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Cardiovascular risk factors, lifestyle, and social determinants:

a cross-sectional population study

Abstract

Background
The influence of socioeconomic development is often disregarded in epidemiological studies into the prevalence of cardiovascular risk factors.

Aim
To analyse the relationship between major cardiovascular risk factors and socioeconomic indicators.

Design and setting
Cross-sectional, population-wide study in primary care practices in the health area of Don Benito-Villanueva de la Serena, Badajoz, Extremadura, Spain.

Method
A total of 2833 people aged 25–79 years (mean age 51.2 years), representative of the population, participated in the study. The prevalence and odds ratios (ORs) were calculated for diabetes, arterial hypertension, obesity, hypercholesterolaemia, smoking, and sedentary behaviour, according to level of education and employment status.

Results
A high prevalence of cardiovascular risk factors related to the level of education and employment status. Females who had not studied at university had a higher risk of obesity (OR = 2.5, 95% confidence interval [CI] = 1.5 to 4.2), smoking (OR 2.5, 95% CI = 1.7 to 3.7), and sedentary behaviour (OR = 2.5, 95% CI = 1.5 to 3.9) than females with a university education. Males who had not studied at university showed an increased risk of smoking (OR = 2.1, 95% CI = 1.4 to 3.1), arterial hypertension (OR = 1.5, 95% CI = 1.0 to 2.4), hypercholesterolaemia (OR = 1.5, 95% CI = 1.0 to 2.2), and obesity (OR = 1.5, 95% CI = 1.0 to 2.3) than males with a university education. The risk of obesity was higher in unemployed females than those in paid employment (OR =1.4, 95% CI = 1.1 to 1.9), but they showed a lower risk of smoking (OR = 0.7, 95% CI = 0.5 to 0.9).

Conclusion
The study results confirm an inverse association between the level of education and the prevalence of cardiovascular risk factors. Public health studies and interventions are needed to understand this association and develop interventions targeted at the population that is at greatest risk.

Keywords
cardiovascular disease; employment status; primary care; risk factors; social inequalities; socioeconomic status.

INTRODUCTION

The association of many vascular diseases and their risk factors with socioeconomic status has been well described.[1,2] In fact, a relationship between social determinants and diabetes mellitus, hypercholesterolaemia, or high blood pressure,[3–5] as well as between the level of education or social class and tobacco smoking or obesity, has been documented.[6]

The prevalence of tobacco smoking among males from the EU member states concentrates mainly among the lowest socioeconomic groups and those with the lowest levels of education.[7] In general, males and females with the lowest level of education are three to four times more likely to be smokers than those with higher education,[7] and the use of tobacco can explain one-third of the socioeconomic differences in mortality.[8,9] In addition, the increasing prevalence of diabetes mellitus is directly related to obesity and sedentary behaviour,[10,11] which may also be related to social determinants. The level of education and a patient's socioeconomic circumstances are, therefore, two important determinants of decisions adopted about lifestyle.

Access to sports participation or adequate nutrition depends often on the economic resources, leisure time, or the information available to each person.[12] Often, cardiovascular risk factors are analysed using models related to the lifestyle adopted by individuals, assuming that this is a fully free choice. Nevertheless, it is generally accepted that the prevalence of cardiovascular risk factors, as well as that of other determinants of morbidity and mortality, is related to socioeconomic standards. Among the mechanisms linking psychosocial factors (for example, stress, absence of social integration, and levels of deprivation) to cardiovascular risk is an unhealthy lifestyle (mainly tobacco use, inappropriate diet, and sedentary behaviour), along with poor adherence to medication or medical counselling.[13–19]

The groups with greater levels of deprivation show a broader exposure to material risk factors (such as worse living and working conditions) and pernicious habits (for example, tobacco smoking, excessive alcohol intake, unhealthy diet, and sedentary behaviour). They also have poorer access to health resources,[7] due to employment instability and limited access to medical insurance through their employer.

