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ORIGINAL

Relationship between sociodemographic variables and tobacco consumption with vascular age values using the Framinghan model in 336,450 spanish workers

Relación entre variables sociodemográficas y consumo de tabaco con los valores de edad vascular con el modelo de Framinghan en 336.450 Trabajadores españoles

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Abstract

Introduction: Traditionally, risk scales have been used to assess the probability of presenting a cardiovascular event in a given period. In recent years, tools have been developed to assess cardiovascular risk by estimating the age of the vascular tree.
Material and methods: Descriptive, cross-sectional study of 336450 Spanish workers in which vascular age was calculated using the Framingham model and the number of years lost (ALLY). The relationship of ALLY of vascular age with different sociodemographic variables (age, sex and social class) and tobacco consumption was also determined.
Results: In our study, the cut-off points for considering ALLY of vascular age with the Framingham model as moderate at 10 years and high at 18 years were established. Both the mean values and the prevalence of high vascular-age ALLY values increased in men, with increasing age, in people from the most disadvantaged social classes, and in those who smoked. The multivariate analysis showed that the sociodemographic variables analyzed and smoking increased the risk of presenting moderate or high ALLY, of which the one that increased the risk the most was age followed by smoking.
Conclusions: The cut-off points for moderate and high ALLY are 10 and 18 years respectively. Male sex, age, belonging to lower social classes and smoking increase the ALLY values for vascular age with the Framingham model.

Keywords: Vascular age, sociodemographic variables, cut-off, cardiovascular risk, Framingham.

Resumen

Introducción: Tradicionalmente se han empleado escalas de riesgo para valorar la probabilidad de presentar un evento cardiovascular en un periodo determinado. En los últimos años se han desarrollado herramientas que valoran ese riesgo cardiovascular estimando la edad del arbol vascular.
Material y métodos: Estudio descriptivo y transversal en 336450 trabajadores españoles en los que se calcula la edad vascular con el modelo Framingham y el número de años perdidos (ALLY). Se determina igualmente la relación de ALLY de edad vascular con diferentes variables sociodemográficas (edad, sexo y clase social) y consumo de tabaco.
Resultados: En nuestro estudio se establecen como puntos de corte para considerar ALLY de edad vascular con el modelo Framingham como moderada en 10 años y como alta en 18 años. Tanto los valores medios como la prevalencia de valores elevados de ALLY de edad vascular se ven incrementados en los varones, a medida que aumenta la edad, en personas de las clases sociales más desfavorecidas y en los que fuman. En el análisis multivariante se aprecia que las variables sociodemográficas analizadas y el tabaco incrementan el riesgo de presentar ALLY moderado o alto, de todas ellas la que más incrementa el riesgo es la edad seguida del consume de tabaco.
Conclusiones: Los puntos de corte para ALLY moderado y alto son de 10 y 18 años respectivamente. El sexo masculino, la edad, pertenecer a clases sociales más baja y fumar elevan los valores de ALLY de edad vascular con el modelo Framingham.

Palabras clave: Edad vascular, variables sociodemográficas, puntos de corte, riesgo cardiovascular, Framingham.

Introduction

Tobacco consumption has been responsible for the death of more than 100 million people during the 20th century, a figure that exceeds those caused jointly by the first and second world wars. According to figures from the World Health Organization (WHO), in the first years of this century some 5 million people over 30 years of age have died annually as a direct consequence of smoking[1]. According to the same organization, tobacco was responsible for one out of every eight adult deaths at the beginning of the century, with Europe and the Americas being the regions with the highest mortality rates[2].

Many studies have linked tobacco consumption to a higher prevalence of different diseases such as cardiac pathologies, including heart attacks, various types of cancer, such as lung cancer and chronic obstructive disease, among others. It has also been observed that the life expectancy of smokers is much lower than that of non-smokers[3-4].

It has been known for years that the prevalence of cardiovascular disease is lower in women mainly due to the protection afforded by estrogens[5]. It has also been observed that the presence of cardiovascular pathologies increases over the years[6].

Many studies have linked cardiovascular disease and socioeconomic level, with most of them concluding that there is a higher prevalence of cardiovascular disease in people with lower incomes6. Among the possible causes, we could highlight poorer diet and less access to health care[7].

Cardiovascular risk has traditionally been estimated using scales that assess the probability of presenting a cerebrovascular event, fatal or non-fatal, in a given period of time, generally 10 years. These scales give a false sense of security because, although the person presents various risk factors, their values are not very high. For this reason, different tools have been developed that, based on the traditional risk scales, determine the aging of the vascular tree, known as vascular age scales, in which the percentage risk is replaced by a number that represents the age of the vessels and which different studies have shown to be more easily understood[8].

