Supplemental material

"Prevalence of metabolic syndrome among Vietnamese adult employees"

Table S1. Definitions of metabolic syndrome.

	NCEP ATP III (2005 revisions)	NCEP ATP III - Asian	IDF (2005)
Absolutely required			Central obesity (waist circumference) ≥94 cm (M) or ≥80 cm (F)
Criteria	*Any three of the five criteria below*	*Any three of the five criteria below*	*Obesity, plus two of the four criteria below*
Obesity	Waist circumference: >40 inches (101.6 cm) (M) or >35 inches (88.9 cm) (F)	Waist circumference ≥90cm (M) or ≥80 cm (F)	Central obesity already required
Hyperglycemia	Fasting glucose ≥100 mg/dL or Rx (taking medication)	Fasting glucose ≥100 mg/dL (5.6 mmol/L)	Fasting glucose ≥100 mg/dL
Dyslipidemia	TG (triglyceride) ≥150 mg/dL or Rx	Triglyceride ≥150 mg/dL or Rx	Triglyceride ≥150 mg/dL or Rx
Dyslipidemia (second, separate criteria)	HDL cholesterol: <40 mg/dL (M), <50 mg/dL(F); or Rx	HDL cholesterol: <40 mg/dL (M) or <50 mg/dL(F); or Rx	HDL cholesterol: <40 mg/dL(M) or <50 mg/dL (F); or Rx
Hypertension	>130 mmHg systolic or 85 mmHg diastolic or Rx	>130 mmHg systolic or 85 mmHg diastolic or Rx	>130 mmHg systolic or 85 mmHg diastolic or Rx

Rx, pharmacologic treatment.

Table S2. Crude prevalence (and 95%CI) of MtS by sex and age group using the NCEP ATP III-Asia definition.

Age group	Female	Male
<30	2.5 (2.3, 2.9)	10.8 (10.1, 11.6)
30-39	5.0 (4.7, 5.5)	17.7 (17.0, 18.4)
40-49	10.4 (9.6, 11.3)	29.3 (28.1, 30.4)
50-59	31.6 (29.6, 33.6)	36.8 (35.1, 38.5)
≥60	54.7 (52.4, 57)	44.3 (42.1, 46.4)

Table S3. Unadjusted prevalence of MtS and population distribution by occupational group and region

Age group	Sex	Stratum population	Cases	Population distribution	Stratum-specific prevalence	Standard population distribution
By Occupational group						
Technology and Industry						
<30	Female	567	12	0.091	0.0212	0.126
<30	Male	1,216	107	0.195	0.088	0.131
30–39	Female	945	38	0.151	0.0402	0.115
30–39	Male	1,864	274	0.299	0.147	0.119
40–49	Female	433	29	0.069	0.067	0.093
40–49	Male	760	209	0.122	0.275	0.094
50–59	Female	79	26	0.013	0.3291	0.081
50–59	Male	211	79	0.034	0.3744	0.075
≥60	Female	69	39	0.011	0.5652	0.096
≥60	Male	95	40	0.015	0.4211	0.069
Total		6,239	853			
Trade Service						
<30	Female	5,431	144	0.214	0.0265	0.126
<30	Male	2,979	330	0.117	0.1108	0.131
30–39	Female	5,767	266	0.227	0.0461	0.115
30–39	Male	4,640	803	0.183	0.1731	0.119
40–49	Female	1,813	161	0.071	0.0888	0.093
40–49	Male	2,273	624	0.09	0.2745	0.094
50–59	Female	589	168	0.023	0.2852	0.081
50–59	Male	1,082	372	0.043	0.3438	0.075
≥60	Female	332	181	0.013	0.5452	0.096
≥60	Male	489	209	0.019	0.4274	0.069
Total		25,395	3,258			
Social Enterprise						
<30	Female	1,700	48	0.325	0.0282	0.126
<30	Male	279	30	0.053	0.1075	0.131
30–39	Female	1,171	60	0.224	0.0512	0.115
30–39	Male	446	78	0.085	0.1749	0.119
40–49	Female	401	39	0.077	0.0973	0.093
40–49	Male	296	94	0.057	0.3176	0.094
50–59	Female	143	35	0.027	0.2448	0.081
50–59	Male	232	101	0.044	0.4353	0.075
≥60	Female	156	72	0.03	0.4615	0.096
≥60	Male	400	160	0.077	0.4	0.069
Total		5,224	717			
Unclassified						
<30	Female	2,503	55	0.118	0.022	0.126

