



ORIGINAL ARTICLE

## Knowledge about cardiovascular disease in Portugal



Nelson Andrade<sup>a,1</sup>, Elisabete Alves<sup>a,b,\*,1</sup>, Ana Rute Costa<sup>a</sup>,  
Pedro Moura-Ferreira<sup>c</sup>, Ana Azevedo<sup>a,b</sup>, Nuno Lunet<sup>a,b</sup>

<sup>a</sup> EPIUnit - Instituto de Saúde Pública, Universidade do Porto, Porto, Portugal

<sup>b</sup> Universidade do Porto, Faculdade de Medicina, Departamento de Ciências da Saúde Pública e Forenses e Educação Médica, Porto, Portugal

<sup>c</sup> Institute of Social Sciences, University of Lisbon, Lisbon, Portugal

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### KEYWORDS

Cardiovascular disease;  
Health information management;  
Health knowledge;  
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### Abstract

**Objectives:** To characterize specific knowledge on cardiovascular disease, particularly stroke and myocardial infarction (MI), and its relationship with sociodemographic factors, health literacy and clinical history, among the Portuguese population.

**Methods:** In a cross-sectional study conducted in 2012, a total of 1624 Portuguese-speaking residents of mainland Portugal, aged between 16 and 79 years, were assessed through face-to-face interviews using a structured questionnaire.

**Results:** Around 30% of participants were unable to estimate the risk of MI or stroke. On average, those who responded estimated that 34.2% and 35.6% of Portuguese will suffer a stroke or MI, respectively, during their lifetime. “Not smoking” (36.8%) and a “healthy diet” (32.8%) were identified as the most important behaviors for prevention of cardiovascular disease, and less than half of the participants responded that the most appropriate option in the presence of acute cardiovascular signs or symptoms was to call the emergency number. “Dependence on daily activities” (90.7%) and “impaired speech” (89.8%) were frequently recognized as consequences of stroke, while “heart failure” (86.4%) and “dependence on daily activities” (85.3%) were the most frequently identified consequences of MI. Overall, participants with adequate health literacy revealed more appropriate cardiovascular health-related knowledge.

**Conclusions:** There are important gaps in cardiovascular health-related knowledge in the Portuguese population. Health education strategies and practices should be sensitive to the differences in health literacy described herein, in order to improve cardiovascular health knowledge among the Portuguese population.

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\* Corresponding author.

E-mail address: [elisabete.alves@ispup.up.pt](mailto:elisabete.alves@ispup.up.pt) (E. Alves).

<sup>1</sup> Equally contributing authors.

**PALAVRAS-CHAVE**

Doenças cardiovasculares;  
Gestão da informação em saúde;  
Conhecimento em saúde;  
Prevenção primária

**Conhecimento sobre a doença cardiovascular em Portugal****Resumo**

**Objetivos:** Caracterizar o conhecimento específico sobre a doença cardiovascular (DCV), nomeadamente o acidente vascular cerebral (AVC) e o enfarte agudo do miocárdio (EAM), da população portuguesa, de acordo com fatores sociodemográficos, literacia em saúde e história clínica.

**Métodos:** Num estudo transversal realizado em 2012, foram avaliados 1624 residentes em Portugal continental, entre 16 e 79 anos, através de entrevistas presenciais com questionário estruturado.

**Resultados:** Cerca de 30% dos participantes não conseguiram estimar o risco de AVC e EAM. Em média, os que responderam estimaram que 34,2% e 35,6% dos portugueses sofrerão um AVC ou um EAM durante a sua vida, respetivamente. «Não fumar» (36,8%) e uma «dieta saudável» (32,8%) foram identificados como os comportamentos mais importantes para prevenção da DCV e menos de metade dos participantes respondeu «telefonar para o 112» como opção correta perante a presença de sinais ou sintomas de eventos cardiovasculares agudos. A «dependência nas atividades diárias» (90,7%) e as «perturbações da fala» (89,8%) foram frequentemente reconhecidas como consequências de AVC, enquanto a «insuficiência cardíaca» (86,4%) e «dependência nas atividades diárias» (85,3%) foram as consequências de EAM identificadas com maior frequência. Em geral, participantes com literacia em saúde adequada revelaram um conhecimento em saúde cardiovascular mais apropriado.

**Conclusões:** Verificaram-se importantes lacunas no conhecimento específico sobre a doença cardiovascular da população portuguesa. As estratégias e práticas de educação em saúde devem ser sensíveis às diferenças descritas de acordo com o nível de literacia em saúde, de forma a melhorar o conhecimento em saúde cardiovascular da população portuguesa.

