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The burden of behavioural risk factors for cardiovascular disease in Europe. A significant prevention deficit.

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Abstract

Objective—The study objective was to assess the burden of major cardiovascular disease (CVD) behavioural risk factors (BRFs) (i.e., smoking, excess body weight, physical inactivity, risky alcohol consumption) among individuals in the community with and without CVD history.

Methods—For the current study, a subset of the data from the Survey of Health, Ageing and Retirement in Europe (SHARE) was analyzed, which were collected from 26,743 individuals aged 50+ years old, during the 1st wave of SHARE in 2004/05 in eleven European countries.

Results—Among those with CVD, there is a statistically significant higher percentage of inactive individuals (81.4% vs. 69.5 among those without CVD), and of individuals with excess body weight (64.3%) or obese (21.6%). Patients with CVD had a lower prevalence of smoking and risky alcohol consumption in most countries, whereas the prevalence of high body weight and physical inactivity was higher in CVD patients compared to individuals without CVD in almost all countries. More than half of the population has at least two BRFs, with a significantly higher prevalence of multiple BRFs among those diagnosed with CVD.

Conclusion—Study findings suggest that a significant burden of behavioural risk factors for CVD remains in the population overall but also among patients diagnosed with CVD. Given the significant prevalence of BRFs, the prevention benefits would be immense for all stakeholders involved and negligence would be perilous.

Keywords

Behavioural risk factors; prevalence; cardiovascular disease; SHARE study

Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide (Hobbs et al., 2010), is responsible for almost half of all deaths in Europe, and is the main cause of disease burden

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(Reiner, 2009) despite the fact that several of the major CVD risk factors are well-established, modifiable and amenable to intervention, such as high blood pressure, elevated cholesterol, obesity, smoking, poor diet, or physical inactivity (Hobbs et al., 2010).

The effect of these CVD risk factors is synergistic, fortifying the effect of each risk factor and resulting in a combined effect that exceeds their additive impact (Graham et al., 2007; Hobbs et al., 2010). Investigators point out that even among patients with established CVD there are significant treatment gaps, with patients not reaching suggested goals (e.g., total cholesterol values) or other risk factors present, such as smoking, obesity, might be undermanaged with little improvement.(Hobbs et al., 2010)

Undoubtedly though, modification of CVD risk factors reduces morbidity and mortality, also for those with a history of CVD (Reiner, 2009) and have been selected as a very high priority group for prevention (Graham et al., 2007). Previous studies (EUROASPIRE, 1997; Kotseva et al., 2001) among coronary heart disease (CHD) patients in the late nineties, have reported the prevention deficit in this group of patients that still persists, with one in five patients with coronary heart disease still smoking or 30% of them being obese. Such prevention deficit or failure, regardless of the dissemination of repeated updated CVD prevention guidelines, could also in part be explained by the skepticism of practitioners on how to incorporate preventive cardiology care in clinical practice, as well as, politicians' and policy makers' who determine resource allocation to hospital care vs. prevention services (Reiner, 2009).

The study aim was to assess the burden of major behavioural risk factors (BRFs) (i.e., smoking, risky alcohol consumption, excess body weight, physical inactivity) among currently non-hospitalized individuals in the community with and without CVD history; i.e., assess the BRFs prevalence and cross-sectional association with CVD among individuals of 50 years old or older in the Survey of Health, Ageing and Retirement in Europe (SHARE Project, 2004/05).

Methods

Participants and data collection

For the current study, a subset of the data from the Survey of Health, Ageing and Retirement in Europe (SHARE, <http://www.shareproject.org>) was analyzed, which were collected from 26,743 individuals aged 50+ years old, during the 1st wave of SHARE in 2004/05 in eleven European countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden and Switzerland). Based on stratification using the complex sampling design, the selected sample for the current study (26,743 individuals aged 50+ years) corresponds to a target estimated population of 104,871,350 and was selected from 27,444 total participants in the eleven participating countries. Details of the sampling frame and data collection instruments have been described previously (Borsch-Supan A, 2005; Linardakis et al., 2013). Data were collected using computer-aided personal interviews (CAPI); proxy interviews (6% of completed interviews) were allowed when the participant could not complete the interview due to physical or mental limitations. One of the CAPI questions inquired: "Has your doctor told you that you have...", allowing there after 14

choices of diseases and conditions, including myocardial infarction, heart attack, coronary thrombosis, chronic heart failure or other heart disease, stroke or other brain vessels' disease, high blood pressure or hypertension, high cholesterol levels, and diabetes mellitus among others. Cardiovascular disease was defined as any choice or the following: myocardial infarction, heart attack, coronary thrombosis, chronic heart failure or other heart disease, stroke or other brain vessels' disease.

