Cardiovascular Health in a Southern Mediterranean European Country
A Nationwide Population-Based Study

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Background—There are no published data on cardiovascular health from a national representative sample in a European country.

Methods and Results—Data were taken from a cross-sectional study among 11,408 persons representative of the Spanish population ≥18 years of age during 2008 to 2010. Information was collected at participants’ homes through structured questionnaires, physical examination, and fasting blood samples, which were centrally analyzed. The American Heart Association has defined ideal cardiovascular health as the simultaneous presence of 4 health behaviors (nonsmoking, body mass index <25 kg/m², physical activity at goal, and diet consistent with current recommendations) and 4 health factors (nonsmoking, untreated total cholesterol <200 mg/dL, untreated blood pressure <120/80 mm Hg, and untreated fasting glucose <100 mg/dL) in the absence of clinical cardiovascular disease and diabetes mellitus. Only 0.2% of subjects attained ideal values for all 7 cardiovascular disease health metrics and 3.4% and 15.3% for at least 6 and 5 metrics, respectively. The percentage of subjects who achieved the 4 ideal lifestyles was lower than that for the 4 ideal health factors (0.7% versus 8.1%). Lack of ideal diet was the most frequent health metrics (88.9%). In general, ideal levels of cardiovascular disease health metrics were more frequent in younger subjects, women, and those with higher education.

Conclusion—Cardiovascular health in Spain is poor, particularly lifestyles. This illustrates the low effectiveness of public health efforts addressing cardiovascular prevention and the need to improve preventive healthcare services. Given that coronary mortality in Spain is low compared with other Western countries, the factors responsible for this situation should be investigated.

Key Words: cardiovascular diseases ■ epidemiology ■ health outcomes ■ lifestyle ■ risk factors

Although mortality rates from cardiovascular disease (CVD) have declined in Western countries during the last decades, CVD remains the leading cause of death and an important cause of morbidity,1,2 contributing to escalating healthcare costs.3,4 Moreover, the decline in CVD death rates could be threatened by the increasing prevalence of obesity and diabetes mellitus1,2 and by the suboptimal management of traditional CVD risk factors such as unhealthy lifestyle, hypertension, and dyslipidemia.2,4-6 In this regard, the American Heart Association (AHA) recently published recommendations aimed to improve cardiovascular health and reduce CVD mortality by encouraging the general population to meet 7 defined ideal cardiovascular health behaviors or factors: not smoking; being physically active; having normal blood pressure (BP), blood glucose, total cholesterol levels, and weight; and eating a healthy diet.7,8 These recommendations represent an important shift in the approach to CVD control because the objectives go beyond preventing cardiovascular deaths to attaining good cardiovascular health.11,12

Accordingly, we report the prevalence of ideal cardiovascular health in Spain. This is the first study to report population-based data on cardiovascular health in an entire European country.

Methods

Study Design and Participants
Data were taken from the Study on Nutrition and Cardiovascular Risk in Spain, whose methods have been reported elsewhere.11 This cross-sectional study was conducted from June 2008 through October 2010 in a representative sample of the noninstitutionalized population of Spain ≥18 years of age.

Study participants were selected by multistage clustered random sampling. The sample was first stratified by province and size of municipality. Clusters were then randomly selected in 2 stages: municipalities and census sections. Finally, the households within each section were selected by random telephone dialing. Subjects in the households were selected proportionally to the distribution of the population of Spain by sex and age. Information was collected in 3 sequential stages: (1) Computer-assisted telephone interview, with a structured questionnaire always conducted in the same order, which mean duration was 35 minutes; (2) first home visit, to obtain blood and urine samples; and (3) second home visit, to measure anthropometric variables and BP and to take a dietary history, which mean duration was 2 hours.

Persons who collected information (nurses to obtain biological samples and nonhealth personnel for the remaining task) received specific
WHAT IS KNOWN

- The American Heart Association defines ideal cardiovascular health as the simultaneous presence of 4 favorable health behaviors and 4 favorable health risk factors.
- Recent studies in the United States have found low levels of cardiovascular health (1.2% for ideal health and 8.7% for at least 6 ideal indicators).

