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Prevalence of the seven cardiovascular health metrics in a Mediterranean country: results from a cross-sectional study

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Aim: Primordial prevention is essential for reaching cardiovascular (CV) health. This is defined by seven health metrics identified by the American Heart Association. Aim of the present study was to assess prevalence and distribution of these seven CV health metrics within an unselected population. **Methods:** All the 1110 consecutive individuals (mean age 56 ± 13 years; 56% women) who agreed to be screened within the context of a national campaign of CV prevention were included. The following findings have been considered as ideal: never/former smoker, regular participation in physical activity, body mass index lower than 25.0, healthy diet, cholesterol lower than 200 mg/dl, diabetes absence and a blood pressure lower than 120/80 mmHg. **Results:** Participants presented, on average, 4.1 ± 1.2 ideal CV health metrics, with a decreasing number across age-groups. Only 10.4% covered more than five ideal CV health metrics and 8.3% covered less than three ideal health metrics. Only 1.9% of the study population met all the seven ideal metrics. In particular, only 34% (379 subjects) in our population presented an ideal level of cholesterol. The higher prevalence was observed in younger subjects (45%) and the lower (28%) in people older than 62 years ($P < 0.001$). **Conclusion:** Prevalence of the seven CV health metrics was low in our population and just 1 in 10 met more than five ideal CV health metrics. Social initiatives and awareness policies from governments are mandatory to promote CV health. Further studies should address the impact of such CV metrics on several outcomes in European countries.

Introduction

Despite prevention policies adopted in the recent past and growing therapeutic options, cardiovascular (CV) disease remains the main cause of mortality both in Europe and in the USA, affecting one in three adults and accounting for one in three deaths.[1,2] Whereas primary and secondary prevention policies continue to address those who have already presented with a CV event or those who developed one or more risk factors, primordial prevention has been suggested to be essential for reaching CV health on a large scale.[3] This is defined by seven health behaviours and health factors: smoking, body mass index (BMI), healthy diet, participation in physical activity, levels of blood pressure, blood glucose and total cholesterol. Such CV metrics were identified in 2010, in the New Impact Goal of the American Heart Association (AHA), as the key points for reducing, by 2020, deaths from CV disease and stroke by 20% and improving the CV health of all Americans by 20%.[4]

In a recent investigation involving a US population, Yang *et al.*[5] stated that meeting a greater number of CV heath metrics was associated with a lower risk of total and CV disease mortality, but the prevalence of the seven CV health metrics was low within that same population. Even though CV prevention—by controlling the well-known risk factors—represents a key action of health care programmes of all European countries, no data about the prevalence of these factors among the general population are available.

The aim of the present study was to assess within an unselected Italian population of 1110 individuals, the prevalence and the distribution of the seven CV health metrics identified by the AHA.

Methods

Study sample and setting

Within the context of a national campaign of CV prevention, named 'Check your Cholesterol' and promoted by the Catholic University of Rome, we enrolled 1110 individuals in seven Italian cities (Roma, Milano, Bologna, Ferrara, Modena, Crema and Cremona). 'Check your Cholesterol' took place during 1 week in seven different shopping centres between March and June 2012 and aimed to sensitize the general population to be aware about their CV health. Shopping centres were chosen as the setting for the initiative because of the chance to meet an unselected population of individuals not referring to a traditional health care service. All the 1110 consecutive individuals who agreed to be screened underwent individual counselling that consisted of a brief questionnaire and the measurement of the objective metrics of interest. Finally, a chart of CV risk was filled out and indications about future prevention measures were given. The Catholic University of Sacred Heart ethical committee ratified the entire study protocol. A written informed consent was also obtained from each participant.

CV health metrics

Age and gender of all participants were recorded. The seven CV health metrics were assessed through closed questions and direct measurement.

Smoking habit was categorized as current or never/former smoker.

Regular participation in physical activity was considered as involvement in physical activities at least twice a week.

Body weight was measured through an analogue medical scale. Body height was measured using a standard stadiometer. BMI was defined as weight (kilograms) divided by the square of height (metres). BMI was categorized as less than 25.0 (normal), between 25.0 and 29.9 (overweight) and more or equal to 30.0 (obesity).

Healthy diet was considered as the consumption of two or more portions of fruit and vegetables per day.

