ACTA MÉDICA PORTUGUESA
A Revista Científica da Ordem dos Médicos

Estimation of 10-Year Cardiovascular Disease Risk in the Portuguese Population Using the Systematic Coronary Risk Evaluation 2 (SCORE2)

Estimativa do Risco a 10 Anos de Doença Cardiovascular na População Portuguesa Utilizando o Systematic Coronary Risk Evaluation 2 (SCORE2)

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Acta Med Port 2024 Oct;37(10):720-724 ▪ https://doi.org/10.20344/amp.21376

ABSTRACT

Cardiovascular diseases are the leading cause of death globally. The objective of this study was to estimate the 10-year cardiovascular risk in the Portuguese population using the new Systematic Coronary Risk Evaluation 2. Data from the first National Health Examination Survey from 2015 were used. Inclusion criteria were age between 40 and 69 years, absence of pregnancy, available information on sex, age, smoking status, systolic blood pressure, total cholesterol, and high-density lipoprotein cholesterol. Participants who had an acute myocardial infarction or a stroke, had diabetes, chronic kidney disease, or reported taking medication for these conditions were excluded from the analysis. The prevalence of high and very high cardiovascular risk was stratified by sex, age group, marital status, education level, occupational activity, degree of urbanization of the area of residence, health region, and income quintile. The sample consisted of 2817 individuals. In Portugal, in 2015, 36.7% (95% CI: 34.2 - 39.3) and 6.1% (95% CI: 4.8 - 7.4) of the individuals aged between 40 and 69 years had a high and a very high risk of having a cardiovascular disease in the following 10 years, respectively. In 2015, there was a high percentage (42.8%) of the Portuguese population aged 40 to 69 years in high or very high risk of developing cardiovascular disease (fatal and non-fatal) in the following 10 years. A possible explanation may be the high prevalence of risk factors for cardiovascular disease in Portugal.
Keywords: Cardiovascular Diseases; Heart Disease Risk Factors; Risk Assessment; Sociodemographic Factors

RESUMO

As doenças cardiovasculares são a principal causa de morte globalmente. O objetivo deste estudo foi atualizar a estimativa do risco cardiovascular a 10 anos na população portuguesa utilizando o novo *Systematic Coronary Risk Evaluation 2*. Foram utilizados dados do Primeiro Inquérito Nacional de Saúde com Exame Físico de 2015. Os critérios de inclusão foram a idade entre 40 e 69 anos, ausência de gravidez, informação disponível sobre o sexo, idade, consumo de tabaco, pressão arterial sistólica, colesterol total e colesterol da lipoproteína de alta densidade. Os participantes previamente diagnosticados com enfarte agudo do miocárdio, acidente vascular cerebral, diabetes, doença renal crónica ou com terapêutica para estas doenças foram excluídos da análise. A prevalência de risco cardiovascular alto e muito alto foi estratificada por sexo, grupo etário, estado civil, nível de escolaridade, atividade profissional, grau de urbanização da zona de residência, região de saúde e quintil de rendimento. A amostra foi constituída por 2817 indivíduos. Em Portugal, em 2015, 36,7% (IC 95%: 34,2 - 39,3) e 6,1% (IC 95%: 4,8 - 7,4) dos indivíduos entre os 40 e 69 anos apresentaram um risco alto e muito alto, respetivamente, de desenvolver uma doença cardiovascular a 10 anos. Em 2015 houve uma elevada percentagem (42,8%) da população portuguesa entre os 40 e 69 anos em risco alto ou muito alto de desenvolver doença cardiovascular (fatal e não fatal) a 10 anos. Uma explicação possível poderá ser a elevada prevalência de fatores de risco para doença cardiovascular em Portugal.
Palavras-chave: Avaliação de Risco; Doenças Cardiovasculares; Fatores de Risco de Doenças Cardíacas; Fatores Sociodemográficos

INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of mortality worldwide, accounting for 20.5 million deaths in 2021.[1] The Systematic Coronary Risk Evaluation (SCORE) was developed by the European Society of Cardiology (ESC) in 2003 to estimate cardiovascular (CV) risk, validated for European populations to predict the 10-year risk of fatal events (coronary heart disease, heart failure, stroke, and sudden death), in asymptomatic individuals without a diagnosis of CVD.[2] In 2015, among Portuguese individuals aged 40 to 65 years, SCORE identified a 5.1% high CV risk and a 11.9% very high CV risk of a fatal cardiovascular event within 10 years.[3]

