

# Metabolic Syndrome, Diabetes, and Cardiovascular Disease in an Elderly Caucasian Cohort: The Italian Longitudinal Study on Aging

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**Background.** The metabolic syndrome (MetS) is represented by a cluster of risk factors for cardiovascular diseases (CVDs). In spite of its high frequency and strong association with morbidity and mortality in the adult population, little is known about its magnitude in elderly persons.

**Methods.** We assessed the prevalence of MetS by diabetic status and sex in the participants in the Italian Longitudinal Study on Aging (ILSA), a population-based study on a sample of 5632 individuals 65–84 years old at baseline (1992). We measured the association of MetS with stroke, coronary heart disease, and diabetes at baseline and with CVD mortality at 4-year follow-up.

**Results.** The prevalence of MetS was 25.9% in nondiabetic men and 55.2% in nondiabetic women; in diabetic individuals it was 64.9% and 87.1% in men and women, respectively. At baseline, in both men and women there was a significant association with stroke (odds ratio [OR] = 1.67, 95% confidence interval [CI], 1.02–2.75 in men and OR = 1.72, CI, 1.01–2.93 in women) and diabetes (OR = 4.58, CI, 3.12–6.74 in men and OR = 5.15, CI, 3.23–8.20 in women). A significant association with chronic heart disease was found in men only (OR = 1.40; CI, 1.02–1.97). During the approximately 4-year follow-up, nondiabetic men with MetS had a risk of CVD mortality 12% higher compared to those without MetS, whereas no significant differences were found in women.

**Conclusions.** MetS is very common in aged Italians, and it is associated with stroke and diabetes in both sexes, and with chronic heart disease in men. In men, it increases significantly the risk of CVD mortality.

SINCE the first description of the metabolic syndrome (MetS) (1), number of studies has reported that this condition is highly prevalent in the adult population, with large variability across races and genders, and is a strong risk factor for cardiovascular events, which is relatively independent from the risk conferred by the single risk factors that compose the syndrome (2–7).

However, fewer data are available on the prevalence of MetS in the older population. According to the The National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, the prevalence of MetS in non-institutionalized individuals 70 years or older participating in the National Health And Nutrition Examination Survey (NHANES III) was 42% (2). Data from the San Antonio Heart and Framingham Offspring Studies confirmed the results reported in the NHANES III cohort, including the higher rates among Mexican American women compared to men. (3). More recently, Scuteri and colleagues (4) reported a prevalence of about 32% in men and 37% in women, aged 65+, free of cardiovascular disease (CVD) at the baseline examination of the Cardiovascular Health Study.

The 1998 Korea National Health and Nutrition Examination Survey conducted on a national representative sample of 6147 adults reported an increased prevalence of MetS with aging. In men, the age-related increment in prevalence reached a plateau after 55 years of age, whereas in women the prevalence increased linearly with age and became as high as 50% among those women 65 years old and older (5).

Using data from a large, population-based study conducted in Italy, we assessed the prevalence of MetS and its association with CVDs in individuals 65–84 years old.

## METHODS

### Study Population

All analyses were performed on data from the Italian Longitudinal Study on Aging (ILSA), an epidemiological study conducted in Italy, described in detail elsewhere (8). A random sample of 5632 individuals aged 65–84 years, stratified by age and sex using an equal allocation strategy, was selected from the population registries of eight Italian municipalities. Eighty-eight persons of each gender in four age groups (65–69, 70–74, 75–79, and 80–84 years) were included in the study sample.

The study's protocol and aims were explained to each participant before they provided written informed consent. The protocol was approved by the Ethics Committees of the participating centers. All the data used in this report were collected directly from the participants. Data obtained from proxy interviews were excluded from the analysis.