Cholesterol was measured from capillary blood samples using changing reagent strips based on a reflectometric system with the portable device MultiCare-In®.[6] Total blood cholesterol was also categorized as less than 200 (if untreated), between 200 and 239 (or treated to goal) and more or equal to 240 mg/dl. Lipid-lowering drugs use was also assessed.

Random blood glucose was measured from capillary blood samples using changing reagent strips based on an amperometric system with the portable device MultiCare-In®.[6] Those who declared being diabetic and, according to international guidelines,[7] those who presented with a random blood glucose level of more than 200 mg/dl were considered to be suffering from diabetes.

Blood pressure was measured with a mercury sphygmomanometer according to recommendations from international guidelines.[8] Blood pressure findings were categorized as less than 120/80 mm of mercury (if untreated), between 120/80 and 139/89 mm of mercury (or treated to goal) and more or equal to 140/90 mm of mercury. Antihypertensive drugs use was also assessed.

We considered the following findings as ideal CV health metrics: never/former smoker, regular participation in physical activity, a BMI lower than 25.0, healthy diet, total blood cholesterol lower than 200 mg/dl when untreated, diabetes absence and a blood pressure lower than 120/80 mm of mercury when untreated. We also assigned 1 point to each of them and 0 for the other categories. Based on the sum of these points, a CV health metrics score was constructed.[5]

Statistical analysis

Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies by absolute value and percentage (%) of the total. Age was stratified in tertiles and characteristics of participants were compared according to them (<50, 51–62 and >62 years) using analyses of variance for normally distributed variables, non-parametric Mann–Whitney U test for skewed variables and chi-square analyses for dichotomous variables. All tests were two-sided, and a *P*-value lower than 0.05 was considered statistically significant.

Finally, a correlation matrix was computed of all the CV health metrics, using the Yule's Q measure of association and average linkage as a combination method.

All analyses were performed using the SPSS 10.0 package (SPSS Inc., Chicago, IL).

Results

Sample characteristics according to age-groups are shown in table 1. The 1110 participants (mean age 56 ± 13 years, 56% women) presented, on average, 4.1 ± 1.2 ideal CV health metrics, with a decreasing number across age-groups (4.2 ± 1.3, 4.0 ± 1.1 and 4.0 ± 1.1 from the lower to the higher tertile, respectively; $P < 0.007$). In our sample, only 10.4% covered more than five ideal CV health metrics and 8.3% covered less than three ideal CV health metrics. Only 1.9% of the study population met all the seven ideal metrics.

Table 1 Principal characteristics of the study sample according to age-groups[a]

Characteristics	Total ($n=1110$)	<51 years ($n=365$)	51–62 years ($n=365$)	>62 years ($n=380$)
Age	56 ± 13	41 ± 8	57 ± 4	70 ± 5
Gender (female)	622 (56)	191 (52)	234 (64)	197 (52)
BMI	25.5 ± 4.3	24.8 ± 4.5	25.6 ± 4.5	26.2 ± 3.9
Systolic blood pressure (mmHg)	128 ± 15	121 ± 14	127 ± 14	135 ± 15
Diastolic blood pressure (mmHg)	78 ± 10	75 ± 11	78 ± 9	80 ± 9
Cholesterol (mg/dl)	203 ± 36	201 ± 31	207 ± 29	202 ± 45
Blood glucose (mg/dl)	99 ± 22	94 ± 16	97 ± 20	101 ± 29
CV health metrics scale	4.2 ± 1.2	4.2 ± 1.3	4.0 ± 1.1	4.0 ± 1.1

[a]Data are given as number (percent) for gender; for all the other variables, means ± SD are reported.