WHAT THE STUDY ADDS

- This is the first study to report information on cardiovascular health from Spain, a European country with low coronary heart disease mortality compared with many Western countries.
- The level of ideal cardiovascular health in Spain is as low as in the United States, primarily due to poor lifestyles, especially lack of ideal diet.
- Despite the apparent paradox of low coronary heart disease mortality and poor cardiovascular health in Spain, decisive interventions on major cardiovascular risk factors should be pursued because coronary heart disease remains an important cause of morbidity and mortality.

training in the study procedures. Those who conducted physical examination received three and a half days of training, after which they passed a certification process including every aspect of the fieldwork.

Study participants provided informed consent over telephone (before the telephone interview) and in writing (before the biological sample collection and physical examination). The study was approved by the Clinical Research Ethics Committees of the University Hospital La Paz in Madrid and the Hospital Clinic in Barcelona.

Study Variables

Study participants reported their age, sex, level of education, smoking status, physical activity, diet, history of clinical CVD (coronary heart disease [CHD], heart failure, or stroke), drug treatment for hyperension, dyslipidemia and diabetes mellitus, use of healthcare services, and self-rated health.

Age was categorized in 3 groups: 18 to 44, 45 to 64, and 65 years and more. Educational level was classified in 2 categories: primary or below primary school, and secondary or higher (which includes middle school, high school, and university). Smoking status was categorized as never smoker, former smoker, and current smoker. Physical activity was measured by a validated scale derived from the short questionnaire used in the European Prospective Investigation Into Cancer and Nutrition (EPIC) study, which combines physical activity at work and during leisure time into 4 levels: very active, moderately active, moderately inactive, and inactive.

Diet information was obtained from a computerized diet history, which collects information on the usual diet during the past year with questions related to all possible meals during the day. Questions are asked about food consumed in a typical week, and all food consumed at least once every 15 days is recorded. Information on year with questions related to all possible meals throughout the day.

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Despite the apparent paradox of low coronary heart disease mortality and poor cardiovascular health in Spain, decisive interventions on major cardiovascular risk factors should be pursued because coronary heart disease remains an important cause of morbidity and mortality.

We 4444 Seca). Body mass index was calculated as weight in kilograms divided by squared height in meters. BP was measured using standardized procedures13 with validated automatic devices (model Omron M6) and cuffs of 3 sizes according to arm circumference. Two sets of BP readings were recorded at 90-minute intervals. In each set, BP was measured 3X at 1- to 2-minute intervals. In the analyses, BP was calculated as the mean of at least 3 of the last 5 readings, excluding the first to reduce the alerting reaction to BP determination.

Study participants provided 12-hour fasting samples of blood and urine at their homes. Total cholesterol was measured by the cholesterol-esterase and cholesterol-oxidase method, and fasting glucose (FG) was measured by the glucose oxidase method on the ADVIA 2400 Chemistry System (Siemens, Erlange, Germany). Glycosylated hemoglobin was measured by chromatography with high-performance liquid chromatography (ADAMS A1c HA-8160, Arckay, Kyoto, Japan). The laboratory tests were performed centrally at the Center of Biological Diagnosis of the Hospital Clinic in Barcelona, according to standard procedures and appropriate quality controls.

Ideal Cardiovascular Health

In accordance with AHA,16 ideal cardiovascular health was defined as the simultaneous presence of 4 favorable health behaviors (nonsmoking, ideal body mass index, physical activity at goal, and diet consistent with current recommendations) and 4 favorable health factors (nonsmoking, untreated total cholesterol <200 mg/dL, untreated BP <120/80 mm Hg, and untreated FG <100 mg/dL) in the absence of clinical CVD or diabetes mellitus. To emphasize the importance of nonsmoking to health promotion, the AHA Committee includes it in the lists of both health factors and health behaviors.