In Spain the highest levels of cardiovascular risk factors have been observed in the Mediterranean and south-eastern areas of the country. Extremadura, Andalusia, and Levante are the geographic areas where the risk of death from ischaemic heart disease is greatest,[20–22] although the association between cardiovascular risk factors, cardiovascular morbidity, and socioeconomic status has not been documented. The aim of this study

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How this fits in

Often, the implication of socioeconomic factors, such as the level of education, is not considered in studies on morbidity and mortality related to cardiovascular risk factors. To the studies knowledge, no studies on cardiovascular morbidity and lifestyle, and their possible relationship with the level of education or socioeconomic status have been carried out in Badajoz, Extremadura, Spain. The results of this study suggest that socioeconomic factors, such as low educational level or the lack of a paid job, have an influence on the distribution of risk among the population. As such, GPs should focus on advising those patients without paid employment or who have a low level of education to adopt a healthy lifestyle and make healthy lifestyle choices

was to analyse the relationship between cardiovascular risk factors, education level, and current employment status among the population included in the HERMEX study in Extremadura.[23]

METHOD

The HERMEX study[23] is a cross-sectional, population-wide study of randomly selected individuals aged 25–79 years, which has been designed to determine the prevalence of cardiovascular risk factors and subclinical atherosclerotic disease in the Don Benito-Villanueva de la Serena health area in Badajoz, Extremadura, a Spanish region with a high cardiovascular morbimortality.[20–22] This is an area with 150 000 inhabitants; it is mainly rural, with only two towns that have more than 10 000 people: Don Benito has 34 000 inhabitants and Villanueva de la Serena 25 000. The target population of the study was formed of 75 455 individuals (99% of whom are white and of Spanish nationality) from 16 towns and villages, each of which with more than 2000 people.

The contents and format of the research, as well as the response rates, main results, and a detailed description of the procedures used, have been published elsewhere.[23–26] The questionnaire used was the same as in the MONICA (MONItoring of trends and determinants in CArdiovascular disease) study,[27] validated for Spain.[28] For this survey, data were collected on the level of education, urban or rural origin, employment status, presence of cardiovascular risk factors, or cardiovascular disease and treatment.[23]

Study sample

It was estimated that a sample size of 2400 individuals would allow the authors to determine the prevalence of cardiovascular risk factors with a confidence interval (CI) of ±2%. However, according to the 56.5% response rate observed in a previous pilot study,[23] the estimated number of participants needed was 4692. These were selected by means of random numbers from the healthcare database, Civitas, which covers almost the entire population (99.4%) of Extremadura.

The sample generated was identical to the target population as far as sex and age were concerned. After excluding those who were not living in the area or in the recorded addresses, as well as those who had a disability, were deceased, pregnant, or had a terminal illness, and those living in public care institutions, 3521 remained eligible. In total, 80.5% of these (n = 2833) agreed to participate.

Variables

Two sociodemographic variables related to cardiovascular risk, the maximum educational level attained and the work conditions, together with age and sex, were taken into account. Educational level was categorised as:

- university education;
- secondary school education;
- primary school education; and
- illiterate.

Five categories concerning the employment status were also considered:

- employed;
- housewife (or househusband);
- retired or permanently unable to work;
- those unemployed or out of work for >3 months due to temporary illness'; and
- student.

The cardiovascular risk factors considered were:

- diabetes mellitus, basal glycemia ≥126 mg/dl and/or treatment with antidiabetic drugs;
- hypertension, blood pressure of ≥140/90 mmHg and/or antihypertensive therapy;
- hypercholesterolaemia, total serum cholesterol of ≥240 mg/dl and/or lipid-lowering treatment; and

- obesity, body mass index of ≥30 kg/m^2.

Two sociodemographic variables or habits usually considered as cardiovascular risk factors were also analysed:

- smoking, present smoking or cessation of smoking <1 year before the study took place; and
- sedentary habits, absence of scheduled weekly physical activity during leisure time (according to the criteria of the questionnaire used to establish cardiovascular risks by the MONICA study).[27,28]

Statistical analysis

SPSS (version 13.0) for Windows was used to process and analyse the data. A descriptive statistical analysis of variables grouped by sex was performed. The eventual associations between sociodemographic variables and the prevalence of cardiovascular risk factors were studied by means of the Pearson's χ^2 test. The χ^2 test of linear tendency was used to search for differences in the prevalence ratios of lifestyle and cardiovascular risk factors, according to schooling level and employment status in each sex.