Prevalence of the seven CV health parameters, according to age-groups, is shown in table 2. Within our sample, 932 (84%) subjects did not present with a current smoking habit. This ideal status was highly prevalent in older individuals, accounting for 90% of those older than 62 years ($P < 0.001$). More than 500 (48%) individuals participated in a regular physical activity, with a higher prevalence among the older (57%) compared with the younger subjects (42%; $P < 0.001$). An ideal body weight, expressed by a BMI lower than 25.0, was present in only 542 (49%) subjects, and those younger reported a better healthy weight (60%) compared with those older than 62 years ($P < 0.001$). Differences among age classes were reduced for those who presented with a BMI higher or equal to 30. A healthy diet was followed by 842 (76%) people, with a higher prevalence among those older (87%; $P < 0.001$). Only 379 (34%) individuals in our population presented with a normal level of cholesterol without specific pharmacological treatment. Higher prevalence was observed in younger subjects (45%) and lower (28%) in people older than 62 years ($P < 0.001$). On the contrary, higher prevalence of cholesterol levels between 200 and 239 mg/dl and cholesterol levels treated to goal were observed in the higher age-group (61%). One hundred ninety subjects (17%) reported use of cholesterol-lowering drugs and people older than 62 years presented with higher prevalence, accounting for 31%. Non-treated blood pressure level lower than 120/80 mmHg was seen in 233 (21%) individuals. People younger than 51 years presented with the higher prevalence (38%), with only 7% prevalence among those older than 62 years ($P < 0.001$). The absence of diabetes was observed in 1064 (96%) subjects, and higher prevalence of this status was observed in those younger (98%) compared with those older (92%, $P < 0.001$).

Finally, to better understand the distribution of health metrics among the study sample, a correlation matrix was computed of all the CV health metrics. Figure 1 presents the dendogram based on hierarchical cluster analysis of the findings of CV health metrics. It is important to highlight that two different clusters were observed. The first cluster encloses clinical conditions such as ideal blood pressure, ideal blood cholesterol, diabetes absence and ideal BMI. The second cluster encloses habits such as healthy diet, physical activity and absence of smoking.

Discussion

Advances in medicine and technology have generated an ever longer expectancy of life; at the same time, such an achievement represents an emergency for health care due to an ever higher number of older adults characterized by an accumulation of a higher number of

Table 2 Prevalence of the seven cardiovascular health parameters according to age-groups

Characteristics	Total $n=1110$ (%)	<51 years $n=365$ (%)	51–62 years $n=365$ (%)	>62 years $n=380$ (%)	*P*-value
Smoking					
Never/Former	932 (84)	292 (80)	299 (82)	341 (90)	0.001
Current	178 (16)	73 (20)	66 (18)	39 (10)	
Regular physical activity					
Yes	536 (48)	152 (42)	167 (46)	217 (57)	<0.001
No	574 (52)	213 (58)	198 (54)	163 (43)	
BMI					
<25.0	542 (49)	219 (60)	176 (48)	147 (39)	<0.001
25.0–29.9	425 (38)	100 (27)	149 (41)	176 (46)	
≥30.0	143 (13)	46 (13)	40 (11)	57 (15)	
Healthy diet					
Yes	842 (76)	224 (61)	286 (78)	332 (87)	<0.001
No	268 (24)	141 (39)	79 (22)	48 (13)	
Total serum cholesterol (mg/dl)					
<200 (untreated)	379 (34)	162 (44)	110 (30)	107 (28)	<0.001
200–239 (or treated to goal)	610 (55)	170 (47)	208 (57)	232 (61)	
≥240	120 (11)	32 (9)	47 (13)	41 (11)	
Blood pressure (mmHg)					
<120/80 (untreated)	194 (21)	118 (41)	57 (19)	19 (6)	<0.001
120–139/80–89 (or treated to goal)	431 (48)	127 (45)	162 (54)	142 (44)	
≥140/≥90	383 (31)	41 (14)	82 (27)	160 (50)	
Diabetes					
No	1064 (96)	359 (98)	354 (97)	351 (92)	<0.001
Yes	46 (4)	6 (2)	11 (3)	29 (8)	

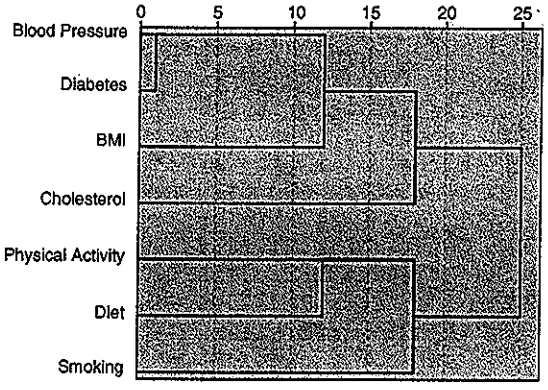

Figure 1 Dendogram based on hierarchical cluster analysis of the seven cardiovascular health metrics