The association of cardiovascular diseases with four health behavior-related risk factors, i.e., excess body weight, smoking habits, physical inactivity and risky alcohol consumption, were assessed. Excess body weight was assessed by calculating Body Mass Index (BMI, kg/m^2) based on self-reported weight (kg) and height (m) measurements (Peytremann-Bridevaux et al., 2007). Individuals were considered to have excess body weight if they were overweight ($\text{BMI} = 25.0\text{--}29.9 \text{ kg/m}^2$) or obese ($\text{BMI} \geq 30.0 \text{ kg/m}^2$) (WHO, 2000). Smoking habits were assessed by a self-reported record of use of cigarettes, cigars or pipes during the year preceding the survey. Physical inactivity was defined as lack of engagement in moderate-vigorous activities (per week) (Romero-Ortuno et al., 2010). Activities of moderate intensity included gardening, cleaning of the car or walking whereas activities such as sports or heavy home labor were considered of vigorous intensity. Activity frequency was defined as "more than once per week", "once per week", "one to three times per month", "hardly ever or never". As the specific time spent in moderate/vigorous activities per week could not be assessed, physical inactivity was estimated using the three last answers on moderate/vigorous activities (Fine et al., 2004; Klein-Geltink et al., 2006). Alcohol consumption was assessed for frequency and period of use (Fine et al., 2004). Risky alcohol consumption was determined as the consumption of 4+ glasses of alcoholic beverages, at least three days/week, during the six months preceding the survey (Borsch-Supan A, 2005). As household income was defined the total income from any source (e.g. personal income, pension etc.) during 2003, converted to Euros for countries outside the European Monetary Union, treated with imputations on missing data (Borsch-Supan A, 2005), the 25th 50th and 75th percentiles of income by country were calculated.

Statistical analysis

Weights were applied according to the complex sampling design of the study, reflecting non-responses and stratification design, resulting in the estimation also of standardized (weighted for age and sex) prevalence rates. The prevalence of risk factors and cardiovascular disease and the respective 95% confidence intervals (95% CIs) were estimated according to the complex sampling design. Logistic regression models were used to estimate the association between smoking, physical inactivity, excess body weight, risky drinking and CVD in terms of odds ratios (OR) and their respective 95% CIs adjusting also for sex, age (years), education (years), living with partner/spouse, countries as regions (north, central, south), and income level (Model 1) and also high blood pressure or hypertension, high blood cholesterol and diabetes or high blood glucose (Model 2). Models were built separately for each of the four behavioural risk factors, and also run simultaneously adjusting for the four behavioural risk factors in the same model. Estimates did not change appreciably and we chose to present Models 1 and 2 that included all four BRFs simultaneously. All hypothesis testing was conducted assuming a 0.05 significance level and a two-sided alternative hypothesis.

Analyses were performed using the SPSS software (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp).

Results

More than half of the study participants in the 2004/05 SHARE Project wave (54.7%) were female, most were living with a spouse or partner and 11.7% of them were over 80 years of age. The prevalence of heart disease and stroke was 12.0 (95%CI: 11.4, 12.7) and 3.6 (95%CI: 3.3, 4.0) respectively. Overall, 4.3% participants in the total population were considered risky drinkers, 18.1% were current smokers, almost 60% reported increased (excess) body weight and 70% were inactive. One in three participants (33.3%) reported high blood pressure, one in five (20.2%) reported high blood cholesterol and approximately one in ten (11.1%) reported diabetes or elevated blood glucose. Among participants with CVD, there is a statistically significant higher estimated percentage of inactive individuals (81.4% vs. 69.5 among those without CVD) (Table 1), and of individuals with excess body weight (64.3%; BMI ≥ 25 kg) or obese (21.6%). Although the estimated frequency of current smokers is lower among CVD patients, still approximately one in ten CVD patients (12.5%) is a current smoker, with a higher percentage of heavy smokers (40+ pack years) in the CVD group (13.9% among CVD patients vs. 9.6% in participants without CVD).