Each behavior and factor was also categorized as ideal, intermediate, or poor.16 We used Folsom’s definition19 for intermediate cardiovascular health (at least 1 intermediate metric and no poor health metrics) and poor cardiovascular health (at least 1 poor metric). Some other indicators based on AHA secondary CVD metrics,20 such as risk factor awareness and treatment, were also used.

Health Behavior and Health Factor Metrics

Ideal, intermediate, and poor health metrics for smoking were, respectively, never smoking, former smoking, and current smoking.

The corresponding metrics for body mass index were <25, 25 to 29.9, and >30 kg/m², whereas for physical activity they were very/moderately active, moderately inactive, and inactive.

Ideal dietary healthy diet was defined as meeting 4 to 5 of the following 5 goals: >4.5 cups/day of fruits and vegetables, >2 (3.5 oz) servings/week of fish, >1.1 g of fiber per 10 g of carbohydrate/day, <1500 mg/day of sodium, and <450 kcal (36 oz) per week of sugar-sweetened beverages.

Intermediate and poor healthy diet was defined as meeting 2 to 3 and 0 to 1 of the above goals, respectively.

Total cholesterol status was also classified as ideal (<200 mg/dL, untreated), intermediate (200–239 mg/dL or drug treated to goal), or poor (>240 mg/dL). For BP status the corresponding categories were: systolic BP <120 mm Hg and diastolic BP <80 mm Hg, untreated; systolic BP 120 to 139 mm Hg or diastolic BP 80 to 89 mm Hg, or drug treated to goal; and systolic BP >140 mm Hg or diastolic BP >90 mm Hg.

Corresponding categories for FG were: <100 mg/dL, untreated; 100 to 125 mg/dL or drug treated to goal; and >126 mg/dL.

Awareness and Treatment of Intermediate and Poor Levels for Each Health Factor

High BP awareness among the persons in the poor level for BP was defined as a positive answer to the question: Have you ever been told by the doctor that you had hypertension, also called high BP? Treatment was defined as current use of hypertension drug therapy.

High total cholesterol awareness among those in the poor level for total cholesterol was also determined by an affirmative response to the question: Have you ever been told by the doctor that you had high cholesterol? Treatment was defined as current use of lipid lowering drug. Likewise, high FG awareness among those in the poor level for FG was based on the question: Have...
you ever been told by the doctor that you had diabetes mellitus, also called high glucose or blood sugar? Treatment was defined as current use of insulin or oral drugs.

Statistical Analysis

Of the 12,948 study participants, we excluded 1,540 subjects who lacked data on any of the study variables. Thus, the analyses were conducted with 11,408 individuals.

Statistical analyses took account of the complex sampling design; thus, individual observations were weighted to reconstruct the Spanish population, and the variances were corrected to obtain \( \approx 95\% \) confidence intervals for the main results. Continuous variables were described by the mean \( +SE \) and categorical variables by a percentage \( +SE \). Subgroup analyses by age, sex, and educational level were conducted. The Student \( t \) test and ANOVA were used to compare means and the \( \chi^2 \) test to compare percentages. Associations between cardiovascular health and sociodemographic variables were summarized using odds ratios and 95% confidence intervals derived from logistic regression models. Independent variables included in the models were sex, age, educational level, self-rated health, and use of healthcare system. All variables were modeled categorically using dummies. Statistical significance was set at 2-sided \( P<0.05 \). Analyses were performed with the survey procedure in STATA version 11.2.

Results

Cardiovascular Behaviors and Risk Factors

Most participants had ideal or intermediate levels of CVD behaviors and risk factors, except for physical activity and BP in older subjects (Table 1). Prevalence of ideal levels was higher in younger subjects (except for healthy diet), in those with secondary or higher education (except for smoking and healthy diet), and in women (except for physical activity and total cholesterol) (Table 1). Lack of ideal diet was the most frequent health metric (88.9%), that is, the sum of intermediate level (57.5%) and poor level (31.4%) (Table 1).