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**Introduction**

Cardiovascular disease (CVD) is the main cause of death worldwide and is projected to remain among the most important contributors to mortality up to 2030.<sup>1</sup> Worldwide, approximately 17.3 million people died from CVD in 2013, representing nearly one-third of the overall number of deaths and 45% of those due to non-communicable diseases.<sup>2</sup> Among these, 8.1 million deaths were due to coronary heart disease (CHD) and 6.4 million to stroke, which constitute the leading and third leading causes of disability worldwide, respectively.<sup>2</sup> In Europe, CVD is responsible for 45% of all deaths each year, with 2.8 million deaths attributed to CHD and stroke.<sup>3</sup> In Portugal, CVD is the main cause of mortality, with stroke and CHD accounting for 6.1% and 6.0%, respectively, of total disability-adjusted life years in 2015.<sup>4</sup>

Despite the high burden of CVD, there has been a considerable decline in mortality in recent decades.<sup>5</sup> These reflect downward trends in exposure to behavioral risk factors such as smoking, as well as increasing use of evidence-based pharmacological treatments for control of hypertension and cholesterol levels, and interventional therapies and techniques for better management of patients in the acute phase.<sup>6-9</sup> However, patterns of variation in mortality are heterogeneous,<sup>5</sup> with many countries, including Portugal, still presenting considerable potential for further decreases in morbidity and mortality from stroke and CHD,<sup>5,10</sup> through both 'high-risk' and 'population' strategies.<sup>11</sup>

Behaviors that increase the risk of CVD are modulated by individuals' health-related knowledge and risk perception,<sup>12</sup> and therefore understanding limitations in specific knowledge is essential to develop strategies aimed at the empowerment of the population for self-care and better use of available health resources.<sup>13,14</sup>

We therefore aimed to characterize specific knowledge on the frequency, prevention, control and consequences of cardiovascular disease, particularly stroke and myocardial infarction (MI), and its relationship with sociodemographic factors, history of CVD and health literacy, among the Portuguese population.

**Methods**

This analysis is based on a cross-sectional study conducted between January and May 2012, with the primary objective of assessing knowledge and health behaviors in a representative sample of Portuguese-speaking residents of mainland Portugal, aged between 16 and 79 years, as previously described in detail.<sup>15</sup> Briefly, a stratified probabilistic sampling procedure was used to select 150 geographical units, among which a total of 585 starting points were designated for the selection of households through standard random route procedures. In each selected household, the resident whose previous birthday was closest to the date of the interview was invited to participate. A total of 1624 valid interviews were obtained (response rate: 70.8%).

Face-to-face interviews were conducted to collect data on sociodemographic characteristics, clinical history, health literacy and specific knowledge on the frequency, prevention, control and consequences of CVD.

A personal history of hypertension, stroke or MI was considered present when participants recalled a medical diagnosis of these conditions.

To assess the perceived risk of stroke and MI, participants were asked "For every 100 Portuguese, how many will suffer from stroke and how many will suffer from MI during their lives?" and the quantitative estimates were used as continuous variables in data analysis.

Regarding behaviors for CVD prevention, participants were asked to select the most important from a list of different behaviors, namely "not smoking", "not drinking", "healthy diet", "regular exercise", "regular blood pressure measurement", and "other behaviors", which included the intake of multivitamins, regular weighing, regular blood tests and general check-ups. The proportion of participants identifying each behavior as the most important was presented.

Awareness of the most appropriate action in the presence of an alarm sign or symptom of a potential cardiovascular event was obtained through the question "In the presence of each of the following symptoms or signs (chest pain or facial drooping) state how to proceed". The options were "call emergency number", "go to emergency department", "call Saúde 24 (the national health helpline)", "schedule an appointment with physician", "go to pharmacy" and "take a 'wait and see' approach". Only the option "call emergency number" was considered correct.

To assess knowledge on the potential consequences of CVD, participants were asked to indicate whether each of five options – "paralysis", "dependence in daily activities", "impaired speech", "dementia" and "epilepsy" – could result from stroke. Similarly, participants were also asked to state whether each of five options – "angina pectoris", "heart failure", "impaired driving", "impaired sexual activity" and "dependence in daily activities" – could result from MI. In both questions, the possible answers were "yes", "no", "do not know" and "did not answer" for each response category and for data analysis the latter two options were recoded as "no".

Health literacy was assessed using the Newest Vital Sign (NVS) instrument.<sup>16</sup> This tool was designed to assess health literacy skills, specifically reading and numeracy skills. The number of correct answers was used to compute a score ranging from 0 to 6 (0-1: high likelihood of limited literacy [HLLL], 2-3: possibility of limited literacy and 4-6: adequate literacy [AL]). Participants who reported that they were unable to read or write were classified as having HLLL.

Statistical analyses were performed using STATA 11.1 (College Station, TX, 2009). Adjusted mean differences in the estimated number of people affected by stroke and MI, according to sociodemographic characteristics, health literacy and history of CVD (hypertension, stroke and MI), with respective 95% confidence intervals (95% CIs), were computed by multiple linear regression. To estimate the associations between explanatory factors and health-related knowledge variables, adjusted prevalence ratios (PRs) and 95% CIs were computed using Poisson regression. All models were adjusted for age, gender, educational level and health literacy. The product of design and population weights was used for weighting in all analyses.

The survey was approved by the Ethics Committee of the University of Porto.

