Original article

Estimating Cardiovascular Risk in Spain by the European Guidelines on Cardiovascular Disease Prevention in Clinical Practice

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ABSTRACT

Introduction and objectives: There are no nationwide, population-based studies in Spain assessing overall cardiovascular risk. We aimed to describe cardiovascular risk and achievement of treatment goals following the 2012 European Guidelines on cardiovascular disease prevention strategy. We also investigated clinical characteristics (non-classical risk factors) associated with moderate risk.

Methods: Participants (n = 2310, 58% women) aged 40 to 65 years from a national population-based study (Di@bet.es Study) were identified. First, a priori high/very-high risk individuals were identified. Next, total cardiovascular risk (Systematic Coronary Risk Evaluation equation including high-density lipoprotein cholesterol) was used to assess risk of a priori non-high risk individuals. Variables independently associated with moderate versus low-risk were investigated by multiple logistic regression analysis.

Results: Age-and-sex standardized (direct method) percentages of high/very-high, moderate, and low-risk were 22.8%, 43.5%, and 33.7%, respectively. Most men were at moderate (56.2%), while 55.4% of women were at low risk. Low-density lipoprotein cholesterol (< 70, < 100, < 115 mg/dL) and blood pressure (<140/90 mmHg) goals for very-high, high and moderate risk were met in 15%, 26% and 46%, and 77%, 68% and 85% of the individuals, respectively. Body mass index, high triglycerides concentrations, diastolic blood pressure, and low Mediterranean diet adherence (in women) were independently associated with moderate (versus low) risk.

Conclusions: Cardiovascular risk in Spain is mainly moderate in men and low in women. Achievement of treatment goals in high-risk individuals should be improved. The prevalence of non-classical cardiovascular risk factors is elevated in subjects at moderate risk, an important aspect to consider in a population-based strategy to decrease cardiovascular disease in the most prevalent group.

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Estimación del riesgo cardiovascular en España según la guía europea sobre prevención de la enfermedad cardiovascular en la práctica clínica

RESUMEN

Introducción y objetivos: En España no se dispone de estudios poblacionales de ámbito nacional en los que se haya evaluado el riesgo cardiovascular total. El objetivo del estudio es describir el riesgo cardiovascular y la consecución de los objetivos terapéuticos según lo establecido en la guía europea de 2012 para la estrategia de prevención de la enfermedad cardiovascular. Se investigaron también las características clínicas (factores de riesgo no clásicos) asociadas a un riesgo moderado.

Métodos: Se seleccionó a los participantes (n = 2.310; el 58% mujeres), de entre 40 y 65 años de edad, de un estudio de base poblacional de ámbito nacional (estudio Di@bet.es). En primer lugar, se identificó a los sujetos con un riesgo a priori alto o muy alto. A continuación, se utilizó el riesgo cardiovascular total (equación Systemic Coronary Risk Evaluation con inclusión del colesterol unido a lipoproteínas de alta densidad) para evaluar el riesgo de los individuos con un riesgo a priori no alto. Se investigaron las variables con asociación independiente con el riesgo moderado frente al riesgo bajo, utilizando para ello un análisis de regresión logística múltiple.
Resultados: Los porcentajes estandarizados respecto a edad y sexo (método directo) de los participantes con riesgo alto/muy alto, moderado y bajo fueron del 22.8, el 43.5 y el 33.7% respectivamente. La mayoría de los varones tenían un riesgo moderado (56.2%), mientras que el 55.4% de las mujeres tenían riesgo bajo. Alcanzaron los objetivos de colesterol unido a lipoproteínas de baja densidad (< 70, < 100 y < 115 mg/dl) y presión arterial (< 140/90 mmHg) los participantes de riesgo muy alto, alto y moderado, respectivamente, en el 15, el 26 y el 46% y el 77, el 68 y el 85% de los individuos. El índice de masa corporal, las concentraciones altas de triglicéridos, la presión arterial diastólica y la baja adherencia a la dieta mediterránea (en las mujeres) presentaron asociación independiente con un riesgo moderado (frente a riesgo bajo).