| Table 1. Percentage (SE) of Ideal, Intermediate, and Poor Levels of CVD Risk Behavior and Factors by Sex, Age, and Educational Level |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Smoking                                         |                 |                 |                 |                 |                 |                 |                 |                 |
| Ideal (never)                                   |                 |                 |                 |                 |                 |                 |                 |                 |
| Sex                                             | Total | Men   | Women | 18–44 | 45–64 | >65  | <Primary | >Secondary |
| N: 11,408                                       | 5621  | 5787  | 5714  | 3373  | 2321  | 3418 | 7990  |         |
| Smoking                                         | 48.0 (0.6) | 38.7 (0.8) | 57.0 (0.8) * | 46.5 (0.8) | 41.3 (1.0) | 61.3 (1.3) | 54.9 (1.1) | 45.0 (0.7) * |
| Intermediate (former)                           | 24.7 (0.5) | 31.6 (0.8) | 18.2 (0.6)   | 18.8 (0.7) | 31.5 (0.9) | 29.5 (1.3) * | 23.8 (0.9) | 25.2 (0.6)   |
| Poor (current)                                  | 27.3 (0.5) | 29.8 (0.8) | 24.8 (0.7)   | 34.7 (0.8) | 27.2 (0.9) | 9.2 (0.7)   | 21.3 (0.9) | 29.8 (0.6)   |
| Body mass index                                 | 38.2 (0.6) | 29.6 (0.9) | 46.4 (0.8) * | 52.2 (1.0) | 27.5 (1.0) | 19.1 (1.0) * | 23.4 (0.9) | 44.5 (0.7) * |
| Physical activity                               | 39.3 (0.6) | 46.3 (0.9) | 32.6 (0.7)   | 33.1 (0.8) | 43.1 (1.1) | 46.3 (1.3) * | 42.3 (1.0) | 38.0 (0.7)   |
| Total cholesterol                               | 22.5 (0.5) | 24.1 (0.7) | 21.0 (0.7)   | 14.7 (0.6) | 27.5 (1.0) | 34.6 (1.2) | 34.3 (1.0) | 17.5 (0.5)   |
| Healthy diet score                              | 11.1 (0.4) | 8.2 (0.4) | 14.0 (0.6) * | 5.6 (0.4) | 14.6 (0.8) | 19.8 (1.0) * | 13.8 (0.7) | 10.0 (0.4) * |
| Poor (<25 kg/m²)                                 | 35.6 (0.9) | 58.8 (0.8) | 58.8 (0.8)   | 51.4 (0.8) | 62.0 (1.1) | 66.0 (1.2) | 59.4 (1.0) | 56.7 (0.7)   |
| Poor (0–1 components)                           | 31.4 (0.6) | 36.5 (0.9) | 27.2 (0.8)   | 43.0 (0.9) | 23.4 (1.0) | 14.2 (0.9) | 26.8 (1.0) | 33.3 (0.7)   |
| Total cholesterol                               | 49.7 (0.6) | 52.0 (0.9) | 47.5 (0.8) * | 68.0 (0.8) | 31.2 (0.9) | 31.5 (1.2) * | 37.7 (1.1) | 54.8 (0.7) * |
| Poor (>240 mg/dL)                               | 12.4 (0.4) | 11.1 (0.5) | 13.6 (0.5)   | 6.8 (0.4) | 20.3 (0.8) | 14.5 (0.8) | 14.4 (0.7) | 11.5 (0.4)   |
| Blood pressure                                  | 29.6 (0.6) | 15.3 (0.6) | 43.5 (0.9) * | 43.6 (1.0) | 21.2 (0.8) | 7.5 (0.6) * | 18.5 (0.8) | 34.4 (0.7) * |
| Poor (>140/90 mm Hg)                            | 44.7 (0.6) | 53.4 (0.8) | 36.2 (0.8)   | 45.0 (0.9) | 46.5 (1.0) | 41.3 (1.2) | 44.3 (1.0) | 44.9 (0.7)   |
| Fasting glucose                                 | 76.9 (0.5) | 73.8 (0.8) | 79.8 (0.7) * | 90.5 (0.5) | 69.2 (0.9) | 54.2 (1.2) * | 64.2 (1.0) | 82.2 (0.5) * |
| Poor (>126 mg/dL)                               | 4.8 (0.2) | 5.7 (0.4) | 4.0 (0.3)    | 0.1 (0.2) | 6.0 (0.5) | 12.6 (0.8) | 8.9 (0.6) | 3.1 (0.2)    |