The baseline survey (1992) included a standardized interview on health-related behaviors and medical history, laboratory tests performed on a blood sample obtained after an overnight fast, a physician examination, and selected diagnostic tests. Participants who screened positive for

selected medical conditions (CVDs, diabetes, stroke, dementia, Parkinson's disease) underwent a second phase for the clinical confirmation of the diagnosis (9). Participants who had a positive Rose questionnaire; reported a history of angina pectoris (typical chest pain relieved by nitrates, beta blockers, or calcium-channel blockers), coronary artery bypass surgery, or myocardial infarction; and those with a diagnostic electrocardiogram were further evaluated by a certified internist. A diagnosis of chronic heart disease (CHD; angina or myocardial infarction) was confirmed based on clinical examination or information from hospital discharge records. Participants who reported a stroke or a history of neurological symptoms and signs compatible with a previous stroke were further examined by a certified neurologist who confirmed the diagnosis based on neurological examination findings and review of medical records. Participants who reported diabetes or were under treatment were evaluated by an internist who reviewed all available information, including medical records. Those participants with fasting glycemia  $\geq 140$  mg/dl were considered to be diabetic only if the levels were confirmed in a second blood determination. Positive screening of hypertension was defined as systolic blood pressure  $\geq 140$  mmHg, diastolic blood pressure  $\geq 90$  mmHg (three sitting and three standing blood pressure measurements were taken), or participant's report of a physician's diagnosis of hypertension and/or antihypertensive medication; the medical confirmation phase was based on the review of clinical records and repetition of blood pressure measurements.

#### *Assays Performed on Blood Samples*

Plasma lipids (total and high-density lipoprotein [HDL] cholesterol and triglycerides) and glucose were measured using standard enzymatic methods; insulin was measured by radioimmunoassay; fibrinogen and hemoglobin by electrophoresis. Cell blood counts were performed by an automatic counter. Low-density lipoprotein (LDL) cholesterol was calculated by using Friedewald's equation (10).

#### *Anthropometric Measures*

Anthropometric measurements were taken by trained personnel during clinical evaluation. Height and weight were measured with the participant barefooted and lightly dressed. Body weight was measured on a balance beam platform scale (Salus, Milan, Italy) to the nearest 0.1 kg. Height was taken by a stadiometer (Salus) at head level to the nearest centimeter with the participant standing barefoot, with feet together. Body mass index was calculated as weight (kg) divided by height squared ( $m^2$ ). Circumferences were measured to the nearest centimeter using a flexible steel tape, with the participant standing. The abdominal circumference (waist) was measured at the end of expiration, by wrapping the tape at the level of the umbilicus (11).

#### *Definition of MetS*

In accordance with the ATP III criteria (12), the diagnosis of MetS was established based on the presence of three or more of the following criteria: abdominal obesity (waist circumference  $>102$  cm for men and  $>88$  cm for women), elevated plasma triglycerides ( $\geq 150$  mg/dl); low HDL

cholesterol ( $<40$  mg/dl for men and  $<50$  mg/dl for women), high blood pressure ( $\geq 130/\geq 85$  mmHg), and high fasting plasma glucose ( $\geq 110$  mg/dl). The criteria for MetS also included participants using lipid-lowering medication ( $n = 343$ ) and antihypertensive treatment ( $n = 1471$ ).

#### *Mortality*

Mortality rates per person-year were assessed for an average of 4 years from baseline. If a participant died, a copy of the official death certificate was obtained. Causes of death were classified according to the International Classification of Diseases, Ninth revision (ICD-9) codes. CVD mortality was defined by codes 390–459 (13).

#### *Statistical Analysis*

Analyses were conducted separately for men and women. To generalize the ILSA sample to the Italian population, a set of weights was defined according to sex and age distribution of the reference population (Census 1991) and the sample fraction, and applied to the analyses. The differential distribution of smoking status, selected diseases, and MetS, according to sex and diabetic status, was tested by a Chi-squared test. The group's specific mean age, anthropometric measures, and blood determinations were evaluated using generalized linear models (GLMs). The homoscedasticity of variances between groups was tested by the Levene's test, and when the assumption of homoscedasticity was violated, the Welch's test was performed.

