

SUPPLEMENTAL MATERIAL

Data S1.

Supplemental Methods

Details regarding data collection.

Collected clinicodemographic variables

The following information was collected at the third health screening (S3) as baseline characteristics: age, sex, body mass index (BMI), waist circumference, systolic and diastolic blood pressure, fasting glucose, total cholesterol, high-density lipoprotein cholesterol, triglycerides, serum creatinine, estimated glomerular filtration rate, alanine transaminase, aspartate transaminase, and hemoglobin. Those who were included in the lowest quartile of the nation's income were defined as the low-income group. The Charlson Comorbidity Index was used to represent the burden of underlying comorbidities in the included people. A diagnostic code category identified multiple times within a year before the baseline health screening (S3) was considered to indicate a comorbidity, and the definition for the diagnostic codes followed a reference.²⁶ The number of present MetS components was collected, both at baseline (S3) and at a prior health screening (S1), to describe the metabolic burden in each study subgroup. We also collected other lifestyle variables from the questionnaire results: smoking (non-smoker, ex-smoker, and current smoker) and alcohol consumption [none, moderate consumption (≤ 2 standard drinks for men and ≤ 1 standard drink for women per single session), and heavy consumption (more than moderate)]. Places of residence (rural or urban), and the urban region was the capital region and 7 metropolitan cities, and the other regions were categorized as rural area.

Variables representing the severity of MetS

The severity of MetS as a covariate was defined, as the metabolic burden can be diverse even within a study subgroup, according to the following two aspects: the number of MetS components present and the actual measured values of the components included in the MetS criteria. The two aspects were complementary because the number of preexisting MetS components could not reflect the continuous information (e.g., high glucose values) pertaining to each MetS parameter, and the actual values of the MetS parameters could be affected by medications.

Data S2.

Details regarding the adjustment variables for multivariable analyses.

Continuous variables are presented as the mean values (standard deviations), and categorical variables are presented as numbers (percentages).

In the first analysis, comparing the risk of MACEs or all-cause mortality in each study subgroup divided according to the dynamic MetS status and frequency of MV-PA, the MetS-free group with 0 days/week of self-reported MV-PA was the reference group. As the other clinical characteristics would be distinct in each subgroup (e.g., a higher body mass index in the MetS-chronic group or a lower comorbidity burden in the MetS-free group), the multivariable model in the first analysis was adjusted for baseline age, sex, eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, and place of residence (urban or rural). The results comparing the MetS subgroups in detail have been reported in our previous study,¹ with further consideration of other important potential confounders.

In the second analysis, the association between the frequency of MV-PA and the risk of MACE or all-cause mortality in each MetS subgroup was assessed, with those who did not engage in MV-PA in each subgroup serving as the reference group. The main purpose of this analysis was to assess whether MV-PA was related to a lower MACE or all-cause mortality risk in those with similar clinical and metabolic status. Therefore, additional clinical variables were used to adjust the models, including the MetS severity. The model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index, Charlson Comorbidity Index score, place of residence, and MetS severity. The MetS severity was determined as the number of MetS components or the actual values of the MetS components. In addition, as smoking or alcohol consumption behaviors might also confound the association, the lifestyle variables were additionally adjusted in a model. Further subgroup analyses were performed, and the

subgroups were divided according to age (20-39, 40-64, ≥ 65 years old) or sex (male or female). Additional subgroup analysis was performed for the initially excluded subjects due to their fluctuating/transient MetS status (N = 1,544,500). Those who had impaired kidney function or previous MACE history were again not considered in the subgroup analysis, yielding 1,297,589 subjects with transient/fluctuating MetS status in the analysis. The multivariable results for the subgroup analyses were adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

In the third analysis, we divided the study population according to whether they had a consistently absent (absence in S1, S2, and S3) or present (presence in S1, S2, and S3) states of individual MetS components (central obesity, high blood pressure, impaired glucose tolerance, high triglyceride, low high-density lipoprotein cholesterol). The purpose of this analysis was to additionally test the significance of MV-PA for each MetS component, as MetS is a cluster of 5 risk components and the significance of MV-PA may vary according to the components. In the analysis, those who were initially excluded due to their fluctuating/transient status of MetS were included, and the dynamic status of each MetS component was re-assessed. The unadjusted and age-/sex-adjusted models were first constructed. In addition, a multivariable model adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index, Charlson Comorbidity Index score, place of residences (urban or rural), MetS severity represented by the number of MetS components, and other lifestyle variables (smoking status and alcohol consumption behavior) was presented. Those who developed a component or recovered from a previous presence of a MetS component were not separately analyzed, as the total number of persons and outcomes in each subgroup was small when we divided subgroups in this manner.

Table S1. Risks of acute myocardial infarction according to frequency of moderate-to-vigorous physical activity and dynamic metabolic syndrome status.

MetS status	Frequency of MV-PA	Number of persons	Number of acute MI	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	1,840,026	5,521	7,981,116	0.69	Reference		Reference	
	1-2 days/week	1,531,152	3,086	6,878,663	0.45	0.65 (0.62-0.68)	< 0.001	0.81 (0.78-0.85)	< 0.001
	3-4 days/week	756,270	1,700	3,367,586	0.50	0.73 (0.69-0.77)	< 0.001	0.77 (0.72-0.81)	< 0.001
	≥5 days/week	420,090	1,234	1,825,140	0.68	0.98 (0.92-1.04)	0.468	0.81 (0.76-0.87)	< 0.001
MetS-recovery	0 days/week	145,047	969	610,910	1.59	2.29 (2.14-2.45)	< 0.001	1.43 (1.34-1.53)	< 0.001
	1-2 days/week	104,911	474	468,051	1.01	1.46 (1.33-1.61)	< 0.001	1.24 (1.13-1.36)	< 0.001
	3-4 days/week	59,716	278	262,637	1.06	1.53 (1.36-1.73)	< 0.001	1.12 (0.99-1.26)	0.067
	≥5 days/week	38,639	217	163,687	1.33	1.92 (1.67-2.19)	< 0.001	1.11 (0.97-1.28)	0.123
MetS-developed	0 days/week	156,540	1,264	634,582	1.99	2.88 (2.71-3.06)	< 0.001	1.50 (1.41-1.60)	< 0.001
	1-2 days/week	101,511	566	436,851	1.30	1.87 (1.72-2.04)	< 0.001	1.35 (1.24-1.47)	< 0.001
	3-4 days/week	54,830	338	231,489	1.46	2.11 (1.89-2.36)	< 0.001	1.24 (1.11-1.39)	< 0.001
	≥5 days/week	35,282	248	143,535	1.73	2.5 (2.20-2.84)	< 0.001	1.17 (1.03-1.32)	0.019
MetS-chronic	0 days/week	406,137	4,088	1,624,864	2.52	3.64 (3.49-3.79)	< 0.001	1.51 (1.44-1.58)	< 0.001
	1-2 days/week	225,524	1,871	965,660	1.94	2.80 (2.66-2.95)	< 0.001	1.59 (1.51-1.68)	< 0.001
	3-4 days/week	136,733	1,051	572,285	1.84	2.65 (2.49-2.84)	< 0.001	1.26 (1.18-1.35)	< 0.001
	≥5 days/week	95,669	811	384,604	2.11	3.05 (2.83-3.28)	< 0.001	1.18 (1.09-1.27)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, MI = myocardial infarction, IRR = incidence rate ratio, CI = confidence interval
The multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, and place of residence (urban or rural).

Table S2. Risks of revascularization according to frequency of moderate-to-vigorous physical activity and dynamic metabolic syndrome status.