## Results

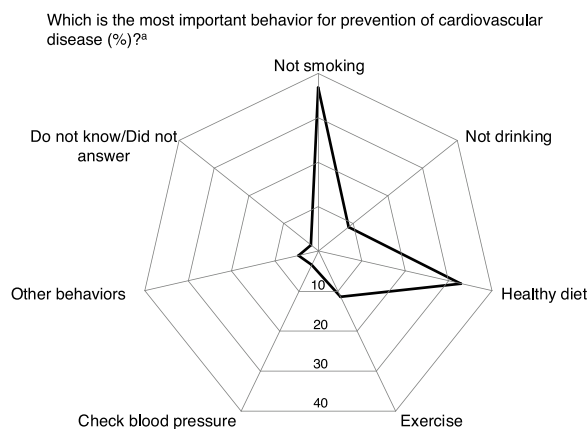
Participants in our sample were evenly distributed in terms of gender. More than 60% were less than 50 years of age, 42.5% had less than five years of schooling and 45.9% presented HLLL (Table 1). A previous diagnosis of hypertension was reported by 14.1% of participants, and 2.8% reported prior stroke or MI (1.8% for stroke and 1.8% for MI).

Nearly 30% of the participants did not answer or did not know how to answer the questions regarding perceived risk of stroke and MI. The proportion of non-responses was approximately two times higher among older participants and nearly 40% lower among those with AL. Subjects with a previous diagnosis of stroke were less likely to estimate the lifetime risk of stroke in the population (PR=0.41, 95% CI: 0.21-0.79). The respondents stated that, on average, 34.2% and 35.6% of the Portuguese population would suffer a stroke or MI, respectively, during their lifetime (Table 2). The risk estimates provided by men were approximately 8% lower than those provided by women, and for stroke those provided by participants older than 69 were 9.6% higher than the estimates by younger participants.

**Table 1** Characteristics of study participants.

	n	Unweighted (%)	Weighted (%)
<i>Overall</i>	1624	-	-
<i>Gender</i>			
Female	998	61.4	50.3
Male	626	38.6	49.7
<i>Age, years</i>			
<30	233	14.4	27.7
30-39	224	13.8	16.6
40-49	236	14.5	19.1
50-59	283	17.4	14.4
60-69	358	22.0	12.9
70-79	290	17.9	9.3
<i>Education, years</i>			
0-4	793	48.9	42.5
5-9	301	18.6	18.4
10-12	313	19.3	25.2
>12	216	13.3	13.9
<i>Health literacy (NVS)</i>			
HLLL	786	48.4	45.9
PLL	471	29.0	28.6
AL	367	22.6	25.5
<i>Hypertension</i>			
No	1330	81.9	85.9
Yes	294	18.1	14.1
<i>Previous stroke</i>			
No	1589	97.8	98.2
Yes	35	2.2	1.8
<i>Previous MI</i>			
No	1591	98.0	98.2
Yes	33	2.0	1.8

AL: adequate literacy; HLLL: high likelihood of limited literacy; MI: myocardial infarction; NVS: Newest Vital Sign; PLL: possibility of limited literacy.



**Figure 1** Knowledge on behaviors for prevention of cardiovascular diseases.

<sup>a</sup> Percentage of participants identifying each behavior as the most important for prevention of cardiovascular disease. Other behaviors included the intake of multivitamins, regular weighing, regular blood tests, and regular general check-ups.

“Not smoking” and a “healthy diet” were identified as the most important behaviors for prevention of cardiovascular disease by 36.8% and 32.8% of the participants, respectively, while only 3.4% reported “check blood pressure” (Figure 1). No significant differences were observed in responses concerning preventive behaviors according to sociodemographic characteristics, health literacy or previous diagnosis of hypertension, stroke or MI, except for physical exercise, which was less frequently identified by respondents over 69 years old (PR=0.39, 95% CI: 0.17-0.89).

Less than half of the participants answered “call emergency number” as the most appropriate procedure in the presence of facial drooping and chest pain (48.0% and 45.1%, respectively); this was independently associated with greater levels of health literacy (AL: PR=1.44; 95% CI: 1.17-1.76 and AL: PR=1.45; 95% CI: 1.17-1.80, respectively, in comparison with HLLL). Among the other participants, 42.2% and 39.6% answered “go to an emergency department” when faced with an alarm sign or symptom of stroke and MI, respectively, while 1.1% and 0.8% were unable to answer.

Data about knowledge on the consequences of stroke and MI are presented in Figure 2. The most frequently reported consequences were “dependence in daily activities” (90.7%), “impaired speech” (89.8%) and “paralysis” (84.3%) for stroke, and “heart failure” (86.4%),

“dependence in daily activities” (85.3%), “impaired driving” (81.6%) and “angina pectoris” (81.5%) for MI.