Age-adjusted logistic regression models were fitted separately for men and women, with baseline stroke, diabetes, and CHD as dependent variables, and MetS (or its components), smoking status, fasting insulin, and fibrinogen as independent variables.

The association of MetS and each of its components with CVD mortality was evaluated by using Cox proportional hazards models, adjusted for sex, age, diabetic status, fasting insulin, and fibrinogen. The assumption of proportionality was assessed through the analysis of Schoenfeld residuals of the covariates introduced in the model. Adjusted hazard ratio (HR) and 95% confidence intervals (CIs) were calculated to estimate the strength of this association. The analyses were performed by using the SAS statistical package (release 8.02; SAS, Cary, NC).

#### **RESULTS**

The age-adjusted prevalence of MetS was significantly higher in women than in men. In both genders, the prevalence of MetS was higher in diabetic than in nondiabetic participants ( $p < .0001$ ), reaching rates of approximately 65% and 87%, respectively, in men and women (Figure 1). In both groups, however, the rates were greater in women than in men; this is mainly caused by two components that were almost three times more frequent in women: visceral obesity (75.2% vs 29.5%) and low HDL cholesterol (56.5% vs 22.8%).

In Tables 1 and 2, the sex-specific characteristics of the participants are reported by diabetic status and MetS. Among nondiabetic men, those affected by MetS tended to have a less favorable lipid profile and had higher fasting

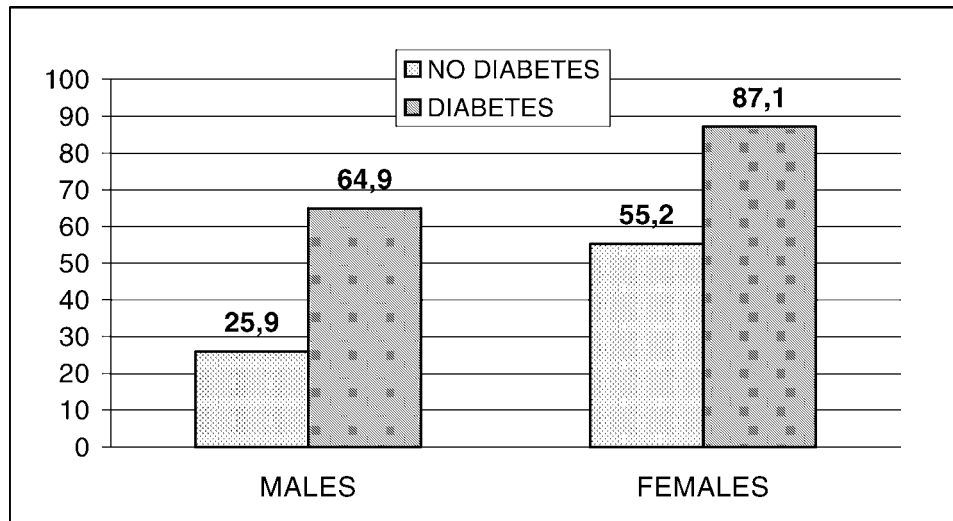


Figure 1. Prevalence rates (%) of the metabolic syndrome (MetS), by sex and diabetic status. From the Italian Longitudinal Study on Aging (ILSA).

glucose, insulin, fibrinogen, and blood pressure. Among diabetic men, no differences related to MetS were found for LDL cholesterol, total cholesterol, HbA1C (Hemoglobin A1C), and fibrinogen. A similar pattern of differences was found in women, except for fibrinogen (which, regardless of diabetes, was no different according to MetS status) and blood pressure (which was different according to MetS in nondiabetic women only).