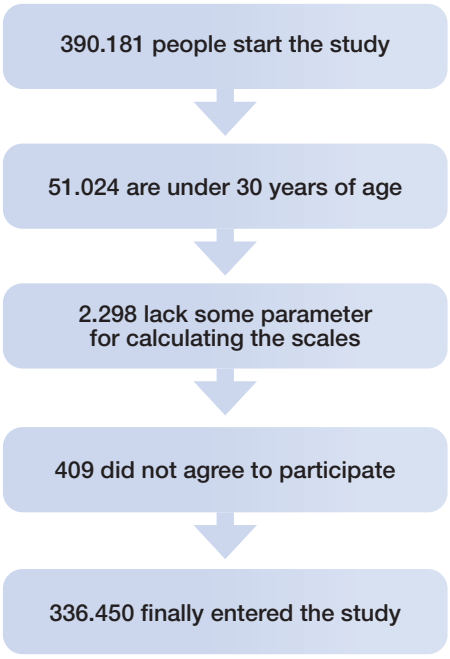
The aim of this study is to assess the relationship between various sociodemographic variables and tobacco consumption and the vascular age values determined with the Framingham model. The cut-off points for considering moderate and high vascular ageing will also be established.

Methods

A prospective study was conducted in 390181 Spanish workers in companies of different productive sectors, mainly hospitality, construction, commerce, health, public administration, education, industry and cleaning between the years 2019-2022.

The flowchart of the participants is presented in **figure 1**.

Figure 1: flowchart of the participants.



Inclusion criteria

- Age between 30 and 69 years.
- To have completed the occupational medical examination.
- Belonging to one of the companies collaborating in the study.
- To agree to participate in the study and to cede the data for epidemiological studies.

Different anthropometric, clinical and analytical variables were determined by the personnel of the different occupational health units participating in the study.

To measure weight, expressed in kilograms, and height, expressed in cm, a SECA 700 model scale with a capacity of 200 kg and 50 g divisions was used, with a SECA 220 telescopic measuring rod with millimetric division and a range of 60 to 200 cm.

Waist circumference was measured with a tape measure while the person was standing upright with feet together and trunk erect, abdomen relaxed and upper limbs hanging on both sides of the body. The tape measure was placed parallel to the ground at the level of the last floating rib.

Blood pressure was obtained with the person seated and after a resting period of 10 minutes, three determinations were made at one-minute intervals and the mean of the three measurements was obtained. The analytical determinations were performed after a fasting period of no less than 12 hours in reference laboratories. Automated enzymatic methods were used to measure blood glucose, total cholesterol and triglycerides. HDL was determined by precipitation with dextran sulfate Cl2Mg. LDL was calculated with the Friedewald formula (provided triglycerides were less than 400 mg/dL). All values are expressed in mg/dL.

Friedewald formula: LDL = total cholesterol – HDL – triglycerides/5

A person was considered a smoker when he or she had consumed at least 1 cigarette per day in the last 30 days or if he or she had quit smoking less than 12 months before.

The 2011 National Classification of Occupations (CNO-11) was used, according to the proposal of the social determinants group of the Spanish Society of Epidemiology to establish the social class was classified into three categories based on the 2011 national classification of occupations (CNAE) and applying the criteria of the Spanish Society of Epidemiology[9]: class I (directors/managers, university professionals, athletes and artists); II (intermediate occupations and self-employed workers without salaried workers); and III (unskilled workers).

Vascular age with the Framingham model was calculated by applying tables[10] using different variables: sex, age, HDL, total cholesterol, systolic and diastolic blood pressure, tobacco use, diabetes, and antihypertensive treatment.

Avoidable lost life years (ALLY) was defined as the difference between chronological age (CA) and vascular age (VA)[11]. ALLY = VA - CA. As the significance of the value of ALLY is different according to the CA, we defined' the ratio of ALLY to CA as ratio of avoidable lost life years (RALLY = ALLY/CA).

Statistical analysis

Categorical variables were described by frequency and percentage, and quantitative variables by mean and standard deviation (SD). To evaluate the association between the different variables, the chi-square test was used (with Fisher's test if necessary) and Student's t test when the samples were independent. Multivariate analysis was performed using the multinomial logistic regression test, calculating the odds ratio and 95% confidence intervals. The Hosmer-Lemeshow goodness-of-fit test was also performed.

Cut-off points to determine moderate and high values of vascular age were calculated using ROC curves and determining sensitivity, specificity and Youden index.

Statistical calculations were performed with the SPSS 28.0 package, establishing a statistical significance level of $p < 0.05$

Ethical Considerations and Aspects

The study was approved by the Clinical Research Ethics Committee of the Balearic Islands Health Service (Approval Code: IB 4383/20). All procedures were performed in accordance with the ethical standards of the institutional research committee and the 2013 Declaration of Helsinki. All participants signed written informed consent documents before participating in the study.

