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ORIGINAL ARTICLE

Population and methodology of the SIMETAP study: Prevalence of cardiovascular risk factors, cardiovascular diseases, and related metabolic diseases☆

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Abbreviations: ACR, albumin/creatinine ratio; ADA, American Diabetes Association; AHA, American Heart Association; AIP, atherogenic index of plasma; ALT, alanine aminotransferase; AST, aspartate aminotransferase; ATPIII, Adult Treatment Panel III; BMI, body mass index; CDA, Canadian Diabetes Association; CHD, coronary heart disease; CI, 95% confidence interval; CKD, chronic kidney disease; CKD-EPI, Chronic Kidney Disease Epidemiology Collaboration; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident or disease, stroke; CVD, cardiovascular disease; CVR, cardiovascular risk; CVRF, cardiovascular risk factors; DBP, diastolic blood pressure; DM, diabetes mellitus; eGFR, estimated glomerular filtration rate (CKD-EPI); FHpCVD, family history of premature CVD (in first-degree relative); FPG, fasting plasma glucose; GGT, gamma-glutamyl transferase; HbA1c, glycosylated haemoglobin A1c; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; HTG, hypertriglyceridaemia; HTN, hypertension; ICD-9, International Classification of Diseases; ICPC-2, International Classification of Primary Care; IDF, International Diabetes Federation; INE, Instituto Nacional de Estadística [Spanish Statistics Institute]; IQR, interquartile range; IR, insulin resistance; KDIGO, Kidney Disease: Improving Global Outcomes; MetSyn, metabolic syndrome; NCEP, National Cholesterol Education Program; NHLBI, National Heart, Lung, and Blood Institute; OR, odds-ratio; PAD, peripheral arterial disease; SBP, systolic blood pressure; SCORE, systematic coronary risk evaluation; SD, standard deviation; SERMAS, Servicio de Salud de la Comunidad de Madrid [Madrid Region Health Service]; TC, total cholesterol; TG, blood triglycerides* TyG index* TG and glucose index; UAE, urinary albumin excretion; VLDL-C, very low-density lipoprotein cholesterol; WHtR, waist-to-height ratio.

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KEYWORDS
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Abstract The prevention of cardiovascular disease is based on the detection and control of cardiovascular risk factors (CVRF). In Spain there are important geographical differences both in the prevalence and in the level of control of the CVRF. In the last decade there has been an improvement in the control of hypertension and dyslipidaemia, but a worsening of cardiometabolic risk factors related to obesity and diabetes.

The SIMETAP study is a cross-sectional descriptive, observational study being conducted in 64 Primary Care Centres located at the Community of Madrid. The main objective is to determine the prevalence rates of CVRF, cardiovascular diseases, and metabolic diseases related to cardiovascular risk. A report is presented on the baseline characteristics of the population, the study methodology, and the definitions of the parameters and diseases under study. A total of 6631 study subjects were selected using a population-based random sample. The anthropometric variables, lifestyles, blood pressure, biochemical parameters, and pharmacological treatments were determined.

The highest crude prevalences were detected in smoking, physical inactivity, obesity, prediabetes, diabetes, hypertension, dyslipidaemias, and metabolic syndrome. A detailed analysis needs to be performed on the prevalence rates, stratified by age groups, and prevalence rates adjusted for age and sex to assess the true epidemiological dimension of these CVRF and diseases.

PALABRAS CLAVE
Dislipidemia;
Enfermedad cardiovascular;
Factores de riesgo;
Prevalencia;
Síndrome metabólico

Población y metodología del estudio SIMETAP: Prevalencia de factores de riesgo cardiovascular, enfermedades cardiovasculares y enfermedades metabólicas relacionadas

Resumen La prevención de la enfermedad cardiovascular se fundamenta en la detección y control de los factores de riesgo cardiovascular (FRCV). En España existen importantes diferencias territoriales tanto en la prevalencia como en el grado de control de los FRCV. En la última década ha habido una mejora del control de la hipertensión y la dislipidemia, pero un empeoramiento de los factores de riesgo cardiometabólicos relacionados con la obesidad y la diabetes.

El estudio SIMETAP es un estudio observacional descriptivo transversal realizado en 64 centros de atención primaria de la Comunidad de Madrid. El objetivo principal es determinar las tasas de prevalencia de FRCV, de las enfermedades cardiovasculares y de las enfermedades metabólicas relacionadas con el riesgo cardiovascular. El presente artículo informa sobre las características basales de la población, la metodología del estudio, y las definiciones de los parámetros y enfermedades en estudio. Se seleccionaron 6.631 sujetos de estudio mediante una muestra aleatoria base poblacional. Se determinaron variables antropométricas, estilos de vida, presión arterial, parámetros bioquímicos, y tratamientos farmacológicos.

Las prevalencias crudas más elevadas se detectaron en tabaquismo, inactividad física, obesidad, prediabetes, diabetes, hipertensión, dislipidemias y síndrome metabólico. Para valorar la verdadera dimensión epidemiológica de estas enfermedades y FRCV, es necesario realizar un análisis pormenorizado de tasas de prevalencia estratificadas por grupos etarios y de las tasas de prevalencia ajustadas por edad y sexo.

Introduction

Atherosclerotic cardiovascular disease (CVD) can be considered the result of a pathogenic continuum involving an unhealthy lifestyle and multiple cardiovascular risk factors (CVRF). The clinical manifestations of CVD are the leading cause of death in the western world. It is therefore a priority that we implement high-impact healthcare interventions to reduce cardiovascular risk (CVR).

The Spanish adaptation[1] of the European Guidelines on cardiovascular disease prevention in clinical practice[2] recommend prior screening to assess CVR, promoting healthy lifestyles and intervening in CVRF and CVD-related syndromes and disorders with an intensity proportional to the pre-established CVR.

These considerations can also be applied in clinical conditions related to insulin resistance (IR) such as prediabetes, diabetes mellitus (DM), chronic kidney disease (CKD), familial combined hyperlipidaemia, metabolic syndrome (MetSyn) and obesity. The European guidelines[2,3] place great emphasis on the fact that patients with DM are at high or very high CVR, and the consensus of American endocrinology associations[4] considers CVR to be extreme if CVD is associated with DM or CKD.

Continued action of the most important CVRF, such as smoking, hypertension and hypercholesterolaemia, causes deterioration of the vascular endothelium, favouring the formation, oxidation and vulnerability of atherosclerotic plaque, until clinical manifestation of CVD in the form of coronary heart disease (CHD), stroke or cerebrovascular accidents (CVA), or peripheral arterial disease (PAD).