The prevalence of each of the four behavioural risk factors by country and CVD status is shown in figure 1. Patients with CVD had a lower prevalence of smoking and risky alcohol consumption in most countries, whereas the prevalence of high body weight and physical inactivity was higher in CVD patients compared to individuals without CVD in almost all countries. More than half of the population has at least 2 BRFs, with a statistically significant higher prevalence of at least 2 BRFs among those with CVD (Table 2).

When we examined the cross-sectional association of BRFs and CVD adjusting for potential confounders, heavy smokers (40+ pack years), physically inactive and obese individuals were 48% (OR=1.48, 95%CI: 1.21, 1.82), 49% (OR=1.49, 95%CI: 1.27, 1.74) and 36% more likely to report CVD compared with never smokers, physically active and healthy weight individuals respectively (Table 3, Model 2). Although the estimates did not really change for smoking and physical activity once model adjustment included high blood pressure, high blood cholesterol and high blood glucose, the estimates for overweight (OR=1.22, 95%CI: 1.05, 1.41) and obesity (OR=1.65, 95%CI: 1.38, 1.98) changed significantly towards the null (for overweight (OR=1.09, 95%CI: 0.94, 1.27) and obesity (OR=1.36, 95%CI: 1.13, 1.65). Individuals with two or more BRFs were 1.6 times more likely to report CVD compared with individuals without any BRFs (Table 4, Model 2), exhibiting a dose-response relationship with increasing numbers of BRFs.

Discussion

Cardiovascular disease, the major cause of death in Europe, causes significant disability, burden to health care systems and consequently to the economies in Europe (Nichols et al., 2013). Study findings suggest that a significant burden of multiple BRFs for CVD remains

in the population overall but also among patients diagnosed with CVD, with 12.5% of CVD patients being current smokers, most of them being obese and inactive.

The study chose to examine the burden of the BRFs both among the healthy but also SHARE participants without CVD, as BRFs are often undermanaged (Hobbs et al., 2010) among these patients, as well. All CVD patients, after a diagnosis, an intervention or an acute event, require counseling to prevent progression of disease, to adhere to a pharmacotherapy and also adopt a healthy lifestyle (Piepoli et al., 2010). Low compliance with lifestyle modifications (e.g. smoking cessation or maintaining a healthy BMI) among CVD patients has been reported and such compliance with lifestyle improvements could even be lower than adherence to prescription medications (Castellano et al., 2014). Such low compliance with lifestyle modifications and low adherence to pharmacotherapy has an impact on the individual's health and mortality, and can contribute to increased hospitalizations and increased health care costs (Castellano et al., 2014). The integration of CVD prevention strategies into daily medical practice is inadequate throughout Europe, regardless of professional recommendations (Piepoli et al., 2010).

In the Prospective Urban Rural Epidemiology (PURE) study,²⁰ current smoking among CVD patients was 18.5% (compared to 12.5% in the present study), with a 39% of patients being overweight and 23% of them being obese; such risk factor frequencies are quite close to the current study especially for overweight and obesity. In the EUROASPIRE III survey (Kotseva et al., 2009) in 22 European countries, 17% of CHD patients were smoking, 35% were obese and 53% centrally obese approximately 6 months after the CHD event. Physical inactivity was the most common behavioural risk factor in the 2001 National Health Interview Survey (NHIS), (Fine et al., 2004) with 66% of physically inactive, 58% of overweight/obese and 23% smokers in the sample. In 2001 NHIS 58% of participants had 2 or more behavioural risk factors (comparable to the current findings), although the sample is representative overall of US adults 18 years or older. Our findings, in addition to other reports (Kotseva et al., 2009) show detrimental lifestyle health behaviours, which are currently quite prevalent in CVD patients and individuals without CVD. Such reports are informative and important - while investigators are pondering the possibility of a leveling off coronary heart disease mortality together with a significant increase in the prevalence of some of the preventable CVD risk factors (e.g. obesity, diabetes) (Piepoli et al., 2010; Romero and Romero, 2010), and help avoid complacency as there is unfortunately a big gap between what we consider ideal and the actual practice of healthy behaviors such as healthy eating, smoking avoidance/cessation or physical activity after a CVD event (Teo et al., 2013).

