary, United States). Data from categorical variables are given as percentages with 95% confidence intervals (CI). Data from continuous variables are given as means ± standard deviation (SD). Values are given to the first decimal place. Comparison of categorical variables was carried out using the χ^2 test and the Cochrane-Armitage test was used for the analysis of trends. Continuous variables were compared using analysis of variance. When analyzing correlations between CRF and type of employment, logistic regression was used to adjust for possible confounders (particularly age and sex), as the distribution of these variables varies according to type of employment (data not shown). The significance level was set at $P=.01$.

Ethical Aspects

The study was approved by Ibermutuamur's Scientific Ethics Committee and the Helsinki guidelines were followed. Data was treated confidentially in accordance with current Spanish legislation on data protection. All workers provided signed informed consent to participate.

RESULTS

The proportion of cases with a history of cardiovascular disease or known CRFs is shown in Table 2. Only 0.7% of the study population had a history of clinically diagnosed cardiovascular disease (coronary, cerebral or peripheral arteriopathy). The most frequent CRF was smoking, with approximately half of all cases being classified as smokers, although 8.9% of males and 11.0% of females were only occasional smokers. Women smoked fewer cigarettes than men (6.4% of women smoked over 20 cigarettes daily compared to 18.6% of men). Following smoking, the most frequent CRFs, were dyslipidemia, high BP, and diabetes mellitus, in that order. The prevalence of cardiovascular disease and known CRFs was higher in males than in females (Table 2).

Table 3 shows the anthropometric and biochemical values for the study population stratified by sex. Males had higher values for BP, BMI, waist circumference, total cholesterol, LDL cholesterol, and triglycerides than females. HDL cholesterol values were higher in females than in men.

Table 4 shows the frequency of anthropometric and biochemical values indicating the presence of CRFs. There was some evidence of dyslipidemia in almost two-thirds of subjects, though the condition had only been previously diagnosed in 7.7% and only 2.7% were receiving treatment. Almost two-thirds of males and one third of females in the study were overweight or obese. Over a quarter of males and 9% of females had BP levels hypertension range. Of these, 26% had previously been diagnosed with high BP and 17% were being treated. In total, 6.2% of subjects had blood glucose >110 mg/dL and 29% of those with blood glucose ≥126 mg/dL were being treated with oral anti-diabetic drugs or insulin. Prevalence rates for all of these variables were higher in men, except for HDL cholesterol. Prevalence rates of high BP, oveweight/obesity and high blood glucose were over twice as high in males as in females (Table 4).

The association between age and cardiovascular risk parameters are illustrated in Table 5. The prevalence of most CRFs increased significantly with age except altered HDL cholesterol values, which tended to decrease with age, and smoking prevalence which also decreased significantly with age (54.1% in

TABLE 2. **History of Cardiovascular Disease and Cardiovascular Risk Factors in the Study Population by Sex**

	Males (n=158 593)	Females (n=58 321)	Total (n=216 914)
Cardiovascular disease*	0.9 (0.81-0.93)	0.4 (0.31-0.44)	0.7 (0.69-0.79)
Smoking	51.3 (50.9-51.6)	43.8 (43.3-44.3)	49.3 (49-49.5)
Hypertension†	7.2 (7.0-7.3)	3.5 (3.3-3.7)	6.2 (6.1-6.3)
Dyslipidemia‡	10.1 (9.9-10.3)	5.7 (5.4-5.9)	8.9 (8.7-9.1)
Type 1 diabetes§	0.3 (0.3-0.4)	0.2 (0.1-0.2)	0.3 (0.3-0.3)
Type 2 diabetes§	1.1 (1.1-1.2)	0.3 (0.3-0.4)	0.9 (0.9-1.0)

*Coronary heart disease, stroke or peripheral arteriopathy.
†Anti-hypertensive medication or previous diagnosis of high blood pressure.
‡Anti-cholesterol medication or prior diagnosis of dyslipidemia.
§Prior diagnosis of diabetes or use of anti-diabetic medication/insulin.
Differences between males and females are statistically significant for all variables in the table.
Values are percentages and 95% confidence intervals (in parentheses).