MetS status	Frequency of MV-PA	Number of persons	Number of revascularization	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	1,840,026	4,257	7,981,116	0.53	Reference		Reference	
	1-2 days/week	1,531,152	2,702	6,878,663	0.39	0.74 (0.70-0.77)	< 0.001	0.91 (0.87-0.96)	< 0.001
	3-4 days/week	756,270	1,618	3,367,586	0.48	0.90 (0.85-0.95)	< 0.001	0.92 (0.86-0.97)	0.003
	≥5 days/week	420,090	1,198	1,825,140	0.66	1.23 (1.15-1.31)	< 0.001	0.95 (0.89-1.02)	0.137
MetS-recovery	0 days/week	145,047	936	610,910	1.53	2.87 (2.68-3.08)	< 0.001	1.71 (1.59-1.83)	< 0.001
	1-2 days/week	104,911	525	468,051	1.12	2.10 (1.92-2.30)	< 0.001	1.62 (1.48-1.78)	< 0.001
	3-4 days/week	59,716	320	262,637	1.22	2.28 (2.04-2.56)	< 0.001	1.51 (1.35-1.69)	< 0.001
	≥5 days/week	38,639	266	163,687	1.63	3.05 (2.69-3.45)	< 0.001	1.56 (1.38-1.76)	< 0.001
MetS-developed	0 days/week	156,540	1,303	634,582	2.05	3.85 (3.62-4.10)	< 0.001	1.97 (1.85-2.10)	< 0.001
	1-2 days/week	101,511	756	436,851	1.73	3.24 (3.00-3.51)	< 0.001	2.16 (1.99-2.33)	< 0.001
	3-4 days/week	54,830	440	231,489	1.90	3.56 (3.23-3.93)	< 0.001	1.93 (1.75-2.13)	< 0.001
	≥5 days/week	35,282	338	143,535	2.35	4.41 (3.95-4.93)	< 0.001	1.86 (1.67-2.08)	< 0.001
MetS-chronic	0 days/week	406,137	5,127	1,624,864	3.16	5.92 (5.68-6.16)	< 0.001	2.50 (2.39-2.61)	< 0.001
	1-2 days/week	225,524	2,613	965,660	2.71	5.07 (4.83-5.33)	< 0.001	2.67 (2.53-2.81)	< 0.001
	3-4 days/week	136,733	1,626	572,285	2.84	5.33 (5.03-5.64)	< 0.001	2.35 (2.22-2.50)	< 0.001
	≥5 days/week	95,669	1,281	384,604	3.33	6.24 (5.87-6.65)	< 0.001	2.21 (2.07-2.36)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

The multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, and place of residence (urban or rural).

Table S3. Risks of acute ischemic stroke according to frequency of moderate-to-vigorous physical activity and dynamic metabolic syndrome status.

MetS status	Frequency of MV-PA	Number of persons	Number of acute ischemic stroke	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	1,840,026	9,414	7,981,116	1.18	Reference		Reference	
	1-2 days/week	1,531,152	4,353	6,878,663	0.63	0.54 (0.52-0.56)	< 0.001	0.83 (0.80-0.87)	< 0.001
	3-4 days/week	756,270	2,605	3,367,586	0.77	0.66 (0.63-0.68)	< 0.001	0.78 (0.75-0.81)	< 0.001
	≥5 days/week	420,090	2,093	1,825,140	1.15	0.97 (0.93-1.02)	0.244	0.81 (0.77-0.85)	< 0.001
MetS-recovery	0 days/week	145,047	1,748	610,910	2.86	2.43 (2.31-2.55)	< 0.001	1.32 (1.26-1.39)	< 0.001
	1-2 days/week	104,911	678	468,051	1.45	1.23 (1.14-1.33)	< 0.001	1.15 (1.06-1.24)	< 0.001
	3-4 days/week	59,716	438	262,637	1.67	1.41 (1.28-1.56)	< 0.001	1.06 (0.97-1.17)	0.199
	≥5 days/week	38,639	397	163,687	2.43	2.06 (1.86-2.27)	< 0.001	1.09 (0.99-1.21)	0.082
MetS-developed	0 days/week	156,540	2,339	634,582	3.69	3.12 (2.99-3.27)	< 0.001	1.34 (1.28-1.41)	< 0.001
	1-2 days/week	101,511	837	436,851	1.92	1.62 (1.51-1.74)	< 0.001	1.22 (1.14-1.31)	< 0.001
	3-4 days/week	54,830	489	231,489	2.11	1.79 (1.64-1.96)	< 0.001	1.00 (0.92-1.10)	0.933
	≥5 days/week	35,282	454	143,535	3.16	2.68 (2.44-2.95)	< 0.001	1.07 (0.97-1.17)	0.176
MetS-chronic	0 days/week	406,137	8,274	1,624,864	5.09	4.32 (4.19-4.45)	< 0.001	1.39 (1.34-1.44)	< 0.001
	1-2 days/week	225,524	2,688	965,660	2.78	2.36 (2.26-2.46)	< 0.001	1.29 (1.24-1.35)	< 0.001
	3-4 days/week	136,733	1,791	572,285	3.13	2.65 (2.52-2.79)	< 0.001	1.12 (1.07-1.18)	< 0.001
	≥5 days/week	95,669	1,528	384,604	3.97	3.37 (3.19-3.56)	< 0.001	1.06 (1.00-1.12)	0.054

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

The multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, and place of residence (urban or rural).

Table S4. Risks of major adverse cardiovascular events according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age 20-39 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	703,712	1,012	3,216,593	0.31	Reference		Reference	
	1-2 days/week	714,886	1,101	3,306,908	0.33	1.06 (0.97-1.15)	0.19	1.01 (0.93-1.1)	0.82
	3-4 days/week	275,702	428	1,284,732	0.33	1.06 (0.95-1.19)	0.32	1.02 (0.91-1.14)	0.78
	≥5 days/week	121,386	176	565,971	0.31	0.99 (0.84-1.16)	0.89	0.96 (0.82-1.13)	0.63
MetS-recovery	0 days/week	25,987	82	120,679	0.68	Reference		Reference	
	1-2 days/week	30,272	97	142,395	0.68	1 (0.75-1.35)	0.99	0.96 (0.72-1.3)	0.81
	3-4 days/week	12,780	54	60,557	0.89	1.31 (0.93-1.85)	0.12	1.33 (0.94-1.89)	0.10
	≥5 days/week	5,936	21	27,984	0.75	1.1 (0.68-1.78)	0.69	1.18 (0.73-1.91)	0.51
MetS-developed	0 days/week	20,426	98	92,136	1.06	Reference		Reference	
	1-2 days/week	24,477	119	111,780	1.06	1 (0.77-1.31)	0.99	0.99 (0.76-1.3)	0.96
	3-4 days/week	8,175	41	37,771	1.09	1.02 (0.71-1.47)	0.91	1.04 (0.72-1.51)	0.82
	≥5 days/week	3,102	18	14,372	1.25	1.18 (0.71-1.95)	0.52	1.24 (0.75-2.06)	0.40
MetS-chronic	0 days/week	28,739	206	131,534	1.57	Reference		Reference	
	1-2 days/week	36,795	274	170,383	1.61	1.03 (0.86-1.23)	0.77	1.02 (0.85-1.22)	0.87
	3-4 days/week	13,024	102	61,088	1.67	1.07 (0.84-1.35)	0.60	1.03 (0.81-1.32)	0.78
	≥5 days/week	4,989	40	23,282	1.72	1.1 (0.78-1.54)	0.59	1.09 (0.78-1.54)	0.61