Patients with IR-related conditions have a particularly high CVR because they have a characteristic lipid profile which accelerates the atherosclerosis process known as atherogenic dyslipidaemia. This lipid phenotype is characterised by low levels of high-density lipoprotein cholesterol (HDL-c), hypertriglyceridaemia (HTG) and non-high levels of low-density lipoprotein cholesterol (LDL-C), although with a high concentration of LDL particles with apolipoprotein B, which are typically small and dense.[5] Given its importance in aetiopathogenic terms, we need to assess the different phenotypic expressions of lipid profiles and IR in patients suffering from clinical or metabolic manifestations of CVD or DM.

The concept of MetSyn[6] emerged almost 40 years ago to define a non-coincidental grouping of factors associated with IR observed in clinical practice: central obesity, dyslipidaemia, abnormalities in glucose metabolism and hypertension. MetSyn is of particular importance because it increases the risk of DM,[7,8] CVD,[8] and CKD.[9] MetSyn increases all-cause mortality rates and doubles the risk of suffering CVD.[8] Even if the most commonly used definitions of MetSyn[10–13] excluded DM from among the diagnostic criteria, the increased risk of suffering from CVD would be maintained.

Probably the best thing we can do is accept that MetSyn covers a group of individuals in whom some of the criteria may be absent, but who have a high CVR, and that this would not be detected if we did not consider the overall view. Hence the dual importance of MetSyn. On the one hand, it serves to alert the physician to look for other CVRF in patients with a particular cardiometabolic risk factor. While on the other, it can identify a large number of subjects with

high CVR who need intervention with both medical and public health strategies. The WHO experts[14] consider that the key action on MetSyn needs to focus on health policies based in primary healthcare.

However, studies on prevalence have encountered several conceptual issues. One is understanding that MetSyn is a cluster of factors which are associated with CVRF, CVD and the related morbidity of IR. Another is the fact that there are a number of definitions of MetSyn that include classic CVRF and other cardiometabolic risk factors which are considered differently depending on the scientific society.[10–13] Moreover, as the definitions of MetSyn do not currently appear in the episode coding of the International Classification of Primary Care (ICPC-2)[15] or in the International Classification of Diseases (ICD-9),[16] it is not easy to record an episode of MetSyn in the patient's medical records. Nor do the codes in the ICPC-2 (K22) or the ICD-9 (277.7; 277.9) specifically refer to any of the existing definitions of MetSyn. This causes difficulties in terms of detecting MetSyn, assessing the patient's overall CVR, and comprehensive intervention on all cardiovascular and cardiometabolic risk factors related to MetSyn.

CVD prevention requires prior assessment of the epidemiology of all the factors that can influence the problem to be evaluated. In turn, to make an adequate health diagnosis, we need to know the prevalence in all age groups of the study population. Following this strategy of action, the aim of the SIMETAP study was to determine the prevalence rates, adjusted for age and gender, of CVRF, CKD, CVD and CVD-related metabolic diseases in the adult population of the Madrid Region.

Material and methods

Study design and population

The SIMETAP study was an observational, descriptive, cross-sectional study conducted by 121 general practitioners from 64 primary care centres run by the Public Health Service for the Madrid Region (SERMAS). The study was carried out according to the principles established by the 18th World Medical Assembly (Helsinki, 1964) and its amendments, and by the International Conference on Harmonization and guidelines for good clinical practice. The Research Commission of the Madrid Region Primary Care Management Department for Planning and Quality issued a favourable opinion for the study to be conducted.

The population assigned to SERMAS was 5,144,860 adults (99% of the population census), whose healthcare was provided in 260 primary care centres. A representative sample (10,579 adults) was obtained based on the population assigned to general practitioners aged 18 or over, with no upper age limit (194,073 adults). The sample size was calculated with this finite population for a confidence level of 95% (α error), 0.024 for the confidence interval (margin of error of 1.2%), $p = 0.5$ for the expected proportion, and considering 25% for lack of response and 14% for losses and dropouts.

To obtain the sample population, we used tables of random numbers generated by the Microsoft© Excel© 2013 program. These were applied to randomly sort the lists of patients assigned to general practitioners and to select the subjects for the study.

Institutionalised and terminally ill patients, pregnant women and patients with cognitive impairment were excluded from the study as per protocol. Through an active search of the subjects in the resulting sample, the investigators made up to five telephone calls to contact them and invite them to take part in the study.

Data collection

After obtaining the signed consent, the investigators conducted a clinical interview with the study subjects to gather information on age, gender, healthy lifestyles, anthropometric measurements, systolic and diastolic blood pressure, CVRF, history of metabolic disorders, chronic obstructive pulmonary disease, cardiovascular disease (CHD, stroke, PAD, heart failure, atrial fibrillation), erectile dysfunction, CKD, albuminuria, drug treatments and most recent biochemical parameters determined from blood and urine tests over the previous year. The investigators collected the study data from January to December 2015. Double entry of data guaranteed registration in the database.

Definition of variables

For the purposes of this study, patients were considered to suffer from the syndromes and diseases under study if their respective diagnoses or their related ICPC-2[15] or ICD-9[16] codes were registered in their medical records, considering the following definitions and diagnostic criteria:

Smoking: Consumption of any number of cigarettes or tobacco in the last month.

Former smoker: Patient who has not smoked for over a year.

Alcoholism: Regular consumption of alcohol >21 units (210 g) per week in males and >14 units (140 g) per week in females.

Lack of physical exercise: Less than 150 min physical exercise in one week.

High blood pressure (ICPC-2: K85): Systolic blood pressure $\geq$130 mmHg and/or diastolic blood pressure $\geq$85 mmHg without a diagnosis of hypertension.[17]

Hypertension (ICPC-2: K86, K87. ICD-9: 401–404): Systolic blood pressure $\geq$140 mmHg and/or diastolic blood pressure $\geq$90 mmHg,[17] or if the patient was taking medication to reduce blood pressure.

Marked hypertension: Blood pressure $\geq$180/110 mmHg.

Prediabetes (ADA: American Diabetes Association)[18] (ICPC-2: A91. ICD-9: 271.3): Without criteria for DM, fasting plasma glucose (FPG) from 100 mg/dl (5.6 mmol/l) to 125 mg/dl (6.9 mmol/l) both inclusive, or glycosylated haemoglobin A_{1c} (HbA_{1c}) from 5.7% (39 mmol/mol) to 6.4% (47 mmol/mol), both inclusive.

Prediabetes (CDA: Canadian Diabetes Association)[19] (ICPC-2: A91. ICD-9: 271.3): Without criteria for DM, FPG from 110 mg/dl (6.1 mmol/l) to 125 mg/dl (6.9 mmol/l) both inclusive, or HbA_{1c} from 6% (42 mmol/mol) to 6.4% (47 mmol/mol), both inclusive.