TABLE 3. Demographic, Anthropometric, and Biochemical Parameters for the Study Population by Sex*

	Men (n=158 593)	Women (n=58 321)	Total (n=216 914)
Age, years	37.0±11.2	34.9±9.6	36.4±10.8
SBP, mm Hg	130±16.2	116.4±14.9	126.3±17.0
DBP, mm Hg	77.6±11.0	72.7±10.0	76.3±11.0
Weight, kg	79.8±13.2	62.1±11.0	75.1±14.9
Height, m	1.73±0.1	1.62±0.1	1.7±0.1
BMI	26.6±4.0	23.8±4.2	25.9±4.3
Waist circumference, cm	92.1±11.3	77.7±10.5	88.2±12.8
Blood glucose, mg/dL	93.0±20.4	86.4±12.4	91.2±18.8
Total cholesterol, mg/dL	201.2±44.1	193.7±36.1	199.2±42.2
HDL cholesterol, mg/dL	47.1±10.9	58.0±12.9	50.1±12.4
LDL cholesterol, mg/dL	129.9±35.0	120.5±30.8	127.4±34.2
Triglycerides, mg/dL	121.1±89.8	77.5±41.9	109.4±82.2

*HDL indicates high density lipoprotein; LDL, low density lipoprotein; BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure.
Differences between males and females are statistically significant for all variables in the table.
Values are means ± standard deviations.

TABLE 4. **Prevalence of Risk Parameters (Anthropometric and Biochemical Measurements) in the Study Population by Sex***

	Males (n=158 593)	Females (n=58 321)	Total (n=216 914)
SBP≥140 mm Hg or DBP≥90 mm Hg	27.0 (26.7-27.2)	8.8 (8.5-9.1)	22.1 (21.9-22.3)
BMI 25-29.9	44.8 (44.6-45)	21.2 (20.9-21.5)	38.5 (38.3-38.7)
BMI≥30	18.3 (18.1-18.5)	8.0 (7.7-8.3)	15.5 (15.3-15.7)
Abdominal obesity†	15.5 (15.3-15.7)	13.3 (13.1-13.6)	14.9 (14.8-15.1)
Blood glucose 110-125 mg/dL	4.8 (4.7-4.9)	1.3 (1.2-1.4)	3.8 (3.7-3.9)
Blood glucose ≥126 mg/dL	3.0 (2.9-3.1)	0.6 (0.5-0.7)	2.4 (2.3-2.5)
Cholesterol ≥200 mg/dL	48.7 (48.5-49.0)	40.6 (40.2-41.1)	46.6 (46.3-46.8)
Cholesterol ≥240 mg/dL	16.9 (16.8-17.1)	10.2 (10.0-10.5)	15.1 (15.0-15.3)
Low HDL cholesterol‡	24.9 (24.7-25.1)	27.3 (27-27.7)	25.6 (25.4-25.7)
LDL cholesterol ≥160 mg/dL	19.3 (19.1-19.5)	10.8 (10.5-11.0)	17.0 (16.8-17.2)
Triglycerides ≥200 mg/dL	10.8 (10.6-11.0)	1.5 (1.4-1.6)	8.3 (8.2-8.4)
Dyslipidemia§	65.5 (65.3-65.8)	60.6 (60.2-61.0)	64.2 (64.0-64.4)

*HDL indicates high density lipoprotein; LDL, low density lipoprotein; BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure.
†Waist circumference >102 cm (men) or >88 cm (women).
‡HDL cholesterol <40 mg/dL (men) or <50 mg/dL (women).
§Total cholesterol >200 mg/dL or HDL cholesterol <40 mg/dL (men) and <50 mg/dL (women) or LDL cholesterol ≥160 mg/dL or triglycerides ≥200 mg/dL.
Differences between males and females are statistically significant for all variables in the table.
Values are percentages and 95% confidence intervals (in parentheses).

those aged <30, 49.0% in those aged 30-39, 49.3% in the 40-49 age group, 40.5% in the 50-60 age group, and 32.0% in those aged over 60; *P*<.01). The high prevalence of modifiable CRFs in the under-30 age group is particularly noteworthy: over half were smokers, almost half had at least some degree of dyslipidemia, more than a third were overweight or obese, and over 10% had abnormal BP.