Conclusiones: El riesgo cardiovascular en España es principalmente moderado en los varones y bajo en las mujeres. Debe mejorarse la consecución de los objetivos terapéuticos por los individuos de alto riesgo. La prevalencia de factores de riesgo cardiovascular no clásicos está aumentada en los individuos de riesgo moderado, lo cual es un aspecto importante que tener en cuenta en una estrategia de base poblacional para reducir las enfermedades cardiovasculares en el grupo de mayor prevalencia.

INTRODUCCIÓN

Aunque la incidencia de corona y enfermedad cerebrovascular sea alta, la causa principal de la mortalidad y discapacidad en España, así como en otros países europeos, es la enfermedad cardiovascular (CVD) y el riesgo cardiovascular (CVR). Nuestro objetivo fue evaluar la prevalencia de los factores de riesgo cardiovascular no clásicos en la población adulta de más de 18 años en España, utilizando el enfoque de la Asociación Europea de Cardiología (AESC) y las directrices del Consorcio para el Estudio de la Prevención Cardiovascular (CAPPV) para la prevención de la enfermedad cardiovascular. Se realizó un estudio transversal mediante un cuestionario de autoaplicación en 10640 participantes seleccionados de forma aleatoria en 243 poblaciones españolas. Los resultados muestran que la prevalencia de los factores de riesgo cardiovascular no clásicos es alta en la población general y sugiere la necesidad de una estrategia integral de prevención cardiovascular.
obtained and a standard oral glucose tolerance test (in nondiabetics) performed. Serum glucose, triacylglycerols, and cholesterol were measured enzymatically, and HDL-C by direct method. Low-density lipoprotein cholesterol (LDL-C) was estimated by the Friedewald formula. Atherogenic dyslipidemia was defined as triglycerides > 150 mg/dL and HDL-C < 40 mg/dL for men and < 45 mg/dL for women. The MDRD (Modification of Diet in Renal Disease) formula was used to estimate glomerular filtration rate.

**Estimation of Cardiovascular Risk**

The stepped approach suggested in the European Guidelines on cardiovascular disease prevention in clinical practice was used to estimate CVR in our cohort. Flowchart of study participants is shown in Figure 1. First, individuals with a *priori* very high-risk were identified (*n* = 384): diabetes (*n* = 280), either known diabetes (*n* = 177) or diagnosed after the blood test (*n* = 103), with one or more CVRF or microalbuminuria (> 20 mg/L); chronic renal failure with estimated glomerular filtration rate ≤ 30 ml/min; or documented CVD. From our questionnaire, 105, 42, and 12 individuals who had coronary heart, cerebrovascular, or peripheral vascular disease, respectively, were identified. Overall, 139 (6.02% total, 3.42% women, 9.63% men) participants had CVD. This prevalence was similar to the one reported in previous studies in a population with similar (35-64 years) age range (6.4% all, 3.9% women and 9.2% men). Second, we identified individuals with a *priori* high risk (*n* = 102); diabetes (*n* = 48), either known diabetes (*n* = 34) or diagnosed after the blood test (*n* = 14) without other CVRF and without microalbuminuria; estimated glomerular filtration rate between 30 to 60 ml/min; total cholesterol > 8 mmol/L, systolic blood pressure ≥ 180 mmHg, or diastolic blood pressure ≥ 110 mmHg. For the remaining participants (*n* = 1824), total CVR was estimated with the current version of the SCORE equation for low-risk regions, which includes HDL-C. Finally, very-high (*a priori* very-high risk or SCORE ≥ 10%), high (*a priori* high risk or SCORE 5%-10%), moderate (non-high risk and SCORE 1%-5%), and low (non-high risk and SCORE ≤ 1%) risk categories were defined. The LDL-C goals according to estimated CVR were defined as: < 130 mg/dL in low, < 115 mg/dL in moderate, < 100 mg/dL in high and < 70 mg/dL in very-high risk individuals.

Similarly, CVR was estimated by means of the Framingham-REGICOR strategy. According to this, individuals with documented CVD were classified as very-high risk, while those with one or more markedly elevated risk factors (total cholesterol > 8 mmol/L, systolic blood pressure > 180 mmHg or diastolic blood pressure > 110 mmHg) as high risk. For the remaining, total CVR was estimated with the latest (which also includes HDL-C) Framingham–REGICOR equation, with values ≥ 15% representing very-high, 10-15% high, 5-10% moderate and < 5% low risk.