DM Type 1 (ICPC-2: T89. ICD-9: 250.01). ADA[18] or CDA[19] criteria.

DM Type 2 (ICPC-2: T90. ICD-9: 249; 250.02): ADA[18] or CDA[19] criteria. FPG ≥126 mg/dl (7 mmol/l) or HbA_{1c} ≥6.5% (48 mmol/mol).

Hypercholesterolaemia (ICPC-2: T93. ICD-9: 272.0; 272.2; 272.4): Serum total cholesterol (TC) ≥200 mg/dl (5.17 mmol/l), or if the patient was taking medication to reduce their cholesterol.

Marked hypercholesterolaemia: Serum TC ≥300 mg/dl (7.76 mmol/l), or LDL-C ≥190 mg/dl (4.91 mmol/l), or if the diagnosis of familial hypercholesterolaemia or familial combined hyperlipidaemia was registered in the patient's medical records.

HTG[10] (ICD-9: 272.1; 272.3): Serum triglycerides (TG) ≥150 mg/dl (1.69 mmol/l), or if the patient was taking medication to reduce their TG.

High HDL-C: Serum HDL-C ≥60 mg/dl (1.55 mmol/l).

Low HDL-C: Serum HDL-C < 40 mg/dl (1.03 mmol/l) in males or < 45 mg/dl (1.16 mmol/l) in females.[5] HDL-C < 50 mg/dl (1.29 mmol/l) was also considered in females.[10–13] Non-HDL cholesterol: Difference between serum TC and HDL-C.

LDL-C: Determined with the Friedewald formula (LDL-C = TC - [HDL-C] - TG/5) if TG were < 400 mg/dl (<4.52 mmol/l).[20]

Very low-density lipoprotein cholesterol: TC − (HDL-C) − (LDL-C).

Atherogenic dyslipidaemia[5]: HTG with low HDL-C.

Castelli index-I[21]: TC/HDL-C.

Castelli index-II[21]: LDL-C/HDL-C

Atherogenic non-HDL cholesterol/HDL-C coefficient.

TG/HDL-C ratio.

Atherogenic index of plasma[22]: log (TG/HDL-C).

TG and glucose index[23]: Ln [TG (mg/dl) × FPG (mg/dl)/2]

Overweight[24] (ICPC-2: T83. ICD-9: 278.02): body mass index (BMI) from 25.0 to 29.9 kg/m^2.

Obesity[24] (ICPC-2: T82; ICD-9: 278.00; 278.01): BMI (weight/height^2) ≥30 kg/m^2.

Abdominal or central obesity: Waist circumference ≥102 cm in males or ≥88 cm in females,[13] and ≥94 cm in males and ≥80 cm in females,[12] measured with the subject in a standing position using a flexible tape measure tightened without compressing the skin, at the end of a normal expiration, locating the upper edge of the iliac crests and, above that point, surrounding the waist parallel to the floor.[24]

Waist-to-height ratio[25] (WHtR): Waist circumference/height (cm/cm).

Hypothyroidism (ICPC-2: T86; ICD-9: 244.9) on replacement therapy.

Hepatic steatosis (ICD-9: 571.8) registered in medical records.

CHD (ICPC-2: K74, K75, K76. ICD-9: 410–414): Includes ischaemic heart disease, prior acute myocardial infarction, acute coronary syndromes, coronary artery bypass and other arterial revascularisation procedures.

CVA (ICPC-2: K89, K90; K91. ICD-9: 430; 431–436): It includes cerebrovascular accident, cerebral ischaemia or intracranial haemorrhages and transient ischaemic attack.

PAD (ICPC-2: K92. ICD-9: 440; 443.9; 444): Also includes intermittent claudication and an ankle/brachial index ≤0.9.

CVD: Includes CHD, CVA and PAD.

Heart failure (ICPC-2: K77. ICD-9: 428).

Atrial fibrillation (ICPC-2: K78. ICD-9: 427.3).

MetSyn (ICPC-2: K22. ICD-9: 277.7; 277.9): Three concepts were considered: The National Cholesterol Education Program-Adult Treatment Panel III[10] definition (NCEP-ATPIII), maintained by the National Heart, Lung, and Blood Institute/American Heart Association[11] (NHLBI/AHA); the definition of the International Diabetes Federation (IDF) for the European population[12]; and the harmonised consensus[13] definition of MetSyn for the European population

Table 1 Definitions of metabolic syndrome for the European population.

	NCEP-ATPIII 2001 NHLBI/AHA 2004	IDF 2005	2009 Consensus
Factors required	At least 3 factors	At least 3 factors including central obesity	At least 3 factors
Central obesity (waist circumference)	Males: >102 cm Females: >88 cm	Males: ≥94 cm Females: ≥80 cm	Males: ≥102 cm Females: ≥88 cm
Fasting blood glucose	≥110 mg/dl (≥6.1 mmol/l)	≥100 mg/dl (≥5.6 mmol/l) or previous diagnosis of type 2 diabetes	≥100 mg/dl (≥5.6 mmol/l) or lipid-lowering treatment
Triglycerides	≥150 mg/dl (≥1.7 mmol/l)	≥150 mg/dl (≥1.7 mmol/l) or specific treatment	
HDL Cholesterol	Males: <40 mg/dl (<1.03 mmol/l) Females: <50 mg/dl (<1.29 mmol/l)	Males: <40 mg/dl (<1.03 mmol/l) Females: <50 mg/dl (<1.29 mmol/l) or specific treatment	
Blood pressure	Systolic ≥130 mmHg or diastolic ≥ 85 mmHg	Systolic ≥130 mmHg or diastolic ≥85 mmHg or anti-hypertensive treatment	

IDF: International Diabetes Federation; NCEP-ATPIII: National Cholesterol Education Program-Adult Treatment Panel III; NHLBI/AHA: National Heart, Lung, and Blood Institute/American Heart Association.

established by the following scientific societies: IDF, Task Force on Epidemiology and Prevention; NHLBI; AHA; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity (Table 1).

Morbid MetSyn: MetSyn with DM or CVD.

Premorbid MetSyn: MetSyn without DM or CVD.

Chronic obstructive pulmonary disease (ICPC-2: R95. ICD-9: 491.2; 492; 496): Criteria of the GOLD guidelines.[26]

Urinary albumin excretion and albumin/creatinine ratio (ICPC-2: U90; U98. ICD-9: 593.6; 791): Criteria of the KDIGO guidelines.[27]

Albuminuria: albumin/creatinine ratio $\geq$30 mg/g.