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S5. Risks of major adverse cardiovascular events according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age 40-64 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	976,905	8,871	4,163,437	2.13	Reference		Reference	
	1-2 days/week	770,823	6,169	3,396,451	1.82	0.85 (0.83-0.88)	< 0.001	0.92 (0.89-0.95)	< 0.001
	3-4 days/week	439,019	3,468	1,922,719	1.80	0.85 (0.81-0.88)	< 0.001	0.84 (0.8-0.87)	< 0.001
	≥5 days/week	252,297	2,232	1,083,420	2.06	0.97 (0.92-1.01)	0.16	0.86 (0.82-0.9)	< 0.001
MetS-recovery	0 days/week	90,232	1,594	382,771	4.16	Reference		Reference	
	1-2 days/week	67,267	955	297,656	3.21	0.77 (0.71-0.83)	< 0.001	0.83 (0.76-0.9)	< 0.001
	3-4 days/week	40,246	587	176,549	3.32	0.8 (0.73-0.88)	< 0.001	0.8 (0.73-0.88)	< 0.001
	≥5 days/week	25,033	406	106,888	3.80	0.91 (0.82-1.02)	0.10	0.83 (0.74-0.93)	< 0.001
MetS-developed	0 days/week	96,352	1,988	395,779	5.02	Reference		Reference	
	1-2 days/week	67,144	1,211	288,122	4.20	0.84 (0.78-0.9)	< 0.001	0.87 (0.81-0.94)	< 0.001
	3-4 days/week	37,707	680	160,224	4.24	0.84 (0.77-0.92)	< 0.001	0.83 (0.76-0.9)	< 0.001
	≥5 days/week	22,755	466	94,298	4.94	0.98 (0.89-1.09)	0.75	0.89 (0.8-0.98)	0.02
MetS-chronic	0 days/week	236,590	6,630	975,632	6.80	Reference		Reference	
	1-2 days/week	155,107	3,921	670,350	5.85	0.86 (0.83-0.9)	< 0.001	0.9 (0.87-0.94)	< 0.001
	3-4 days/week	92,355	2,283	394,689	5.78	0.85 (0.81-0.89)	< 0.001	0.83 (0.79-0.87)	< 0.001
	≥5 days/week	57,905	1,459	240,775	6.06	0.89 (0.84-0.94)	< 0.001	0.82 (0.78-0.87)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S6. Risks of major adverse cardiovascular events according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age \geq 65 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	159,409	7,354	601,086	12.23	Reference		Reference	
	1-2 days/week	45,443	1,683	175,303	9.60	0.78 (0.74-0.83)	< 0.001	0.86 (0.82-0.91)	< 0.001
	3-4 days/week	41,549	1,330	160,135	8.31	0.68 (0.64-0.72)	< 0.001	0.76 (0.71-0.8)	< 0.001
	\geq 5 days/week	46,407	1,619	175,750	9.21	0.75 (0.71-0.79)	< 0.001	0.77 (0.73-0.81)	< 0.001
MetS-recovery	0 days/week	28,828	1,546	107,460	14.39	Reference		Reference	
	1-2 days/week	7,372	371	28,000	13.25	0.92 (0.82-1.03)	0.15	0.95 (0.84-1.06)	0.34
	3-4 days/week	6,690	269	25,531	10.54	0.73 (0.64-0.83)	< 0.001	0.78 (0.69-0.89)	< 0.001
	\geq 5 days/week	7,670	345	28,816	11.97	0.83 (0.74-0.94)	0.002	0.83 (0.73-0.93)	0.002
MetS-developed	0 days/week	39,762	2,261	146,666	15.42	Reference		Reference	
	1-2 days/week	9,890	510	36,948	13.80	0.9 (0.81-0.99)	0.02	0.94 (0.85-1.04)	0.21
	3-4 days/week	8,948	363	33,494	10.84	0.7 (0.63-0.79)	< 0.001	0.75 (0.67-0.83)	< 0.001
	\geq 5 days/week	9,425	438	34,865	12.56	0.81 (0.74-0.9)	< 0.001	0.81 (0.73-0.9)	< 0.001
MetS-chronic	0 days/week	140,808	8,789	517,698	16.98	Reference		Reference	
	1-2 days/week	33,622	1,901	124,928	15.22	0.9 (0.85-0.94)	< 0.001	0.93 (0.89-0.98)	0.006
	3-4 days/week	31,354	1,482	116,507	12.72	0.75 (0.71-0.79)	< 0.001	0.79 (0.75-0.84)	< 0.001
	\geq 5 days/week	32,775	1,720	120,548	14.27	0.84 (0.8-0.89)	< 0.001	0.84 (0.79-0.88)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S7. Risks of all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age 20-39 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	703,712	1,236	3,218,583	0.38	Reference		Reference	
	1-2 days/week	714,886	1,154	3,309,093	0.35	0.91 (0.84-0.98)	0.02	0.88 (0.81-0.95)	0.001
	3-4 days/week	275,702	494	1,285,576	0.38	1.00 (0.90-1.11)	0.98	0.94 (0.85-1.05)	0.28
	≥5 days/week	121,386	240	566,333	0.42	1.10 (0.96-1.27)	0.16	1.01 (0.88-1.17)	0.84
MetS-recovery	0 days/week	25,987	51	120,847	0.42	Reference		Reference	
	1-2 days/week	30,272	57	142,574	0.40	0.95 (0.65-1.38)	0.78	0.92 (0.63-1.35)	0.68
	3-4 days/week	12,780	25	60,635	0.41	0.98 (0.61-1.58)	0.92	0.98 (0.61-1.59)	0.94
	≥5 days/week	5,936	17	28,025	0.61	1.44 (0.83-2.49)	0.20	1.45 (0.83-2.52)	0.19
MetS-developed	0 days/week	20,426	70	92,333	0.76	Reference		Reference	
	1-2 days/week	24,477	72	112,013	0.64	0.85 (0.61-1.18)	0.33	0.83 (0.6-1.15)	0.27
	3-4 days/week	8,175	27	37,838	0.71	0.94 (0.60-1.47)	0.790	0.85 (0.54-1.33)	0.48
	≥5 days/week	3,102	11	14,411	0.76	1.01 (0.53-1.90)	0.98	0.85 (0.44-1.66)	0.64
MetS-chronic	0 days/week	28,739	89	131,946	0.67	Reference		Reference	
	1-2 days/week	36,795	129	170,899	0.75	1.12 (0.85-1.47)	0.41	1.10 (0.84-1.45)	0.48
	3-4 days/week	13,024	42	61,291	0.69	1.02 (0.70-1.47)	0.93	0.92 (0.63-1.34)	0.68
	≥5 days/week	4,989	16	23,357	0.69	1.02 (0.60-1.73)	0.96	0.93 (0.55-1.6)	0.80

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S8. Risks of all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age 40-64 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	976,905	6,221	4,180,767	1.49	Reference		Reference	
	1-2 days/week	770,823	3,934	3,408,883	1.15	0.78 (0.75-0.81)	< 0.001	0.84 (0.80-0.87)	< 0.001
	3-4 days/week	439,019	2,293	1,929,731	1.19	0.80 (0.76-0.84)	< 0.001	0.80 (0.76-0.84)	< 0.001
	≥5 days/week	252,297	1,716	1,087,843	1.58	1.06 (1.00-1.12)	0.03	0.92 (0.88-0.97)	0.004
MetS-recovery	0 days/week	90,232	925	385,822	2.40	Reference		Reference	
	1-2 days/week	67,267	480	299,547	1.60	0.67 (0.60-0.75)	< 0.001	0.73 (0.65-0.82)	< 0.001
	3-4 days/week	40,246	279	177,731	1.57	0.65 (0.57-0.75)	< 0.001	0.68 (0.59-0.77)	< 0.001
	≥5 days/week	25,033	223	107,725	2.07	0.86 (0.75-1.00)	0.049	0.77 (0.67-0.90)	< 0.001
MetS-developed	0 days/week	96,352	899	399,819	2.25	Reference		Reference	
	1-2 days/week	67,144	549	290,656	1.89	0.84 (0.76-0.93)	0.001	0.89 (0.80-0.99)	0.03
	3-4 days/week	37,707	299	161,619	1.85	0.82 (0.72-0.94)	0.003	0.77 (0.67-0.87)	< 0.001
	≥5 days/week	22,755	219	95,233	2.30	1.02 (0.88-1.19)	0.77	0.84 (0.72-0.98)	0.023
MetS-chronic	0 days/week	236,590	2,496	989,194	2.52	Reference		Reference	
	1-2 days/week	155,107	1,289	678,683	1.90	0.75 (0.70-0.81)	< 0.001	0.78 (0.73-0.84)	< 0.001
	3-4 days/week	92,355	867	399,493	2.17	0.86 (0.80-0.93)	< 0.001	0.80 (0.74-0.86)	< 0.001
	≥5 days/week	57,905	624	243,869	2.56	1.01 (0.93-1.11)	0.76	0.87 (0.80-0.95)	0.002

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S9. Risks of all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within subjects with age ≥ 65 years old.