CVD indicates cardiovascular disease; DBP indicates diastolic blood pressure; and SBP, systolic blood pressure. * \( P<0.001 \).
Figure 1 shows adherence to the dietary recommendations. The recommendation most frequently met was for consumption of sugar-sweetened beverages (82%), and the least frequently met was for sodium intake (8.4%), which rose to 22.7% if the recommendation was restricted to <1500 mg/day in hypertensive subjects, leaving the maximum acceptable intake for the rest of the population at 2300 mg/day. In general, adherence to the dietary recommendations increased with age and was higher in women and in persons with primary or lower education (except for the recommendation on fish consumption). Figure 2 shows that 52% of subjects with BP >140/90 mm Hg were not aware of this situation, a percentage that rose to 70% in persons under 45 years of age; also only 9% of subjects with cholesterol levels >240 mg/dL were being treated, and 28% of subjects with FG >126 mg/dL were not aware of their diabetic status.

Ideal Cardiovascular Health

Only 0.2% of subjects attained ideal values for all 7 CVD health metrics, although this proportion rose to 3.4% and 15.3% for ideal levels of at least 6 and 5 metrics, respectively. The percentage of subjects who achieved the 4 ideal lifestyles was lower than the percentage of those with the 4 ideal biological factors (0.7% versus 8.1%). Table 2 shows the distribution of participants according to the number of ideal indicators attained. Again, we observe better results in women, younger subjects, and those with secondary or higher education (Tables 2 and 3). However, the association between health factor status and educational level disappears after adjustment for sex, age, self-rated health, and use of healthcare system (Table 3).

A total of 19.8% of subjects had intermediate cardiovascular health (at least 1 intermediate metric and no poor indicator), and 80% had poor cardiovascular health (at least 1 poor indicator). Table 4 shows the distribution of CVD health metrics within each category of cardiovascular health. Lack of ideal diet was the indicator most frequently responsible for intermediate (86%) and poor (39.2%) health status, followed by suboptimal BP (in 55.5% and 32.1% of subjects with intermediate and poor health, respectively). Of note is that diet (28.1%) and smoking (21.5%) weighed far more heavily than the others as the unique metric responsible for poor cardiovascular health.

Discussion

The prevalence of ideal cardiovascular health in the Spanish general population is low. Only 1 of every 12 subjects had all 4 ideal biological factors, and <1% had all 4 cardiohealthy lifestyles, whereas physical inactivity, smoking, and obesity affected one fourth of the population. Moreover, diet is the most frequent contributor to poor cardiovascular health and the only factor responsible for this status in ≈1 of every 4 subjects.

However, in comparing our results with those of the general population in the United States, we found that diet shows the largest differences in our favor, whether we use the cutoff recommended by the AHA (>4 ideal components), 11.1%...
versus 0.5%, or the less restrictive criterion used by Yang et al (≥2 ideal components), 69% versus 22%. The comparison of the rest of the ideal indicators shows that, except for BP (30% in Spain versus 43% in the United States), physical activity (39% versus 45%, respectively), and smoking status (48% versus 53%, respectively), our indicators are considerably more favorable, especially with regard to ideal levels of FG (77% versus 60%, respectively), which could be explained by the lower prevalence of diabetes mellitus and obesity that still exists in Spain, despite the epidemic experienced by both factors in recent decades. Considering all the indicators together, the aforementioned differences translate into quite comparable, although equally low, overall levels of cardiovascular health in the 2 populations (1.6% versus 1.2% for ideal health and 9.5% versus 8.7% for at least 6 ideal indicators, in Spain and the United States, respectively). This contrasts with the as yet low CHD mortality in Spain compared with the United States and northern European countries.