Age group	Sex	Stratum population	Cases	Population distribution	Stratum-specific prevalence	Standard population distribution
<30	Male	2,058	238	0.097	0.1156	0.131
30–39	Female	3,226	197	0.153	0.0611	0.115
30–39	Male	3,566	705	0.169	0.1977	0.119
40–49	Female	2,114	266	0.1	0.1258	0.093
40–49	Male	2,673	829	0.126	0.3101	0.094
50–59	Female	1,265	426	0.06	0.3368	0.081
50–59	Male	1,486	555	0.07	0.3735	0.075
≥60	Female	1,181	659	0.056	0.558	0.096
≥60	Male	1,067	499	0.05	0.4677	0.069
Total		21,139	4,429			
By Region						
Northern						
<30	Female	8,136	212	0.179	0.0261	0.126
<30	Male	5,162	535	0.113	0.1036	0.131
30–39	Female	9,119	413	0.2	0.0453	0.115
30–39	Male	8,243	1,340	0.181	0.1626	0.119
40–49	Female	3,691	350	0.081	0.0948	0.093
40–49	Male	4,576	1,275	0.101	0.2786	0.094
50–59	Female	1,465	438	0.032	0.299	0.081
50–59	Male	2,144	760	0.047	0.3545	0.075
≥60	Female	1,310	728	0.029	0.5557	0.096
≥60	Male	1,640	718	0.036	0.4378	0.069
Total		45,486	6,769			
Central and Southern						
<30	Female	2,065	47	0.165	0.0228	0.126
<30	Male	1,370	170	0.11	0.1241	0.131
30–39	Female	1,990	148	0.159	0.0744	0.115
30–39	Male	2,273	520	0.182	0.2288	0.119
40–49	Female	1,070	145	0.086	0.1355	0.093
40–49	Male	1,426	481	0.114	0.3373	0.094
50–59	Female	611	217	0.049	0.3552	0.081
50–59	Male	867	347	0.069	0.4002	0.075
≥60	Female	428	223	0.034	0.521	0.096
≥60	Male	411	190	0.033	0.4623	0.069
Total		12,511	2,488			

The stratum-specific prevalence of MtS was calculated separately for strata of sex and age group among occupational groups and regions of Vietnam. We present both the distribution of the population of different occupational groups and regions (population distribution) and the standard population (standard population distribution) for comparison.

Table S4. Associated factors of MtS using the regression model with sex-age group interaction

	Prevalence ratio (95%CI)
Sex	
Female	REF
Male	**4.3 (3.7, 4.9)**
Age group	
<30	REF
30–39	**2.0 (1.7, 2.3)**
40–49	**4.0 (3.5, 4.7)**
50–59	**11.8 (10.3, 13.6)**
≥60	**20.5 (18.0, 23.3)**
Sex-age group interaction	
Male × <30	REF
Male × 30–39	0.8 (0.7, 1.0)
Male × 40–49	**0.7 (0.6, 0.8)**
Male × 50–59	**0.3 (0.2, 0.3)**
Male × ≥60	**0.2 (0.2, 0.2)**
Occupational group	
Technology and Industry	REF
Trade and Services	1.1 (1.0, 1.1)
Social enterprises	1.1 (1.0, 1.2)
Unclassified	**1.2 (1.1, 1.3)**
Region	
Northern	REF
Central and Southern	**1.2 (1.1, 1.2)**

REF, reference group.