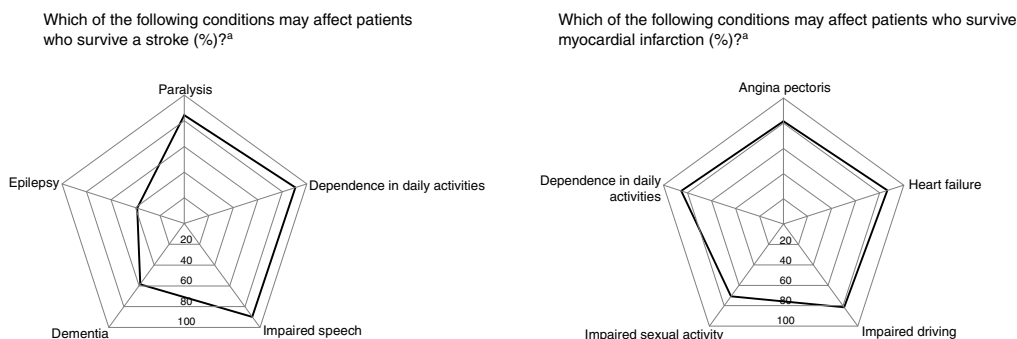
Table 3 presents the distribution of the two most frequently reported consequences of stroke and MI, according to sociodemographic characteristics, health literacy, and clinical history of the participants. Identification of “dependence in daily activities” as a consequence of stroke was more frequent among those with adequate health literacy (AL vs. HLLL: PR=1.08; 95% CI: 1.01-1.14) and with a previous diagnosis of hypertension (PR=1.05; 95% CI: 1.00-1.09), while “impaired speech” was more likely to be reported by more educated participants (>12 vs. <5 years education: PR=1.10; 95% CI: 1.00-1.21), those with adequate health literacy (AL vs. HLLL: PR=1.07; 95% CI: 1.02-1.13) and with a previous diagnosis of MI (PR=1.12; 95% CI: 1.06-1.18). Regarding the main consequences of MI, participants with adequate health literacy (AL vs. HLLL: PR=1.11; 95% CI: 1.04-1.19) and with a previous diagnosis of MI (PR=1.18; 95% CI: 1.06-1.31) more frequently stated “heart failure”, while those who had experienced stroke were more likely to identify “dependence in daily activities” (PR=1.14; 95% CI: 1.06-1.22).

## Discussion

The present study is innovative, providing a characterization of key aspects of health-related knowledge on the frequency, prevention, control and consequences of CVD among the Portuguese population. Interpretation of the results needs to take into account that gaps in specific aspects of such knowledge may be expected to have different impacts on efforts for prevention and control of stroke and MI.

Nearly one third of the participants were unable to estimate the lifetime risk of MI and stroke in the population. The proportion of non-respondents was high, especially among older participants, taking into account the high burden of stroke and MI in the Portuguese population,<sup>4</sup> the attention given in the last decade to this subject in health promotion campaigns aimed at the general population,<sup>17,18</sup> and the increasing incidence of these conditions with age.<sup>19</sup>

Overall, the perceived risk of stroke and MI was overestimated, with available studies on the Portuguese population reporting incidence rates of 207.3/100 000 and 82.9/100 000 population, respectively,<sup>20</sup> and prevalence estimates between 1.6 and 3.2%.<sup>21-23</sup> However, it would probably be difficult for the general population to distinguish between these measures, and information regarding the risk of stroke and MI comes from methodologically heterogeneous studies carried out in populations with different



**Figure 2** Knowledge of consequences of stroke and myocardial infarction.

<sup>a</sup> Percentage of participants identifying each condition as a possible consequence affecting patients who survive stroke and myocardial infarction.

**Table 2** Perceived risk of stroke and myocardial infarction, according to sociodemographic characteristics, health literacy and history of cardiovascular disease.