Several factors, other than the traditional cardiovascular risk factors, may contribute to this discrepancy. They include sedentary behavior (as approximated by sitting and lying time), specific dietary factors such as wine consumption and the Mediterranean diet, psychosocial factors (e.g., family and other social support), and quality of medical care, among others. Future research should assess the individual contribution of these factors to the apparent paradox of CHD in Spain: low CHD mortality with relatively high cardiovascular risk. Moreover, coronary CHD mortality is not the only relevant indicator of CHD risk. Recent research indicates that the prevalence of angina in Spain is high and comparable with that in Northern European countries, such as England and Sweden. This suggests that in Spain the prevalence of stable atheromatous
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The reasons that these plaques are fairly stable, so that they do not translate into a high incidence of acute myocardial infarction, are a topic of active research. Notwithstanding this, various cohort studies have shown the inverse relation between the number of ideal indicators defined by the AHA and general mortality, cardiovascular mortality, and the risk of cardiovascular events, which confirm the preventive potential of these indicators.

In Spain, lifestyles contribute far more heavily than biological factors to poor cardiovascular health. This highlights the need to strengthen the role of public health efforts in the management of CVD risk. However, health services also need to improve because 5 of every 10 persons with total cholesterol >240 mg/dL are not being treated. Also, 1 of every 4 subjects has BP >140/90 mm Hg, about half of whom are unaware of their hypertension, highlighting the improved but still high hypertension unawareness in Spain, which is comparable with other European countries, but it is much higher than in the United States.

In recent years, several prevention campaigns have been conducted in Spain to increase physical activity, improve diet, and reduce smoking habit. But the results do not seem to reflect the effort. This finding may due to the implicit difficulty in changing lifestyles and also because the messages are not reaching the entire population. For instance, the highest prevalence of ideal cardiovascular health is found in younger subjects.

Table 2. Percentage (SE) of Ideal Cardiovascular Health Metrics (Score 0–7), Ideal Health Behaviors, and Ideal Health Factors (Score 0–4), by Sex, Age, and Educational Level

<table>
<thead>
<tr>
<th></th>
<th>Total N: 11,408</th>
<th>Men N: 5,621</th>
<th>Women N: 5,787</th>
<th>P</th>
<th>Age in Years</th>
<th>Educational Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18–44</td>
<td>45–64</td>
<td>&gt;65</td>
<td>&lt;Primary</td>
<td>&gt;Secondary</td>
</tr>
</tbody>
</table>
| No. of ideal cardiovascular health metrics | 0   | 3.6 (0.2) | 5.5 (0.4) | 1.8 (0.2) | 0.8 (0.2) | 6.1 (0.5) | 6.9 (0.6) | 5.1 (0.4) | 3.0 (0.2) | 1
|                      | 1   | 13.7 (0.4) | 17.4 (0.6) | 10.1 (0.5) | 5.5 (0.4) | 20.3 (0.8) | 24.2 (1.1) | 19.7 (0.8) | 11.1 (0.4) | 1
|                      | 2   | 23.3 (0.5) | 25.1 (0.7) | 21.6 (0.6) | 15.7 (0.6) | 29.7 (0.9) | 33.7 (1.1) | 30.5 (0.9) | 20.2 (0.7) | 1
|                      | 3   | 23.8 (0.5) | 23.1 (0.7) | 24.5 (0.7) | 24.3 (0.7) | 22.9 (0.8) | 24.1 (1.0) | 24.5 (0.9) | 23.5 (0.6) | 1
|                      | 4   | 20.1 (0.5) | 16.8 (0.7) | 23.3 (0.7) | 28.1 (0.8) | 14.1 (0.7) | 9.0 (0.7) | 14.7 (0.8) | 22.4 (0.6) | 1
|                      | 5   | 12.0 (0.4) | 9.8 (0.5) | 14.1 (0.6) | 19.6 (0.6) | 5.5 (0.5) | 2.6 (0.4) | 4.5 (0.4) | 15.2 (0.5) | 1
|                      | 6   | 3.2 (0.2) | 2.1 (0.2) | 4.2 (0.3) | 5.5 (0.4) | 1.1 (0.2) | 0.5 (0.1) | 1.0 (0.2) | 4.2 (0.3) | 1
|                      | 7   | 0.3 (0.1) | 0.1 (0.1) | 0.4 (0.1) | 0.4 (0.1) | 0.1 (0.1) | 0.1 (0.1) | 0.0 (0.0) | 0.4 (0.1) | 1