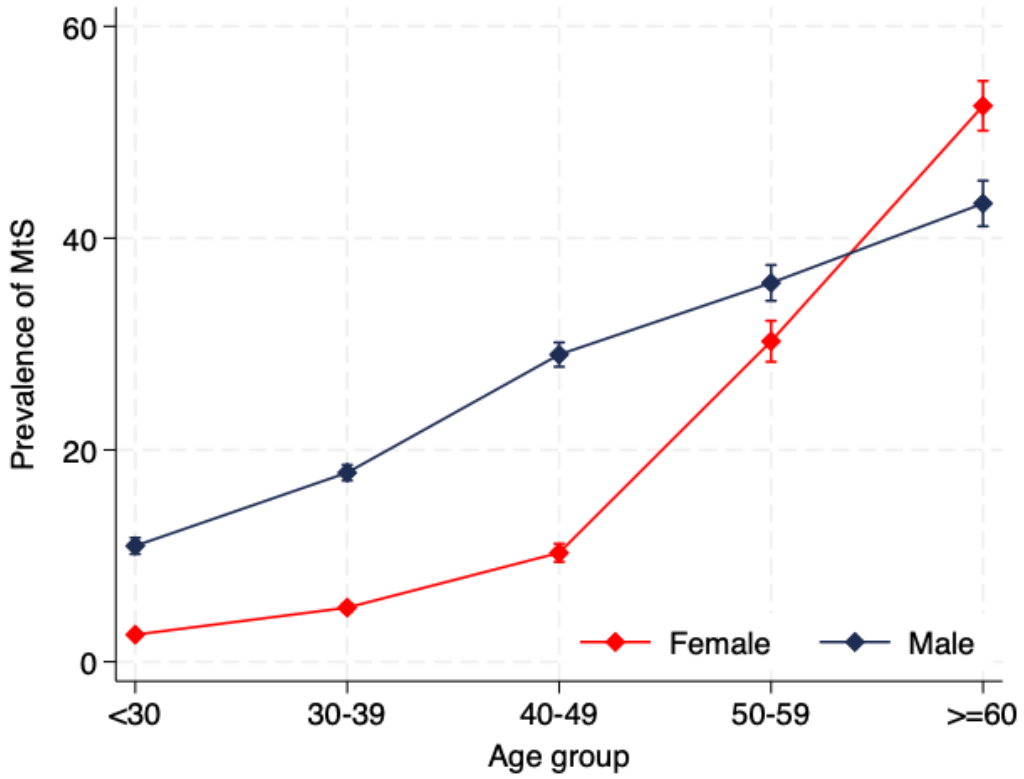

Figure S1. Prevalence of MtS by sex and age group estimated from the regression model with interactions.

MtS was defined using the NCEP ATP III-Asia defintion. The marginal prevalence of MtS was estimated from a Poisson regression model with robust variance estimation that included sex-age group interaction terms. This marginal plot agrees with the trend observed in the crude prevalence (**Error! Reference source not found.**).

32 **Table S5. Metabolic profile of the study population using different MtS definitions**