Estimated glomerular filtration rate (eGFR): The following Chronic Kidney Disease Epidemiology collaboration (CKD-EPI)[28] equations were used, expressed in ml/min/1.73 m^2: Females with creatinine $\leq$0.7 mg/dl = $144 \times (\text{creatinine})^{-0.329} \times (0.993)^{\text{age}}$; females with creatinine > 0.7 mg/dl = $144 \times (\text{creatinine})^{-1.209} \times (0.993)^{\text{age}}$; males with creatinine $\leq$0.9 mg/dl = $141 \times (\text{creatinine})^{-0.411} \times (0.993)^{\text{age}}$; males with creatinine > 0.9 mg/dl = $141 \times (\text{creatinine})^{-1.209} \times (0.993)^{\text{age}}$.

CKD (ICPC-2: U99. ICD-9: 585): eGFR < 60 ml/min/1.73 m^2 or albumin/creatinine ratio $\geq$30 mg/g (KDIGO).[27]

Erectile dysfunction: Inability to get and maintain an erection that is sufficient for satisfactory sexual intercourse.[29]

CVRF: Risk factor that predicts the likelihood of developing a CVD: Age (>55 in males; > 65 in females), hypertension, hypercholesterolaemia, smoking.

Very high CVRF: Marked hypercholesterolaemia or marked hypertension.

CVR modifier: Factor with possible potential for CVR reclassification when the SCORE (systematic coronary risk evaluation)[2] score is close to the decision threshold. Lack of physical exercise, a history of premature CVD (males < 55 or females < 65) in a first-degree relative, low HDL-C, obesity.

CVR: Risk of death due to cardiovascular disease at 10 years. For the population aged 40 to 65, the CVR categories were assigned using the SCORE system[2] for low-risk European countries. Low CVR: Population aged < 40 without two or more CVRF; SCORE = 0%. Moderate CVR: Population aged < 40 with two or more CVRF; DM < 40; MetSyn; SCORE 1–4%. High CVR: Very high CVRF; DM without CVRF; moderate CKD (eGFR 30–59 ml/min/1.73 m^2); SCORE 5–9%. Very high CVR: Clinical CVD or CVD documented by imaging; DM with target organ damage or with CVRF; severe CKD (eGFR < 30 ml/min/1.73 m^2); SCORE $\geq$10%. Extreme CVR[4]: CVD associated with DM or CKD. The assigning of CVR in the population aged > 65 was determined with the SCORE OP criteria.[30]

Statistical analysis

Statistical analysis was carried out using the Statistical Package for the Social Sciences program (IBM® SPSS® Statistical release 20.0, Armonk, NY, United States). We determined the range, median and interquartile range (IQR) (25th percentile, 75th percentile) of the age variable. The mean and the standard deviation ($\pm$SD) were determined for the descriptive statistical analysis. Quantitative variables were compared using the two-tailed Levene's and Student's *t* tests for two variables or the one-way ANOVA for more than two variables. The variables analysed had normal distribution (skewness and kurtosis between −2 and +2). The qualitative variables were analysed by prevalence rates and percentages in each category, presented with lower and upper limits of the 95% confidence interval (CI). The inferential analysis of the qualitative data was performed with the Chi-square test, and of the quantitative data with Fisher's test. The odds ratios were determined with a 95% CI. All tests were considered statistically significant if the odds ratio estimates were greater than 1 or the 2-tail *p* value was less than 0.05. The prevalence rates were determined as gross rates and adjusted for age and gender. The adjustment of rates was carried out using the direct method[31] using as standard populations the distributions by five-year and ten-year age brackets of the male and female populations of Madrid Region and Spain; information obtained from the database of the *Instituto Nacional de Estadística*[32] [Spanish National Institute of Statistics] in January 2015.

Results

The population aged over 18 of the Madrid Region and Spain was 5,196,828 and 38,102,546, respectively. The distribution by five-year age segments of the study and reference populations are shown in Table 2. The distribution of the ethnic origin of the inhabitants of the Madrid Region was as follows[32]: Spanish (88.9%); other European (4.9%); Central and South American (3.4%); North American (0.2%); African (1.5%); Asian (1.1%); and Oceanian (0.01%).

Of the initial sample, 7.6% refused to take part in the study or did not sign the informed consent form, 13.8% of the subjects had personal data errors or could not be contacted after an active search, and 4.7% met exclusion criteria. We also excluded 7.1% of the study subjects for whom there was no clinical data or whose medical records lacked relevant clinical information. The response rate was 74%. Losses, dropouts or study subjects who did not attend the clinical interview amounted to 4.2% (Fig. 1).

The study population consisted of 6631 subjects, 44.25% of them male (CI: 43.05; 45.45) (Table 1). The mean age ($\pm$SD) of the study population was 55.03 ($\pm$17.54 years), the median age was 54.56, and the range (IQR) was from 18.01 to 102.80 (41.55, 67.98).

The mean age ($\pm$SD) of the male population was 55.06 ($\pm$16.90 years), the median was 54.75, and the range (IQR) from 18.01 to 102.12 (42.01; 67.35). The mean age ($\pm$SD) of the female population was 55.01 ($\pm$18.04 years), the median was 54.36, and the range (IQR) from 18.01 to 102.80 (40.94; 68.77). The difference in the mean ages (0.05 [CI: −0.80, 0.90] years) between the male and female populations was not significant ($p = 0.908$).

The means ($\pm$SD) of the anthropometric, blood pressure and biochemical variables of the study population and the significance of the differences between the male and female populations are shown in Table 3. The means of the highest parameters were: overweight (BMI: 27.5 kg/m^2), waist circumference (97.9 cm in men and 89.7 cm in women), WHtR (0.57), and HbA_{1c} (5.6%). All the parameters mentioned were significantly higher in the male population, except for eGFR,

Table 2 Age distribution of the study and reference populations.