Study findings, however, pointed out to a missed prevention opportunity also among those without diagnosed CVD, as a little more than half of the disease-free population 50 years old and older has two or more lifestyle risk factors for CVD and for other chronic diseases. Such high prevalence of multiple risk factors is also significant as their combined effect exceeds their additive one, as aforementioned (Graham et al., 2007; Hobbs et al., 2010), and potentially resulting in the co-occurrence of multiple morbidities and the rising prevalence of multimorbidity that is becoming the norm in primary care among the adult population (Barnett et al., 2012). On the other hand, optimization of one's lifestyle can improve several

risk factors often simultaneously (Kones, 2011) (e.g. healthy diet, adoption of a physically active lifestyle and a healthy body weight) and improvement of multiple BRFs would greatly benefit CVD but also other chronic diseases, such as diabetes mellitus, some types of cancer, arthritis, and chronic obstructive pulmonary disease (Linardakis et al., 2013).

Having such a high prevalence of behavioural risk factors among CVD patients but also individuals without CVD, underscores the importance of continued significant preventive efforts. Such preventive efforts need to be multifaceted, considering also the socioeconomic factors (e.g., education or income) influencing CVD risk factors (e.g. obesity, sedentary lifestyle or smoking) and the built environment (Romero and Romero, 2010). In order to move risk factor distributions to more favourable levels, we would need to employ not only high-risk but also general population strategies (Rose, 1985) for CVD prevention. “Downstream” approaches (focusing on personal risk factors) but also “upstream” population-based interventions are needed that could make better health-related choices easier, even for the more disadvantaged in the European communities, through e.g. regulation, legislation, access to safe environments or pavements to combat inactivity etc. Considering the high prevalence of these CVD risk factors, we need to take advantage of such “upstream” approaches resulting in the health benefit of individuals without considering their knowledge of CVD prevention and also facilitating their capability to beneficially change behaviours; thus lowering CVD risk as a desired “side effect” of legislative, economic, or other social actions (National Institute for Health and Clinical Excellence, 2010; Vassilaki et al., 2014). Such population CVD “side-effects” would be especially advantageous, as CVD is a chronic disease with an incubation period of several decades and prevention strategies spanning adulthood, but also earlier years (Gillman, 2015), could be extremely profitable in public health improving the societal burden of CVD and also additional chronic conditions with which CVD shares behavioural risk factors.

High BMI, has been associated with CVD (e.g., premature atherosclerosis, myocardial infarction, heart failure, decreased survival, stroke)(Apovian and Gokce, 2012) and cancer, smoking is associated with cardiovascular and respiratory diseases and many types of cancer, and physical inactivity is associated with CVD (e.g., myocardial infarction and stroke), diabetes and cancer among others (Filippidis et al., 2011). Although, we cannot explore in the present study the question of whether CVD patients have changed their behavioural risk factors after their CVD diagnosis, it is of interest the finding that patients with CVD had a lower prevalence of smoking and risky alcohol consumption, whereas the prevalence of high body weight and physical inactivity was higher in CVD patients compared to individuals without CVD in almost all countries.

Long-term smokers had the highest association with CVD, which concurs with previous findings that CVD risk is very high when smoking starts early in life, especially before 15 years of age (Stramba-Badiale, 2010). Smoking is a major CVD risk factor, the second after dyslipidemia for risk for myocardial infarction (Conroy et al., 2003) and CVD is the leading cause of death from smoking (Erhardt, 2009). Its cessation leads to major reduction of the CVD risk within the first 2 years, with coronary heart disease mortality reduced more by smoking cessation than any other secondary prevention interventions (e.g., lowering cholesterol) (Erhardt, 2009). Although clinicians address smoking cessation to their patients

(Solberg et al., 2005), often they don't provide an optimal level of assistance for smoking cessation, limiting their aid to instructions related to prescribed medication and might fail to monitor regularly on patients' cessation efforts. Successful primary or secondary CVD prevention needs effective smoking cessation strategies and support to individuals to treat nicotine addiction, for which further research is needed.

The detrimental effect of obesity is due to its direct impact on the cardiovascular system (e.g., structural and functional alteration of the myocardium, creation of a pro-inflammatory and prothrombotic state that can predispose to coronary heart disease, heart failure or sudden death), as well as its effect on other CVD risk factors (Ashraf and Baweja, 2013). The effect of high BMI can also in part be mediated by increased blood pressure, cholesterol and blood glucose (Lu et al., 2014) and such mediation was supported by current findings where the cross-sectional association for high body weight (especially obesity) was decreased once high blood pressure, high blood cholesterol and diabetes or elevated blood glucose were adjusted for in the model (i.e. adjusting for variables on the causal pathway between the behaviours and outcomes). So, improvement in BMI could result in an additional beneficial effect on these risk factors. The obesity epidemic, worsening over the last four decades, unfortunately has not been mitigated by effective interventions on how to halt it in the long run, although such evidence is growing (Gortmaker et al., 2011). Study findings are similar to the United States, where the prevalence of overweight and obesity together reached almost 69% of the population with about 36% being obese (Flegal et al., 2012). Such prevalence re-emphasizes the need for continued efforts to accumulate and broaden the evidence of "what works" in obesity prevention by many different stakeholders, including not only controlled clinical trials but also policy changes, cost analysis, natural experiments, involvement of governments and organizations (Gortmaker et al., 2011).