	IDF			NCEP ATP III			NCEP ATP III-Asia		
	Yes (n=4,874)	**No (n=53,123)**	**p-value**	**Yes (n=5,897)**	**No (n=52,100)**	**p-value**	**Yes (n=9,257)**	**No (n=48,740)**	**p-value**
Waist circumference (cm), median (IQR)	94.0 (13.0)	78.0 (14.0)	<0.0001	89.0 (11.0)	78.0 (13.0)	<0.0001	90.0 (11.0)	77.0 (12.0)	<0.0001
Abdominal obesity, n (%)			<0.0001			<0.0001			<0.0001
<90 cm (M) or <80 cm (F)	0 (0.0)	43,759 (82.4)		2,362 (40.1)	41,397 (79.5)		2,362 (25.5)	41,397 (84.9)	
≥90 cm (M) or ≥80 cm (F)	4,874 (100.0)	9,364 (17.6)		3,535 (59.9)	10,703 (20.5)		6,895 (74.5)	7,343 (15.1)	
BMI (kg/m^2), median (IQR)	26.8 (4.5)	22.4 (3.9)	<0.0001	25.6 (4.1)	22.4 (3.9)	<0.0001	25.8 (3.8)	22.2 (3.7)	<0.0001
BMI group using general cutoffs, n (%)			<0.0001			<0.0001			<0.0001
Underweight (<18.5)	0 (0.0)	3,084 (5.8)		11 (0.2)	3,073 (5.9)		11 (0.1)	3,073 (6.3)	
Normal (18.5–24.9)	1,385 (28.4)	39,516 (74.4)		2,401 (40.7)	38,500 (74.0)		3,498 (37.8)	37,403 (76.8)	
Overweight (25–29.9)	2,600 (53.4)	9,849 (18.6)		2,753 (46.7)	9,696 (18.6)		4,813 (52.0)	7,636 (15.7)	
Obese (≥30.0)	887 (18.2)	632 (1.2)		730 (12.4)	789 (1.5)		932 (10.1)	587 (1.2)	
BMI categories using Asian cutoffs, n (%)			<0.0001			<0.0001			<0.0001
Underweight (<18.5)	0 (0.0)	3,084 (5.8)		11 (0.2)	3,073 (5.9)		11 (0.1)	3,073 (6.3)	

	IDF			NCEP ATP III			NCEP ATP III-Asia		
	Yes (n=4,874)	**No (n=53,123)**	**p-value**	**Yes (n=5,897)**	**No (n=52,100)**	**p-value**	**Yes (n=9,257)**	**No (n=48,740)**	**p-value**
Normal (18.5–22.9)	502 (10.3)	27,465 (51.7)		978 (16.6)	26,989 (51.8)		1,321 (14.3)	26,646 (54.7)	
Overweight (23–24.9)	883 (18.1)	12,051 (22.7)		1,423 (24.1)	11,511 (22.1)		2,177 (23.5)	10,757 (22.1)	
Obese (≥25.0)	3,487 (71.6)	10,481 (19.7)		3,483 (59.1)	10,485 (20.1)		5,745 (62.1)	8,223 (16.9)	
Hypertension, n (%)			<0.0001			<0.0001			<0.0001
SBP ≤130 and/or DBP ≤85 mmHg	2,189 (44.9)	45,196 (85.1)		1,654 (28.0)	45,731 (87.8)		3,653 (39.5)	43,732 (89.7)	
SBP >130 or DBP ≥85 mmHg	2,685 (55.1)	7,927 (14.9)		4,243 (72.0)	6,369 (12.2)		5,604 (60.5)	5,008 (10.3)	
Fasting triglyceride (mg/dL), median (IQR)	194.0 (122.2)	98.3 (82.4)	<0.0001	225.0 (152.3)	96.5 (76.2)	<0.0001	212.6 (137.3)	93.0 (68.2)	<0.0001
Fasting triglyceride, n (%)			<0.0001			<0.0001			<0.0001
<150 mg/dL	1,161 (23.8)	39,811 (74.9)		588 (10.0)	40,384 (77.5)		1,540 (16.6)	39,432 (80.9)	
≥150 mg/dL	3,713 (76.2)	13,312 (25.1)		5,309 (90.0)	11,716 (22.5)		7,717 (83.4)	9,308 (19.1)	
Fasting HDL-cholesterol (mg/dL), median (IQR)	42.9 (10.8)	50.7 (14.7)	<0.0001	39.4 (10.8)	51.0 (14.7)	<0.0001	41.4 (11.2)	51.4 (14.3)	<0.0001
Fasting HDL-cholesterol, n (%)			<0.0001			<0.0001			<0.0001
≥40 mg/dL (M) or ≥50 mg/dL (F)	1,790 (36.7)	38,444 (72.4)		1,750 (29.7)	38,484 (73.9)		3,472 (37.5)	36,762 (75.4)	