In Table 3, the prevalence rates of stroke, CHD, and diabetes are presented for men and women, according to MetS status. Except for that of CHD in women, the rates of all three medical conditions were significantly higher in individuals with MetS. After adjusting for age, smoking status, fasting insulin, and fibrinogen, participants with MetS were approximately 1.7 and 5 times more likely to be affected by, respectively, stroke and diabetes. Men with MetS were also

Table 1. Clinical and Metabolic Characteristics by Sex, Diabetic Status, and MetS (From ILSA)

	Men					
	No Diabetes (N = 1169)			Diabetes (N = 190)		
	No MetS	MetS	p Value	No MetS	MetS	p Value
Age, y	71.8 ± 4.9	71.2 ± 4.9	.049	71.4 ± 4.6	70.9 ± 4.8	NS
Smoking status, %			NS			NS
Current smoker	20.0	22.1		23.7	17.4	
Ex-smoker	58.3	61.7		51.1	66.7	
Nonsmoker	21.7	16.2		25.2	15.9	
Waist circumference, cm	94.5 ± 9.0	104.4 ± 9.5	<.0001	92.8 ± 6.8	104.6 ± 9.3	<.0001
Weight, kg	70.2 ± 9.8	79.1 ± 11.3	<.0001	67.7 ± 7.8	79.0 ± 10.0	<.0001
Height, cm	165.5 ± 6.7	166.3 ± 6.7	NS	165.6 ± 6.4	166.0 ± 6.8	NS
BMI, kg/m <sup>2</sup>	25.6 ± 3.1	28.5 ± 3.5	<.0001	24.7 ± 2.6	28.7 ± 3.5	<.0001
Triglycerides, mg/dl	125.4 ± 50.5	201.5 ± 79.9	<.0001	110.2 ± 44.4	229.4 ± 107.1	<.0001
HDL cholesterol, mg/dl	50.1 ± 10.7	42.2 ± 9.0	<.0001	52.7 ± 9.9	43.2 ± 8.9	<.0001
LDL cholesterol, mg/dl	131.1 ± 35.7	141.4 ± 37.7	<.0001	133.8 ± 34.7	130.3 ± 37.4	NS
Cholesterol, mg/dl	206.0 ± 35.6	223.6 ± 39.5	<.0001	208.6 ± 36.0	216.8 ± 38.1	NS
Fasting glucose, mg/dl	94.8 ± 10.6	105.5 ± 13.7	<.0001	145.5 ± 68.0	170.8 ± 47.8	.0032
Fasting insulin, μU/ml*	16.5 ± 12.0	23.7 ± 12.7	<.0001	15.3 ± 8.7	29.8 ± 17.8	<.0001
HbA <sub>1c</sub> , %	6.4 ± 1.4	6.4 ± 1.6	NS	7.9 ± 2.3	8.4 ± 2.5	NS
Fibrinogen, mg/dl	332.2 ± 87.1	351.5 ± 83.9	.0018	350.0 ± 83.2	349.7 ± 82.1	NS
APO A1, mg/dl	150.8 ± 24.6	141.8 ± 24.8	<.0001	151.8 ± 24.0	137.3 ± 20.5	<.0001
APO B, mg/dl	126.8 ± 54.7	147.3 ± 31.6	<.0001	119.4 ± 29.7	153.3 ± 77.5	.0007
APO B/APO A1	0.87 ± 0.47	1.10 ± 0.55	<.0001	0.81 ± 0.24	1.14 ± 0.68	.0002
Systolic blood pressure <sup>†</sup>	140.8 ± 17.5	145.9 ± 15.6	.0003	140.1 ± 14.4	149.3 ± 18.1	.003
Diastolic blood pressure <sup>†</sup>	80.1 ± 8.8	82.6 ± 8.9	.0005	77.0 ± 7.6	82.1 ± 11.3	.0057

Notes: Data are means ± standard deviation and %, unless otherwise indicated.

\*Insulin-treated participants excluded.

<sup>†</sup>Antihypertensive-treated participants excluded.

MetS = metabolic syndrome; ILSA = Italian Longitudinal Study on Aging; NS = not significant; BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; HbA<sub>1c</sub> = glycosylated hemoglobin; APO A1 = Apolipoprotein A1; APO B = Apolipoprotein B.