Table 3. Association Between Cardiovascular Health and Main Demographic Variables. OR (95% CI)

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th>Age in Years</th>
<th>Educational Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>18–44</td>
</tr>
<tr>
<td>Cardiovascular health status (≥6 vs &lt;1 ideal metrics)</td>
<td>1</td>
<td>5.49 (3.77–7.99)*</td>
<td>23.27 (12.03–45.02)*</td>
</tr>
<tr>
<td>Health behaviors status (≥3 vs &lt;1 ideal metrics)</td>
<td>1</td>
<td>1.52 (1.30–1.76)*</td>
<td>1.69 (1.34–2.13)*</td>
</tr>
<tr>
<td>Health factors status (≥3 vs &lt;1 ideal metrics)</td>
<td>1</td>
<td>3.83 (3.34–4.39)*</td>
<td>10.98 (8.94–13.48)*</td>
</tr>
</tbody>
</table>

OR indicates odds ratio for each main outcome adjusted by the demographic variables (sex, age, and educational level, as appropriate), self-rated health, and use of health care system; and CI, confidence interval.

*P<0.001. 1: reference value.
subjects, basically due to their better physical health status (half of them have ≥3 ideal biological factors). This, however, stands in contrast to the poor results on lifestyles, given that more than one third of this group smokes and has a poor diet, and half of them are overweight and physically inactive. Hence, the young people in Spain should be a priority objective for primordial prevention. The correct handling of this situation may prevent worsening of current cardiovascular health of these subjects in the future through a deterioration of biological CVD risk factors.

Other groups particularly at risk are men and those with lower education. In general, less-educated people have the worst cardiovascular health, second only to the oldest, with downer levels in all indicators except for smoking and diet. However, those better levels in diet indicators are mediated by the higher proportion of women and older subject in the less-educated group (data not shown). After adjustment, the observed relation between cardiovascular health and educational level disappear for health factor but do not for behavior factor. That situation can be explained by the universal and free access to Spanish health care, which could reduce inequities in management of traditional biological risk factor but could not affect lifestyles.

**Strengths and Limitations**

The main strength of this study is its large size and that it is representative of the Spanish population >18 years of age; however, by not including institutionalized subjects, the levels of ideal health could even be overestimated. We excluded 12% of all study participants from the present analysis because of missing data and performed a complete case analysis. However, such relatively small levels of drop out in the data would probably not substantially affect the overall accuracy of analysis. Although we do not have sufficient data for performing a comparison of participants included and excluded from the analysis, sociodemographic characteristics of participants with complete data (11,408) reliably resemble the