	Male population *N* (%)			Female population *N* (%)		
Age (years)	Spain	Madrid Region	Study subjects	Spain	Madrid Region	Study subjects
18–24	1,621,285 (9)	212,006 (9)	103 (4)	1,553,370 (8)	209,934 (8)	154 (4)
25–29	1,321,886 (7)	181,252 (7)	124 (4)	1,318,453 (7)	189,349 (7)	188 (5)
30–34	1,642,803 (9)	233,340 (9)	147 (5)	1,627,061 (8)	241,791 (9)	217 (6)
35–39	2,011,297 (11)	288,141 (12)	241 (8)	1,938,493 (10)	292,360 (11)	302 (8)
40–44	1,982,454 (11)	281,920 (11)	266 (9)	1,907,214 (10)	286,175 (10)	342 (9)
45–49	1,861,331 (10)	253,561 (10)	295 (10)	1,829,678 (9)	263,036 (10)	334 (9)
50–54	1,698,889 (9)	221,702 (9)	307 (10)	1,710,108 (9)	238,303 (9)	349 (9)
55–59	1,467,132 (8)	185,035 (8)	284 (10)	1,511,242 (8)	207,951 (8)	316 (9)
60–64	1,219,621 (7)	151,984 (6)	270 (9)	1,288,216 (7)	176,697 (6)	341 (9)
65–69	1,120,627 (6)	140,455 (6)	297 (10)	1,236,887 (6)	168,286 (6)	292 (8)
70–74	902,510 (5)	112,073 (5)	204 (7)	1,046,518 (5)	138,030 (5)	257 (7)
75–79	673,645 (4)	78,652 (3)	156 (5)	879,421 (4)	109,891 (4)	223 (6)
80–84	573,317 (3)	65,954 (3)	141 (5)	852,248 (4)	104,151 (4)	223 (6)
85–89	301,428 (2)	35,055 (1)	73 (2)	553,996 (3)	70,373 (3)	113 (3)
90–94	105,675 (1)	12,553 (1)	22 (1)	251,486 (1)	33,786 (1)	38 (1)
95–102	22,029 (0.1)	2696 (0.1)	4 (0.1)	72,226 (0.4)	10,336 (0.4)	8 (0.2)

N: population sizes; (%): percentage of the total.

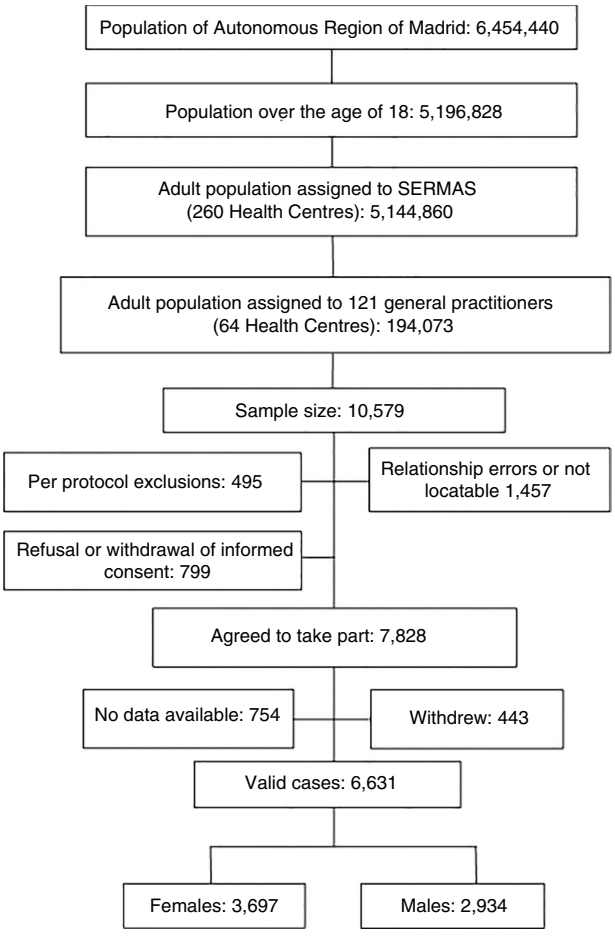

Figure 1 Diagram showing the sampling process for the SIMETAP study.

TC, LDL-C and HDL-C, which were significantly higher in the female population.

The crude prevalence rates of the qualitative characteristics and morbidity of the study population and the significance of the differences between the male and female populations are shown in Table 4. The highest overall crude prevalence rates were: smoking (22%); physical inactivity (47%); overweight (38%); obesity (28%); abdominal obesity (65%); WHtR $\geq$0.55 (56%); prediabetes (22%); DM (16%); hypertension (38%); hypercholesterolaemia (61%); HTG (29%); atherogenic dyslipidaemia (14%); MetSyn (43%); and premorbid MetSyn (25%). There were no differences in crude prevalence rates between male and female populations in the following CVRF and disorders: history of premature CVD in first-degree relative; obesity; type 1 DM; hypercholesterolaemia; premorbid MetSyn; heart failure; atrial fibrillation; and CKD. The rest of the crude prevalence rates were significantly higher in the male population, except for physical inactivity, abdominal obesity, hypothyroidism and HDL-C $\geq$60 mg/dl, which were significantly higher in the female population.

Discussion

CVD caused 119,778 deaths in 2016 and was the leading cause of death (30%) in the Spanish population.[33] Cardiovascular mortality has been reduced in recent years thanks to intervention on CVRF such as smoking, hypertension and hypercholesterolaemia. However, the intervention has not had such positive effects[34] on eating habits, physical inactivity, obesity and DM. The preliminary information provided in this article describes the epidemiological situation of a population with a sustained high prevalence of lifestyle-related CVRF and metabolism-related morbidity. The study population had quantitative anthropometric and metabolic characteristics that predispose to the diagnosis of MetSyn. The mean BMI indicated grade II overweight or obesity; waist

Table 3 Quantitative characteristics[a] of the study population.