In 2021, the risk of non-fatal CV events (acute myocardial infarction and stroke) was added to SCORE, combining fatal and non-fatal CV risk, naming this update SCORE2.[4] For the application of SCORE2, ESC defined four CV risk zones based on World Health Organization age- and sex-standardized CV mortality rates. Portugal was classified within the moderate-risk category.[4] SCORE2 consists of three categories: low to moderate risk [< 2.5% (< 50 years) or < 5% (50 - 69 years)]; high risk [2.5% - 7.4% (< 50 years) or 5.0% - 9.9% (50 - 69 years)]; and very high risk [≥ 7.5% (< 50 years) or ≥ 10.0% (50 - 69 years)].[4] It uses the variables sex, age, smoking status, systolic blood pressure, and non-high-density lipoprotein cholesterol (non C-HDL).[4] SCORE is recommended for people aged 40 to 69, without documented CVD, diabetes, chronic kidney disease, familial hypercholesterolemia, or other genetic/rare lipid or blood

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Recebido/*Received*: 14/02/2024 - **Aceite/*Accepted*:** 24/06/2024 - **Publicado *Online*/*Published Online*:** 09/08/2024 - **Publicado/*Published*:** 01/10/2024

pressure disorders.[4,5] As stated in the 2021 ESC Guidelines, individuals with diabetes can have a moderate, high, or very high CV risk *a priori*.[5] 2021 ESC Guidelines do not advise the application of SCORE2 charts in pregnant women.[5]

To the best of our knowledge, no studies have evaluated SCORE2 in the Portuguese population. This study aimed to estimate and characterize the 10-year CV risk using SCORE2 in the Portuguese population aged 40 to 69.

METHODS

Study population

Data from the INSEF, collected between February 2nd and December 21st, 2015, was used.[6] INSEF was an observational, cross-sectional study of a population-based sample, targeting individuals aged 25 to 74 years who had been residing in mainland Portugal or the autonomous regions of the Azores and Madeira for at least 12 months before the interview. The sample was selected using a complex multistage probabilistic design to ensure regional and national representativeness.[6]

For this study, the inclusion criteria were age 40 - 69 years, not being pregnant, available information on sex, age, smoking status, systolic blood pressure, total cholesterol, and C-HDL. Diagnosis of acute myocardial infarction, stroke, diabetes, chronic kidney disease, or undergoing medication for these conditions were excluded.[5] The INSEF indicated the use of medication for high blood pressure, myocardial infarction, stroke, diabetes, and chronic renal failure, without specification of drug.[6]

Statistical analysis

The statistical analysis was performed using the R software for Windows, version 4.3.1.[7] The significance level was set at 5% for all analyses.

The participants were described by sociodemographic variables and relative and absolute frequencies. The prevalence of CV risk was determined using SCORE2 for moderate-risk European countries. The 95% confidence interval (CI) was calculated using the "confint" function in the R program. The adjusted version of the Pearson chi-squared test ("svychisq" function) for complex samples was used to compare the distribution of CV risk. Sample weighting was included in all estimates to account for different selection probabilities,[6] using the "survey" package in R.[7]

Ethical issues

The INSEF study received approval from the INSA Health Ethics Committee, the National Data Protection Authority and from eight regional Ethics Committees.[6] The INSA Health Ethics Committee issued a favorable opinion for the conduct of this research study on February 7, 2023.

RESULTS

The subsample consisted of 2817 individuals, mostly female (55.5%). Most participants resided in urban areas (73.2%; 95% CI: 70.0 - 76.4) and were married or cohabiting (76.1%; 95% CI:73.9 - 78.3). Nearly one-third of participants (30.9%; 95% CI:28.0 - 33.8) had no formal education or completed primary school, and over one-third (38.1%; 95% CI:32.8 - 43.4) had low-skilled occupations (e.g., farmers, industry, and construction) (Table1). The

Table 1 – Description of INSEF 2015 participants by sociodemographic characteristics

Socio-demographic characteristics	n	%
Sex (n = 2817)		
Female	1570	55.5
Male	1247	44.5
Age group (n = 2817)		
40 - 44 years	589	21.9
45 - 49 years	525	18.6
50 - 54 years	547	19.0
55 - 59 years	433	14.3
60 - 64 years	414	14.6
65 - 69 years	309	11.5
Marital status[a] (n = 2817)		
Married	2136	76.1
Not married	681	23.9
Educational level (n = 2815)		
No education/ basic 1st cycle	941	30.9
Basic 2nd/3rd cycle	1002	35.6
Secondary education	469	18.0
Higher education	403	15.5
Occupational activity[b] (n = 2526)		
A	402	17.1
B	1142	44.8
C	982	38.1
Degree of urbanization (n = 2817)		
Urban	2026	73.2
Rural	791	26.8
Health Region (n = 2817)		
North	441	35.7
Centre	432	17.9
Lisbon and Tagus Valley	342	32.6
Alentejo	392	4.7
Algarve	392	4.4
Autonomous Region of Madeira	422	2.6
Autonomous Region of Azores	396	2.1
Income quintile (n = 2668)		
Low	667	20.7
Medium - low	522	17.0
Medium	503	18.8
Medium - high	450	17.2
High	526	18.8

[a] Married: cohabiting and married; Not married: single, divorced, widowed.
[b] A: armed forces, managers, professionals; B: technicians & associate professionals, clerical support workers, services & sales workers; C: skilled agricultural workers, craft & related trades workers, plant & machine operators, elementary occupations.[3]

characteristics of excluded individuals can be consulted in Table 1 of the Appendix 1 (Appendix 1: https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/21376/15489).