### Table 4. Percentage (SE) of Cardiovascular Health Metrics by Cardiovascular Health Categories

| Smoking | Ideal (never) | 100 (0.00) | 68.7 (1.15) | 95.8 (1.45) | 42.7 (0.66) | 52.8 (0.96) |
|         | Intermediate (former) | --- | 31.3 (1.15) | 4.2 (1.45) | 23.2 (0.56) | 25.7 (0.85) |
|         | Poor (current) | --- | --- | --- | 34.1 (0.63) | 21.5 (0.79) |
| Body mass index | Ideal (<25 kg/m²) | 100 (0.00) | 53.5 (1.25) | 96.0 (1.34) | 34.2 (0.70) | 45.2 (1.05) |
|         | Intermediate (25–29.9 kg/m²) | --- | 46.5 (1.25) | 4.0 (1.34) | 37.6 (0.67) | 44.3 (1.00) |
|         | Poor (>30 kg/m²) | --- | --- | --- | 28.2 (0.62) | 10.5 (0.60) |
| Physical activity | Ideal (active) | 100 (0.00) | 55.6 (1.22) | 91.1 (2.14) | 34.3 (0.68) | 44.9 (0.98) |
|         | Intermediate (moderately inactive) | --- | 44.4 (1.22) | 8.9 (2.14) | 31.3 (0.60) | 38.5 (0.91) |
|         | Poor (inactive) | --- | --- | --- | 34.4 (0.64) | 16.6 (0.69) |
| Healthy diet score | Ideal (4–5 components) | 100 (0.00) | 14.0 (0.82) | 26.9 (3.61) | 10.2 (0.40) | 11.3 (0.64) |
|         | Intermediate (2–3 components) | --- | 86.0 (0.82) | 73.1 (3.61) | 50.6 (0.68) | 60.6 (1.00) |
|         | Poor (0–1 components) | --- | --- | --- | 39.2 (0.73) | 28.1 (1.00) |
| Total cholesterol | Ideal (<200 mg/dL, untreated) | 100 (0.00) | 59.7 (1.22) | 96.7 (1.26) | 47.1 (0.68) | 53.2 (1.02) |
|         | Intermediate (200–239 mg/dL, or treated to goal) | --- | 40.3 (1.22) | 3.3 (1.26) | 37.4 (0.62) | 38.7 (0.96) |
|         | Poor (>240 mg/dL) | --- | --- | --- | 15.5 (0.46) | 8.1 (0.50) |
| Blood pressure | Ideal (SBP/DBP <120/80 mm Hg, untreated) | 100 (0.00) | 44.5 (1.23) | 93.5 (2.46) | 25.7 (0.65) | 36.0 (0.99) |
|         | Intermediate (SBP 120–139/DBP 80–89 mm Hg or treated to goal) | --- | 55.5 (1.23) | 6.5 (2.46) | 42.2 (0.67) | 50.1 (1.05) |
|         | Poor (>140/90 mm Hg) | --- | --- | --- | 32.1 (0.66) | 13.9 (0.66) |
| Fasting glucose | Ideal (<100 mg/dL, untreated) | 100 (0.00) | 87.4 (0.84) | 100 (0.000) | 74.2 (0.61) | 82.8 (0.75) |
|         | Intermediate (100–125 mg/dL, or treated to goal) | --- | 12.6 (0.84) | --- | 19.8 (0.54) | 16.0 (0.71) |
|         | Poor (>126 mg/dL) | --- | --- | --- | 6.0 (0.31) | 1.2 (0.27) |

DBP indicates diastolic blood pressure; and SBP, systolic blood pressure.

*Ideal health is all 7 health metrics at ideal levels.

†Intermediate health is at least 1 of 7 health metrics at intermediate levels, but no poor health metrics.

‡Poor health is at least 1 of 7 health metrics at a poor level.
whole sample of study participants (12948) (data not shown). Physical examinations were performed at any time of the day, mostly in the morning. Although BP determination at any time of day could have influenced BP, practically all participants (99%) had 6 BP measurements. The data to calculate most of the cardiovascular health indicators were obtained by physical examination and laboratory measurements under standardized conditions and using validated methods. Nonetheless, the information on smoking, diet, and awareness of and treatment for hypertension, hypercholesterolemia, and diabetes mellitus was self-reported and may be subject to recall bias.

Conclusion

In conclusion, cardiovascular health in Spain is not good due primarily to poor lifestyles, especially with regard to the diet. Of special concern is the situation among young adults, which shows the need to improve primary or primordial prevention at earlier ages. Given that coronary mortality in Spain is low compared with the United States and other Western countries, the factors responsible for this situation should be investigated. However, the apparent paradox of low CHD mortality with high cardiovascular risk factors in Spain should not lead to self-complacency because CHD is 1 of the most important contributors to disease burden in Spain. In fact, our data clearly suggest that cardiovascular health in Spain can be further improved by decisive intervention on the classical cardiovascular risk factors.

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Disclosures

None.

References


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