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ORIGINAL ARTICLE

Assessment of global cardiovascular risk and risk factors in Portugal according to the SCORE® model

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Abstract
Background/objective Cardiovascular diseases (CVD) are the leading cause of mortality in European countries. This study aimed at estimating the 10-year risk of fatal CVD in Portuguese adults and to assess the prevalence of major cardiovascular risk factors, according to the SCORE® risk prediction system.

Subjects and methods A cross-sectional survey was carried out in 60 community pharmacies (CP) from October 2005 to January 2006 in a sample of CP users (≥40 and ≤65 years). Data were collected by patient interviews using a structured questionnaire applied by a trained pharmacist.
Results A total of 1,043 individuals were enrolled in the study (participation rate: 91%). The mean age was 53.7 years (SD: 7.1) with a ratio men/women of 0.68. The average risk in the sample was 1.94 (minimum 0, maximum 28, SD=2.69). About 20% of the studied adults were at high risk, of which 39.4% were asymptomatic. CV risk was significantly higher in the oldest age group and in men ($p< 0.05$). The prevalence of main CV risk factors was: hypertension-54.8%; hypercholesterolemia-63.1%, diabetes-13.4%; smoking-10.4% and obesity–29.0%. About 1/3 of those asked had family history of premature CVD. Mean values of biochemical and clinical parameters were: systolic blood pressure (mmHg): 134.8±19.7; diastolic blood pressure (mmHg): 81.0±11.4; total cholesterol (mg/dl): 193.8±34.6; body mass index (kg/m^2): 28.0±4.5.
Conclusions According to SCORE®, about one-fifth of the individuals was classified as high risk, and 7.7% was asymptomatic. CV risk was significantly higher in the oldest age group (55–65 years old) and in men ($p<0.05$). These results show a high prevalence of some risk factors, particularly hypertension and hypercholesterolemia.

Keywords Cardiovascular risk estimation · Cardiovascular risk factors · Epidemiology · Portugal · SCORE® risk chart

Headline of the contribution: Assessment of major cardiovascular risk factors and the 10-year risk of fatal CVD estimation in Portuguese adults, according to the SCORE® risk prediction system.

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Introduction

Cardiovascular diseases (CVD) are the main cause of death in Europe, accounting for over 4.35 million annual deaths:

CVDs cause nearly half of all deaths in Europe (49%) and in the European Union (42%) (Petersen et al. 2005; European Guidelines of CV Prevention 2003). CVDs are important sources of disability and loss of productivity, contributing, in large part, to the escalating costs of health care (European Guidelines of CV Prevention 2003). In 2000 CVD accounted for 22% of all disability adjusted life years (DALYs) lost in Europe (WHO European Health Report 2002).

The detection and treatment of major cardiovascular risk factors, such as hypertension, hypercholesterolemia, diabetes and smoking, have substantially reduced the incidence of cardiovascular deaths (Kuulasmaa et al. 2000; Simon et al. 2006).

The scientific evidence shows that simple additive models cannot explain the interaction among the risk factors, since there is a kind of synergy among them. Instead focussing on the impact of a single risk factor on the CVD development, the concept of global risk assessment has been emphasised in the last decades (Quaglini et al. 2005).

In the last 50 years, different multifactorial risk models have been developed, based on prospective cohort studies, with the aim of producing models for estimating the probability of developing CVD in the next *x* years (x being a pre-defined period), according to each person's risk factors (European Guidelines of CV Prevention 2003; Quaglini et al. 2005). Such methods allow the population to be stratified into risk groups that enable the optimisation and the prioritisation of the course of actions to be taken (Amariles et al. 2004).