diseases, generating a saturation of public health care services and expenditure.[9] Within this context, the burden related to CV diseases represents a prevalent and growing issue that raises the need for effective preventive policies on a large scale and the relative planning of efficacious short- and long-term goals.[10–12] The anticipation of risk factor development, the so-called primordial prevention, seems to be the most efficacious kind of preventive measure for this purpose, so that the aforementioned seven CV health metrics were identified by the AHA as the key factors to be taken into account.[4] Notwithstanding, in Europe, the same long-term policies have been actually planned just in small contexts, and data about the prevalence and distribution of the seven CV health metrics identified by the AHA are available not for all but only for some of them and in different surveys.[13–15]

Our study for the first time provides data about the prevalence of the seven CV health metrics in a European country. According to our data, people met, an average of, four ideal CV metrics, a slightly higher number compared with that reported by Yang and colleagues in USA[5]; however, this rate is still too low, especially considering the high prevalence of hypertension and hypercholesterolaemia, two risk factors potentially modifiable through changes in lifestyle and susceptible to efficacious pharmacological treatments. In particular, only 1 in 10 participants met more than five ideal CV metrics and almost the same number met less than three ideal CV metrics. High blood pressure, high serum cholesterol and limited physical activity were the most prevalent CV risk factors within our sample. In contrast, diabetes and smoking habit were the less prevalent risk factors.

Beyond the work of Yang and colleaguesm,[5] other studies reported the prevalence of the seven CV metrics identified by AHA and their impact on several outcomes in the USA, sometimes with different findings.[16–18] Diabetes absence and non-smoker status were the most prevalent ideal conditions both in the US series and in our study. This reflects the effectiveness of several campaigns against smoking carried out in Western countries during the past years.[19] Further, the low prevalence of diabetes (ranging from 4 to 8%) in all these series is justified by the wide age range of the study participants (mean age 50–60 years), with a consistent presence of younger adults.

Among participants in our study, three in four followed a healthy diet and one in two presented a BMI less than 25, making them the third and the fourth most frequent ideal metrics, respectively. In particular, daily consumption of a proper amount of fruits and vegetables represents the cornerstone of the so-called Mediterranean diet that is a rooted cultural feature of the Italian population, often associated to an adequate body weight and other CV outcomes.[20–22] On the contrary, the prevalence of an ideal body weight was quite low (20–35%) within the US samples, with a notable variability in the prevalence of healthy diet (5–40%). This finding reflects the already reported high prevalence of obesity in the USA compared with other Mediterranean countries, such as Italy, which could be ascribed to a lifestyle characterized by consumption of junk food, low intake of fruit and vegetables and inadequate physical activity.[23] Interestingly, two of the main and better codified CV risk factors, high blood pressure and high serum cholesterol, were the most prevalent among our population of Italian subjects. In fact, just one in three presented a serum cholesterol level lower than 200 mg/dl and just one in five presented a normal blood pressure. Although the prevalence of subjects with an ideal serum cholesterol level is about the same as that reported in US surveys, ideal blood pressure accounts for a higher variability, ranging from 15 to 44%.

Ethnic differences, bias in measurement procedure and white coat hypertension could explain such differences in the several samples.[24–26]

In our sample, age played an important role in the distribution of the ideal CV metrics within the study population. In fact, the prevalence of the three ideal CV behaviours—smoking abstinence, regular physical activity and healthy diet—was higher in older individuals. On the contrary, the prevalence of the four clinical ideal CV metrics—low cholesterol, diabetes absence, low blood pressure and normal body weight—was higher in younger individuals. Aging process is related to many changes in body composition and in glucose and lipid metabolism. It is also an independent risk factor for the development of hypertension, explaining, in this way, such findings.[27–29] Interestingly, those parameters are the same that describe the so-called metabolic syndrome, whose higher prevalence is well-known in older adults and is considered an independent CV risk factor.[30] Smoking cessation in older age is also a well-described event as well as the habit to follow a healthier diet compared with younger people.[31,32] Despite the fact that advanced age is linked to a higher prevalence of morbidity and disability, in our sample, older people declared a higher prevalence of regular physical activity compared with the younger people, with 6 in 10 practicing movement less than twice a week, underlining how diffuse sedentary lifestyle is in this subgroup. Such trends in CV metrics distribution are confirmed by the cluster analysis that shows how these parameters tend to aggregate in two different groups: on one hand, those characteristics that give rise to the metabolic syndrome and on the other hand, those parameters linked to habits and behaviours; exactly the same distribution delineated by age.