Physical inactivity was the most prevalent of the behavioural risk factors for CVDs, which was not surprising, as it is the most prevalent BRF in this population overall (Linardakis et al., 2013). Physical inactivity has been also characterized as a pandemic - the fourth cause of death worldwide; it accounts for 6–8% of all death in non-communicable diseases, although such fraction is quite higher in specific diseases (e.g., 30% for ischemic heart disease) (Kohl et al., 2012). The burden of amounting chronic diseases, including CVD, related to inactivity has mobilized countries and agencies to monitor physical activity, there is progress in worldwide surveillance, although until recently it has been difficult to motivate both populations and also states to pay attention to physical inactivity as an important public health issue (Hallal et al., 2012). However, as it has been pointed out, the choice of being physically active, should be a healthy choice but also an enjoyable, convenient, safe or affordable one; as such researchers, policy makers and governments should contribute in building and assuring such environments (Hallal et al., 2012), the benefits both for individuals but also societies and states would be profound.

In the current analyses, risky alcohol drinking was not associated with increased odds of reporting CVDs, although high levels of alcohol consumption are associated with an increased CVD risk (O'Keefe et al., 2014). We speculate however that as the prevalence of risky drinking was quite low in the study population, estimates for risky alcohol drinking were quite imprecise and the analysis lacks statistical power for this CVD risk factor.

The study is not without limitations, partly due to the nature of the SHARE data used, which might limit generalizability. CAPI data collection relies on “self-reported” information (or proxy interviews when the participant could not complete the interview due to physical or mental limitations) without independent verification, with the possibility of disease or behavioural risk factor misclassification. It is possible, however, for such misclassification to be non-differential (i.e. influencing results towards the null and having lower estimates overall) as participants did not have our research question in mind. There is no global definition of BRFs and the categories we chose might not agree with all previous reports limiting comparisons between studies. Self-reported weight and height might differ from objective measures (Connor Gorber et al., 2007) and smoking prevalence was based on smoking occurrence but not on total burden such as pack-years. In addition, the cross-sectional study design limits causal inference related to the associations observed.

Conclusions

Current findings suggest a significant prevention deficit or failure relating to behavioural risk factors for CVD, which is even greater among CVD patients but also significant among participants without CVD. More than half of the population examined has concurrently two or more BRFs that are amenable to improvement. Researchers, policy makers, governments and communities are all interested stakeholders that need to cooperate in continued efforts to use intensely already effective preventive interventions and also examine and collect evidence of additional interventions that are cost effective, accessible, safe, provide long-term beneficial behavioural risk factor change and facilitate “grassroots” improvements (Kones, 2011) in public health. Given the significant prevalence of the examined BRFs, the prevention profits would be immense for all stakeholders involved and negligence would be perilous.

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Abbreviations

BRFs	Behavioural risk factors
CVD	Cardiovascular disease

CHD	Coronary heart disease
SHARE	Survey of Health, Ageing and Retirement in Europe
BMI	Body mass index
CAPI	Computer-aided personal interviews
OR	Odds ratio
CI	Confidence interval

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Highlights

- Significant prevention deficit in behavioural risk factors (BRFs) for CVD.
- More than half had at least two BRFs, with higher prevalence in CVD patients.
- Need to employ both high-risk and general population prevention strategies.
- The CVD prevention profits would be immense and negligence would be perilous.

Figure 1. Prevalence of multiple behavioural risk factors in patients with cardiovascular disease (CVD) and individuals without CVD by country - the Study of Health, Ageing and Retirement in Europe (SHARE) 2004/5.

Table 1.

Population characteristics by Cardiovascular Disease (CVD) status in 26,656 adults aged 50+ years from 11 European countries - the Study of Health, Ageing and Retirement in Europe (SHARE) 2004/5.