The risk of diabetes mellitus, arterial hypertension, hypercholesterolaemia, obesity, smoking, and sedentary behaviour in relation to the social determinants considered (educational level and employment status) was explored for each sex by means of a binary logistic regression model, and was expressed as an odds ratio (OR) and 95% CI. Having a university diploma and being employed were considered the reference categories. Binary logistic regression analysis was also used to study the risk of having diabetes mellitus, arterial hypertension, hypercholesterolaemia, and obesity, in relation to smoking and sedentary behaviour and adjusted by age, employment status, and level of education in each sex. A *P*-value of <0.05 was considered statistically significant for every analysis.

RESULTS

Of the 3521 people who were approached to participate in the study, a total of 2833 were interviewed and examined between November 2007 and November 2009. A non-participation enquiry was applied to 458 of the 688 (66.6%) who could not, or did not agree to, participate. The results of this enquiry revealed that 66.0% were not interested in the study, 18.5% did not have the time needed to participate, 1.7% had a severe disease or were hospitalised, and 1.1% were temporarily absent from home; 12.7% did not respond.

The mean age of the 2833 participants studied was 51.2 years and 46.5% were males. The sociodemographic variables and the prevalence of the analysed cardiovascular risk factors by sex are shown in Table 1. Among the population there was a 39.6% rate of arterial hypertension and

Table 1. Patients' baseline characteristics

	Females	Males	*P*-value
Age in years, mean (SD)	51.1 (14.9)	51.3 (14.6)	0.730
Diabetes, *n* (%)	194 (12.8)	206 (15.6)	<0.05
Arterial hypertension, *n* (%)	539 (35.6)	584 (44.3)	<0.001
Hypercholesterolaemia, *n* (%)	567 (37.4)	530 (40.3)	0.118
Obesity, *n* (%)	494 (32.6)	496 (37.7)	<0.01
Smoker, *n* (%)	386 (25.5)	508 (38.6)	<0.001
Sedentary behaviour, *n* (%)	1350 (89.1)	1210 (91.9)	<0.05
Education level			
University graduate, *n* (%)	208 (13.8)	140 (10.7)	<0.05
Secondary school, *n* (%)	298 (19.7)	288 (22.0)	0.14
Primary school, *n* (%)	783 (51.9)	743 (56.8)	<0.05
Illiterate, *n* (%)	220 (14.6)	138 (10.5)	<0.05
Employment status			
Employed, *n* (%)	514 (33.9)	827 (62.9)	<0.001
Housewife/househusband, *n* (%)	836 (55.1)	1 (0.1)	<0.001
Retired or permanent disability, *n* (%)	60 (4.0)	372(28.2)	<0.001
Temporary[a] disability or unemployed, *n* (%)	94 (6.2)	110 (8.4)	<0.05
Student, *n* (%)	12 (0.8)	7 (0.5)	0.39

[a]*>3 months.*

Table 2. Prevalence of lifestyle and cardiovascular risk factors, according to education level

	Lifestyle/cardiovascular risk factor											
	Diabetes		Hypercholesterolaemia		Obesity		Arterial hypertension		Smoker		Sedentary behaviour	
Education level	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males
University graduate, *n* (%)	6 (2.9)	12 (8.5)	40 (19.2)	38 (27.1)	19 (9.1)	37 (26.4)	19 (9.1)	35 (24.6)	59 (28.3)	42 (30.0)	170 (81.7)	108 (77.1)
Secondary school, *n* (%)	12 (4.0)	29 (10.0)	73 (24.5)	109 (37.8)	52 (17.4)	101 (35.0)	40 (13.4)	76 (26.4)	133 (44.6)	123 (42.7)	270 (90.6)	259 (89.9)
Primary school, *n* (%)	107 (13.6)	124 (16.7)	328 (41.9)	306 (41.1)	290 (37.0)	298 (40.1)	299 (38.2)	364 (48.9)	189 (24.1)	305 (41.0)	699 (89.3)	703 (94.6)
Illiterate, *n* (%)	67 (30.4)[a]	40 (29.0)	121 (55.0)	74 (53.6)	131 (59.5)[a]	57 (41.3)	177 (80.4)[a]	106 (76.8)[a]	4 (1.8)	34 (24.6)[a]	205 (93.2)[a]	132 (95.6)[a]

[a]$P<0.05$ (χ^2 of linear trend for the prevalence ratio).