	For every 100 Portuguese, how many will have this disease during their lives?							
	Stroke				Myocardial infarction			
	Don't know/did not answer		No. of people affected		Don't know/did not answer		No. of people affected	
	%	PR (95% CI) <sup>a</sup>	Mean	β (95% CI) <sup>a</sup>	%	PR (95% CI) <sup>a</sup>	Mean	β (95% CI) <sup>a</sup>
<i>Overall</i>	29.9	—	34.2	—	29.7	—	35.6	—
<i>Gender</i>								
Female	29.2	[reference]	38.4	[reference]	30.4	[reference]	40.0	[reference]
Male	30.6	1.09 (0.90 to 1.32)	29.8	−8.26 (−11.37 to −5.15)	29.0	0.98 (0.80 to 1.21)	31.3	−8.13 (−11.44 to −4.83)
<i>Age (years)</i>								
<30	20.3	[reference]	31.6	[reference]	19.3	[reference]	33.4	[reference]
30-39	19.5	0.95 (0.60 to 1.51)	33.9	2.73 (−2.78 to 8.24)	20.1	1.01 (0.63 to 1.63)	36.5	3.68 (−2.13 to 9.50)
40-49	37.4	1.67 (1.11 to 2.52)	35.2	3.07 (−2.40 to 8.54)	37.8	1.73 (1.14 to 2.63)	36.2	2.29 (−3.64 to 8.22)
50-59	30.6	1.33 (0.89 to 1.99)	35.4	2.92 (−2.59 to 8.44)	33.7	1.48 (0.99 to 2.21)	36.9	2.52 (−3.94 to 8.98)
60-69	34.0	1.47 (0.97 to 2.22)	34.7	1.69 (−5.31 to 8.68)	32.1	1.40 (0.92 to 2.12)	34.5	−1.19 (−8.85 to 6.47)
70-79	55.5	2.27 (1.49 to 3.46)	41.4	9.59 (0.91 to 18.26)	51.7	2.09 (1.36 to 3.22)	42.2	8.43 (−0.60 to 17.46)
<i>Education (years)</i>								
<5	36.9	[reference]	35.3	[reference]	36.9	[reference]	37.0	[reference]
5-9	33.5	1.21 (0.91 to 1.62)	34.8	1.67 (−3.80 to 7.14)	34.1	1.19 (0.90 to 1.58)	34.9	−2.24 (−8.14 to 3.66)
10-12	21.5	0.91 (0.63 to 1.32)	31.8	−1.10 (−7.27 to 5.07)	20.9	0.86 (0.59 to 1.25)	33.9	−3.24 (−10.22 to 3.75)
>12	19.6	0.90 (0.59 to 1.40)	34.3	1.61 (−5.04 to 8.25)	17.9	0.77 (0.49 to 1.22)	35.6	−1.93 (−9.33 to 5.48)
<i>Health literacy (NVS)</i>								
HLLL	37.7	[reference]	34.6	[reference]	37.5	[reference]	34.2	[reference]
PLL	28.3	0.87 (0.68 to 1.11)	36.3	1.83 (−2.42 to 6.08)	26.9	0.82 (0.64 to 1.06)	39.6	6.19 (1.70 to 10.68)
AL	17.8	0.61 (0.42 to 0.87)	31.5	−1.92 (−6.60 to 2.75)	18.8	0.66 (0.48 to 0.91)	33.6	1.34 (−3.62 to 6.31)
<i>Hypertension</i>								
No	27.9	[reference]	33.6	[reference]	27.6	[reference]	35.2	[reference]
Yes	42.1	1.11 (0.87 to 1.42)	38.8	1.69 (−2.68 to 6.06)	42.6	1.14 (0.88 to 1.48)	39.2	1.02 (−3.54 to 5.57)
<i>Previous stroke</i>								
No	30.2	[reference]	34.1	[reference]	29.7	[reference]	35.6	[reference]
Yes	17.4	0.41 (0.22 to 0.79)	36.3	0.95 (−6.16 to 8.06)	29.5	0.71 (0.30 to 1.67)	36.0	0.82 (−8.13 to 9.76)
<i>Previous MI</i>								
No	29.8	[reference]	34.1	[reference]	29.6	[reference]	35.5	[reference]
Yes	38.2	0.83 (0.39 to 1.77)	40.4	5.77 (−5.41 to 16.95)	34.9	0.79 (0.35 to 1.75)	39.9	3.80 (−6.11 to 13.71)

AL: adequate literacy; CI: confidence interval; HLLL: high likelihood of limited literacy; MI: myocardial infarction; NVS: Newest Vital Sign; PLL: possibility of limited literacy; PR: prevalence ratio.

<sup>a</sup> Adjusted for age, gender, education and health literacy.

**Table 3** The two most frequently reported consequences of stroke and myocardial infarction, according to sociodemographic characteristics, health literacy and history of cardiovascular disease.

	Consequences of stroke				Consequences of MI			
	Dependence in daily activities		Impaired speech		Heart failure		Dependence in daily activities	
	%	PR (95% CI) <sup>a</sup>	%	PR (95% CI) <sup>a</sup>	%	PR (95% CI) <sup>a</sup>	%	PR (95% CI) <sup>a</sup>
<i>Gender</i>								
Women	92.1	[reference]	88.4	[reference]	86.2	[reference]	85.7	[reference]
Men	89.2	0.97 (0.93 to 1.01)	91.2	1.03 (0.98 to 1.08)	86.6	1.00 (0.93 to 1.07)	85.0	0.99 (0.94 to 1.04)
<i>Age (years)</i>								
<30	92.3	[reference]	88.4	[reference]	87.7	[reference]	85.6	[reference]
30-39	87.1	0.94 (0.87 to 1.02)	90.7	1.02 (0.95 to 1.10)	87.2	0.99 (0.90 to 1.09)	83.5	0.98 (0.89 to 1.08)
40-49	88.5	0.98 (0.89 to 1.08)	93.7	1.09 (1.00 to 1.18)	89.2	1.04 (0.94 to 1.15)	86.0	1.02 (0.92 to 1.12)
50-59	95.0	1.07 (0.99 to 1.15)	90.5	1.06 (0.97 to 1.16)	90.6	1.07 (0.99 to 1.15)	90.7	1.07 (0.98 to 1.17)
60-69	90.9	1.05 (0.95 to 1.16)	90.0	1.08 (0.97 to 1.20)	86.1	1.04 (0.94 to 1.15)	84.9	1.01 (0.90 to 1.14)
70-79	89.3	1.04 (0.93 to 1.16)	83.1	1.01 (0.89 to 1.13)	69.6	0.85 (0.72 to 1.01)	78.9	0.94 (0.80 to 1.10)
<i>Education (years)</i>								
<5	88.4	[reference]	87.2	[reference]	82.6	[reference]	85.0	[reference]
5-9	91.7	1.05 (0.96 to 1.16)	92.1	1.05 (0.97 to 1.14)	89.8	1.05 (0.97 to 1.13)	84.1	0.98 (0.89 to 1.07)
10-12	91.8	1.05 (0.94 to 1.17)	89.0	1.03 (0.93 to 1.14)	88.8	1.03 (0.94 to 1.14)	87.3	1.02 (0.93 to 1.12)
>12	94.6	1.07 (0.96 to 1.19)	96.8	1.10 (1.00 to 1.21)	90.1	1.03 (0.94 to 1.13)	85.4	0.99 (0.89 to 1.10)
<i>Health literacy (NVS)</i>								
HLLL	87.6	[reference]	87.3	[reference]	81.8	[reference]	83.9	[reference]
PLL	91.7	1.04 (0.98 to 1.10)	88.6	1.00 (0.94 to 1.07)	87.4	1.03 (0.97 to 1.10)	85.4	1.00 (0.93 to 1.08)
AL	94.8	1.08 (1.01 to 1.14)	95.7	1.07 (1.02 to 1.13)	93.5	1.11 (1.04 to 1.19)	87.9	1.04 (0.97 to 1.12)
<i>Hypertension</i>								
No	90.2	[reference]	89.8	[reference]	86.9	[reference]	85.4	[reference]
Yes	93.4	1.05 (1.00 to 1.09)	89.7	1.03 (0.98 to 1.08)	83.7	1.01 (0.93 to 1.10)	85.3	1.01 (0.92 to 1.11)
<i>Previous stroke</i>								
No	90.6	[reference]	89.7	[reference]	86.3	[reference]	85.1	[reference]
Yes	94.4	1.04 (0.95 to 1.15)	95.4	1.08 (0.98 to 1.19)	91.0	1.09 (0.96 to 1.24)	97.0	1.14 (1.06 to 1.22)
<i>Previous MI</i>								
No	90.6	[reference]	89.7	[reference]	86.3	[reference]	85.6	[reference]
Yes	93.7	1.06 (0.97 to 1.16)	97.6	1.12 (1.06 to 1.18)	93.7	1.18 (1.06 to 1.31)	74.3	0.89 (0.60 to 1.31)