Results

Study participants and participant characteristics

Table I shows the sociodemographic, clinical and analytical characteristics of the 336450 workers included in the study. The mean age of the participants was 43.4 years in women and 44.3 years in men, with the majority group being between 30 and 49 years of age. The percentage of smokers was similar in both sexes, approximately one third. Most of the workers belonged to social class III. All analytical and clinical parameters showed worse values in men.

Table II shows the ALLY and RALLY values according to the different sociodemographic variables and tobacco consumption. ALLY and RALLY values are much higher in men. The values of ALLY and RALLY increase with age and as we descend in social class. The values of both parameters are significantly lower among non-smokers. In all cases the differences obtained are statistically significant.

In the areas under the ROC curve, values of 0.913 (95% CI 0.909-0.916) for moderate ALLY and 0.970 (95% CI 0.967-0.973) are observed. The cut-off point established for moderate ALLY is 10 years (sensitivity 0.833, specificity 0.830 and Youden index 0.664) and for high ALLY is 18 years (sensitivity 0.973, specificity 0.876 and Youden index 0.849).

Figure 2: ROC curve of ALLY moderate and high.

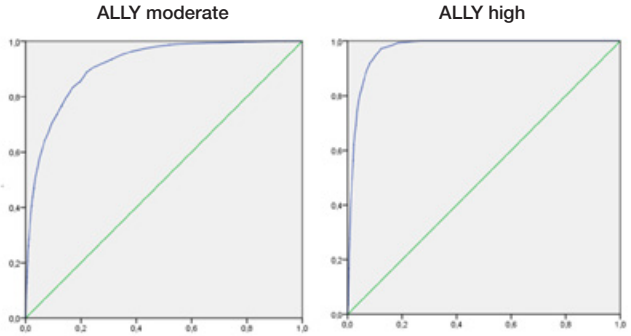


Table I: Characteristics of the population.

	Men n=199829	Women n=136621	
	Mean (SD)	Mean (SD)	p-value
Age (years)	44.3 (8.7)	43.4 (8.6)	<0.0001
Height (cm)	174.3 (7.0)	161.5 (6.5)	<0.0001
Weight (kg)	82.4 (14.5)	67.0 (13.9)	<0.0001
Body mass index (kg/m²)	27.1 (4.4)	25.7 (5.1)	<0.0001
Waist circumference (cm)	86.7 (10.9)	75.0 (10.6)	<0.0001
Systolic blood pressure (mmHg)	129.2 (15.8)	118.6 (16.2)	<0.0001
Diastolic blood pressure (mmHg)	79.2 (10.8)	73.6 (10.5)	<0.0001
Total cholesterol (mg/dl)	198.8 (37.7)	195.5 (35.5)	<0.0001
HDL-c (mg/dl)	49.6 (8.5)	56.1 (8.7)	<0.0001
LDL-c (mg/dl)	123.8 (35.6)	121.1 (34.3)	<0.0001
Triglycerides (mg/dl)	130.7 (90.3)	91.5 (47.6)	<0.0001
Glycaemia (mg/dl)	94.9 (22.3)	88.8 (15.6)	<0.0001
	%	%	p-value
30-39 years	33.9	37.4	<0.0001
40-49 years	37.0	37.3	
50-59 years	24.3	21.2	
60-69 years	4.8	4.1	
Social class I	5.2	6.7	<0.0001
Social class II	15.9	24.4	
Social class III	78.9	68.9	
Non smokers	67.1	67.5	0.002
Smokers	32.9	32.5	

Table II: Mean values of ALLY and RALLY vascular age with Framingham model according sociodemographic variables and tobacco consumption.

		ALLY VA Framingham		RALLY VA Framingham	
	n	Mean (SD)	p-value	Mean (SD)	p-value
Women	136621	0.9 (11.9)	<0.0001	0.14 (0.22)	<0.0001
Men	199829	6.7 (10.5)		0.001 (0.26)	
30-39 years	118852	-0.5 (7.4)	<0.0001	-0.01 (0.21)	<0.0001
40-49 years	124952	3.6 (10.8)		0.08 (0.24)	
50-59 years	77473	10.9 (13.0)		0.20 (0.24)	
60-69 years	15173	14.4 (12.2)		0.23 (0.20)	
Social class I	19545	1.8 (10.6)	<0.0001	0.03 (0.23)	<0.0001
Social class II	65150	2.4 (11.6)		0.04 (0.24)	
Social class III	251755	5.0 (11.6)		0.10 (0.25)	
Non smokers	226310	1.0 (9.8)	<0.0001	0.01 (0.21)	<0.0001
Smokers	110140	11.3 (11.4)		0.24 (0.24)	

Table III: Prevalence of moderate and high values of ALLY vascular age with Framingham model according sociodemographic variables and tobacco consumption.