	n	Study population	Male population	Female population	*p* value
Weight (kg)	6631	74.2 (15.6)	81.7 (14.5)	68.2 (13.8)	<0.001
Height (cm)	6631	164.2 (9.8)	171.1 (7.8)	158.8 (7.4)	<0.001
BMI (kg/m^2)	6631	27.5 (5.1)	27.9 (4.5)	27.1 (5.6)	<0.001
Waist circumference (cm)	6631	93.3 (14.1)	97.9 (12.6)	89.7 (14.1)	<0.001
WHtR (cm/cm)	6631	0.57 (0.09)	0.57 (0.08)	0.57 (0.10)	0.002
FPG (mg/dl)	6506	96.1 (26.1)	99.9 (28.7)	93.2 (23.4)	<0.001
HbA_{1c} (%)	5201	5.64 (0.90)	5.71 (0.94)	5.58 (0.86)	<0.001
SBP (mmHg)	6631	121.9 (15.4)	124.0 (14.1)	120.2 (16.2)	<0.001
DBP (mmHg)	6631	73.3 (9.8)	74.9 (9.4)	72.1 (9.9)	<0.001
Creatinine (mg/dl)	6506	0.84 (0.29)	0.96 (0.30)	0.75 (0.26)	<0.001
eGFR (ml/min/1.73 m^2)	6506	90.5 (20.6)	89.8 (19.8)	91.1 (21.1)	0.014
UAE (mg/dl)	4402	15.1 (65.4)	19.6 (81.8)	11.5 (47.7)	<0.001
ACR (mg/g)	4402	16.0 (74.6)	19.6 (92.0)	13.0 (56.3)	<0.001
Uric acid (mg/dl)	6088	4.96 (1.49)	5.68 (1.44)	4.39 (1.26)	<0.001
AST (U/l)	4749	23.1 (43.5)	25.7 (47.4)	22.0 (40.0)	<0.001
ALT (U/l)	6330	24.9 (17.0)	29.2 (19.2)	21.5 (14.0)	<0.001
GGT (U/l)	6001	33.4 (51.0)	42.3 (65.3)	26.5 (34.5)	<0.001
TC (mg/dl)	6496	192.7 (39.4)	188.1 (39.0)	196.3 (39.2)	<0.001
HDL-C (mg/dl)	6496	54.8 (14.7)	49.2 (12.6)	59.2 (14.7)	<0.001
Non-HDL-C (mg/dl)	6496	137.9 (38.5)	138.9 (38.8)	137.1 (38.2)	0.618
LDL-C (mg/dl)	6434	114.1 (34.5)	112.4 (34.4)	115.4 (34.6)	<0.01
VLDL-C (mg/dl)	6434	23.2 (12.2)	25.5 (13.2)	21.3 (11.0)	<0.001
TG (mg/dl)	6496	120.6 (83.4)	135.8 (100.9)	108.7 (64.1)	<0.001
TC/HDL-C	6496	3.72 (1.13)	4.03 (1.23)	3.47 (0.98)	<0.001
Non-HDL-C/HDL-C	6496	2.72 (1.13)	3.03 (1.23)	2.47 (0.98)	<0.001
TG/HDL-C	6496	2.53 (2.53)	3.13 (3.24)	2.06 (1.70)	<0.001
LDL-C/HDL-C	6434	2.21 (0.88)	2.41 (0.96)	2.06 (0.79)	<0.001
AIP	6496	-0.07 (0.29)	0.03 (0.29)	-0.14 (0.27)	<0.001
TyG index	6496	8.49 (0.61)	8.64 (0.61)	8.38 (0.58)	<0.001

ACR: albumin/creatinine ratio; AIP: atherogenic index of plasma; ALT: alanine aminotransferase; AST: aspartate aminotransferase; BMI: body mass index (weight/height^2); DBP: diastolic blood pressure; eGFR: estimated glomerular filtration rate according to CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration); FPG: fasting plasma glucose; GGT: gamma-glutamyl transferase; HbA_{1c}: glycosylated haemoglobin A_{1c}; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; n: number of cases; *p* value: of the difference in means between the male and female populations; SBP: systolic blood pressure; TC: total blood cholesterol; TG: blood triglycerides; TyG: TG and glucose index; UAE: urinary albumin excretion; VLDL-C: very low-density lipoprotein cholesterol; WHtR: waist-to-height ratio.

[a] Mean (±standard deviation).

Table 4 Qualitative characteristics[a] of the study population.

	Study population *n* = 6631	Male population *n* = 2934	Female population *n* = 3697	*p* value
Smoking	1431 (21.6)	756 (25.8)	675 (18.3)	<0.001
COPD	246 (3.7)	182 (6.2)	64 (1.7)	<0.001
Alcoholism	610 (9.2)	503 (17.1)	107 (2.9)	<0.001
Lack of physical exercise	3092 (46.6)	1259 (42.9)	1833 (49.6)	<0.001
Normal weight	2152 (32.5)	771 (26.3)	1381 (37.4)	<0.001
Overweight	2530 (38.2)	1307 (44.5)	1223 (33.1)	<0.001
Obesity	1835 (27.7)	834 (28.4)	1001 (27.1)	0.224
Central obesity	2928 (44.2)	1106 (37.7)	1822 (49.3)	<0.001
Central obesity (IDF)	4329 (65.3)	1744 (59.4)	2585 (69.9)	<0.001
WHtR ≥0.55	3705 (55.9)	1785 (60.8)	1920 (51.9)	<0.001
Prediabetes (CDA)	519 (7.8)	252 (8.6)	267 (7.2)	0.043
Prediabetes (ADA)	1447 (21.8)	701 (23.9)	746 (20.2)	<0.001
DM	1033 (15.6)	568 (19.4)	465 (12.6)	<0.001
DM Type 1	58 (0.9)	30 (1.0)	28 (0.8)	0.288
DM Type 2	975 (14.7)	538 (18.3)	437 (11.8)	<0.001

Table 4 (*Continued*)

	Study population $n = 6631$	Male population $n = 2934$	Female population $n = 3697$	p value
Hypertension	2548 (38.4)	1223 (41.7)	1325 (35.8)	<0.001
Hypercholesterolaemia	4063 (61.3)	1800 (61.3)	2263 (61.2)	0.919
HDL-C <40/45 mg/dl	1346 (20.3)	839 (28.6)	507 (13.7)	<0.001
HDL-C <40/50 mg/dl	1808 (27.3)	839 (28.6)	969 (26.2)	0.030
HDL-C ≥60 mg/dl	2174 (32.8)	541 (18.4)	1633 (44.2)	<0.001
Hypertriglyceridaemia	1936 (29.2)	1063 (36.2)	873 (23.6)	<0.001
Atherogenic dyslipidaemia (45)	764 (11.5)	508 (17.3)	256 (6.9)	<0.001
Atherogenic dyslipidaemia (50)	934 (14.1)	508 (17.3)	426 (11.5)	<0.001
Premorbid MetSyn (AHA)	1412 (20.6)	623 (21.2)	789 (21.3)	0.928
MetSyn (AHA)	2618 (39.5)	1279 (43.6)	1339 (36.2)	<0.001
Premorbid MetSyn (IDF)	1650 (24.9)	724 (24.7)	926 (25.0)	0.732
MetSyn (IDF)	2623 (41.0)	1266 (43.1)	1456 (39.4)	0.002
Premorbid MetSyn[b]	1629 (24.6)	728 (24.8)	901 (24.4)	0.688
MetSyn[b]	2847 (42.9)	1392 (47.4)	1455 (39.4)	<0.001
Hypothyroidism	648 (9.8)	102 (3.5)	546 (14.8)	<0.001
Hepatic steatosis	580 (8.7)	384 (13.1)	196 (5.3)	<0.001
Coronary heart disease	319 (4.8)	210 (7.2)	109 (2.9)	<0.001
CVA	250 (3.8)	128 (4.4)	122 (3.3)	0.027
PAD	150 (2.3)	94 (3.2)	56 (1.5)	<0.001
CVD	613 (9.2)	369 (12.6)	244 (6.6)	<0.001
DM or CVD	1407 (21.2)	784 (26.7)	623 (16.9)	<0.001
FHpCVD	387 (5.8)	169 (5.8)	218 (5.9)	0.833
Heart failure	183 (2.8)	80 (2.7)	103 (2.8)	0.940
Atrial fibrillation	247 (3.7)	108 (3.7)	139 (3.8)	0.896
UAE ≥30 mg/dl ($n = 4402$)	347 (7.9)	198 (10.0)	149 (6.2)	<0.001
ACR ≥30 mg/g ($n = 4402$)	369 (8.4)	206 (10.4)	163 (6.8)	<0.001
eGFR < 60 ml/min/1.73 m^2 ($n = 6506$)	522 (8.0)	215 (7.5)	307 (8.4)	0.183
CKD ($n = 6506$)	748 (11.5)	335 (11.7)	413 (11.3)	0.667
Low CVR	2186 (33.0)	728 (24.8)	1458 (39.4)	<0.001
Moderate CVR	1395 (21.0)	624 (21.9)	753 (20.4)	0.133
High CVR	1010 (15.2)	480 (16.4)	530 (14.3)	0.023
Very high CVR	1694 (25.5)	890 (30.3)	804 (21.7)	<0.001
Extreme CVR	346 (5.2)	194 (6.6)	152 (4.1)	<0.001