MetS status	Frequency of MV-PA	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	159,409	8,164	613,527	13.31	Reference		Reference	
	1-2 days/week	45,443	1,645	178,328	9.22	0.69 (0.66-0.73)	< 0.001	0.81 (0.77-0.86)	< 0.001
	3-4 days/week	41,549	1,358	162,522	8.36	0.63 (0.59-0.67)	< 0.001	0.78 (0.74-0.83)	< 0.001
	≥ 5 days/week	46,407	1,603	178,636	8.97	0.67 (0.64-0.71)	< 0.001	0.75 (0.71-0.79)	< 0.001
MetS-recovery	0 days/week	28,828	1,400	110,159	12.71	Reference		Reference	
	1-2 days/week	7,372	223	28,662	7.78	0.61 (0.53-0.71)	< 0.001	0.67 (0.59-0.78)	< 0.001
	3-4 days/week	6,690	222	26,033	8.53	0.67 (0.58-0.77)	< 0.001	0.79 (0.68-0.91)	0.001
	≥ 5 days/week	7,670	249	29,435	8.46	0.67 (0.58-0.76)	< 0.001	0.71 (0.62-0.81)	< 0.001
MetS-developed	0 days/week	39,762	1,498	150,598	9.95	Reference		Reference	
	1-2 days/week	9,890	312	37,855	8.24	0.83 (0.73-0.94)	0.003	0.9 (0.80-1.02)	0.09
	3-4 days/week	8,948	224	34,137	6.56	0.66 (0.57-0.76)	< 0.001	0.72 (0.62-0.83)	< 0.001
	≥ 5 days/week	9,425	242	35,638	6.79	0.68 (0.60-0.78)	< 0.001	0.66 (0.58-0.76)	< 0.001
MetS-chronic	0 days/week	140,808	5,016	533,058	9.41	Reference		Reference	
	1-2 days/week	33,622	950	128,396	7.40	0.79 (0.73-0.84)	< 0.001	0.82 (0.76-0.88)	< 0.001
	3-4 days/week	31,354	754	119,212	6.32	0.67 (0.62-0.73)	< 0.001	0.70 (0.65-0.76)	< 0.001
	≥ 5 days/week	32,775	937	123,595	7.58	0.81 (0.75-0.86)	< 0.001	0.76 (0.71-0.82)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S10. Risks of major adverse cardiovascular events according to the frequency of moderate-to-vigorous physical activity in each study group within subjects within male subjects.

MetS status	Frequency of MV-PA	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	930,237	11,817	4,132,793	2.86	Reference		Reference	
	1-2 days/week	968,312	6,996	4,456,336	1.57	0.55 (0.53-0.57)	< 0.001	0.92 (0.89-0.95)	< 0.001
	3-4 days/week	457,437	3,993	2,114,502	1.89	0.66 (0.64-0.68)	< 0.001	0.83 (0.80-0.86)	< 0.001
	≥5 days/week	252,775	3,118	1,135,773	2.75	0.96 (0.92-1.00)	0.04	0.82 (0.79-0.85)	< 0.001
MetS-recovery	0 days/week	82,818	2,093	359,770	5.82	Reference		Reference	
	1-2 days/week	79,227	1,126	361,219	3.12	0.54 (0.50-0.58)	< 0.001	0.84 (0.78-0.91)	< 0.001
	3-4 days/week	42,056	715	191,365	3.74	0.64 (0.59-0.70)	< 0.001	0.81 (0.75-0.89)	< 0.001
	≥5 days/week	25,752	599	112,314	5.33	0.92 (0.84-1.00)	0.06	0.83 (0.76-0.91)	< 0.001
MetS-developed	0 days/week	80,162	2,521	337,783	7.46	Reference		Reference	
	1-2 days/week	73,896	1,414	327,046	4.32	0.58 (0.54-0.62)	< 0.001	0.90 (0.84-0.96)	0.001
	3-4 days/week	35,099	785	155,125	5.06	0.68 (0.63-0.73)	< 0.001	0.80 (0.74-0.87)	< 0.001
	≥5 days/week	20,448	657	86,568	7.59	1.02 (0.93-1.11)	0.70	0.86 (0.78-0.93)	< 0.001
MetS-chronic	0 days/week	182,679	7,615	766,556	9.93	Reference		Reference	
	1-2 days/week	160,057	4,438	708,105	6.27	0.63 (0.61-0.65)	< 0.001	0.92 (0.88-0.95)	< 0.001
	3-4 days/week	85,122	2,710	374,510	7.24	0.73 (0.70-0.76)	< 0.001	0.85 (0.81-0.88)	< 0.001
	≥5 days/week	52,922	2,105	221,409	9.51	0.96 (0.91-1.00)	0.08	0.84 (0.80-0.88)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S11. Risks of major adverse cardiovascular events according to the frequency of moderate-to-vigorous physical activity in each study group within subjects within female subjects.

MetS status	Frequency of MV-PA	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	909,789	5,420	3,848,323	1.41	Reference		Reference	
	1-2 days/week	562,840	1,957	2,422,327	0.81	0.57 (0.54-0.60)	< 0.001	0.92 (0.87-0.97)	0.001
	3-4 days/week	298,833	1,233	1,253,084	0.98	0.70 (0.66-0.74)	< 0.001	0.84 (0.79-0.90)	< 0.001
	≥5 days/week	167,315	909	689,367	1.32	0.94 (0.87-1.00)	0.07	0.85 (0.8-0.92)	< 0.001
MetS-recovery	0 days/week	62,229	1,129	251,140	4.50	Reference		Reference	
	1-2 days/week	25,684	297	106,833	2.78	0.62 (0.54-0.70)	< 0.001	0.94 (0.83-1.07)	0.37
	3-4 days/week	17,660	195	71,272	2.74	0.61 (0.52-0.71)	< 0.001	0.85 (0.73-0.99)	0.04
	≥5 days/week	12,887	173	51,373	3.37	0.75 (0.64-0.88)	< 0.001	0.86 (0.73-1.01)	0.07
MetS-developed	0 days/week	76,378	1,826	296,799	6.15	Reference		Reference	
	1-2 days/week	27,615	426	109,805	3.88	0.63 (0.57-0.70)	< 0.001	0.91 (0.82-1.02)	0.09
	3-4 days/week	19,731	299	76,365	3.92	0.64 (0.56-0.72)	< 0.001	0.83 (0.73-0.93)	0.002
	≥5 days/week	14,834	265	56,968	4.65	0.76 (0.66-0.86)	< 0.001	0.86 (0.76-0.98)	0.03
MetS-chronic	0 days/week	223,458	8,010	858,308	9.33	Reference		Reference	
	1-2 days/week	65,467	1,658	257,555	6.44	0.69 (0.65-0.73)	< 0.001	0.92 (0.87-0.97)	0.002
	3-4 days/week	51,611	1,157	197,775	5.85	0.63 (0.59-0.67)	< 0.001	0.78 (0.73-0.83)	< 0.001
	≥5 days/week	42,747	1,114	163,195	6.83	0.73 (0.69-0.78)	< 0.001	0.83 (0.78-0.89)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S12. Risks of all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within subjects within male subjects.