AL: adequate literacy; CI: confidence interval; HLLL: high likelihood of limited literacy; MI: myocardial infarction; NVS: Newest Vital Sign; PLL: possibility of limited literacy; PR: prevalence ratio.

<sup>a</sup> Adjusted for age, gender, education and health literacy.

characteristics. It is estimated that stroke will affect at least one in six middle-aged people during the rest of their lives.<sup>24,25</sup> Although similar estimates are presented for men regarding MI, the risk is lower for women, with approximately one in nine middle-aged women suffering MI in their remaining lifetime.<sup>26</sup> Despite the higher prevalence of CVD among men,<sup>3</sup> in our study women reported a higher perception of risk, as observed in previous studies.<sup>27,28</sup> Also, older participants tended to have higher risk perception, which may be due to more frequent provision of information by the health care system about stroke and MI, since they are at greater risk of disease.<sup>19</sup>

Prevention and control of the main modifiable CVD risk factors, such as smoking, alcohol consumption, unhealthy diet, obesity, hypertension, dyslipidemia, diabetes, psychological stress and a sedentary lifestyle, are fundamental tools to reduce the burden of stroke and CHD.<sup>29,30</sup> Participants identified not smoking and a healthy diet as the main preventive behaviors for CVD, although they attributed lower importance to blood pressure control, despite the high prevalence of hypertension in the country.<sup>22</sup> However, since participants were asked to select the most important from a list of different behaviors, it is possible that they assumed high blood pressure would be a consequence of unhealthy lifestyles. Recent guidelines on CVD prevention in clinical practice suggest that cognitive-behavioral methods are effective in helping individuals to adopt a healthy lifestyle, emphasizing the implementation of nutrition, exercise, relaxation training, weight management and smoking cessation programs.<sup>31</sup> This calls for appropriate and effective communication between patients and health professionals, which will facilitate treatment and prevention of CVD.

In Portugal, in the presence of signs and/or symptoms suspicious of stroke or MI, the correct procedure is to call the emergency number.<sup>32</sup> Although less than half of the participants surveyed selected this option in the presence of facial drooping or chest pain, approximately 40% indicated that they would go directly to the emergency department, which is also a valid procedure. The results presented are in agreement with previous Portuguese studies, which revealed that only between 22.4% and 68.0% of respondents would call the emergency number when faced with a possible stroke or MI.<sup>33–35</sup> These low percentages may be due to two main factors: lack of awareness of the importance of calling the emergency number, thus activating fast-track protocols, or the inability to link these signs and symptoms to events such as stroke or MI. One study conducted in Portugal showed that 24% of respondents did not recognize the signs and symptoms of MI.<sup>33</sup> Nevertheless, in our population, the likelihood of taking appropriate action, i.e., calling the emergency number in the presence of facial drooping or chest pain, increased with health literacy, which highlights the need to improve health literacy and cardiovascular disease knowledge in the Portuguese population.