In the 2015 INSEF, of those who qualified for SCORE2 assessment, 42.8% had a high risk [36.7% (95% CI: 34.2 - 39.3)] or very high risk [6.1% (95% CI: 4.8 - 7.4)] of developing CVD within 10 years (fatal or non-fatal). The prevalence was higher in men [high risk of 56.3% [95% CI: 52.6 - 60.0) and a very high risk of 13.4% (95% CI: 10.6 - 16.1)]; older age (65 - 69 years), with a high CV risk prevalence of 71.0% (95% CI: 62.4 - 79.5) and a very high CV risk prevalence of 20.4% (95% CI: 14.7 - 26.1); no education or only primary education [high risk of 43.1% (95% CI: 38.6 - 47.7) and a

Table 2 – Distribution of cardiovascular risk by SCORE2 according to sociodemographic characteristics

	% (95% CI)			
	Low/moderate risk n = 1623	**High risk** n = 992	**Very high risk** n = 202	***p*-value**
Sex (n = 2817)				
Female	78.6 (75.9 - 81.4)	21.1 (18.3 - 23.9)	0.3 (0.0 - 0.6)	< 0.001
Male	30.4 (25.7 - 35.0)	56.3 (52.6 - 60.0)	13.4 (10.6 - 16.1)	
Age group (n = 2817)				
40 - 44 years	71.2 (65.0 - 77.3)	27.3 (22.1 - 32.6)	1.5 (0.1 - 2.9)	< 0.001
45 - 49 years	55.5 (49.5 - 61.5)	41.6 (35.8 - 47.4)	2.9 (1.5 - 4.3)	
50 - 54 years	80.3 (73.0 - 87.6)	18.0 (10.5 - 25.5)	1.7 (0.4 - 3.0)	
55 - 59 years	58.5 (50.0 - 67.0)	34.9 (28.3 - 41.6)	6.6 (2.3 - 10.9)	
60 - 64 years	45.0 (37.7 - 52.3)	43.9 (36.2 - 51.5)	11.2 (7.2 - 15.2)	
65 - 69 years	8.6 (3.7 - 13.6)	71.0 (62.4 - 79.5)	20.4 (14.7 - 26.1)	
Marital status[a] (n = 2817)				
Married	56.8 (53.9 - 59.6)	36.9 (34.4 - 39.4)	6.3 (5.0 - 7.6)	0.8672
Not married	58.4 (50.9 - 65.8)	36.2 (29.7 - 42.7)	5.5 (1.8 - 9.1)	
Educational level (n = 2815)				
No education/ basic 1st cycle	46.4 (42.1 - 50.7)	43.1 (38.6 - 47.7)	10.5 (7.7 - 13.3)	< 0.001
Basic 2nd/3rd cycle	60.2 (55.4 - 65.0)	35.6 (30.4 - 40.7)	4.3 (2.7 - 5.8)	
Secondary education	59.8 (55.6 - 64.1)	34.9 (29.2 - 40.7)	5.3 (1.4 - 9.1)	
Higher education	68.6 (61.3 - 76.0)	28.8 (22.6 - 35.0)	2.6 (0.1 - 5.1)	
Occupational activity[b] (n = 2526)				
A	58.0 (52.3 - 63.4)	36.3 (30.8 - 41.7)	5.8 (1.9 - 9.7)	0.008
B	60.0 (56.6 - 63.4)	34.1 (30.8 - 37.4)	5.9 (4.0 - 7.8)	
C	49.0 (44.3 - 53.6)	43.1 (38.8 - 47.4)	7.9 (6.1 - 9.7)	
Degree of urbanization (n = 2817)				
Urban	57.0 (54.6 - 59.4)	37.1 (35.2 - 39.1)	5.8 (4.4 - 7.3)	0.7252
Rural	57.5 (47.8 - 67.2)	35.6 (27.2 - 44.1)	6.9 (4.6- 9.1)	
Health Region (n = 2817)				
North	59.0 (53.8 - 64.2)	35.5 (31.2 - 39.8)	5.5 (4.3 - 6.8)	0.5333
Centre	52.6 (45.6 - 59.6)	39.9 (32.4 - 47.4)	7.5 (4.9 - 10.1)	
Lisbon and Tagus Valley	57.8 (52.1 - 63.5)	36.8 (33.2 - 40.5)	5.4 (1.3 - 9.4)	
Alentejo	54.9 (50.0 - 59.8)	36.4 (31.8 - 41.1)	8.7 (7.0 - 10.4)	
Algarve	56.4 (51.6 - 61.2)	37.0 (31.2 - 42.9)	6.6 (2.6 - 10.6)	
Autonomous Region of Madeira	63.4 (59.4 - 67.4)	29.2 (24.3 - 34.1)	7.4 (3.3 - 11.4)	
Autonomous Region of Azores	53.9 (48.7 - 59.1)	38.9 (34.8 - 43.0)	7.2 (4.6 - 9.8)	
Income quintile (n = 2668)				
Low	59.8 (52.8 - 66.9)	32.8 (27.2 - 38.5)	7.4 (3.9 - 10.8)	0.6083
Medium - low	54.8 (49.7 - 59.9)	38.7 (32.5 - 45.0)	6.5 (4.2 - 8.8)	
Medium	59.2 (50.9 - 67.5)	36.7 (28.0 - 45.3)	4.2 (1.4 - 7.0)	
Medium - high	58.7 (53.3 - 64.1)	34.8 (28.4 - 41.1)	6.5 (3.3 - 9.8)	
High	53.1 (47.7 - 58.6)	40.1 (34.5 - 45.7)	6.8 (3.9 - 9.7)	
Total (n = 2817)	57.2 (54.2 - 60.1)	36.7 (34.2 - 39.3)	6.1 (4.8 - 7.4)	