Some methodological issues should be taken into account in the interpretation of results. First, the random cholesterol and glucose determinations could lead to an overestimation of both parameters. Second, the cholesterol and glucose determinations have been obtained by capillary blood samples. Even though this procedure has been previously validated,[6] the standard error of this portable device is higher than the standard equipment. Furthermore, using only one reagent strip, we analysed the value of total cholesterol and no specific information on low- and high-density lipoprotein was available. Third, the chosen setting of shopping centres could lead to an overestimation of the blood pressure. Even though the blood pressure was measured according to recommendations from international guidelines, it is important to underline that the subjects who decided to participate in the study procedures were involved—before being assessed—in the usual shopping centre activities, such as carrying bags and eating.

Apart from these limitations, this national campaign of CV prevention ('Check your Cholesterol') offers a unique opportunity to investigate the prevalence of CV health metrics in the Italian population. As seen in other analyses, the prevalence of having all seven factors at ideal levels is <2%. Considering that the pattern of ideal CV health is usually lost during adolescence and young adulthood, through adoption of adverse health behaviours related to diet, weight and sedentary lifestyle, it is important that social and health initiatives will move the population closer to achieving the seven ideal CV metrics. A good start will be for each person to assess his or her own CV health, for example by the annual serum cholesterol blood check. The health care programmes of the developed countries can, and must, take this first step toward improving CV health. On the other hand, specific intervention will be needed for new public health and social policies to drive all the individuals of all ages toward healthier choices, so everyone can move from intermediate to ideal levels or maintain ideal CV health.

Conflicts of interest: None declared.

Key points

- The AHA identifies seven health behaviours and health factors: smoking, BMI, healthy diet, participation in physical activity, levels of blood pressure, blood glucose and total cholesterol.
- No data in Europe are available about the prevalence and distribution of the seven CV health metrics identified by the AHA.
- Our study for the first time provides data about the prevalence of the seven CV health metrics in a European country.
- Participants presented, on average, 4.1 ± 1.2 ideal CV health metrics; only 1.9% of the study population met all the seven ideal metrics.
- It is important for social and health initiatives to move the population closer toward achieving the seven ideal CV metrics.

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Time trends of cigarette and waterpipe smoking among a cohort of school children in Irbid, Jordan, 2008–11

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Background: Coordinated high-impact interventions and community-level changes in smoking behaviour norms effectively reduced prevalence of smoking among youth in many developed countries. Smoking trends among Jordanian adolescents are likely different than their Western counterparts and must be understood in the context of their daily lives to tailor interventions specifically for adolescents in this setting. **Methods:** Between 2008 and 2011, a school-based longitudinal study was conducted in Irbid, Jordan. All seventh-grade students in 19 randomly selected schools (of 60) were surveyed annually for 4 years. Outcomes of interest were time trends in smoking behaviour, age at initiation and change in frequency of smoking. **Results:** Among 1781 participants, baseline prevalence of current smoking (cigarettes or waterpipe) for boys was 22.9% and 8.7% for girls. Prevalence of ever-smoking and current any smoking, cigarette smoking, waterpipe smoking and dual cigarette/waterpipe smoking was significantly higher in boys than girls each year ($P<0.001$). Smoking prevalence increased every year after year 2 for current smoking ($P<0.05$) across all methods (any, cigarette, waterpipe and dual). At all time points for both boys and girls, prevalence of waterpipe smoking was higher than that of cigarette smoking ($P<0.001$). **Conclusion:** This study shows intensive smoking patterns at early ages among Jordanian youth in Irbid, characterized by a predominance of waterpipe smoking and steeper age-related increase in cigarette smoking. It also points to the possibility of waterpipe being the favourite method for introducing youth to tobacco, as well as being a vehicle for tobacco dependence and cigarette smoking.