**Statistical Analysis**

Data are presented as median [interquartile range] and number of individuals (percentage) unless otherwise indicated. To estimate total CVR in Spain, standardized rates (× 100 population) of risk categories (low/moderate/high/very-high) were calculated using the direct method described in Armitage et al.21 The age and sex structure of the Spanish population (INE [Instituto Nacional de Estadística], 2010) was used as the standard population. Therefore, our age- and sex-adjusted rates are the rates that would occur if the observed age- and sex-specific rates in the Di@bet.es study population were present in a population with the age and sex distribution of the standard (INE, 2010) Spanish population. The kappa coefficient was used to examine the agreement between CVR strategies (European Guidelines on cardiovascular disease prevention in clinical practice and Framingham–REGICOR) in the classification of the participants as very high/high risk vs non-high-risk (moderate/low risk). Differences in age, sex, anthropometric variables, lifestyle, sociodemographic variables, other CVRF, active medications, lipid parameters, and estimated glomerular filtration rate were analyzed using the χ2 test or Fisher’s exact test.

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Figure 1. Flow chart of study participants. CVR, cardiovascular risk; CVRF, cardiovascular risk factor; DM, diabetes mellitus; eGFR: estimated glomerular filtration rate; SCORE, Systematic Coronary Risk Evaluation.
filtration rate across the different categories of CVR were evaluated by means of chi-square or Kruskal-Wallis tests as appropriate. Logistic multiple regression analysis was used to investigate CVRF not included in the SCORE equation (ie, non-classical risk factors) that were independently associated with moderate risk (vs low risk). Because most of these factors are age- and sex-dependent, a stepwise multiple logistic regression model adjusted for age, and separate for each sex, was built to investigate variables associated with the moderate risk category. Predictive performance of these models was evaluated by area under the receiver operating characteristic curve and Hosmer-Lemeshow goodness-of-fit test. The significance level was set at \( P \leq .05 \). Analyses were performed with SAS software, v.9.2 (SAS Institute Inc.; Cary, North Carolina, United States).

RESULTS

Prevalence of Cardiovascular Risk Categories

In individuals aged 40 to 65 years, CVR estimated by the European Guidelines on cardiovascular disease prevention in clinical practice is mainly moderate (43.4%; CI, 41.4-45.5), and the prevalence of very-high risk is > 15% (Figure 2). Sex differences were found in the SCORE (\( P < .0001 \)). In men, 56% and 32% were in moderate and high/very-high risk categories, respectively. However, most of the women (55%) were in the low-risk category and only 4% and 10% of them were at high or very-high risk, respectively. Furthermore, diabetes accounted for a large percentage of the high (25% and 35%) and, especially, very-high (60% and 69%) risk categories in men and women, respectively.

Cardiovascular Risk Strategies’ Agreement

Because individuals with diabetes are \textit{a priori} defined as a high/very-high risk in the European Guidelines on cardiovascular disease prevention in clinical practice, but not in Framingham-REGICOR, which includes specific risk estimates for these individuals, we first investigated risk concordance in individuals with diabetes.\(^7\) Participants with diabetes (\( n = 331; 14% \)) were categorized in the high (\( n = 48; 15\% \)) or very high (\( n = 283; 85\% \)) risk category by the European Guidelines on cardiovascular disease prevention in clinical practice and in the low (\( n = 55; 18\% \)), intermediate (\( n = 130; 43\% \)), high (\( n = 54; 18\% \)), or very high (\( n = 66; 22\% \)) risk category by Framingham-REGICOR. Thereafter, concordance was evaluated in nondiabetic individuals (Tables 1 and 2 of the supplementary material), and because one of the main goals of the CVR prevention strategy is to identify high-risk individuals, our nondiabetic population was dichotomized: individuals at high/very high and at low/moderate risk. After excluding individuals with diabetes, there was a substantial agreement (\( \kappa = 0.77 \) [0.73-0.82]) between European Guidelines on cardiovascular disease prevention in clinical practice and Framingham-REGICOR strategies (Table 1). Kappa coefficient was slightly higher for the European Guidelines vs Framingham-REGICOR concordance in women (\( \kappa = 0.82 \) [0.75-0.90]) than in men (\( \kappa = 0.74 \) [0.67-0.80]) (Table 1).