MetS status	Frequency of MV-PA	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	930,237	12,215	4,154,926	2.94	Reference		Reference	
	1-2 days/week	968,312	5,531	4,470,415	1.24	0.42 (0.41-0.43)	< 0.001	0.80 (0.78-0.83)	< 0.001
	3-4 days/week	457,437	3,424	2,122,554	1.61	0.55 (0.53-0.57)	< 0.001	0.78 (0.75-0.81)	< 0.001
	≥5 days/week	252,775	2,970	1,141,840	2.60	0.88 (0.85-0.92)	< 0.001	0.81 (0.78-0.84)	< 0.001
MetS-recovery	0 days/week	82,818	1,711	363,733	4.70	Reference		Reference	
	1-2 days/week	79,227	646	363,399	1.78	0.38 (0.35-0.41)	< 0.001	0.73 (0.66-0.8)	< 0.001
	3-4 days/week	42,056	442	192,758	2.29	0.49 (0.44-0.54)	< 0.001	0.72 (0.65-0.8)	< 0.001
	≥5 days/week	25,752	418	113,520	3.68	0.78 (0.70-0.87)	< 0.001	0.76 (0.68-0.85)	< 0.001
MetS-developed	0 days/week	80,162	1,661	342,702	4.85	Reference		Reference	
	1-2 days/week	73,896	765	329,933	2.32	0.48 (0.44-0.52)	< 0.001	0.87 (0.79-0.95)	0.002
	3-4 days/week	35,099	445	156,708	2.84	0.59 (0.53-0.65)	< 0.001	0.73 (0.65-0.81)	< 0.001
	≥5 days/week	20,448	365	87,821	4.16	0.86 (0.77-0.96)	0.008	0.69 (0.62-0.78)	< 0.001
MetS-chronic	0 days/week	182,679	4,378	781,635	5.60	Reference		Reference	
	1-2 days/week	160,057	1,811	717,283	2.52	0.45 (0.43-0.48)	< 0.001	0.78 (0.74-0.83)	< 0.001
	3-4 days/week	85,122	1,284	380,113	3.38	0.60 (0.57-0.64)	< 0.001	0.73 (0.69-0.78)	< 0.001
	≥5 days/week	52,922	1,163	225,588	5.16	0.92 (0.86-0.98)	0.012	0.77 (0.72-0.83)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S13. Risks of all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within subjects within female subjects.

MetS status	Frequency of MV-PA	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MetS-free	0 days/week	909,789	3,406	3,857,951	0.88	Reference		Reference	
	1-2 days/week	562,840	1,202	2,425,889	0.50	0.56 (0.53-0.60)	< 0.001	0.9 (0.84-0.96)	0.003
	3-4 days/week	298,833	721	1,255,274	0.57	0.65 (0.60-0.70)	< 0.001	0.82 (0.76-0.89)	< 0.001
	≥5 days/week	167,315	589	690,973	0.85	0.97 (0.88-1.05)	0.43	0.92 (0.84-1.00)	0.06
MetS-recovery	0 days/week	62,229	665	253,094	2.63	Reference		Reference	
	1-2 days/week	25,684	114	107,384	1.06	0.40 (0.33-0.49)	< 0.001	0.68 (0.56-0.83)	< 0.001
	3-4 days/week	17,660	84	71,642	1.17	0.45 (0.36-0.56)	< 0.001	0.72 (0.58-0.91)	0.006
	≥5 days/week	12,887	71	51,665	1.37	0.52 (0.41-0.67)	< 0.001	0.69 (0.54-0.88)	0.003
MetS-developed	0 days/week	76,378	806	300,048	2.69	Reference		Reference	
	1-2 days/week	27,615	168	110,590	1.52	0.57 (0.48-0.67)	< 0.001	0.91 (0.77-1.08)	0.28
	3-4 days/week	19,731	105	76,885	1.37	0.51 (0.41-0.62)	< 0.001	0.74 (0.60-0.90)	0.003
	≥5 days/week	14,834	107	57,460	1.86	0.69 (0.57-0.85)	< 0.001	0.85 (0.69-1.04)	0.11
MetS-chronic	0 days/week	223,458	3,223	872,563	3.69	Reference		Reference	
	1-2 days/week	65,467	557	260,695	2.14	0.58 (0.53-0.63)	< 0.001	0.84 (0.77-0.92)	< 0.001
	3-4 days/week	51,611	379	199,884	1.90	0.51 (0.46-0.57)	< 0.001	0.72 (0.65-0.80)	< 0.001
	≥5 days/week	42,747	414	165,234	2.51	0.68 (0.61-0.75)	< 0.001	0.84 (0.76-0.93)	< 0.001

MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S14. Characteristics of those with undetermined MetS status who were not included in the main analysis.

Variables	Undetermined MetS status (N = 1,297,589)
Clinical and demographic characteristics at S3	
Age (years)	51.0 ± 12.8
Sex (male)	829,324 (63.9)
Height (cm)	164.9 ± 9.6
Weight (kg)	68.7 ± 12.2
BMI (kg/m ²)	25.1 ± 3.0
Low-income status*	248,855 (19.2)
CCI (score)	0.9 ± 1.2
Hemoglobin (g/dL)	14.4 ± 1.6
AST (IU/L)	27.5 ± 22.6
ALT (IU/L)	29.8 ± 26.9
Cr (mg/dL)	0.89 ± 0.19
eGFR (mL/min/1.73 m ²)	90.1 ± 31.8
Self-reported lifestyle (n (%))	
Moderate-to-vigorous activity	
None	602,875 (46.5)
1-2 days/wk	380,888 (29.4)
3-4 days/wk	189,579 (14.6)
≥ 5 days/wk	124,247 (9.6)
Smoking	
Nonsmoker	684,976 (52.8)
Ex-smoker	211,688 (16.3)
Current light-to-moderate smoker	202,816 (15.6)
Current heavy smoker	198,109 (15.3)
Alcohol	
No alcohol intake	608,088(46.9)
Moderate consumption	58,720(4.5)
Heavy consumption	630,781(48.6)
Parameters of MetS	
Waist circumference (cm)	84.5 ± 7.8
Systolic BP (mmHg)	126.9 ± 13.4
Diastolic BP (mmHg)	79.2 ± 9.4
Glucose (mg/dL)	101.8 ± 22.4
Triglycerides (mg/dL)	173.2 ± 120.7
HDL cholesterol (mg/dL)	50.7 ± 14.5
Baseline N of MetS components (n (%))	
0	41,098 (3.2)
1	167,341 (12.9)
2	363,965 (28.1)
3	536,723 (41.4)
4	163,997 (12.6)
5	24,465 (1.9)

AST = aspartate aminotransferase, ALT = alanine aminotransferase, BMI = body mass index, BP = blood pressure, CCI = Charlson Comorbidity Index, Cr = creatinine, eGFR = estimated glomerular filtration rate, HDL = high-density lipoprotein, MetS = metabolic syndrome

There were no missing values in the table.