Table 2. Clinical and Metabolic Characteristics by Sex, Diabetic Status, and MetS (From ILSA)

	Women					
	No Diabetes (N = 1493)			Diabetes (N = 231)		
	No MetS	MetS	p Value	No MetS	MetS	p Value
Age, y	72.2 ± 6.2	72.2 ± 6.1	NS	74.5 ± 6.3	73.1 ± 5.9	NS
Smoking status, %			NS			NS
Current smoker	10.2	8.8		6.1	5.7	
Ex-smoker	8.6	10.7		4.2	7.0	
Nonsmoker	81.2	80.5		89.7	87.6	
Waist circumference, cm	90.5 ± 14.3	100.9 ± 12.1	<.0001	90.8 ± 13.2	102.7 ± 11.4	<.0001
Weight, kg	59.4 ± 12.7	67.1 ± 12.4	<.0001	57.1 ± 7.0	66.6 ± 12.4	.0001
Height, cm	152.7 ± 7.8	152.1 ± 7.5	NS	151.2 ± 7.6	151.6 ± 7.0	NS
BMI, kg/m <sup>2</sup>	25.5 ± 5.1	29.0 ± 5.1	<.0001	25.0 ± 3.4	29.0 ± 5.1	.0001
Triglycerides, mg/dl	110.4 ± 45.3	173.5 ± 94.0	<.0001	120.5 ± 48.0	187.6 ± 113.1	.0016
HDL cholesterol, mg/dl	56.9 ± 17.6	46.3 ± 14.1	<.0001	59.0 ± 7.6	48.3 ± 10.7	<.0001
LDL cholesterol, mg/dl	146.7 ± 45.5	157.1 ± 49.1	<.0001	132.8 ± 35.4	142.7 ± 46.1	NS
Cholesterol, mg/dl	225.5 ± 44.8	237.1 ± 48.4	<.0001	215.9 ± 36.5	226.5 ± 46.6	NS
Fasting glucose, mg/dl	92.1 ± 11.1	98.8 ± 16.4	<.0001	118.4 ± 33.1	164.2 ± 54.0	<.0001
Fasting insulin, μU/ml*	15.9 ± 12.0	20.6 ± 20.0	<.0001	23.0 ± 13.7	22.5 ± 17.0	NS
HbA <sub>1c</sub> , %	6.3 ± 1.6	6.6 ± 1.8	.0016	7.6 ± 1.8	9.1 ± 3.1	.0181
Fibrinogen, mg/dl	364.7 ± 101.3	360.1 ± 102.0	NS	339.6 ± 116.8	383.8 ± 108.8	NS
APO A 1, mg/dl	171.9 ± 33.2	159.4 ± 29.8	<.0001	171.9 ± 34.4	155.0 ± 28.3	.0036
APO B, mg/dl	125.1 ± 42.4	145.3 ± 42.9	<.0001	115.4 ± 28.9	142.9 ± 46.3	.0018
APO B/APO A 1	0.74 ± 0.25	0.95 ± 0.56	<.0001	0.69 ± 0.23	0.95 ± 0.37	.0003
Systolic blood pressure <sup>†</sup>	139.7 ± 21.9	146.0 ± 19.1	<.0001	148.8 ± 26.1	151.0 ± 19.7	NS
Diastolic blood pressure <sup>†</sup>	79.2 ± 10.1	81.3 ± 8.9	.001	78.9 ± 8.3	79.6 ± 10.4	NS

Notes: Data are means ± standard deviation and %, unless otherwise indicated.

\*Insulin-treated participants excluded.

<sup>†</sup>Antihypertensive-treated participants excluded.

MetS = metabolic syndrome; ILSA = Italian Longitudinal Study on Aging; NS = not significant; BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; HbA<sub>1c</sub> = glycosylated hemoglobin; APO A 1 =Apolipoprotein A1; APO B = Apolipoprotein B.

more likely to be affected by CHD than were those without MetS, but this association was not found in women (Table 4). None of the individual components of MetS were significantly associated with CHD in either sex, except hyperglycemia, which was associated with stroke (odds ratio [OR] = 1.76; 95% CI, 1.12–2.78) and hypertriglyceridemia, which was associated with diabetes (OR = 1.77; 95% CI, 1.22–2.56) in women. As expected, in both men and women, hyperglycemia was strongly associated with diabetes (OR = 32.06, 95% CI, 20.43–50.31 in men and OR = 39.91, 95% CI, 26.18–60.83 in women; data not shown).