Characteristics and Diseases		Participants with CVD		Participants without CVD	
		n	weight % (95%CI)	n	weight % (95%CI)
Demographic and social characteristics					
Gender	<i>males</i>	2,208	53.6 (51.0, 56.3)	10,101	44.5 (43.4, 45.6)
	<i>females</i>	1,715	46.4 (43.7, 49.0)	12,615	55.5 (54.4, 56.6)
Age, years	<i>50–59</i>	687	15.9 (14.2, 17.9)	9,237	38.9 (37.8, 39.9)
	<i>60–69</i>	1,129	27.0 (24.8, 29.3)	7,363	30.7 (29.8, 31.7)
	<i>70–79</i>	1,351	33.4 (31.0, 35.9)	4,435	20.7 (19.8, 21.6)
	<i>80+</i>	756	23.6 (21.2, 26.3)	1,681	9.7 (9.0, 10.5)
	<i>mean (95%CI)</i>		71.2 (70.6, 71.7)		64.4 (64.1, 64.6)
Education, years 0		298	9.7 (8.4, 11.3)	1,179	7.2 (6.8, 7.8)
	<i>1–7</i>	1,396	32.4 (30.0, 34.8)	5,965	25.7 (24.9, 26.6)
	<i>8–12</i>	1,261	26.6 (24.4, 29.0)	8,284	29.4 (28.4, 30.3)
	<i>13+</i>	931	31.3 (28.8, 33.9)	7,119	37.7 (36.8, 38.6)
	<i>mean (95%CI)</i>		8.8 (8.5, 9.1)		9.8 (9.7, 9.9)
Living status	<i>alone</i>	1,172	37.8 (35.1, 40.6)	5,805	32.8 (31.7, 33.9)
	<i>with partner/spouse</i>	2,739	62.2 (59.4, 64.9)	16,881	67.2 (66.1, 68.3)
European region	<i>Northern</i>	753	5.8 (5.3, 6.3)	3,760	4.7 (4.6, 4.8)
	<i>Central</i>	2,171	61.0 (58.6, 63.4)	12,715	58.5 (57.9, 59.1)
	<i>Southern</i>	999	33.2 (30.8, 35.7)	6,241	36.8 (36.2, 37.4)
Income	<i>lower quartile</i>	1,230	35.2 (32.6, 37.9)	5,460	27.2 (26.2, 28.2)
	<i>average quartile</i>	2,019	48.9 (46.2, 51.5)	11,382	48.3 (47.2, 49.4)
	<i>higher quartile</i>	674	15.9 (14.1, 17.9)	5,844	24.5 (23.6, 25.4)
Behavioral Risk Factors (BRFs)					
Smoking	<i>current smokers</i>	566	12.5 (10.9, 14.3)	4,580	19.0 (18.2, 19.9)
	<i>1–39 pack years</i>	1,452	33.4 (30.9, 35.9)	8,345	33.9 (32.9, 34.9)
	<i>40+ pack years</i>	579	13.9 (12.2, 15.8)	2,296	9.6 (9.0, 10.3)
Risky alcohol consumption	<i>risky drinkers*</i>	153	3.7 (2.9, 4.6)	1,019	4.4 (4.0, 4.8)
Physical inactivity	<i>physically inactive</i>	3,166	81.4 (79.3, 83.4)	15,258	69.5 (68.5, 70.4)
Excess body weight	<i>overweight/obese (BMI ≥25kg/m²)</i>	2,534	64.3 (61.7, 66.8)	13,329	59.0 (58.0, 60.1)
	<i>obese (BMI ≥30 kg/m²)</i>	825	21.6 (19.6, 23.8)	3,704	16.6 (15.8, 17.4)
Intermediate Risk factors					
High blood pressure or hypertension	<i>yes</i>	1,834	50.2 (47.5, 52.8)	6,559	30.5 (29.5, 31.5)
High blood cholesterol	<i>yes</i>	1,265	31.0 (28.6, 33.4)	4,121	18.4 (17.6, 19.3)
Diabetes or elevated blood glucose	<i>yes</i>	640	17.3 (15.4, 19.4)	1,873	10.0 (9.3, 10.7)

As CVD were defined heart diseases and stroke.

[†] 95% Confidence Intervals (they were estimated according to the complex sampling design of the study).

[§] BMI: body mass index.