There were no sizeable differences in the prevalence of smoking and other CRFs between the 3 geographical regions defined by cardiovascular mortality (Table 6). Although there was a tendency towards a more favorable risk profile in the area with the lowest mortality, particularly as regards body weight and smoking, there was also a high prevalence of altered HDL cholesterol levels in this region, which determines a higher prevalence of dyslipidemia. These differences were maintained after stratifying by sex (Table 6) and adjusting for age and type of employment (Table 7).

Table 7 shows the association between type of employment and the presence of CRFs based on logistic regression analysis and using the service sector as the reference sector. After adjusting for potential confounders (age, sex, BMI, and geographical area), the construction sector showed a positive association with smoking and high BP and, to a lesser degree, with anomalies in glucose metabolism. There was also a positive association between manufacturing sector and smoking and high blood

TABLE 5. **Prevalence of Risk Parameters (Anthropometric and Biochemical Measurements) in the Study Population by Age Group***

	<30 Years (n=67 507)	30-39 Years (n=71 185)	40-49 Years (n=47 548)	50-59 Years (n=25 279)	≥60 Years (n=5392)
SBP ≥140 mm Hg or DBP ≥90 mm Hg	12.0 (11.7-12.2)	16.3 (16.0-16.6)	28.0 (27.6-28.4)	46.9 (46.3-47.5)	59.0 (57.7-60.3)
BMI 25-29.9	28.5 (28.2-28.8)	39.2 (38.8-39.6)	44.7 (44.3-45.2)	48.6 (48.0-49.2)	51.3 (50.0-52.6)
BMI≥30	9.2 (9.0-9.4)	14.4 (14.2-14.7)	19.7 (19.3-20.0)	25.5 (25.0-26.0)	27.0 (25.9-28.2)
Abdominal obesity†	7.6 (7.4-7.8)	12.9 (12.7-13.1)	19.7 (19.3-20.0)	27.2 (26.7-27.8)	34.2 (32.9-35.5)
Blood glucose 110-125 mg/dL	0.90 (0.81-0.95)	2.4 (2.3-2.5)	5.7 (5.5-5.9)	10.5 (10.2-10.9)	12.4 (11.5-13.3)
Blood glucose ≥126 mg/dL	0.40 (0.33-0.42)	0.90 (0.81-0.95)	3.3 (3.2-3.5)	8.2 (7.9-8.6)	11.8 (10.9-12.6)
Cholesterol ≥200 mg/dL	23.7 (23.4-24.0)	46.5 (46.1-46.9)	63.4 (63.0-63.9)	71.7 (71.1-72.3)	70.4 (69.2-71.7)
Cholesterol ≥240 mg/dL	4.3 (4.2-4.5)	13.2 (13.0-13.5)	23.6 (23.3-24.0)	30.5 (30.0-31.1)	28.9 (27.7-30.1)
Low HDL cholesterol‡	26.4 (26.0-26.7)	27.6 (27.2-27.9)	25.0 (24.6-25.4)	20.4 (19.9-20.9)	18.0 (16.9-19.0)
LDL cholesterol ≥160 mg/dL	5.5 (5.3-5.7)	15.6 (15.3-15.9)	25.6 (25.2-26.0)	32.7 (32.2-33.4)	31.0 (29.7-32.2)
Triglycerides ≥200 mg/dL	3.6 (3.4-3.7)	8.5 (8.3-8.8)	12.5 (12.2-12.8)	12.1 (11.7-12.5)	10.0 (9.2-10.8)
Dyslipidemia§	46.6 (46.2-47.0)	65.3 (64.9-65.7)	76.7 (76.3-77.0)	81.6 (81.1-82.1)	80.1 (79.0-81.1)

*HDL indicates high density lipoprotein; LDL, low density lipoprotein; BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure.
†Waist circumference >102 cm (men) or >88 cm (women).
‡HDL cholesterol <40 mg/dL (men) or <50 mg/dL (women).
§Total cholesterol >200 mg/dL or HDL cholesterol <40 mg/dL (men) and <50 mg/dL (women) or LDL cholesterol ≥160 mg/dL or triglycerides ≥200 mg/dL.
All prevalence rates increased significantly with age, except low HDL cholesterol, which decreased significantly with age.
Values are percentages and 95% confidence intervals (in parentheses).

pressure, and those working in the agricultural sector showed a positive association with smoking and altered carbohydrate metabolism. There was a positive association between the service sector and dyslipidemia (Table 7).