Because of inadequate sample size of diabetic participants, the impact of MetS on CVD mortality was assessed only for nondiabetic participants (Table 5). We found an increased risk of CVD mortality among men with MetS (HR = 1.12; CI, 1.09–1.16) after adjusting for age, smoking status, fasting insulin, and fibrinogen, whereas no significant association between MetS and mortality was detected among women. When considering the age variable in our

Cox models, we found that, only for men, this variable did not satisfy the proportionality assumption (Schoenfeld residuals). Therefore, the interaction between Age and Time was added to the models. The product Age × Time was significant and had an HR = 0.96 (95% CI, 0.92–0.99). For women, to the contrary, age and the other confounders satisfied the proportionality assumption. Models including MetS components did not show any significant association with CVD mortality, except for low HDL cholesterol in men (HR = 1.84; CI, 1.18–2.89) and hyperglycemia in women (HR = 2.04; CI, 1.11–3.75).

## DISCUSSION

This study analyzes the prevalence of MetS by diabetic status in a large, representative sample of the Italian population 65–84 years old. In general, epidemiologic studies have found higher prevalence rates of MetS in men than in women at younger ages and, therefore, the higher frequency

Table 3. Prevalence Rates of Stroke, CHD, and Diabetes at Baseline, by MetS and Sex (From ILSA)

Prevalence Rates of:	Men			Women		
	Without MetS	With MetS	p Value	Without MetS	With MetS	p Value
Stroke	6.0	9.6	.0164	3.8	6.6	.014
CHD	15.1	20.1	.0236	10.2	11.1	NS
Diabetes	7.2	28.9	<.0001	4.3	19.6	<.0001

Note: CHD = chronic heart disease; MetS = metabolic syndrome; ILSA = Italian Longitudinal Study on Aging; NS = not significant.

Table 4. Logistic Regression Analysis With Stroke, CHD, and Diabetes at Baseline as Dependent Variables, and MetS as Independent Variable, by Sex (From ILSA)

Dependent Variable	Men		Women	
	OR	95% CI	OR	95% CI
Stroke	1.67	1.02–2.75	1.72	1.01–2.93
CHD	1.40	1.02–1.97	1.07	0.74–1.53
Diabetes	4.58	3.12–6.74	5.15	3.23–8.20

Notes: Models were adjusted for age, smoking status, fasting insulin, and fibrinogen.

CHD = chronic heart disease; MetS = metabolic syndrome; ILSA = Italian Longitudinal Study on Aging; OR = odds ratio; CI = confidence interval.

found in older women in our study, as well as in other cohorts (4,5), may be due to a selective mortality of men with MetS at younger ages.

The frequency of other well known CVD risk factors, such as LDL cholesterol, total cholesterol, fasting insulin, fibrinogen, and unfavorable ApoB/A1 (Apolipoprotein B/A1), is higher in nondiabetic men and women with MetS; this frequency would suggest an increased risk of CVD events. The prevalence of major cardiovascular events, such as stroke and CHD, are indeed higher and strongly associated to MetS in men. The mechanisms for the increased risk of vascular diseases in individuals with MetS include endothelial dysfunction, atherosclerosis, and hypercoagulability (14). In women, significant associations have been found for stroke and diabetes, but not for CHD. It is interesting that the morbidity risk associated with the single components of MetS was generally not significant; this finding is in agreement with that of a previous report on a younger cohort (15). The only factor independently associated with stroke was hyperglycemia in women; this association could support an independent effect of hyperglycemia on the vessels (16).