As a consequence of downward trends in mortality, the number of survivors from CHD and stroke is increasing, which in turn has led to a greater number of individuals suffering from sequelae.<sup>36</sup> There is a wide range of outcomes after a CVD event, from no sequelae to a comatose state, with considerable personal, emotional, professional and financial costs to both individuals and health services.<sup>37</sup> Although dependence in daily activities was frequently recognized as a major outcome of stroke and MI, this sequela is in fact more prevalent in stroke.<sup>38</sup> This finding may be a consequence of the difficulty among the general population of differentiating MI and stroke. Other potential consequences of stroke, such

as epilepsy and dementia, were less frequently reported, possibly because they may be perceived as less severe, or as having other causes. However, previous studies reveal that stroke almost doubles the risk of dementia after the age of 65,<sup>39</sup> and is the leading cause of seizures and epilepsy in the elderly.<sup>40</sup> Thus, the dissemination of more comprehensive information regarding the global burden of CVD is essential among the general population.

Overall, respondents with AL were more likely to answer the questions and to provide correct responses than those with HLLL. However, a recent study reported that 49% of Portuguese respondents have limited health literacy,<sup>41</sup> highlighting the need to assess citizens' health-related knowledge when planning cardiovascular policy strategies.

This study addressed a topic rarely investigated in Portugal – knowledge of CVD – based on a representative sample of Portuguese-speaking residents of mainland Portugal. However, some limitations should be acknowledged. Health literacy was measured using an instrument designed to assess overall health literacy skills<sup>42</sup> that is not specific to cardiovascular health-related knowledge. Thus, the instrument may not be sufficiently sensitive to assess health literacy concerning CVD specifically, given its particular characteristics. Data on the consequences of stroke and MI were obtained from recognition of possible consequences in a list, which could lead to overestimation of knowledge in this domain. It has been shown that closed-ended questions in general yield higher percentages of responses than open-ended questions,<sup>43</sup> and the lower proportion of non-respondents in these questions appears to support this assumption. However, taking into account that the main consequences of stroke and MI were considered, significant overestimation is unlikely.

## Conclusion

Effective prevention and control of CVD risk factors as well as the recognition of signs, symptoms, and what to do when faced with alarm signs of an acute event<sup>44</sup> are essential to reduce the burden of CVD. In the present study, the large proportion of non-respondents to questions addressing health-related knowledge on stroke and MI, which are common conditions in Portugal, as well as participants' lack of knowledge about vital aspects of these diseases, highlight the existence of important gaps in cardiovascular health-related knowledge. However, it was also observed that individuals with adequate health literacy responded more often and more appropriately than those with limited literacy, indicating that health education strategies and practices should be sensitive to these differences in order to improve cardiovascular health knowledge among the Portuguese population.

## Conflicts of interest

The authors have no conflicts of interest to declare.