34.9% of obesity, 31.6% were smokers, and 14.1% had diabetes mellitus. The rate of cardiovascular risk factors was higher among males, with the most marked differences concerning tobacco use (38.6% in men, 25.5% in females, $P<0.001$) and arterial hypertension (44.3% in males, 35.6% in females, $P<0.001$). Both females and males presented a high prevalence of sedentary behaviour (89.1% and 91.9%, respectively). The percentage of males with paid employment was almost double that of females (62.9% versus 33.9%, $P<0.001$), while househusbands were almost non-existent compared with housewives (0.1% versus 55.1%, $P<0.001$).

With regard to the relationship between the level of education and cardiovascular risk factors, the prevalence was generally higher in both males and females whose educational level was lower (Table 2), with the exception of smoking, which was less prevalent among individuals who were illiterate than those with a higher level of education. In the binary logistic regression model, after adjusting for age and occupation (Table 3), females with no university education were more than twice as likely to be obese (OR = 2.5, 95% CI = 1.5 to 4.2), smoke (OR = 2.5, 95% CI = 1.7 to 3.7), or exhibit sedentary behaviour (OR 2.5, 95% CI = 1.5 to 3.9) when compared with those who had been to university. Males with no university education, compared with those who had been to university, showed an OR of 2.1 (95% CI = 1.4 to 3.1) for smoking, 1.5 (95% CI = 1.0 to 2.3) for obesity, 1.5 (95% CI = 1.0 to 2.4) for arterial hypertension, 1.5 (95% CI = 1.0 to 2.2) for hypercholesterolaemia, and 0.2 (95% CI = 0.2 to 0.4) for sedentary behaviour.

With regard to the relationship between employment status and cardiovascular risk factors, a higher prevalence of cardiovascular risk factors was found among males in the four major employment categories considered, with the exception of arterial hypertension in individuals who had retired or had a permanent disability. Only the prevalence rates for arterial hypertension and smoking among males showed a statistically significant relationship with employment status (Table 4). In the binary logistic regression model analyses, after adjusting for age and level of education (Table 5), females who were unemployed showed a higher likelihood of obesity (OR 1.4, 95% CI = 1.1 to 1.9) and a lower likelihood of smoking (OR = 0.7, 95% CI = 0.5 to 0.9). The remaining values of OR and CI were not significant.

When all the variables were introduced in the logistic regression model, females, either those with a university education (OR 0.4, 95% CI = 0.3 to 0.7) or those who were employed (OR 0.7, 95% CI = 0.5 to 0.9), showed a lower probability of developing diabetes (data not shown).

DISCUSSION

Summary

This cross-sectional study reveals a high prevalence of cardiovascular risk factors and their inverse association with educational level in a relatively rural population in Badajoz, Extremadura, Spain. It also shows that some socioeconomic factors, such as a low level of education or the lack of paid employment, have an influence on the heterogeneous lifestyle among the population.

The findings also reveal that the analysed population has a low rate of physical activity in their leisure time (Table 1). The risks of living a sedentary life, smoking, and being obese were clearly increased among females with no university education. Among males smoking, obesity, arterial hypertension, and hypercholesterolaemia were more frequent, but sedentary behaviour was less frequent among those who had not been to university. Moreover, employed males had lower prevalence rates for hypertension and smoking than unemployed males while unemployed females had a higher risk of being obese and a lower likelihood of smoking; females with a university education or paid employment were less likely to have diabetes than those who did not attend university or were unemployed.

Strengths and limitations

The strengths of this study are the high participation rate (80.5%) among the selected population and the detailed information on multiple baseline covariates. However, the study also has some limitations.