We found that nondiabetic men with MetS have a significant increased risk of CVD mortality in a 4-year follow-up. This finding is in agreement with those of a previous study conducted in men (17) and with a study showing predictivity in men and not in women (18). To the contrary, in younger cohorts the risk for CVD mortality has been reported to be increased also in women with MetS (19,20). The reason for the lack of association in older women can be due to several factors. It might reflect the fact that the CVD mortality risk for those women with one or two abnormalities, grouped with the risk for those without any abnormalities, is high and

decreases, therefore, that risk associated with MetS. Indeed, we found a doubled risk of CVD mortality for women with hyperglycemia, whereas in men this association was not significant. This finding is in agreement with those from a recent meta-analysis that assessed the impact of hyperglycemia on CVD incidence and mortality, and showed that the relative risk is higher in cohorts including men and women than in a cohort of men only (21).

However, the lack of association with CHD prevalence and with CVD mortality in women could also challenge the clinical value of MetS in older women and/or would argue the appropriateness of the current ATP III definition for MetS in this group, at least in the Italian population. For example, visceral obesity has been found in two thirds of women in this cohort, but no independent association has been found for this component with CVD morbidity or mortality. This finding could suggest that the validity of the cut-off is questionable, at least in our elderly female population.

This study has some limitations. First, we did not use the latest criteria for the diagnosis of diabetes (22), because the prevalence rates of the diseases were calculated in 1994. Therefore, we have classified as nondiabetic individuals not previously diagnosed and with fasting glycemia between 126 mg/dl and 139 mg/dl. Given this potential misclassification, we might have reported a stronger association between MetS and CHD and stroke in nondiabetic individuals. However, even excluding individuals with glycemia  $\geq 126$  mg/dl who did not undergo the second phase for the clinical confirmation of diabetes, we found results similar to those reported here (CHD: male OR 1.36, 95% CI, 1.02–1.80; female OR 1.28, 95% CI, 0.94–1.74. Stroke: male OR 1.71, 95% CI, 1.15–2.54; female OR 1.81, 95% CI, 1.15–2.85).

Another potential limitation is the use of a cross-sectional design to assess association with clinical outcome. The relatively short follow-up did not allow for the analysis of incident cases of CHD and stroke in relation to MetS; however, the independent association found with CVD mortality in men seems to suggest that the association at baseline is indeed on the basis of a cause–effect relationship.

The strengths of this study include its population-based design (with a sample representative of the Italian older population), the clinical diagnoses of diseases, and the reliable assessment of metabolic and cardiovascular risk factors. Future studies with longer follow-up should be conducted to better understand the consequences of MetS in

Table 5. CVD Mortality Rates (by Diabetic Status and Sex) and HRs for MetS (From ILSA)

	Men		Women	
Total No. of Events	109 (13 among diabetic participants, 95 among nondiabetic participants)		134 (26 among diabetic participants, 108 among nondiabetic participants)	
CVD mortality rates	11.68% person/y among participants without MetS, 14.52% person/y among participants with MetS		11.70% person/y among participants without MetS, 12.28% person/y among participants with MetS	
HR and 95% CI for MetS*	3.35 (1.35–8.30)		1.06 (0.63–1.39)	
HR and 95% CI for MetS <sup>†</sup>	1.12 (1.09–1.16)		0.82 (0.56–1.19)	

Notes: \*Models were adjusted for age.

<sup>†</sup>Models were adjusted for age, smoking status, fasting insulin, and fibrinogen.

CVD = cardiovascular disease; HR = hazard ratio; MetS = metabolic syndrome; ILSA = Italian Longitudinal Study on Aging; CI = confidence interval.

older persons. Moreover, if MetS could be implemented as a standard diagnostic code in hospital records, useful epidemiological information on MetS could be gathered from administrative databases.

### Conclusion

MetS in older Italians is highly prevalent and it is associated with increased risk of diabetes and stroke in both sexes and of CVD morbidity and mortality in men. Screening for MetS should be systematically implemented in clinical geriatric practice, and specific guidelines for the treatment of older persons affected by MetS should be developed. Gender-specific analyses and longitudinal studies in other cohorts should be implemented to confirm our results.

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