DISCUSSION

The present study has shown that there is a high prevalence of CRF in the Spanish working population. One of the study's strong points is the large sample

TABLE 6. **Prevalence of Smoking and Risk Parameters (Anthropometric and Biochemical Measurements) in the Study Population, Stratified by Sex and Geographical Area According to Cardiovascular Mortality***

	Males			Females		
	Low Mortality (n=68.629)	Intermediate Mortality (n=27 122)	High Mortality (n=62 842)	Low Mortality (n=28 289)	Intermediate Mortality (n=8419)	High Mortality (n=21 613)
Smoking	49.7 (49.3-50.1)	51.0 (50.4-51.6)	53.1 (52.8-53.5)	42.2 (41.6-42.8)	43.9 (42.9-45.0)	45.8 (45.1-46.5)
SBP≥140 mm Hg or DBP≥90 mm Hg	26.3 (26.0-26.7)	31.6 (31.0-32.1)	25.7 (25.4-26.1)	8.3 (8.0-8.7)	10.5 (9.8-11.1)	8.8 (8.4-9.2)
BMI 25-29.9	45.2 (44.9-5.6)	45.5 (44.9-46.1)	44.0 (43.6-44.4)	20.2 (19.8-20.7)	22.4 (21.5-23.2)	21.9 (21.4-22.5)
BMI≥30	17.3 (17.0-17.5)	19.1 (18.6-19.6)	19.1 (18.8-19.4)	7.2 (6.9-7.5)	8.6 (8.0-9.2)	8.8 (8.4-9.2)
Abdominal obesity†	16.6 (16.3-16.9)	15.9 (15.5-16.4)	17.7 (17.4-18.0)	12.7 (12.3-13.1)	14.7 (13.9-15.5)	17.0 (16.4-17.5)
Blood glucose 110-125 mg/dL	5.0 (4.8-5.1)	5.9 (5.6-6.2)	4.0 (3.9-4.2)	1.2 (1.1-1.3)	2.0 (1.7-2.3)	1.3 (1.1-1.4)
Blood glucose ≥126 mg/dL	2.6 (2.5-2.8)	3.0 (2.8-3.2)	3.5 (3.4-3.7)	0.45 (0.37-0.53)	0.75 (0.57-0.93)	0.78 (0.66-0.90)
Cholesterol ≥200 mg/dL	49.0 (48.7-49.4)	49.8 (49.2-50.4)	48.0 (47.6-48.4)	40.7 (40.1-41.2)	40.8 (39.8-41.9)	40.6 (39.9-41.3)
Cholesterol ≥240 mg/dL	16.4 (16.1-16.7)	17.6 (17.2-18.1)	17.3 (17.0-17.6)	10.1 (9.8-10.5)	10.0 (9.4-10.6)	10.5 (10.1-10.9)
Low HDL cholesterol‡	28.4 (28.1-28.8)	18.8 (18.4-19.3)	23.8 (23.4-24.1)	29.5 (29.0-30.1)	25.7 (24.7-26.6)	25.1 (24.6-25.7)
LDL cholesterol ≥160 mg/dL	20.0 (19.7-20.3)	19.0 (18.5-19.5)	18.7 (18.4-19.0)	11.2 (10.9-11.6)	10.3 (9.6-10.9)	10.3 (9.9-10.7)
Triglycerides ≥200 mg/dL	10.3 (10.0-10.5)	10.9 (10.5-11.3)	11.3 (11.1-11.6)	1.1 (1.0-1.2)	1.3 (1.1-1.6)	2.0 (1.8-2.2)
Dyslipidemia§	68.0 (67.7-68.4)	62.7 (62.1-63.3)	64.1 (63.7-64.4)	62.2 (61.6-62.8)	59.7 (58.6-60.8)	58.9 (58.2-59.5)