[a] Married: cohabiting and married; Not married: single, divorced, widowed.
[b] A: armed forces, managers, professionals; B: technicians & associate professionals, clerical support workers, services & sales workers; C: skilled agricultural workers, craft & related trades workers, plant & machine operators, elementary occupations.[3]

very high risk of 10.5% (95% CI: 7.7 - 13.3)]; and low-skilled occupations (e.g., farmers, industry, and construction) [high risk of 43.1% (95% CI: 38.8 - 47.4) and a very high risk of 7.9% (95% CI: 6.1 - 9.7)]. There were no statistically significant differences in CV risk between categories of marital status, degree of urbanization, health region, and income quintile (Table 2).

DISCUSSION

In the INSEF, the proportion of individuals at risk was higher when evaluated with SCORE2 (42.8%) compared to the 17.1% CV risk determined by SCORE in 2015.[3] A study in Madeira validated SCORE and SCORE2 for ages 40 - 65, finding SCORE2 is more accurate, classifying over 50% of patients in the high-risk group, versus 25.3% with SCORE, indicating SCORE might underestimate risk by excluding non-fatal CV events.[11]

The higher prevalence of high and very high risk in men may be explained by the cardioprotective role of estrogen in premenopausal women.[8] Older adults may have a higher CVD risk due to the deterioration of cardiovascular function with age.[9] Socioeconomic determinants can also modify the calculated risk.[5] The correlation between education and health literacy stands out as being a potential risk factor for CVD.[10]

To ensure SCORE2 accuracy, only individuals with complete data were included. This study faced limitations, such as a 43.9% participation rate, although no differences were found between participants and non-participants. Selection bias may arise from missing data on CVD symptoms or conditions like aortic aneurysm, peripheral artery disease, or documented atherosclerotic CVD on imaging, considered high-risk CV criteria. Future studies should aim to collect more comprehensive data on CVD symptoms and high-risk criteria and consider incorporating additional variables such as socioeconomic status.

These findings support the need to reinforce measures to prevent CV risk factors for the general population while also focusing on early detection and monitoring in the most susceptible individuals, such as men, the elderly, and individuals with low levels of education and low-skilled occupations.

PREVIOUS AWARDS AND PRESENTATIONS

An abstract of this study was submitted to the 23rd Public Health Congress at Culturgest and was accepted for an oral presentation, which took place on June 16th, 2023.

AUTHOR CONTRIBUTIONS

MS: Literature review, data analysis and interpretation, writing, review, and approval of the manuscript.

MU, SN, TG, CD: Manuscript review and approval.

VG: Supervision of the work, manuscript review and approval.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

FUNDING SOURCES

The Portuguese National Health Examination Survey was developed as part of the project "Improvement of epidemiological health information to support public health decision and management in Portugal. Towards reduced inequalities, improved health, and bilateral cooperation", that benefits from a €1 500 000 Grant from Iceland, Liechtenstein and Norway through the EEA Grants.

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