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## References

- Mendis S, Puska P, Norrving B. Global atlas on cardiovascular disease prevention and control. Geneva: World Health Organization (WHO); 2011.
- GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385:117–71.
- Townsend N, Wilson L, Bhatnagar P, et al. Cardiovascular disease in Europe: epidemiological update 2016. *Eur Heart J*. 2016;37:3232–45.
- Wilkins E, Wilson L, Wickramasinghe K, et al. European Cardiovascular Disease Statistics 2017. Brussels: European Heart Network; 2017.
- Araujo F, Gouveias C, Fontes F, et al. Trends in cardiovascular diseases and cancer mortality in 45 countries from five continents (1980-2010). *Eur J Prev Cardiol*. 2014;21:1004–17.
- Unal B, Critchley J, Capewell S. Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. *Circulation*. 2004;110:1–7.
- Pereira M, Azevedo A, Lunet N, et al. Explaining the decline in coronary heart disease mortality in Portugal between 1995 and 2008. *Circ Cardiovasc Qual Outcomes*. 2013;6:634–42.
- Ford ES, Ajani UA, Croft JB, et al. Explaining the decrease in U.S. deaths from coronary disease, 1980-2000. *N Engl J Med*. 2007;356:2388–98.
- Lackland DT, Roccella EJ, Deutsch AF, et al. Factors influencing the decline in stroke mortality: a statement from the American Heart Association/American Stroke Association. *Stroke*. 2014;45:315–53.
- Pereira M, Carreira H, Vales C, et al. Trends in hypertension prevalence (1990-2005) and mean blood pressure (1975-2005) in Portugal: a systematic review. *Blood Press*. 2012;21:220–6.
- Rose G. The strategy of preventive medicine. Oxford University Press; 1994.
- Safeer RS, Cooke CE, Keenan J. The impact of health literacy on cardiovascular disease. *Vasc Health Risk Manag*. 2006;2:457–64.
- Vaidya A, Aryal UR, Krettek A. Cardiovascular health knowledge, attitude and practice/behaviour in an urbanising community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site. *BMJ Open*. 2013;3:e002976.
- Nielsen-Bohman L, Panzer A, Hamlin B, et al. Health literacy: a prescription to end confusion. Washington: National Academies Press; 2004.
- Costa AR, Silva S, Moura-Ferreira P, et al. Cancer screening in Portugal: sex differences in prevalence, awareness of organized programmes and perception of benefits and adverse effects. *Health Expect*. 2017;20:211–20.
- Weiss BD, Mays MZ, Martz W, et al. Quick assessment of literacy in primary care: the newest vital sign. *Ann Fam Med*. 2005;3:514–22.
- Direcção Geral de Saúde (DGS). Programa Nacional de Prevenção e Controlo das Doenças Cardiovasculares. Lisboa: Direcção Geral da Saúde; 2006.
- Direcção Geral de Saúde (DGS). Programa Nacional de Prevenção e Controlo das Doenças Cérebro-Cardiovasculares. Lisboa: Direcção Geral da Saúde; 2011.
- World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: WHO; 2009.
- Rodrigues A, Silva S, Batista I, et al. Médicos-Sentinela: o que se fez em 2012. Lisboa: Instituto Nacional de Saúde Ricardo Jorge; 2014.
- Fiuzza M, Cortez-Dias N, Martins S, et al. Metabolic syndrome in Portugal: prevalence and implications for cardiovascular risk – results from the VALSIM Study. *Rev Port Cardiol*. 2008;27:1495–529.
- Polonia J, Martins L, Pinto F, et al. Prevalence, awareness, treatment and control of hypertension and salt intake in Portugal: changes over a decade. The PHYSA study. *J Hypertens*. 2014;32:1211–21.
- Sousa-Uva M, Dias CM. Prevalência de Acidente Vascular Cerebral na população portuguesa: dados da amostra ECOS 2013. Instituto Nacional de Saúde Doutor Ricardo Jorge; 2014.
- Seshadri S, Beiser A, Kelly-Hayes M, et al. The lifetime risk of stroke: estimates from the Framingham Study. *Stroke*. 2006;37:345–50.
- Turin TC, Okamura T, Afzal AR, et al. Hypertension and lifetime risk of stroke. *J Hypertens*. 2016;34:116–22.
- Turin TC, Kokubo Y, Murakami Y, et al. Lifetime risk of acute myocardial infarction in Japan. *Circ Cardiovasc Qual Outcomes*. 2010;3:701–3.
- Homko CJ, Santamore WP, Zamora L, et al. Cardiovascular disease knowledge and risk perception among underserved individuals at increased risk of cardiovascular disease. *J Cardiovasc Nurs*. 2008;23:332–7.
- Homko CJ, Zamora L, Santamore WP, et al. Gender differences in cardiovascular risk factors and risk perception among individuals with diabetes. *Diabetes Educ*. 2010;36:483–8.
- O'Donnell MJ, Xavier D, Liu L, et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *Lancet*. 2010;376:112–23.
- Yusuf S, Hawken S, Ounpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364:937–52.
- Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: the Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur Heart J*. 2016;37:2315–81.
- Alto Comissariado da Saúde – Coordenação Nacional para as Doenças Cardiovasculares. Recomendações Clínicas para o Enfarte Agudo do Miocárdio e o Acidente Vascular Cerebral; 2007. Lisboa.
- Pereira H, Pinto FJ, Cale R, et al. Stent for Life in Portugal: this initiative is here to stay. *Rev Port Cardiol*. 2014;33:363–70.
- Branco MJ, Nunes B. Sinais de Alarme de Enfarte Agudo do Miocárdio e Acidente Vascular Cerebral: uma observação sobre conhecimentos e atitudes. Instituto Nacional de Saúde Dr. Ricardo Jorge; 2008.
- Mansur KF. O que sabe o cidadão sobre o Acidente Vascular Cerebral: Inquérito numa população urbana. Instituto de Ciências Biomédicas de Abel Salazar, Universidade do Porto; 2009.



36. Levi F, Chatenoud L, Bertuccio P, et al. Mortality from cardiovascular and cerebrovascular diseases in Europe and other areas of the world: an update. *Eur J Cardiovasc Prev Rehabil.* 2009;16:333–50.
37. Schofield D, Shrestha R, Percival R, et al. The personal and national costs of CVD: impacts on income, taxes, government support payments and GDP due to lost labour force participation. *Int J Cardiol.* 2013;166:68–71.
38. Grimby G, Andren E, Daving Y, et al. Dependence and perceived difficulty in daily activities in community-living stroke survivors 2 years after stroke: a study of instrumental structures. *Stroke.* 1998;29:1843–9.
39. Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: a systematic review and meta-analysis. *Lancet Neurol.* 2009;8:1006–18.
40. Jungehulsing GJ, Heuschmann PU, Holtkamp M, et al. Incidence and predictors of post-stroke epilepsy. *Acta Neurol Scand.* 2013;127:427–30.
41. Espanha R, Ávila P, Mendes R. Literacia em Saúde em Portugal: Relatório Síntese. Lisboa: Fundação Calouste Gulbenkian; 2016.
42. Welch VL, VanGeest JB, Caskey R. Time, costs, and clinical utilization of screening for health literacy: a case study using the Newest Vital Sign (NVS) instrument. *J Am Board Fam Med.* 2011;24:281–9.
43. Reja U, Lozar Manfreda K, Hlebec V, et al. Open-ended vs. close-ended questions in Web questionnaires. *Adv Methodol Stat.* 2003;19:159–77.
44. World Health Organization. Milestones in health promotion. Statements from global conferences. Geneva: WHO Press; 2009.