Framingham Heart Study, initiated in 1949, was the first epidemiological study that prospectively collected population-based data on the association between risk factors and the occurrence of fatal and non-fatal coronary and other cardiovascular events in a systematic and sustained fashion. The Framingham risk function was then widely used to predict the 10-year risk of coronary disease in several populations. However, its accuracy in predicting the 10-year coronary events in European cohorts was questioned. In 2003, the SCORE (Systematic Coronary Risk Evaluation) project group developed a new risk function for cardiovascular (CV) fatal occurrences (Conroy et al. 2003). The SCORE risk prediction system is derived from 12 European cohort studies and comprises over 200,000 persons, 3 million person years of observations and over 7,000 fatal cardiovascular events, covering a wide geographic spread of countries at different levels of cardiovascular risks. SCORE charts, derived from the results of the study, allow a rapid estimation of total fatal cardiovascular events over a 10-year period in a format suited to the constraints of clinical practice and classify countries in high- or low-risk region (Conroy et al. 2003). The following risk factors are integrated in SCORE charts: gender, age, smoking, systolic blood pressure, diabetes and cholesterol (total cholesterol or cholesterol/HDL ratio) (Conroy et al. 2003).

Published studies with the same objectives and using the SCORE system for low-risk countries are scarce, and they are performed in very specific populations (obese hypertensive patients, nurses)(Schindler et al. 2007; Scholte op Reimer et al. 2006). A literature review was undertaken, and no published studies using SCORE® system performed on the Portuguese population were found.

Portugal, as well as the majority of the western European countries, presents a high prevalence of the major cardiovascular risk factors (namely hypertension, hypercholesterolemia, diabetes and obesity)(De Macedo et al. 2007; Costa et al. 2003; Santos and Barros 2003). However, according to the European Guidelines of Cardiovascular Prevention (2003), Portugal was classified as a low-risk country.

Several studies demonstrate, through ongoing screening programmes that community pharmacies can be in a good position to screen people at risk for CVD and to refer them to their physicians for further evaluation (Mangum et al. 2003; Hourihan at al. 2003, Atthobari et al. 2004; Snella et al. 2006).

This study aims to estimate the 10-year risk of fatal CVD using the SCORE® risk chart for low-risk countries and to assess the prevalence of major CV risk factors in a sample of Portuguese adults (40–65 years old) selected in the community pharmacies.

Methods

Study design

A cross sectional survey was carried out on 60 community pharmacies (CP) from October 2005 to January 2006 in a representative sample of Portuguese adults (40–65 years old).

In September 2005, a mixed urban/rural national sample (stratified by Portuguese Health Regions-North, Centre, Lisbon Region, Alentejo and Algarve) of community pharmacies was selected for the implementation of this study (a total of 60 CP, 12 by each Health Region). Previous condition for the CP participation was the executive pharmacist attendance of a training session performed by the Portuguese Foundation of Cardiology.

Each Community pharmacy had to interview 20 patients, 2 eligible individuals per day (the 1st after 11 AM and the 2nd after 4 PM) that were invited to participate in the study. If the first invititation was refused, the pharmacist should select the next one.

Data were collected through patient interviews, using a comprehensive structured questionnaire (socio-demographic, clinical, behavioural and therapeutic variables) administered

by a trained pharmacist. In this systematic sample of adults, biological and physiological parameters were also measured (total cholesterol, systolic and diastolic blood pressure and BMI).

Sampling size

The sample size was estimated assuming a prevalence of high-risk individuals of 15% (based on data of the Portuguese Foundation of Cardiology-Centre Region), a sampling error of 5% and a confidence level of 95%. Based on this estimation, a total of 1,000 individuals have to be recruited.

The stratification of the sample was based on the resident population in 2000 (2001 Census, National Institute of Statistics–Portugal) by each region, and the urban/rural ratios were also taken into account.

A total of 1,043 individuals (about 200 in each health region) was included in the study. Those individuals were selected in 60 CP, each one including a maximum of 20 users in the study (mean of 17.4 valid questionnaires per pharmacy).

Inclusion criteria

Adult individuals (age ≥40 and ≤65 years) without visible or noticeable cognitive impairment and with the ability to understand the Portuguese language were invited to participate in the study. The age range was restricted to the groups referred in SCORE® charts (40–65 years old).