		ALLY VA moderate		ALLY VA high	
	n	%	p-value	%	p-value
Women	136621	8.5	<0.0001	11.2	<0.0001
Men	199829	17.2		15.9	
30-39 years	118852	7.4	<0.0001	2.0	<0.0001
40-49 years	124952	15.7		10.7	
50-59 years	77473	18.8		31.3	
60-69 years	15173	18.8		46.9	
Social class I	19545	11.2	<0.0001	9.5	<0.0001
Social class II	65150	11.9		10.5	
Social class III	251755	14.3		15.3	
Non smokers	226310	9.1	<0.0001	7.3	<0.0001
Smokers	110140	22.9		27.8	

Table III shows the prevalence of moderate and high ALLY values according to the values of the sociodemographic variables and tobacco consumption. The same trend is observed as with the mean values, i.e. higher prevalence in men, as age increases and social class decreases, and in smokers. In all cases the differences observed are also statistically significant.

Tables IV and **V** present the results of the multinomial logistic regression analyses. In both cases, an increase in the risk of presenting moderate or high ALLY values is observed in males, more disadvantaged social classes and smokers. The greatest increase in risk is observed with age.

Table IV: Multinomial logistic regression.

	ALLY VA moderate-high	
	OR (95% CI)	p-value
Women	1	<0.0001
Men	2.36 (2.31-2.41)	
30-39 years	1	<0.0001
40-49 years	2.27 (2.19-2.37)	
50-59 years	8.54 (8.20-8.89)	
60-69 years	38.76 (37.09-40.51)	
Social class I	1	<0.0001
Social class II	1.33 (1.30-1.36)	
Social class III	1.55 (1.48-1.61)	
Non smokers	1	<0.0001
Smokers	9.06 (8.88-9.25)	

Table V: Multinomial logistic regression.

	ALLY VA high	
	OR (95% CI)	p-value
Women	1	<0.0001
Men	1.48 (1.44-1.51)	
30-39 years	1	<0.0001
40-49 years	2.36 (2.27-2.45)	
50-59 years	11.38 (10.92-11.87)	
60-69 years	74.81 (70.75-79.10)	
Social class I	1	<0.0001
Social class II	1.43 (1.38-1.47)	
Social class III	1.65 (1.56-1.74)	
Non smokers	1	<0.0001
Smokers	7.55 (7.37-7.73)	

Discussion

Our work establishes 10 years as the cut-off point for moderate ALLY and 18 years for high ALLY. We have not found in the literature consulted, including the authors of the tool, any reference to cut-off points, for this reason we cannot compare our results with those obtained by other authors. We have found similar determinations to ours in a Spanish study in which the cut-off points for the age of the heart were assessed12.

Our study shows a clear influence of age, male sex, lower social class, and tobacco consumption on the mean values and prevalence of elevated ALLY and RALLY values, and these data are consistent with those obtained in the aforementioned study12.

We have not found research that assesses the effects of sociodemographic variables (age, sex or social class) or tobacco consumption on vascular age values; however, there is a study that relates these variables to heart age8, and this study shows results similar to those found by us.

It is interesting to know that the scales that assess vascular aging have a good relationship with various scales that assess13.

Tobacco consumption is one of the factors that in the present study had the greatest influence on the appearance of moderate and high ALLY with ORs of 9.06 and 7.55, respectively. This negative influence of tobacco consumption was also seen in the RICARTO study14 and in an Indian study where the odds ratio was 15.23, that is, somewhat higher than that obtained here15.

Two studies evaluated the influence of tobacco consumption and vascular age determined by carotid artery measurement, one was performed in 121 Croatian nationals16 and the other in 501 Spanish subjects17, in both cases it was concluded that tobacco had a negative influence on vascular age values. A previously cited review study that assessed arterial stiffness showed the negative effect of tobacco consumption on arterial stiffness18.

An American study concluded that the social determinants of health, which encompass the economic, social, environmental and psychosocial factors that influence health, play an important role in the development of risk factors for cardiovascular disease and morbidity and mortality19. Another North American article on 168,969 people expressed the same view20.

One of the strengths of this study is that it is the first to establish the cut-off points for moderate and high vascular age using the Framingham model. Another aspect to highlight is the large sample size, more than 336,000 persons.

The limitations of this study include the fact that it was carried out in the working population, so it is not known whether the results can be extrapolated to the general population. population, so it is not known whether the results can be extrapolated to the general population. population and also correspond to a specific country, Spain, so the data may not coincide with those found by other researchers in their own countries. data may not coincide with those found by other researchers in their own countries.

Conclusions

The cut-off points for considering moderate ALLY Framingham vascular age are set at 10 years and for high ALLY at 18 years.

Male sex, social class III, tobacco use and especially age are the variables that most affect ALLY Framingham vascular age values.

Conflicts of Interest

None

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