	IDF			NCEP ATP III			NCEP ATP III-Asia		
	Yes (n=4,874)	**No (n=53,123)**	**p-value**	**Yes (n=5,897)**	**No (n=52,100)**	**p-value**	**Yes (n=9,257)**	**No (n=48,740)**	**p-value**
<40 mg/dL (M) or <50 mg/dL (F)	3,084 (63.3)	14,679 (27.6)		4,147 (70.3)	13,616 (26.1)		5,785 (62.5)	11,978 (24.6)	
Fasting blood glucose (mg/dL), median (IQR)	101.3 (19.8)	88.9 (12.6)	<0.0001	104.4 (18.0)	88.2 (12.6)	<0.0001	102.2 (18.4)	88.2 (11.5)	<0.0001
Fasting blood glucose, n (%)			<0.0001			<0.0001			<0.0001
<100 mg/dL	2,139 (43.9)	45,479 (85.6)		1,676 (28.4)	45,942 (88.2)		3,723 (40.2)	43,895 (90.1)	
≥100 mg/dL	2,735 (56.1)	7,644 (14.4)		4,221 (71.6)	6,158 (11.8)		5,534 (59.8)	4,845 (9.9)	

BMI, body mass index; DBP, diastolic blood pressure; HDL, high-density cholesterol; IQR, interquartile range; SBP, systolic blood pressure.

Table S6. Association of MtS with fatty liver on ultrasound.

Characteristic	No or non-severe fatty liver (n=53,550)	Severe fatty liver (grade III) (n=161)	Adjusted prevalence ratio (95%CI)
Metabolic syndrome			
Without Mts	46,014 (99.9)	67 (0.1)	REF
With Mts	7,536 (98.8)	94 (1.2)	**7.8 (5.3, 11.4)**
Sex			
Female	28,515 (99.9)	26 (0.1)	REF
Male	25,035 (99.5)	135 (0.5)	**4.3 (2.7, 6.9)**
Age group			
<30	15,885 (99.7)	43 (0.3)	REF
30–39	20,180 (99.7)	62 (0.3)	0.8 (0.5, 1.2)
40–49	9,754 (99.7)	27 (0.3)	**0.5 (0.3, 0.8)**
50–59	4,385 (99.5)	22 (0.5)	0.6 (0.4, 1.1)
≥60	3,346 (99.8)	7 (0.2)	**0.2 (0.1, 0.5)**
Occupational group			
Technology and Industry	6,064 (99.8)	14 (0.2)	REF
Trade and Services	23,710 (99.7)	69 (0.3)	1.8 (1.0, 3.1)
Social enterprises	5,008 (99.6)	19 (0.4)	**2.8 (1.4, 5.5)**
Unclassified	18,768 (99.7)	59 (0.3)	1.8 (1.0, 3.2)
Region			
Northern	44,592 (99.7)	146 (0.3)	REF
Central and Southern	8,958 (99.8)	15 (0.2)	0.6 (0.4, 1.0)

REF, reference group.

Fatty liver was diagnosed by ultrasound. Grading of diffuse hepatic steatosis on ultrasound (https://radiopaedia.org/articles/diffuse-hepatic-steatosis-grading) was used to classify the extent of fatty changes in the liver as following: **grade I:** diffusely increased hepatic echogenicity but periportal and diaphragmatic echogenicity is still appreciable; **grade II:** diffusely increased hepatic echogenicity obscuring periportal echogenicity but diaphragmatic echogenicity is still appreciable; **grade III:** diffusely increased hepatic echogenicity obscuring periportal as well as diaphragmatic echogenicity.