*HDL indicates high density lipoprotein; LDL, low density lipoprotein; BMI, body mass index; DBP: diastolic blood pressure; SBP, systolic blood pressure.
†Waist circumference >102 cm (males) or >88 cm (females).
‡HDL cholesterol <40 mg/dL (males) or <50 mg/dL (females).
§Total cholesterol >200 mg/dL or HDL cholesterol <40 mg/dL (males) and <50 mg/dL (females) or LDL cholesterol ≥160 mg/dL or triglycerides ≥200 mg/dL.
Geographic areas defined according to cardiovascular-related mortality using data from the 2003 SEA report[1]: low mortality (<175 cases per 100 000 person/years: Aragon, Cantabria, Castille-Leon, Catalonia, La Rioja, Madrid Autonomous Region, Navarre Autonomous Region, and the Basque Country); intermediate mortality (175-200 cases per 100 000 persons/year: Asturias, Extremadura, Castille-La Mancha, and Galicia), and high mortality (>200 cases per 100 000 person/years: Andalusia, Balearic Islands, Canary Islands, Valencian Autonomous Region, and Murcia).
Values are percentages and 95% confidence intervals (in parentheses).

size. The largest similar study performed in Spain to date included fewer than 5000 workers,[8] and the Integrated Plan on Ischemic Heart Disease[2] totaled 10 000 workers over a range of studies. The large sample size in the present study (216 914 subjects included for analysis) helps to provide more precise estimations of the prevalence of CRFs, as well as permitting the exploration of weak associations. A further advantage of the present study is that it covers all types of employment as well as all of the different Spanish autonomous regions, thereby enhancing the representativity of the current sample with respect to the Spanish working population as a whole. The large number of investigators participating in the study could have produced systematic classification errors, but these were avoided as far as possible by standardizing measurement techniques. The sample studied is clearly a selected population (the Spanish working population), and the results cannot be extrapolated to the general population; nevertheless, the results do provide an accurate estimate of the prevalence of CRFs in a large, predominantly young sector of the population, in which intervention is possible.

When comparing our data to that from studies in the Spanish working population aged 35-39 and populations with similar risk thresholds,[5,10,11] we found higher rates of high BP in males than those observed in 2 studies,[10,11] although our prevalence figures were similar to those observed in another study.[5] Prevalence figures for smoking and overweight/obesity in the present study were higher than those reported in one study,[10] and lower than those in another study.[11] The prevalence of cholesterol ≥240 mg/dL in the present study was also lower than that found in one of the other, similar studies.[11] In general, it is difficult to compare studies in the working population[5-12] because of differences in age, sex, geographic area, risk thresholds, and professional activity. The results of measuring waist circumference has alloved the determination that 10% of workers have metabolic syndrome[16] (data not shown). In the great majority of the workers included in the study, none of the CRFs observed had been previously diagnosed or treated. These findings therefore indicate the importance of routine medical check-ups for the detection and control of modifiable CRFs.

As would be expected in a working population, the proportion of subjects with a history of clinical cardiovascular disease was low, which may be due in part to the fact that this is frequently a cause of permanent disability. Likewise, in comparison with the Spanish general population, we observed a higher prevalence of smokers,[1] lower rates of high BP,[20,21] and a lower rate of blood glucose values in the diabetes range.[22,23] These differences are likely all attributable to differences in age. The prevalence of dyslipidemia in the workers studied was similar to that reported previously in the Spanish general population[24] and the higher rates of altered HDL cholesterol values in women had also been described previously.[25] The

TABLE 7. **Variables Associated With Principal CRFs: Results of Logistic Regression Analysis (Odds Ratio and 95% CIs, Adjusted by All Variables Listed and BMI)***