Table S15. Risks of major adverse cardiovascular events and all-cause mortality according to the frequency of moderate-to-vigorous physical activity in each study group within those who were excluded due to their undetermined MetS status

Outcome	Frequency of MV-PA	Number of persons	Number of outcomes	Follow-up (person-years)	Incidence rate (/1000 person-years)	Unadjusted model		Multivariable model	
						IRR (95% CI)	P	Adjusted IRR (95% CI)	P
MACE	0 days/week	561,977	13,450	2,328,970	5.78	Reference		Reference	
	1-2 days/week	393,223	5,814	1,726,226	3.37	0.58 (0.57-0.60)	< 0.001	0.89 (0.86-0.92)	< 0.001
	3-4 days/week	210,454	3,741	909,856	4.11	0.71 (0.69-0.74)	< 0.001	0.88 (0.84-0.91)	< 0.001
	≥5 days/week	131,935	2,996	550,290	5.44	0.94 (0.91-0.98)	0.004	0.87 (0.84-0.91)	< 0.001
All-cause mortality	0 days/week	561,977	8,642	2,353,895	3.67	Reference		Reference	
	1-2 days/week	393,223	3,190	1,737,700	1.84	0.50 (0.48-0.52)	< 0.001	0.85 (0.81-0.88)	< 0.001
	3-4 days/week	210,454	2,026	917,287	2.21	0.60 (0.57-0.63)	< 0.001	0.78 (0.75-0.82)	< 0.001
	≥5 days/week	131,935	1,788	555,994	3.22	0.88 (0.83-0.92)	< 0.001	0.78 (0.74-0.82)	< 0.001

MACE = major adverse cardiovascular event, MetS = metabolic syndrome, MV-PA, moderate-to-vigorous physical activity, IRR = incidence rate ratio, CI = confidence interval

Multivariable model was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), aspartate aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low-income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), Charlson Comorbidity Index score, place of residence (urban or rural), and the number of MetS components at the baseline health screening.

Table S16. Risks of major adverse cardiovascular events according to frequencies of moderate-to-vigorous physical activity in those with consistently free or chronically present metabolic syndrome component.

Subgroups and exposure	Number of persons	Number of MACE	Follow-up (person-years)	Incidence rate (/1000 person-years)	Model 1. Unadjusted model		Model 2. Age-sex adjusted model		Model 3. Baseline severity of MetS (number of MetS components) and other lifestyle variables (smoking, alcohol) adjusted	
					Adjusted IRR (95% CI)	P	Adjusted IRR (95% CI)	P	Adjusted IRR (95% CI)	P
Central obesity-free										
0 days/week	1,653,227	19,084	7,199,247	2.65	Reference		Reference		Reference	
1-2 days/week	1,407,541	10,100	6,355,181	1.59	0.6 (0.59-0.61)	< 0.001	0.9 (0.88-0.92)	< 0.001	0.93 (0.91-0.95)	< 0.001
3-4 days/week	696,957	6,025	3,120,635	1.93	0.73 (0.71-0.75)	< 0.001	0.83 (0.8-0.85)	< 0.001	0.86 (0.83-0.88)	< 0.001
≥ 5 days/week	391,800	4,813	1,706,720	2.82	1.06 (1.03-1.1)	< 0.001	0.84 (0.81-0.87)	< 0.001	0.86 (0.83-0.89)	< 0.001
Central obesity-chronic										
0 days/week	373,002	10,934	1,501,075	7.28						
1-2 days/week	204,696	3,830	877,334	4.37	0.6 (0.58-0.62)	< 0.001	0.91 (0.88-0.94)	< 0.001	0.94 (0.91-0.98)	0.003
3-4 days/week	114,223	2,377	477,967	4.97	0.68 (0.65-0.71)	< 0.001	0.84 (0.8-0.88)	< 0.001	0.88 (0.84-0.92)	< 0.001
≥ 5 days/week	75,812	1,921	306,723	6.26	0.86 (0.82-0.9)	< 0.001	0.83 (0.79-0.87)	< 0.001	0.86 (0.82-0.91)	< 0.001
High blood pressure-free										
0 days/week	1,050,775	5,603	4,562,450	1.23	Reference		Reference		Reference	
1-2 days/week	867,072	3,234	3,871,018	0.84	0.68 (0.65-0.71)	< 0.001	0.87 (0.83-0.91)	< 0.001	0.9 (0.86-0.94)	< 0.001
3-4 days/week	406,945	1,712	1,797,510	0.95	0.78 (0.73-0.82)	< 0.001	0.79 (0.75-0.83)	< 0.001	0.84 (0.8-0.89)	< 0.001
≥ 5 days/week	212,349	1,179	920,271	1.28	1.04 (0.98-1.11)	0.187	0.81 (0.76-0.86)	< 0.001	0.86 (0.81-0.92)	< 0.001
High blood pressure-chronic										
0 days/week	635,759	22,936	2,589,510	8.86	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001
1-2 days/week	391,097	9,014	1,707,914	5.28	0.6 (0.58-0.61)	< 0.001	0.88 (0.86-0.9)	< 0.001	0.92 (0.9-0.95)	< 0.001
3-4 days/week	242,882	5,925	1,042,980	5.68	0.64 (0.62-0.66)	< 0.001	0.79 (0.77-0.81)	< 0.001	0.84 (0.82-0.87)	< 0.001
≥ 5 days/week	169,629	5,151	697,897	7.38	0.83 (0.81-0.86)	< 0.001	0.8 (0.78-0.83)	< 0.001	0.85 (0.83-0.88)	< 0.001
Impaired glucose tolerance-free										
0 days/week	1,366,571	13,549	5,908,689	2.29	Reference		Reference		Reference	
1-2 days/week	1,109,805	6,629	4,977,648	1.33	0.58 (0.56-0.6)	< 0.001	0.9 (0.87-0.93)	< 0.001	0.94 (0.91-0.96)	< 0.001
3-4 days/week	541,418	3,831	2,401,527	1.60	0.7 (0.67-0.72)	< 0.001	0.83 (0.8-0.86)	< 0.001	0.89 (0.86-0.92)	< 0.001
≥ 5 days/week	294,940	2,800	1,276,663	2.19	0.96 (0.92-1)	0.032	0.81 (0.78-0.84)	< 0.001	0.88 (0.84-0.91)	< 0.001
Impaired glucose tolerance-chronic										
0 days/week	322,541	12,083	1,302,705	9.28	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001
1-2 days/week	201,676	5,061	870,880	5.81	0.63 (0.61-0.65)	< 0.001	0.89 (0.86-0.92)	< 0.001	0.94 (0.91-0.98)	< 0.001
3-4 days/week	126,855	3,380	539,761	6.26	0.68 (0.65-0.7)	< 0.001	0.8 (0.77-0.83)	< 0.001	0.87 (0.83-0.9)	< 0.001
≥ 5 days/week	91,049	2,948	371,119	7.94	0.86 (0.82-0.89)	< 0.001	0.8 (0.77-0.83)	< 0.001	0.86 (0.83-0.9)	< 0.001
High Tg-free										
0 days/week	1,395,443	13,959	5,998,236	2.33	Reference		Reference		Reference	
1-2 days/week	1,100,029	6,374	4,898,158	1.30	0.56 (0.54-0.58)	< 0.001	0.9 (0.87-0.93)	< 0.001	0.95 (0.92-0.98)	< 0.001
3-4 days/week	567,617	3,947	2,500,091	1.58	0.68 (0.65-0.7)	< 0.001	0.81 (0.79-0.84)	< 0.001	0.86 (0.83-0.89)	< 0.001
≥ 5 days/week	328,192	3,331	1,409,925	2.36	1.02 (0.98-1.05)	0.434	0.83 (0.8-0.86)	< 0.001	0.87 (0.84-0.9)	< 0.001
High Tg-chronic										
0 days/week	427,767	12,962	1,777,758	7.29	Reference		Reference		Reference	
1-2 days/week	311,342	6,117	1,380,051	4.43	0.61 (0.59-0.63)	< 0.001	0.89 (0.86-0.92)	< 0.001	0.94 (0.91-0.97)	< 0.001
3-4 days/week	160,377	3,572	696,959	5.13	0.7 (0.68-0.73)	< 0.001	0.81 (0.78-0.84)	< 0.001	0.86 (0.83-0.9)	< 0.001
≥ 5 days/week	97,219	2,709	404,610	6.70	0.92 (0.88-0.96)	< 0.001	0.81 (0.78-0.85)	< 0.001	0.85 (0.82-0.89)	< 0.001
Low HDL-free										
0 days/week	1,556,877	17,063	6,767,666	2.52	Reference		Reference		Reference	
1-2 days/week	1,347,104	9,063	6,070,028	1.49	0.59 (0.58-0.61)	< 0.001	0.9 (0.88-0.92)	< 0.001	0.94 (0.92-0.97)	< 0.001
3-4 days/week	668,382	5,390	2,991,964	1.80	0.71 (0.69-0.74)	< 0.001	0.83 (0.81-0.86)	< 0.001	0.89 (0.87-0.92)	< 0.001
≥ 5 days/week	374,961	4,189	1,634,768	2.56	1.02 (0.98-1.05)	0.347	0.83 (0.8-0.86)	< 0.001	0.88 (0.85-0.91)	< 0.001
Low HDL-chronic										
0 days/week	296,655	9,335	1,195,777	7.81	Reference		Reference		Reference	
1-2 days/week	157,794	3,406	676,315	5.04	0.64 (0.62-0.67)	< 0.001	0.88 (0.84-0.92)	< 0.001	0.92 (0.89-0.96)	< 0.001
3-4 days/week	98,268	2,251	408,466	5.51	0.71 (0.67-0.74)	< 0.001	0.78 (0.75-0.82)	< 0.001	0.83 (0.79-0.87)	< 0.001
≥ 5 days/week	67,719	1,904	272,183	7.00	0.9 (0.85-0.94)	< 0.001	0.8 (0.76-0.84)	< 0.001	0.84 (0.8-0.88)	< 0.001