^{*} Consumption of 4+ glasses of alcoholic beverages, at least three days/week, during the six months preceding the survey.

Table 2.

Clustering of behavioral risk factors (BRFs) in adults with and without cardiovascular disease (CVD) - the Study of Health, Ageing and Retirement in Europe (SHARE) 2004/5.

Clustering of BRFs	Participants with CVD		Participants without CVD	
	n	weight % (95%CI) [§]	n	weight % (95%CI)
0	208	5.2 (4.1, 6.5)	2,429	9.8 (9.2, 10.4)
1	1,351	35.5 (33.0, 38.2)	8,563	37.9 (36.8, 38.9)
2+	2,364	59.3 (56.6, 61.9)	11,724	52.3 (51.3, 53.4)

As CVD were defined heart diseases and stroke.

BRFs: Behavioral Risk Factors (smoking, physical inactivity, high body weight, risky alcohol consumption).

[§] 95% Confidence intervals (they were estimated according to the complex sampling design of the study).

Table 3.

Association of behavioural risk factors (BRFs) and cardiovascular diseases (CVD) - the Study of Health, Ageing and Retirement in Europe (SHARE) 2004/5.

Behavioural risk factors		Odds ratio (95%CI) [*]	
		Model 1 ^a	Model 1 ^b
Smoking	<i>current smokers</i>	0.85 (0.71, 1.01)	0.88 (0.74, 1.06)
	<i>1–39 pack years</i>	1.24 (1.07, 1.44)	1.22 (1.05, 1.42)
	<i>40+ pack years</i>	1.53 (1.25, 1.86) ^c	1.48 (1.21, 1.82) ^d
Risky alcohol consumption	<i>risky drinkers</i> [†]	0.87 (0.65, 1.14)	0.88 (0.66, 1.15)
Physical inactivity	<i>physically inactive</i>	1.49 (1.27, 1.75)	1.49 (1.27, 1.74)
High body weight	<i>overweight</i>	1.22 (1.05, 1.41)	1.09 (0.94, 1.27)
	<i>obese</i>	1.65 (1.38, 1.98) ^e	1.36 (1.13, 1.65) ^f
	<i>overweight/obese</i>	1.34 (1.16, 1.53)	1.16 (1.01, 1.34)

As CVD were defined heart diseases and stroke.

^{*} Odds Ratios and 95% confidence intervals (95%CI) were estimated by logistic regression analysis (using complex sample design procedure).

[†] Consumption of 4+ glasses of alcoholic beverages, at least three days/week, during the six months preceding the survey.

^a Smoking, physical inactivity, high body weight and risky alcohol consumption simultaneously adjusted in the model. As covariates were also used gender, age (years), education (years), living with partner/spouse, countries as regions (north, central, south), and income level.

^b Smoking, physical inactivity, high body weight and risky alcohol consumption simultaneously adjusted in the model. As covariates were also used gender, age (years), education (years), living with partner/spouse, countries as regions (north, central, south), income level, and morbidity status (high blood pressure or hypertension, high blood cholesterol and diabetes or high blood glucose).

Category differences:

Between “never smokers”, “1–39 pack years” and “40+ pack years”:

^c p=0.004,

^d p=0.006

Between “normal”, “overweight” and “obese”:

^e p=0.001,

^f p=0.019.

Table 4.

Association of cardiovascular diseases (CVDs) with clustering of behavioral risk factors in adults of the current study.

		Odds ratio (95%CI)	
		1 st model ^a	2 nd model ^b
Clustering of BRFs	0	1.00 (ref.)	1.00 (ref.)
	1	1.38 (1.05, 1.82)	1.29 (0.98, 1.70)
	2+	1.84 (1.41, 2.40) ^c	1.58 (1.21, 2.06) ^d

As CVDs were defined heart diseases and stroke.

BRFs: Behavioral Risk Factors (smoking, physical inactivity, high body weight, risky alcohol consumption).

Odds Ratios and 95% confidence intervals (95%CI) were estimated by logistic regression analysis (using complex sample design procedure).

^a As covariates were used gender, age (years), education (years), living with partner/spouse, countries as regions (north, central, south), and income level.

^b As covariates were used gender, age (years), education (years), living with partner/spouse, countries as regions (north, central, south), income level, and morbidity status (high blood pressure or hypertension, high blood cholesterol and diabetes or high blood glucose).

Category differences:

Between “0”, “1” and “2+” BRFs:

^c p=0.001

^d p=0.007.