Although many data were gathered, not all of the potentially important confounders with regard to socioeconomic status were fully assessed. For example, data on marital status, housing type, rurality, which could be correlated with university education, were not collected. In addition, as the aim of the study was to assess the association between lifestyles or classical cardiovascular risk factors (smoking, diabetes, hypercholesterolaemia, and arterial hypertension) with the level of education and employment status, other recognised cardiovascular risk factors, such as chronic renal disease, were not considered.

Table 4. Prevalence of lifestyle and cardiovascular risk factors, by employment status

	Lifestyle/cardiovascular risk factor											
	Diabetes		Hypercholesterolaemia		Obesity		Arterial hypertension		Smoking		Sedentary behaviour	
Employment status[a]	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males
Employed, *n* (%)	25 (4.8)	85 (10.2)	127 (24.7)	286 (34.5)	92 (1.9)	281 (33.9)	76 (14.7)	357 (43.1)	189 (36.7)	357 (43.1)	453 (88.1)	752 (90.9)
Housewife/househusband, *n* (%)	149 (17.8)	n/a	395 (47.2)	n/a	359 (42.9)	n/a	414 (49.5)	n/a	149 (17.8)	n/a	755 (90.3)	n/a
Retired or permanent disability, *n* (%)	13 (21.6)	108 (29.0)	29 (48.3)	197 (52.9)	21 (35.0)	172 (46.2)	35 (58.3)	85 (22.8)	9 (15.0)	85 (22.8)	45 (95.7)	347 (99.7)
Temporary[b] disability or unemployed, *n* (%)	7 (7.4)	13 (11.8)	12 (12.7)	46 (41.8)	17 (18.1)	41 (37.2)	12 (12.7)	62 (56.3)[b]	38 (40.4)	62 (56.3)[c]	86 (82.7)	103 (90.3)

[a]Students are not considered due their small numbers [b](>3 months). [c]P<0.05 (χ^2 of linear trend for the prevalence ratio). n/a = non=applicable.

Table 3. Association between lifestyle and cardiovascular risk factors, and education level (logistic regression model)[a]

Cardiovascular risk factor	Females, OR (95% CI)	Males, OR (95% CI)
Diabetes	0.6 (0.1 to 1.5)	1.2 (0.6 to 2.3)
Arterial hypertension	0.7 (0.4 to 1.3)	1,5 (1.0 to 2.4)
Hypercholesterolaemia	1.2 (0.8 to 1.8)	1.5 (1.0 to 2.2)
Obesity	2.5 (1.5 to 4.2)	1.5 (1.0 to 2.3)
Smoking	2.5 (1.7 to 3.7)	2,1 (1.4 to 3.1)
Sedentary behaviour	2.5 (1.5 to 3.9)	0.2 (0.2 to 0.4)

[a]Reference category: university graduates. Adjusted for employment status and age. OR = odds ratio.

Another limitation concerns the absence of social class as an integrating variable of socioeconomic status and educational level.[29–31] The reason for that was that neither the profession of the spouse of those classified as housewives or househusbands, nor the previous professions of participants who were retired were recorded in the HERMEX enquiry. However, it is well known that the differences in cardiovascular mortality among social classes are partly explained by known coronary risk factors.[32] Excessive rates of coronary heart disease were reported, both in terms of prevalence and mortality, among males in the lower employment grades than those in the higher grades.[1] More-recent evidence, based on multilevel studies, seems to indicate that an individual's health is determined both by social position and the socioeconomic characteristics of the environment in which they live and work.[6,33]

A social index of poverty, which assesses an individual's ability to cope financially on their monthly earnings until the end of the month, was described in Spain when the collection of this study's data was already complete. This index is consistently related to the prevalence of both obesity and diabetes mellitus,[34] and it could be interesting to use it in future research to test its association with other cardiovascular risk factors. Neither could a modified Townsend Index of material deprivation, previously used in Spain, be used.[35] This index is based on each municipality's rates of unemployment, illiteracy, and private vehicles; data that were not all collected in the current study. Finally, as with every transversal study, it was not possible to establish a causal relationship between risk factors and social determinants.