Assessment of global cardiovascular risk and cardiovascular risk factors

The SCORE® risk estimation model for low-risk regions was applied in order to access the 10-year risk for fatal CVD of the individuals (Conroy et al. 2003). High risk was considered when the score was ≥5% (for asymptomatic individuals). Patients who reported having already had a cardiovascular event (coronary or cerebrovascular disease) were also considered to be at high risk, independently of the score value. The used SCORE® chart comprises age, sex, smoking, total cholesterol, diabetes and systolic blood pressure, providing the overall score of each individual. The SCORE® chart does not directly comprise diabetes as a variable. The score risk in diabetic patients was multiplied two-fold in men and four-fold in women, as stated by Conroy et al. (2003).

We considered as diabetic people those who reported having the Diabetic Guide (Self-Care Guide for diabetes control, given by each health centre, to the diagnosed diabetic patients) and/or those on anti-diabetic medication (confirmed by pharmacy records).

Blood pressure was measured by the pharmacist (using automatic blood pressure monitors, clinically validated and cuff size adjusted to arm circumference), with participants rested for at least 5 min, the mean of two measurements, with an interval of at least 3 min, was registered.

A capillary blood sample to assess concentrations of total cholesterol was obtained in the pharmacy (using the ACCUTREND® GC instrument, a point-of-care analyzer that is a reliable alternative to conventional laboratory devices).

As indicated by the WHO Guidelines (WHO-Guidelines for the Management of Hypertension, 1999), individuals were considered hypertensive if systolic blood pressure was ≥140 mmHg or diastolic blood pressure was ≥90 mmHg and/or on anti-hypertensive therapy. In diabetic patients, hypertension was considered if systolic blood pressure was ≥130 mmHg or diastolic blood pressure was ≥80 mmHg (WHO-Guidelines for the Management of Hypertension, 1999).

The individuals were considered as having hypercholesterolemia if the total cholesterol was over 190 mg/ml and/or were under anti-hypercholesterolemia medication (European Guidelines of CV Prevention 2003).

The BMI was calculated as weight (kg) divided by height squared (m^2). The World Health Organization reported the following categories for BMI (expert panel on the identification, evaluation and treatment of overweight in adults, 1998): underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obese (30.0–39.9 kg/m^2) and super-obese (≥40 kg/m^2).

The studied sample was classified in terms of smoking status as current smoking, non-smoking (never smoked) and past-smoking. Current smoking was considered in individuals reporting smoking until the day of the interview.

Statistical analysis

Statistical analysis was performed using statistic software package SPSS® (V15). Statistic significance was assumed when $p<0.05$. The routines used were frequency distribution and bivariate association by cross tabulation using chi-square and Fisher exact test for categorical variables and *t* tests for continuous variables.

Ethics

The questionnaires were anonymous, with no identification of the responding individuals: only the initials were recorded in order to avoid duplications. In accordance to the Helsinki Declaration, freely given informed consent was obtained from each person.

Results

Population profile

A total of 1,147 adult pharmacy users were invited to participate in this study; 104 refused to be enrolled (9.1%).

The studied sample included 1,043 individuals, of which 59.4% (620) were women and 40.6% were men (423), with a mean age of 53.66 years old (SD=7.08).

Association between CVD risk classification and demographic, social and health covariates is presented in Table 1.

Global cardiovascular risk assessment

About 20% of the sample was at high risk to die from cardiovascular disease in the next 10 years (62.1% men) and 11.8% assumed to have already had a cardiovascular event. Around 40% (80) of the high-risk population were asymptomatic (without established coronary heart disease, peripheral artery disease or cerebrovascular atherosclerotic disease (European Guidelines of CV Prevention 2003).

The mean score risk in the sample was 1.94 (minimum 0, maximum 28, SD=2.69).

According to Table 1, variables such as gender, age group, working status, self evaluation of health status and number of visits to the physician in the past year were statistically associated to the cardiovascular risk classification.

Figure 1 presents SCORE® risk levels of the studied sample, stratified by gender(%), according to the proposed classes by the European Society of Cardiology (European Guidelines of CV Prevention 2003). It shows a clear difference in the distribution of the global CV risk. The great majority of the women presented a global CV risk ≤1%.