Co-Variables	Altered Blood Pressure†	Altered Lipid Metabolism‡	Altered Glucose Metabolism§	Smoking
Sex, male	2.48 (2.39-2.56)	0.90 (0.88-0.93)	2.56 (2.32-2.83)	1.35 (1.32-1.38)
Age, y				
<30	1 (reference)	1 (reference)	1 (reference)	1 (reference)
30-39	1.29 (1.25-1.33)	1.95 (1.91-2.0)	1.86 (1.63-2.12)	0.86 (0.83-0.88)
40-49	2.55 (2.47-2.64)	3.17 (3.09-3.26)	6.14 (5.46-6.94)	0.88 (0.86-0.90)
50-59	5.95 (5.75-6.17)	3.94 (3.78-4.08)	15.15 (13.33-16.95)	0.60 (0.58-0.62)
≥60	9.90 (9.26-10.63)	3.44 (3.20-3.69)	21.15 (18.51-24.39)	0.41 (0.39-0.44)
Area of cardiovascular mortality				
Low	1 (reference)	1 (reference)	1 (reference)	1 (reference)
Medium	1.27 (1.18-2.26)	0.79 (0.77-0.81)	1.08 (0.99-1.16)	1.06 (1.03-1.09)
High	0.99 (0.97-1.16)	0.87 (0.85-0.89)	1.39 (1.31-1.48)	1.16 (1.13-1.18)
Type of employment				
Services	1 (reference)	1 (reference)	1 (reference)	1 (reference)
Agriculture	1.04 (0.96-1.13)	0.91 (0.85-0.98)	1.20 (1.02-1.43)	1.16 (1.09-1.24)
Construction	1.15 (1.11-1.18)	0.96 (0.94-0.99)	1.09 (1.02-1.17)	1.53 (1.49-1.56)
Industrial	1.05 (1.02-1.08)	0.94 (0.92-0.97)	0.98 (0.91-1.05)	1.13 (1.11-1.16)

*Prior diagnosis of hypertension or SBP≥140 mm Hg or DBP≥90 mm Hg in the check-up.
†Prior diagnosis of dyslipidemia, or values suggesting dyslipidemia in the routine check-up (total cholesterol >200 mg/dL or HDL cholesterol <40 mg/dL [males] and <50 mg/dL [females] or LDL cholesterol ≥160 mg/dL or triglycerides ≥200 mg/dL).
‡Prior diagnosis of diabetes or blood sugar ≥126 mg/dL in the check-up.
§Geographic areas defined according to cardiovascular-related mortality using data from the 2003 SEA report[1]: low mortality (<175 cases per 100 000 person/years: Aragon, Cantabria, Castille-Leon, Catalonia, La Rioja, Madrid Autonomous Region, Navarre Autonomous Region, and the Basque Country); intermediate mortality (175-200 cases per 100 000 persons/year: Asturias, Extremadura, Castille-La Mancha, and Galicia), and high mortality (>200 cases per 100 000 person/years: Andalusia, Balearic Islands, Canary Islands, Valencian Autonomous Region, and Murcia).

prevalence of overweight and obesity in male workers was similar to that in the general population,[15] which should be taken as a warning. In female workers, however, the prevalence of overweight and obesity was lower than in the general population,[15] which is likely attributable to the lower mean age of subjects in the current study.

The data show a slightly higher prevalence of some CRFs (smoking, high BP, overweight-obesity, and altered carbohydrate metabolism) in geographic areas with greater cardiovascular mortality,[1] indicating a need to intensify preventive efforts in those regions.[1,26,27] We observed a high prevalence of dyslipidemia (fundamentally because of altered HDL cholesterol values) in the region with the lowest cardiovascular mortality. This may appear paradoxical, but it should be remembered that analyses of this type, in which data for one variable (in this case, cardiovascular mortality) are collected in an aggregated fashion, are susceptible to specific biases such as the ecological fallacy.

An original finding of the present study is that of a significant association between certain types of employment and the presence of CRFs. More specifically, and taking the service sector as the reference sector, workers in manufacturing had higher rates of high blood pressure and smoking. This was particularly true of workers in the construction industry. The association with smoking was also seen in the agricultural sector. The service sector, on the other hand, showed a positive association with dyslipidemia. These associations were maintained after adjusting for potential confounding variables such as age, sex, and BMI. Other confounding variables, such as socio-economic level, may not have been controlled for and would warrant investigation in future studies. Nevertheless, from a predictive point of view, the associations observed are relevant regardless of whether other uncontrolled confounding factors exist, and indicate that measures to intervene against modifiable CRFs could be prioritized by type of employment. We cannot forget that the primary objective of the Plan described here is the reduction of cardiovascular risk in the study population, in accordance with current guidelines.[28]

CONCLUSIONS

The prevalence of cardiovascular risk factors in the working population is high, and workers are generally unaware of the presence of these risk factors. Their detection will allow cardiovascular risk to be stratified, thereby providing a basis for intervention, whilst the observation of an association between risk factors and certain types of employment may help in establishing priorities for prevention. A clearer understanding of the geographic distribution of CRFs may also help to orient preventive strategies in the future.

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