Treatment Goals

Although the proportion of individuals on lipid-lowering, antihypertensive, and antiplatelet drugs increased with increasing risk (all \( P < .0001 \)), the proportion of those with LDL-C meeting goals or with blood pressure \( \leq 140/90 \) mmHg decreased with
increasing risk ($P < .0001$) (Table 2). Only the proportion of individuals with blood pressure $< 140/90$ mmHg was higher ($P = .029$) among very-high as compared with high-risk individuals, even after adjustment for antihypertensive medication ($P = .003$). Although the proportion of individuals at very-high risk with LDL-C $< 70$ mg/dL was very low, this proportion increased to $47\%$ when LDL-C $< 100$ mg/dL was the cut-off point. Similarly, the proportion of individuals at high or moderate risk with LDL-C $< 130$ mg/dL was $63\%$ and $69\%$, respectively. Approximately, one in three (28%-34%) people in moderate, high, and very-high risk categories were smokers (Table 2).

**Moderate Risk Category**

In Table 3, age, sex and several traditional and nontraditional CVRF (which are not a core part of the risk stratification strategy) are presented by CVR categories. Most, but not all (such as sedentaryism and estimated glomerular filtration rate), of the variables shown in Table 3 differed between low and moderate risk individuals. In a stepwise multiple logistic regression model, we found that body mass index (in women), central obesity (in men), diastolic blood pressure, high triglycerides, and low adherence to a Mediterranean diet (in women) were factors associated with moderate risk category (Table 4). This model had good fit based on nonsignificance on the goodness-of-fit Hosmer-Lemeshow test ($P = .13$ and $P = .99$ for women and men, respectively, and area under the receiver operating characteristic curves (0.96; 95%CI, 0.95-0.97, and 0.95; 95%CI, 0.93-0.97 for women and men, respectively) indicated good accuracy of predictive models.

**DISCUSSION**

The Di@bet.es study$^{18}$ was designed to determine the prevalence of diabetes and other CVRF in a representative sample of the people...
Table 3
Distribution of Other Classical or Non-classical Cardiovascular Risk Factors According to Estimated Cardiovascular Risk

<table>
<thead>
<tr>
<th>Low risk (n=791)</th>
<th>Moderate risk (n=961)</th>
<th>High risk (n=171)</th>
<th>Very high risk (n=387)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mev 86</td>
<td>(10.9)</td>
<td>523 [54.4]</td>
<td>120 (70.2)</td>
<td>237 (61.2)</td>
</tr>
<tr>
<td>Diabetes 0</td>
<td>(0.0)</td>
<td>0 (0.0)</td>
<td>48 (28.1)</td>
<td>280 (72.4)</td>
</tr>
<tr>
<td>Microalbuminuria &gt; 20 mg/L 49</td>
<td>(7.0)</td>
<td>71 (8.2)</td>
<td>28 (19.2)</td>
<td>76 (23.4)</td>
</tr>
<tr>
<td>BMI, kg/m² 26</td>
<td>[23.4-29.4]</td>
<td>28.3 [25.9-31.2]</td>
<td>29.1 [26.8-32]</td>
<td>30.8 [27.4-34]</td>
</tr>
<tr>
<td>Obesity 175</td>
<td>(22.1)</td>
<td>318 (33.1)</td>
<td>72 (42.1)</td>
<td>213 (55.1)</td>
</tr>
<tr>
<td>Central obesity 322</td>
<td>(41.0)</td>
<td>372 [38.8]</td>
<td>85 [50.0]</td>
<td>238 [61.7]</td>
</tr>
<tr>
<td>Atherogenic dyslipidemia 27</td>
<td>(3.4)</td>
<td>101 (10.5)</td>
<td>25 (14.6)</td>
<td>92 (23.8)</td>
</tr>
<tr>
<td>Prediabetes 69</td>
<td>(8.7)</td>
<td>162 (16.9)</td>
<td>58 (34.2)</td>
<td>63 (16.4)</td>
</tr>
<tr>
<td>Sedentarism 315</td>
<td>(39.9)</td>
<td>364 (37.9)</td>
<td>63 (37.0)</td>
<td>158 (40.9)</td>
</tr>
<tr>
<td>Low adherence to MedD 529</td>
<td>(66.9)</td>
<td>591 (61.5)</td>
<td>110 (64.7)</td>
<td>260 (67.1)</td>
</tr>
</tbody>
</table>