ACR: albumin-creatinine ratio; ADA: American Diabetes Association; AHA: American Heart Association; ATPIII: Adult Treatment Panel III; BMI: body mass index (weight/height^2); CDA: Canadian Diabetes Association; CKD: chronic kidney disease; COPD: chronic obstructive pulmonary disease; CVA: cerebrovascular accident or stroke; CVD: cardiovascular disease; CVR: cardiovascular risk; DM: diabetes mellitus; eGFR: glomerular filtration rate estimated according to CKD-EPI (Chronic Kidney Disease Epidemiology collaboration); FHpCVD: Family history of premature CVD (in a first-degree relative); HDL-C: high-density lipoprotein cholesterol; IDF: International Diabetes Federation; MetSyn: metabolic syndrome; NCEP-ATPIII: National Cholesterol Education Program-Adult Treatment Panel III; NHLBI: National Heart, Lung, and Blood Institute; p value: of the difference in means between the male and female populations; PAD: peripheral arterial disease; UAE: urinary albumin excretion; WHtR: waist-to-height ratio.

Normal weight[24]: BMI from 18.5 to 24.9 kg/m^2. Overweight[24]: BMI from 25.0 to 29.9 kg/m^2. Obesity[24]: BMI ≥30 kg/m^2. Central obesity[13]: Waist circumference ≥102 cm (males) or ≥88 cm (females). Central obesity (IDF)[12]: ≥94 cm (males) or ≥80 cm (females). Prediabetes (CDA)[19]: blood glucose from 110 to 125 mg/dl, or HbA_{1c} from 6% to 6.4%. Prediabetes (ADA)18: blood glucose from 100 to 125 mg/dl, or HbA_{1c} from 5.7% to 6.4%. HDL-C < 40/45: high-density lipoprotein cholesterol < 40 mg/dl (males) or < 45 mg/dl (females). HDL-C < 40/50: idem < 50 mg/dl (females). Atherogenic dyslipidaemia (45): hypertriglyceridaemia and HDL-C < 45 mg/dl (females). Atherogenic dyslipidaemia (50): hypertriglyceridaemia and HDL-C < 50 mg/dl (females). MetSyn (AHA)[10,11]: metabolic syndrome according to NCEP-ATPIII/NHLBI/AHA. MetSyn (IDF)[12]: Metabolic syndrome according to IDF. eGFR: glomerular filtration rate estimated according to CKD-EPI.[28]

[a] No. cases (%).

[b] Metabolic syndrome harmonised consensus criteria 2009.[13]

circumferences exceeded the limits established by the IDF,[12] and the HbA_{1c} was on the border of the lower limit for prediabetes according to the IDF.[12] However, the population averages showed good control of blood pressure, eGFR, FPG and lipid profile.

The highest overall crude prevalence rates were cardiometabolic CVRF: smoking, physical inactivity, overweight, obesity, abdominal obesity, increased WHtR, prediabetes, DM, hypertension, hypercholesterolaemia, HTG, atherogenic dyslipidaemia, MetSyn and premorbid

MetSyn. The high prevalence of cardiometabolic CVRF suggests that 21% of the population could go on to suffer from CVD or DM, with 31% having very high or extreme CVR.

However, to assess the true epidemiological magnitude and to compare prevalence rates between different populations, it is important to bear in mind that both age and gender are factors directly related to CVRF, CVD and cardiometabolic morbidity. We therefore need to analyse not only the crude prevalence rates, but also the specific prevalence rates stratified by age groups, and the overall prevalence rates adjusted for age and gender.

In Spain, there are large regional differences in both the prevalence and the degree of control of CVRF.[35] Population prevention strategies have been shown to be highly beneficial,[1] and it is therefore essential to make a population health diagnosis that includes all the factors related to cardiovascular pathology.

The aim of the SIMETAP study was to provide an update on the epidemiological dimension of CVRF, CVD, MetSyn and associated metabolic morbidity. Our intention was that this update should facilitate comparison between different populations, stimulate health intervention and encourage health authorities to intensify population prevention strategies by more efficiently applying available resources. This article is the preamble to further more detailed analyses of prevalence rates both by stratified age groups and adjusted for age and gender with reference populations from the Madrid Region and from Spain.

Conclusions

This study found population averages of good control of blood pressure, eGFR, FPG and lipid profile. However, the anthropometric characteristics of the population, which are overweight, central obesity (according to IDF criteria), and a mean HbA_{1c} of 5.6%, suggest a tendency towards the diagnosis of prediabetes or MetSyn.

The highest overall crude prevalence rates were recorded in inadequate lifestyles (smoking, physical inactivity, obesity) and cardiometabolic morbidity (prediabetes, DM, hypertension, dyslipidaemia and MetSyn). This could signify that a large percentage of the population has high or very high CVR.

To determine the true epidemiological dimension and be able to compare populations, we need to analyse prevalence rates stratified by age groups and adjusted for age and gender.

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Conflicts of interest

For this study, the authors declare that there was no interference in the attaining or interpretation of the results and that they therefore have no conflicts of interest.

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References

1. Royo Bordonada MÁ, Armario García P, Lobos Bejarano JM, Pedro-Botet Montoya PJ, Villar Álvarez F, Elosua R, et al. Adaptación española de las guías europeas de 2016 sobre prevención de la enfermedad cardiovascular en la práctica clínica. Clin Investig Arterioscler. 2017;29:69–85.

2. Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts). Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016;37:2315–81.
3. Catapano AL, Graham I, de Backer G, Wiklund O, Chapman MJ, Drexel H, et al. Guía ESC/EAS 2016 sobre el tratamiento de las dislipemias. Rev Esp Cardiol. 2017;70, 115.e1–1160.ee64.
4. Garber AJ, Abrahamson MJ, Barzilay JI, Blonde L, Bloomgarden ZT, Bush MA, et al. Consensus statement by the American Association of Clinical Endocrinologists and American College of Endocrinology on the comprehensive type 2 diabetes management algorithm – 2017 Executive summary. Endocr Pract. 2017;23:207–38.
5. Ascaso JF, Millán J, Hernández-Mijares A, Blasco M, Brea A, Díaz A, et al. Documento de consenso sobre el manejo de la dislipemia aterogénica de la Sociedad Española de Arteriosclerosis. Clin Investig Arterioscler. 2017;29:86–91.
6. Hanefeld M, Leonhardt W. Das metabolische Syndrom. DT Gesundh Wesen. 1981;36:545–51.
7. Ford ES. Risks for all-cause mortality, cardiovascular disease, and diabetes associated with the metabolic syndrome: a summary of the evidence. Diabetes Care. 2005;28:1769–78.
8. Mottillo S, Filion KB, Genest J, Joseph L, Pilote L, Poirier P, et al. The metabolic syndrome and cardiovascular risk a systematic review and meta-analysis. J Am Coll Cardiol. 2010;56:1113–32.
9. Thomas G, Sehgal AR, Kashyap SR, Srinivas TR, Kirwan JP, Navaneethan SD. Metabolic syndrome and kidney disease: a systematic review and meta-analysis. Clin J Am Soc Nephrol. 2011;6:2364–73.
10. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol In Adults. Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA. 2001;285:2486–97.
11. Grundy SM, Brewer HB, Cleeman JI, Smith SC, Lenfant C. Definition of metabolic syndrome: report of the National Heart, Lung, and Blood Institute/American Heart Association. Conference on Scientific Issues Related to Definition. Circulation. 2004;109:433–8.
12. Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome—a new world-wide definition. A Consensus Statement from the International Diabetes Federation. Diabet Med. 2006;23:469–80.
13. Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation task force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation. 2009;120:1640–5.
14. Simmons RK, Alberti KG, Gale EA, Colagiuri S, Tuomilehto J, Qiao Q, et al. The metabolic syndrome: useful concept or clinical tool? Report of a WHO Expert Consultation. Diabetologia. 2010;53:600–5.
15. Comité Internacional de Clasificación de la WONCA. Clasificación Internacional de la Atención Primaria. 2.ª ed. Barcelona: Masson; 1999.
16. Ministerio de Sanidad, Servicios Sociales e Igualdad. Clasificación Internacional de Enfermedades: 9.ª Revisión. Modificación Clínica. CIE-9-MC. 9.ª ed. 2014.
17. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Böhm M, et al. 2013 ESH/ESC Guidelines for the management of arterial hypertension. Eur Heart J. 2013;34:2159–219.
18. American Diabetes Association. Classification and diagnosis of diabetes. Standards of medical care in diabetes – 2018. Diabetes Care. 2018;41 Suppl. 1:S13–27.
19. Goldenberg R, Punthakee Z, Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. Can J Diabetes. 2013;37:S8–11.
20. Catapano AL, Graham I, de Backer G, Wiklund O, Chapman MJ, Drexel H, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidaemias. Eur Heart J. 2016;37:2999–3058.
21. Castelli WP, Abbott RD, McNamara PM. Summary estimates of cholesterol used to predict coronary heart disease. Circulation. 1983;67:730–4.
22. Dobiasova M. AIP-atherogenic index of plasma as a significant predictor of cardiovascular risk: from research to practice. Vnitr Lek. 2006;52:64–71.
23. Simental-Mendia LE, Rodriguez-Moran M, Guerrero-Romero F. The product of fasting glucose and triglycerides as surrogate for identifying insulin resistance in apparently healthy subjects. Metab Syndr Relat Disord. 2008;6:299–304.
24. Salas-Salvadó J, Rubio MA, Barbany M, Moreno B, Grupo colaborativo de la SEEDO. Consenso SEEDO 2007 para la evaluación del sobrepeso y la obesidad y el establecimiento de criterios de intervención terapéutica. Med Clin (Barc). 2007;128:184–96.
25. Schneider HJ, Klotsche J, Silber S, Stalla GK, Wittchen HU. Measuring abdominal obesity: effects of height on distribution of cardiometabolic risk factors risk using waist circumference and waist-to-height ratio. Diabetes Care. 2011;34:e7.
26. Vestbo J, Hurd SS, Agustí AG, Jones PW, Vogelmeier C, Anzueto A, et al. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease: GOLD Executive Summary. Am J Respir Crit Care Med. 2013;187:347–65.
27. Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Int Suppl. 2013;3:S6–308.
28. Levey AS, Coresh J, Greene TH, Stevens LA, Zhang Y, Hendriksen S, Chronic Kidney Disease Epidemiology Collaboration. Using standardized serum creatinine values in the Modification of Diet in Renal Disease study equation for estimating glomerular filtration rate. Ann Intern Med. 2006;145:247–54.
29. NIH Consensus Conference: Impotence. NIH Consensus Development Panel on Impotence. JAMA. 1993;270:83–90.
30. Cooney MT, Selmer R, Lindman A, Tverdal A, Menotti A, Thomsen T, et al. Cardiovascular disease risk estimation in older persons: SCORE O.P. Eur J Prev Cardiol. 2016;23:1093–103.
31. Armitage R, Berry G, Matthews JNS. Statistical methods in medical research. 4th ed. Oxford: Blackwell; 2002. p. 659–67.
32. Instituto Nacional de Estadística. INEbase. Demografía y población. Cifras de población y Censos demográficos. Cifras de población. Available from: http://www.ine.es/dynt3/inebase/es/index.htm?padre=1894&capsel=1895 [accessed 27.02.18].
33. Instituto Nacional de Estadística. Defunciones según la Causa de Muerte 2016. Resultados Nacionales. Defunciones por causas (lista reducida), sexo y edad. Available from: http://www.ine.es/jaxi/Datos.htm?path=/t15/p417/a2016/l0/&file=01001.px [accessed 27.02.18].

34. Flores-Mateo G, Grau M, O'Flaherty M, Ramos R, Elosua R, Violan-Fors C, et al. Análisis de la disminución de la mortalidad por enfermedad coronaria en una población mediterránea: España 1998–2005. Rev Esp Cardiol. 2011;64: 988–96.

35. Grau M, Elosua R, Cabrera de León A, Guembe MJ, Baena-Díez JM, Vega Alonso T, et al. Factores de riesgo cardiovascular en España en la primera década del siglo XXI: análisis agrupado con datos individuales de 11 estudios de base poblacional, estudio DARIOS. Rev Esp Cardiol. 2011;64:295–304.