MetS = metabolic syndrome, IRR = incidence rate ratio, CI = confidence interval, Tg = triglyceride, HDL = high-density lipoprotein cholesterol

^a Model 3 was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), and Charlson Comorbidity Index, place of residences (urban or rural) and the number of MetS components at the baseline (S1) health screening, and the other lifestyle variables (smoking; none, previous, current and alcohol consumption; none, moderate, heavy)

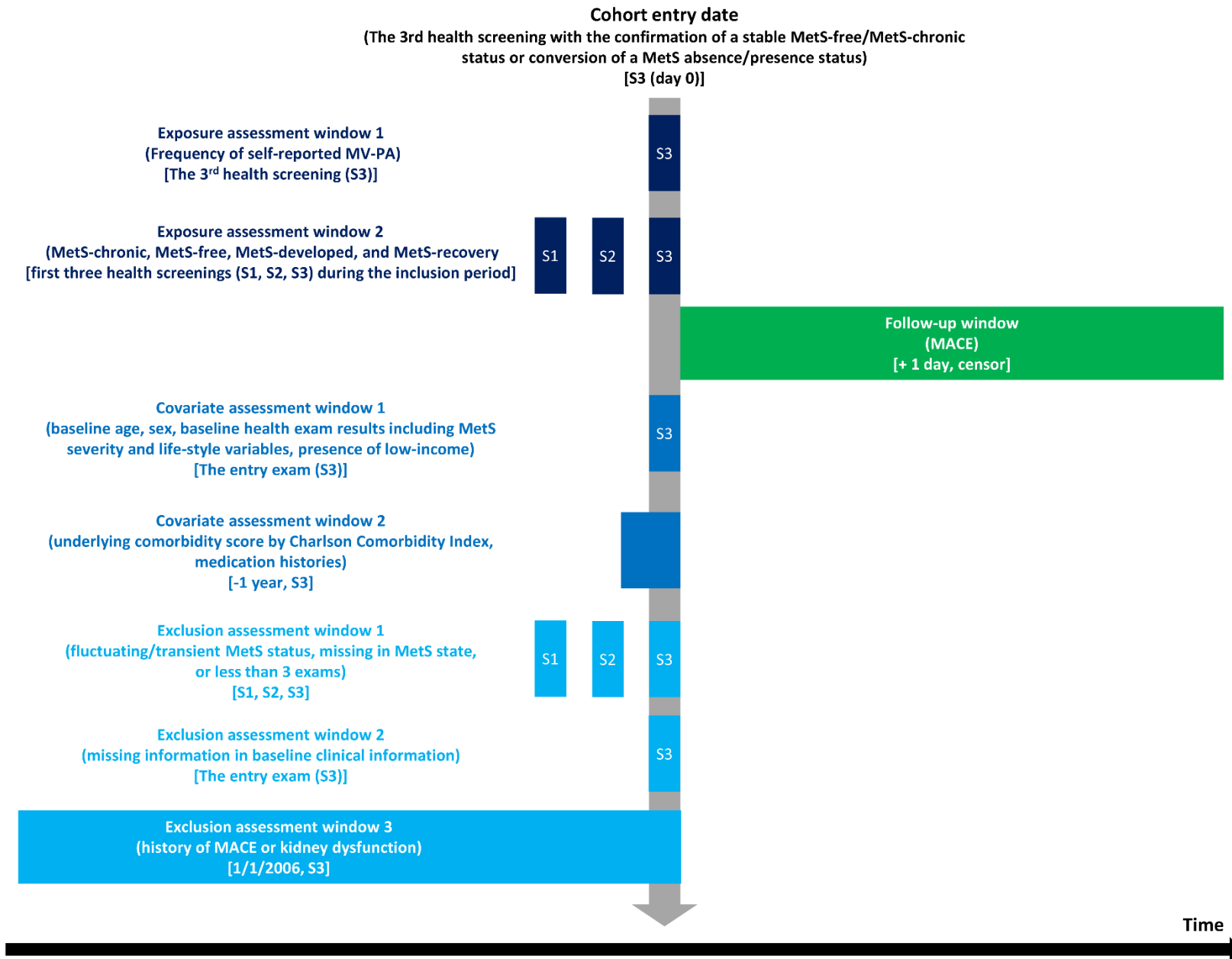
Table S17. Risks of all-cause mortality according to frequencies of moderate-to-vigorous physical activity in those with consistently free or chronically present metabolic syndrome component.