Education level, %

| No studies | 3.0     | 8.9b      | 12.9       | 14.5       | .0001 |
| Primary    | 48.8    | 55.8b     | 56.7       | 58.0       | .023  |
| Secondary  | 30.1    | 22.2b     | 19.3       | 20.0       | .044  |
| University | 18.1    | 13.1b     | 11.1       | 7.5        | .0887 |

Marital status, %

| Single     | 10.9    | 9.3b      | 11.1       | 6.2        | .0001 |
| Married    | 79.6    | 80.3b     | 77.8       | 82.1       | .0001 |
| Widowed    | 2.8     | 5.1b      | 5.3        | 5.2        | .0001 |
| Divorced   | 6.7     | 5.3b      | 5.8        | 6.5        | .0001 |

BMI, body mass index; eGFR, estimated glomerular filtration rate; HDL-C, high-density lipoproteins cholesterol; MDRD, Modification of Diet in Renal Disease; MedD, Mediterranean diet.

Unless otherwise indicated, data are expressed as No. (%) or median [interquartile range].

* Variables considered to estimate the cardiovascular risk on Systematic Coronary Risk Evaluation.

b P < .05 (Mediterranean diet adherence and civil status) and P < .001 (rest of the variables) for differences between moderate and low risk categories.

c Missing information in 278 individuals.

d Central obesity defined as waist/hip ratio > 1 in men and > 0.85 in women.

* Atherogenic dyslipidemia was defined as high-density lipoproteins cholesterol < 40 mg/dL and triglycerides > 150 mg/dL in men, and high-density lipoproteins cholesterol < 45 mg/dL and triglycerides > 150 mg/dL in women.

population of Spain. The CVR in population aged 40 to 65 years in Spain is, according to our results, moderate (43.4%), with 22.8% of the population at high/very-high risk. After excluding individuals with a priori defined high/very-high risk, less than 5% of the population was classified in these categories. Indeed, only 40% and 0.8% of the high and very-high risk individuals were identified by calculating total CVR with the SCORE equation. To the best of our knowledge, this is the first population-based probability sample study of the entire country (Spain) evaluating CVR with the stepped European Guidelines on cardiovascular disease prevention

Table 4
Multiple Logistic Regression Analysis to Identify Variables Associated With Moderate Versus Low Risk

<table>
<thead>
<tr>
<th>Men</th>
<th></th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR (95%CI)</td>
<td>P</td>
<td>OR (95%CI)</td>
</tr>
<tr>
<td>Obesity, yes</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Central obesity, yes</td>
<td>5.83 (1.42-23.99)</td>
<td>.014</td>
</tr>
<tr>
<td>High triglycerides, yes</td>
<td>4.61 (2.02-10.49)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>DBP ≥ 90 mmHg, yes</td>
<td>2.98 (1.07-8.28)</td>
<td>.036</td>
</tr>
<tr>
<td>Low adherence to MedD, yes</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

95%CI, 95% confidence interval; DBP, diastolic blood pressure; MedD, Mediterranean diet; OR, odds ratio.

Variables included in the model: age, obesity (body mass index ≥ 30 kg/m²), central obesity (waist/hip ratio > 1 in men and > 0.85 in women), high triglycerides (> 150 mg/dL), Mediterranean diet (lower vs medium/higher tertile) adherence, diastolic blood pressure, physical activity (inactive vs active), university education, civil status, and prediabetes (yes vs no).