Figures 2 and 3 show the distribution of the CV risk levels (grouped in two classes: high risk (≥5%) and low risk), by gender and age group.

Table 1 Association between CVD risk classification and demographic, social and health covariates

Variable	Frequency n (%)	Low CVR n (%)	High CVR n (%)	P
Gender				
Women	620 (59.4)	543 (52.1)	77 (7.4)	<0.001
Men	423 (40.6)	297 (28.5)	126 (12.1)	
Age group				
40–54 years old	526 (50.4)	470 (45.1)	56 (5.4)	<0.001
55–65 years old	517 (49.6)	370 (35.5)	147 (14.1)	
Type of location				
Urban	791 (75.8)	634 (60.8)	157 (15.1)	0.648
Rural	252 (24.2)	206 (19.8)	46 (4.4)	
Marital status				
Married	865 (83.2)	695 (66.9)	170 (16.4)	0.137
Not married	174 (16.8)	142 (13.6)	32 (3.1)	
Years at school				
<4	89 (8.5)	67 (6.4)	22 (2.1)	0.057
4–11	515 (49.4)	402 (38.6)	113 (10.8)	
≥12	438 (42.1)	371 (35.7)	67 (6.4)	
Working status				
Employed	600 (57.5)	520 (49.9)	80 (7.7)	0.001
Unemployed	45 (4.3)	33 (3.2)	12 (1.2)	
Retired	218 (20.9)	136 (13.0)	82 (7.9)	
Work at home	180 (17.3)	151 (14.5)	29 (2.8)	
Self-evaluation of health status				
Very good/good	396 (38.1)	347 (73.7)	49 (4.7)	0.001
Reasonable	539 (51.8)	420 (40.3)	119 (11.4)	
Bad/very bad	106 (10.2)	85 (7.0)	34 (3.3)	
No. visits to physician the last year				
None	121 (11.7)	101 (9.7)	20 (1.9)	0.001
1 – 3	560 (54.1)	471 (45.5)	89 (8.9)	
More than 3	355 (34.3)	261 (25.2)	94 (9.1)	
Co-morbidities (other than CV)				
No	515 (49.4)	424 (40.7)	91 (8.7)	0.149
Yes	528 (50.6)	416 (39.9)	112 (10.7)	

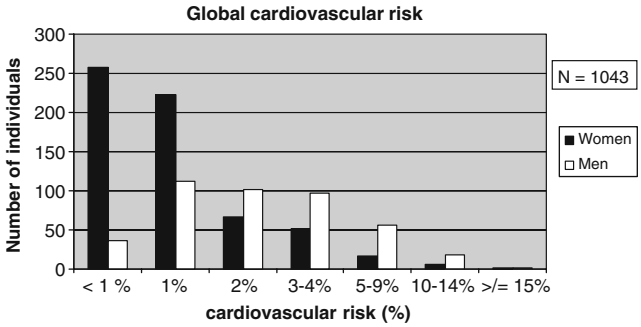

Fig. 1 SCORE® risk stratification of the studied population, by gender (%)

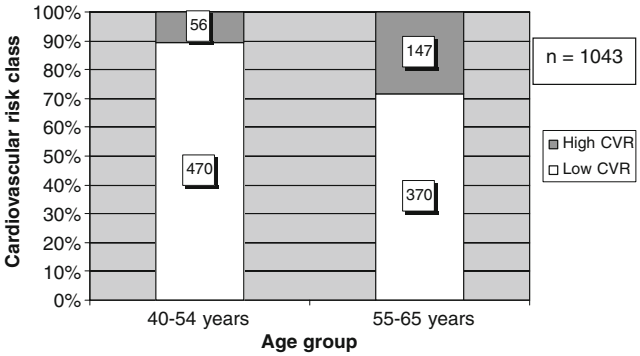

Fig. 3 Distribution of the CV risk levels by gender and age group

As expected, the CV risk was higher in the male gender as well as in older participants ($p<0.05$).