Comparison with existing literature

This study shows that the people who participated, particularly males, are much exposed to the main cardiovascular risk factors (smoking, obesity, and diabetes mellitus), and that the prevalence rates are higher in Extremadura than in the whole of Spain.[20,22,24] This is in contrast to a rate of cardiovascular events that is lower than expected in Spain; it has one of the lowest mortality rates as a result of cardiovascular

Table 5. Association between lifestyle and cardiovascular risk factors, and employment status (logistic regression model)[a]

Cardiovascular risk factor	Females, OR (95% CI)	Males, OR (95% CI)
Diabetes	0.7 (0.4 to 1.2)	0.9 (0.6 to 1.3)
Arterial hypertension	0.9 (0.6 to 1.3)	1.0 (0.7 to 1.3)
Hypercholesterolaemia	1.0 (0.8 to 1.4)	1.0 (0.7 to 1.4)
Obesity	1.4 (1.1 to 1.9)	1.1 (0.8 to 1.4)
Smoking	0.7 (0.5 to 0.9)	1.1 (0.8 to 1.5)
Sedentary behaviour	1.0 (0.7 to 1.5)	1.2 (0.7 to 2.0)

[a]Reference category: employed persons. Adjusted for education level and age. OR = odds ratio.

disease in Europe,[36] a situation known as the Spanish paradox.[37]

In Spain, the inequalities in self-rated health may be explained by social determinants. The country's National Health Surveys indicate that people residing in the municipal areas with the highest levels of deprivation are more likely to report worse self-rated health than those in the areas of lowest deprivation, and that the lower the level of education or occupational class, the greater the likelihood of less-than-good health in all years studied.[35]

Other findings, based on multilevel studies, seem to indicate that a person's health is determined both by their social position and by the socioeconomic characteristics of the setting in which they live.[33] Somewhat in line with this, the current study's data revealed a significant trend between the prevalence of cardiovascular risk factors and the level of education and employment status. The level of education, adjusted for age and sex, could have a stronger effect on cardiovascular risk factors than employment status. Other studies in Spain also show an inverse relationship between the level of education and hypertension, diabetes mellitus, and life habits related to cardiovascular risk factors.[38]

In addition, in Spain there is an inverse relationship between obesity and some socioeconomic indices, such as those relating to level of education or income.[39] This trend is stronger in females, which is also suggested by the findings of this study after adjustments by employment status and age (Table 3).

Some of the differences in cardiovascular morbimortality between social classes could be explained, among males, in terms of the lower levels of blood pressure and (particularly) smoking in the higher employment grades.[1] The current study shows that males without a university education are twice as likely to be smokers as those with such studies. In females, there are also many biological and behavioural factors for which a low level of education involves an elevated risk for coronary heart disease.[2] The current data indicate that females without a university education show a 2.5-fold higher risks of obesity, smoking, and sedentary behaviour than those with such an education. In agreement with the current study, a further study of individuals from the Asian–Indian population shows that those with low educational, occupational, and socioeconomic status have greater prevalence of truncal obesity, low high-density lipoprotein cholesterol, hypertriglyceridemia, tobacco use, low physical activity, and clustering of three or more major cardiovascular risk factors.[40]

Finally, this study also shows that females who have had a university education or who have paid employment have a lower risk of developing diabetes than those without a university education or who are unemployed; this is in concordance with other studies that show a higher incidence of type 2 diabetes among people with low socioeconomic status.[41–43]

Implications for research and practice

This study reveals a high prevalence of cardiovascular risk factors and their inverse association with education level in a Spanish population, which indicates the need to incorporate educational and socioeconomic variables when performing clinico-epidemiological research, because they may influence the acquisition of some lifestyle and cardiovascular risk factors. This study's findings also suggest that additional public health studies are needed to understand these associations and develop interventions targeted at the population that is at greatest risk of cardiovascular risk factors. Accordingly, studies should be undertaken to determine whether modification of educational level or employment status is effective for preventing the development of cardiovascular risk factors. The interest of such studies lies in assessing the impact that social changes and specific economic and social policies may have on the health status of people from different social classes. The current study also suggests that GPs should put special emphasis on helping those patients without paid employment or with a low level of education to make healthy lifestyle choices.

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