Multiple logistic regression model (stepwise), value of significance level for entry P < .15.
in clinical practice strategy and including HDL-C in the risk equation. Most of the previous studies investigating CVR in Spain were focused on patients with prespecified medical conditions (metabolic syndrome, or presence of one or more traditional risk factors) or were limited to regions that might not be representative of the whole national territory. Moreover, none of them included individuals with documented CVD or considered HDL-C in the risk equation, and only some included diabetic patients. Sex differences in CVR in Spain have been reported in previous studies. Jansen-Chaparro et al. and Mostaza et al. showed that the prevalence of high/very-high risk in men and women was 6.9% and 0.5%, and 8.2% and 0.2%, respectively. In our survey, in a population aged 40 to 65 years, the overall prevalence of high/very-high risk in men was more than double that of women (32% vs 13.9%, Figure 2), and after excluding individuals with a priori high or very-high risk, this prevalence was 10.3% and 0.1%, respectively, which is similar to that reported in previous studies. Although male sex is a well-established CVRF and lifelong risk for CVD is higher in men than in women, in Spain, according to the European Heart Network, the percentage of deaths from CVD is higher in women compared with men, 35% vs 27%, respectively. Furthermore, in a cohort of 3856 individuals with a mean follow-up of 7.1 years, more than 80% of total cardiovascular events occurred in women who were classified at baseline as low or moderate risk, compared with 55% in men with the same risk. These data and the high percentage of women currently classified as low/moderate risk in our, and other, studies indicate that the current strategy to assess CVR in females should be further improved. In addition, the efficacy of acetylsalicylic acid and statins in primary prevention is lower in women than in men, and women have a worse prognosis after some cardiovascular events compared to men. Thus, similar to what the American Heart Association has recently proposed, strategies specifically accounting for sex differences in CVR are also needed in European countries.

In Spain, several risk strategies are currently used to estimate CVR in different regions. Among these equations, SCORE and REGICOR are the most popular. It has been previously discussed that the former overestimates and the second underestimates CVR. More recently, Gil-Guillén et al. assessed the agreement of these two equations in the identification of high-risk individuals among more than 8000 people without established CVD, and found low concordance between them (κ = 0.463), where SCORE classified as high risk nearly twice as many people as Framingham-REGICOR. In our study, however, the two strategies had substantial (almost perfect for females) agreement when diabetes (a priori high or very-high risk condition for SCORE) was excluded (Table 1), and when situations such as total cholesterol > 8 mmol/L, systolic blood pressure ≥ 180 mmHg, diastolic blood pressure ≥ 110 mmHg, or documented CVD were a priori defined as high or very-high risk according to European Guidelines on cardiovascular disease prevention in clinical practice and Framingham-REGICOR strategies. Therefore, diabetes may be responsible for a large part of this disagreement. Indeed, we have reported how differently the strategies classified the risk of diabetic patients, with 61% of the high/very-high risk diabetic individuals (according to European Guidelines on cardiovascular disease prevention in clinical practice) classified as non-high risk by the Framingham-REGICOR strategy. Although diabetes is not a coronary risk equivalent in Spain, as well as in other countries, CVR in individuals with diabetes is more than double that of nondiabetics. Moreover, only multifactorial, early, and intensive intervention can delay or prevent cardiovascular mortality in patients with diabetes. Therefore, strategies failing to identify diabetes as a high-risk condition do not prompt physicians to achieve one of the most important components of this early and intensive intervention, ie, appropriate treatment of diabetic dyslipidemia. Tailored LDL-C goals are intentionally set at a lower range for individuals with diabetes to overcome the fact that LDL-C concentrations are only a marginal aspect in the evaluation of diabetic dyslipidemia. Despite the improvement observed in Spain in the control of hypertension or dyslipidemia during recent years, achievement of treatment goals in CVRF remains poor. Furthermore, prevalence of risk factors continues to increase, mainly due to an unhealthy lifestyle (sedentarism and inadequate food intake) and a high prevalence of obesity that in Spain is close to 30% according to the Diabet.es Study. Indeed, if ideal cardiovascular health is evaluated in Spain, only 0.2% and 3.4% (3.2% in our study) of participants attained ideal values for 7 or 6 CVD health metrics, respectively. Notwithstanding, as reported in the EURIKA Study, similar trends in control and prevalence of risk factors have been reported in other European countries, with less than 50% of individuals meeting primary prevention goals for blood pressure, lipids, and diabetes. Moreover, randomized clinical trials where secondary prevention is pursued in diabetic (and nondiabetic) individuals demonstrate that treatment goals are not met in a large proportion of this very-high risk population. In this sense, in our study, the prevalence and degree of control of classical or non-classical CVRF (Table 2) are poor, in agreement with previous studies. Only 15% or 47%, respectively, of the very-high risk participants (most individuals with CVD or diabetes with multiple CVRF) met the proposed LDL-C goals (< 70 or < 100 mg/dL, respectively); 23% had blood pressure > 140/90 mmHg, and 28% were active smokers.