Prevalence of major CV risk factors

The prevalence of modifiable/controllable risk factors was: hypertension 54.8%, hypercholesterolemia 63.1%, diabetes 13.4%, smoking 10.4%, overweight 45.6% and obesity 29%. Table 2 presents the distribution of the major CV risk factors, by gender.

Hypertension and obesity were significantly more frequent in women, while diabetes and smoking were significantly more frequent in men ($p<0.05$).

The mean values and standard deviation of the clinical and biochemical parameters in the studied population were: systolic blood pressure (mmHg): 134.8±19.7; diastolic blood pressure (mmHg): 81.0±11.4; total cholesterol (mg/dl): 193.8±34.6 and BMI (kg/m^2): 28.0±4.5.

Discussion

According to SCORE®, 19.5% of the studied population was at high risk of dying of CVD in the next 10 years. Considering the prevalence of high-risk individuals, the mean age of 53.66 years and the fact that 57.5% reported to have professional activity, we can anticipate the negative impact, at the individual and social level, with humanistic and economic consequences. These results suggest the need to develop national strategies to improve prevention, detection and treatment of the main cardiovascular risk factors.

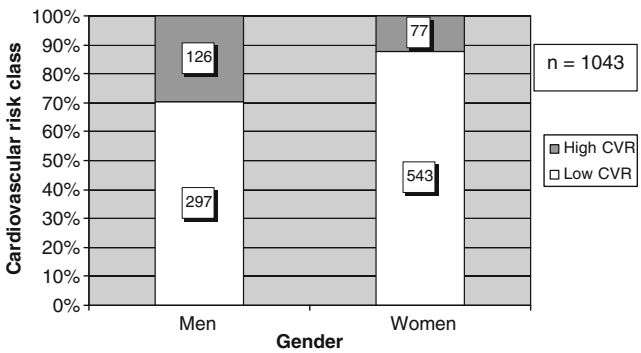

Fig. 2 Distribution of the CV Risk levels by gender and age group

The publications about studies with the same objective and using the SCORE system carried out in low-risk countries (Belgium, France, Italy, Luxemburg, Spain, Switzerland and Portugal) are scarce and performed in very specific populations. Since there is no published information using the SCORE® system in Portugal, until now, we could not compare our results with others performed in the Portuguese population.

In Spain, some authors reported a prevalence of high risk in asymptomatic and non-diabetic individuals ranging from 4.1–9.2% (Gonzalez et al. 2006; Buitrago et al. 2007; Fornasini et al. 2006). In one of the studies, the prevalence of high-risk individuals raises to 29.2% when diabetic patients were included (Fornasini et al. 2006).

Since the prevalence of high-risk individuals, considering just the asymptomatic and non-diabetic individuals, was 5.2% (40/764), our results were similar to those obtained in Spain, a neighbour country also classified as "low-risk" according to SCORE®.

As expected, the CV risk was higher in male gender as well as in older participants: CVDs are strongly related to age and male gender, but attenuation of the gender factor occurs in all populations at older age, reason why the European Guidelines concluded that one should use gender-specific risk estimation charts, but propose the same preventive measures in terms of risk management and lifestyle changes (European Guidelines of CV Prevention 2003).

Our study shows a high frequency of several CV risk factors, namely hypertension (54.8%), hypercholesterolemia (63.1) and obesity (29%). The frequencies of these factors are in line with other Portuguese population-based data for similar age groups (40 to 65 years old) that presented the following prevalences: hypertension-54.7% (De Macedo et al. 2007) (35–64 years old), hypercholesterolemia-

Table 2 Distribution of the major CV risk factors, by gender

Major cardiovascular risk factors of the study participants	Women n (%)	Men n (%)	Total n (%)
Family history of premature CVD			
No	403 (38.7)	299 (28.7)	702 (67.4)
Yes	216 (20.7)	123 (11.8)	339 (32.6)
χ^2=3.775; p>0,05			
Hypertension			
No	306 (29.4)	165 (15.8)	471 (45.2)
Yes	313 (30.0)	258 (24.8)	571 (54.8)
χ^2=11.031; p=0.001			
Hypercholesterolemia			
No	224 (21.5)	160 (15.4)	384 (36.9)
Yes	394 (37.8)	263 (25.3)	657 (63.1)
χ^2=0.269; p>0.05			
Diabetes mellitus			
No	553 (53.1)	349 (33.5)	902 (86.6)
Yes	65 (6.2)	74 (7.1)	139 (13.4)
χ^2=10.563; p=0.001			
Smoking status			
Non smoker	500 (47.9)	141 (13.5)	641 (61.5)
Current-smoker	61 (5.8)	108 (10.4)	169 (16.2)
Past-smoker	59 (5.7)	174 (16.7)	233 (22.3)
χ^2=242.329; p<0.001			
Obesity			
Body mass index <25	180 (17.4)	84 (8.1)	264 (25.5)
Body mass index ≥25 and <30	259 (25.0)	213 (20.6)	472 (45.6)
Body mass index ≥30 and <40	165 (15.9)	121 (11.7)	286 (27.6)
Body mass index ≥40	11 (1.1)	3 (0.3)	14 (1.4)
χ^2=14.928; p=0.002			

63.8% (Costa et al. 2003) and obesity-28.8% (Santos and Barros 2003) (40–69 years old).

Regarding diabetes mellitus, its prevalence observed in our study (13.4%) was higher than that estimated by WHO for Portugal (7.4%-20–79 years old) (WHO Regional publications-European CV Disease Statistics 2005). This fact can be explained by the included different age groups.

It should be emphasised that, in our study, the majority of the population presented mean values of total cholesterol (193.81±34.61 mg/ml) and BMI (28.02±4.53) above the cut offs stated as recommended in international guidelines.

Despite the fact that the Portuguese population was not included in the original cohort used by the SCORE® project group to build the charts and that there is no specific SCORE® chart for Portugal, the use of SCORE® system can bring relevant information from the epidemiologic and preventive viewpoints.

However, it is important to remember that a paramount aim of the systematic coronary risk evaluation project was to encourage the development of national guidelines on prevention of cardiovascular disease, highlighting the importance of evaluating risk scoring systems against epidemiological data from the population to be screened (Getz et al. 2005). In Portugal, this evaluation could be especially relevant, as the Portuguese population is affected by the highest mortality rates from cerebrovascular disease of all the countries in the European Union, being an exception in Western Europe-162/100,000 per year among men and 95/100,000 per year among women (Sarti et al. 2000).

Therefore, it is urgent to implement the European Guidelines on cardiovascular prevention in Portugal using SCORE® charts to identify the high-risk individuals. This will allow an intervention in high-risk groups in order to control and to reduce this major public health problem among the Portuguese population.

The high participation rate (91%) and the fact that the results for the frequencies of the major CV risk factors are in line with Portuguese population-based data (for similar age groups) seem to indicate that community pharmacy can be a valuable and feasible alternative to survey the extent to which populations are affected by chronic conditions, namely cardiovascular risk.

Our study has some limitations that need to be considered when interpreting the results. Firstly, we cannot exclude a selection bias due to the recruitment method, since community pharmacy users represent a selective group of the population. Secondly, since this is a multi-centric study, some variation in the implementation of the study is difficult to avoid. However, to the extent possible,

we standardised procedures and materials across community pharmacies (this aspect was specially focussed on in the training session).

Conclusion

- The prevalence of some risk factors, particularly hypertension and hypercholesterolemia, was very high in the studied sample, but similar to the prevalence found in other Portuguese studies.
- According to SCORE system, about one-fifth of the individuals was classified as high risk, presenting a risk of 5% or more to have a fatal cardiovascular event in the next 10 years.
- Community pharmacy seems to be a valuable and feasible place to get data, assessing the extent to which populations are affected by chronic conditions, namely cardiovascular risk.

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Conflict of interest statement The authors disclose any relevant associations that might pose a conflict of interest.

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