We were also interested in describing individuals at moderate risk. This is the group of individuals in whom, especially for women, most of the future cardiovascular events at the population level will occur. In our study, 54% and 33% of individuals in moderate risk had LDL-C > 115 mg/dL (current target, European Guidelines on cardiovascular disease prevention in clinical practice) or 130 mg/dL (a less strict target), respectively. Furthermore, independently of their older age, other CVRF which are not part of the risk stratification strategy were more prevalent in this group, compared with the low-risk group. Hence, the presence of obesity or central obesity,atherogenic dyslipidemia, elevated diastolic blood pressure, or poor adherence to a healthy cardiovascular diet also could serve to guide the management of this critical risk group. In this regard, lifestyle interventions, which are not generally well implemented, are profoundly associated with these features (Table 4), are related to cardiovascular health and events, and (especially for diet) are in part responsible of the coronary heart disease paradox in Spain, should be pursued by health authorities in this group at moderate risk.

Strengths and Limitations

Several strengths and limitations should be acknowledged in this study. The main strength of the study is that it was intended to be representative of the whole national territory, has no prespecified limitations regarding participant inclusion criteria, and takes into account HDL-C to estimate CVR. The study, however, also has a few limitations. Since the calculation of total risk in the European Guidelines on cardiovascular disease prevention in clinical practice strategy is in part limited (SCORE equation restriction) to persons aged 40 to 65 years, our results does not represent CVR in people > 65 years. Inclusion of this older group would have a priori increased CVR. In addition, the information regarding prevalent CVD, although collected using a structured, standardized, interview–administered questionnaire, was self-reported: an otherwise usual practice in large epidemiological
surveys. Finally, population-based studies, although less prone to referral bias, may include several inherent sources of selection and observation bias due to study design, type of sampling, participation rate\textsuperscript{40} (which was 55.8% in our study), or recall and interviewer bias.\textsuperscript{41}

CONCLUSIONS

In summary, we present current information regarding CVR in a representative sample of the population of Spain. CVR in a population aged 40 to 65 years is mainly moderate in men and low in women, and a large proportion of high/very-high risk individuals do not meet appropriate treatment goals. Furthermore, the presence of other, so-called non-classical CVRF, specifically obesity and hypertriglyceridemia, is elevated in individuals at moderate risk. These data are relevant to public health authorities designing CVD prevention programs to promote, on one side, a better achievement of treatment goals in the high/very-high risk group, the one with higher incidence of cardiovascular events, and, on the other hand, a better identification of individuals (especially women) in the moderate-risk group, the group in which most cardiovascular events will occur.

ACKNOWLEDGEMENTS

This work would not have been possible without the help and support of the primary care managers and personnel of the health care centers participating in the Di@bet.es. The study was supported by CIBERDEM (Centro de Investigación Biomédica en Red de Diabetes y Enfermedades Metabólicas Asociadas) from the Instituto de Salud Carlos III (Ministerio de Ciencia e Innovación), Ministerio de Sanidad y Consumo and the SED (Sociedad Española de Diabetes). We are indebted to José Ríos and Ferran Torres from the Biostatistics and Data Management Core Facility IDIBAPS (Institut d'Investigacions Biomèdiques August Pi i Sunyer) for methodological assessment and statistical recommendations.

CONFLICTS OF INTEREST

None declared.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found in the online version available at doi:10.1016/j.rec.2014.05.023.

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REFERENCES