Subgroups and exposure	Number of persons	Number of deaths	Follow-up (person-years)	Incidence rate (/1000 person-years)	Model 1. Unadjusted model		Model 2. Age-sex adjusted model		Model 3. Baseline severity of MetS (number of MetS components) and other lifestyle variables (smoking, alcohol) adjusted	
					Adjusted IRR (95% CI)	P	Adjusted IRR (95% CI)	P	Adjusted IRR (95% CI)	P
Central obesity-free										
0 days/week	1,653,227	16,751	7,235,006	2.32	Reference		Reference		Reference	
1-2 days/week	1,407,541	7,126	6,375,448	1.12	0.48 (0.47-0.5)	< 0.001	0.75 (0.73-0.77)	< 0.001	0.85 (0.82-0.87)	< 0.001
3-4 days/week	696,957	4,485	3,132,640	1.43	0.62 (0.6-0.64)	< 0.001	0.71 (0.69-0.74)	< 0.001	0.83 (0.81-0.86)	< 0.001
≥ 5 days/week	391,800	3,942	1,715,988	2.30	0.99 (0.96-1.03)	0.658	0.77 (0.74-0.8)	< 0.001	0.87 (0.84-0.9)	< 0.001
Central obesity-chronic										
0 days/week	373,002	5,166	1,521,190	3.40	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001
1-2 days/week	204,696	1,543	884,959	1.74	0.51 (0.49-0.54)	< 0.001	0.8 (0.75-0.85)	< 0.001	0.85 (0.8-0.9)	< 0.001
3-4 days/week	114,223	978	482,688	2.03	0.6 (0.56-0.64)	< 0.001	0.73 (0.68-0.78)	< 0.001	0.77 (0.72-0.83)	< 0.001
≥ 5 days/week	75,812	904	310,321	2.91	0.86 (0.8-0.92)	< 0.001	0.78 (0.73-0.84)	< 0.001	0.81 (0.76-0.87)	< 0.001
High blood pressure-free										
0 days/week	1,050,775	4,776	4,572,913	1.04	Reference		Reference		Reference	
1-2 days/week	867,072	2,494	3,877,338	0.64	0.62 (0.59-0.65)	< 0.001	0.76 (0.73-0.8)	< 0.001	0.84 (0.8-0.88)	< 0.001
3-4 days/week	406,945	1,455	1,800,830	0.81	0.77 (0.73-0.82)	< 0.001	0.77 (0.73-0.82)	< 0.001	0.85 (0.8-0.91)	< 0.001
≥ 5 days/week	212,349	1,085	922,515	1.18	1.13 (1.05-1.2)	< 0.001	0.85 (0.79-0.91)	< 0.001	0.9 (0.84-0.96)	0.001
High blood pressure-chronic										
0 days/week	635,759	14,098	2,632,115	5.36	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001	1 (Ref.)	< 0.001
1-2 days/week	391,097	4,492	1,726,092	2.60	0.49 (0.47-0.5)	< 0.001	0.76 (0.74-0.79)	< 0.001	0.84 (0.81-0.87)	< 0.001
3-4 days/week	242,882	3,175	1,054,728	3.01	0.56 (0.54-0.58)	< 0.001	0.7 (0.68-0.73)	< 0.001	0.77 (0.74-0.8)	< 0.001
≥ 5 days/week	169,629	2,989	707,734	4.22	0.79 (0.76-0.82)	< 0.001	0.72 (0.69-0.75)	< 0.001	0.78 (0.75-0.81)	< 0.001
Impaired glucose tolerance-free										
0 days/week	1,366,571	9,699	5,933,883	1.63	Reference		Reference		Reference	
1-2 days/week	1,109,805	4,078	4,990,844	0.82	0.5 (0.48-0.52)	< 0.001	0.75 (0.72-0.78)	< 0.001	0.82 (0.79-0.85)	< 0.001
3-4 days/week	541,418	2,499	2,409,100	1.04	0.63 (0.61-0.66)	< 0.001	0.74 (0.7-0.77)	< 0.001	0.81 (0.78-0.85)	< 0.001
≥ 5 days/week	294,940	2,033	1,282,111	1.59	0.97 (0.92-1.02)	0.214	0.78 (0.75-0.82)	< 0.001	0.85 (0.81-0.89)	< 0.001
Impaired glucose tolerance-chronic										
0 days/week	322,541	7,525	1,325,296	5.68	Reference		Reference		Reference	
1-2 days/week	201,676	2,539	880,948	2.88	0.51 (0.49-0.53)	< 0.001	0.75 (0.71-0.78)	< 0.001	0.82 (0.79-0.86)	< 0.001
3-4 days/week	126,855	1,791	546,513	3.28	0.58 (0.55-0.61)	< 0.001	0.68 (0.65-0.72)	< 0.001	0.74 (0.71-0.78)	< 0.001
≥ 5 days/week	91,049	1,800	376,786	4.78	0.84 (0.8-0.89)	< 0.001	0.73 (0.7-0.77)	< 0.001	0.78 (0.74-0.82)	< 0.001
High Tg-free										
0 days/week	1,395,443	13,039	6,023,606	2.16	Reference		Reference		Reference	
1-2 days/week	1,100,029	5,050	4,910,424	1.03	0.48 (0.46-0.49)	< 0.001	0.76 (0.74-0.79)	< 0.001	0.84 (0.81-0.87)	< 0.001
3-4 days/week	567,617	3,310	2,507,661	1.32	0.61 (0.59-0.63)	< 0.001	0.72 (0.69-0.75)	< 0.001	0.82 (0.78-0.85)	< 0.001
≥ 5 days/week	328,192	3,034	1,416,202	2.14	0.99 (0.95-1.03)	0.607	0.77 (0.74-0.8)	< 0.001	0.85 (0.82-0.89)	< 0.001
High Tg-chronic										
0 days/week	427,767	6,133	1,802,514	3.40	Reference		Reference		Reference	
1-2 days/week	311,342	2,446	1,392,563	1.76	0.52 (0.49-0.54)	< 0.001	0.79 (0.75-0.83)	< 0.001	0.85 (0.81-0.89)	< 0.001
3-4 days/week	160,377	1,531	704,123	2.17	0.64 (0.6-0.68)	< 0.001	0.74 (0.7-0.79)	< 0.001	0.79 (0.74-0.83)	< 0.001
≥ 5 days/week	97,219	1,309	409,983	3.19	0.94 (0.88-1)	0.037	0.79 (0.74-0.83)	< 0.001	0.83 (0.78-0.88)	< 0.001
Low HDL-free										
0 days/week	1,556,877	14,883	6,799,437	2.19	Reference		Reference		Reference	
1-2 days/week	1,347,104	6,613	6,087,912	1.09	0.5 (0.48-0.51)	< 0.001	0.77 (0.75-0.79)	< 0.001	0.85 (0.82-0.87)	< 0.001
3-4 days/week	668,382	4,097	3,002,588	1.36	0.62 (0.6-0.65)	< 0.001	0.73 (0.71-0.76)	< 0.001	0.82 (0.8-0.85)	< 0.001
≥ 5 days/week	374,961	3,578	1,642,865	2.18	0.99 (0.96-1.03)	0.788	0.79 (0.76-0.82)	< 0.001	0.86 (0.83-0.9)	< 0.001
Low HDL-chronic										
0 days/week	296,655	4,459	1,213,168	3.68	Reference		Reference		Reference	
1-2 days/week	157,794	1,318	683,112	1.93	0.52 (0.49-0.56)	< 0.001	0.77 (0.72-0.82)	< 0.001	0.83 (0.78-0.89)	< 0.001
3-4 days/week	98,268	966	412,846	2.34	0.64 (0.59-0.68)	< 0.001	0.73 (0.68-0.78)	< 0.001	0.78 (0.73-0.84)	< 0.001
≥ 5 days/week	67,719	903	275,775	3.27	0.89 (0.83-0.96)	0.002	0.76 (0.71-0.82)	< 0.001	0.8 (0.75-0.86)	< 0.001

MetS = metabolic syndrome, IRR = incidence rate ratio, CI = confidence interval, Tg = triglyceride, HDL = high-density lipoprotein cholesterol

^a Model 3 was adjusted for age, sex, baseline eGFR (continuous, mL/min/1.73 m²), alanine aminotransferase (continuous, IU/mL), hemoglobin (continuous, g/dL), low income status (the lowest quartile in the nation), body mass index (continuous, kg/m²), and Charlson Comorbidity Index, place of residences (urban or rural) and the number of MetS components at the baseline (S1) health screening, and the other lifestyle variables (smoking; none, previous, current and alcohol consumption; none, moderate, heavy)

Figure S1. Graphical description of the study population.



MetS = metabolic syndrome, MV-PA = moderate-to vigorous physical activity, MACE = major adverse cardiovascular events

Figure S2. English version questionnaire used in general health screenings by the National Health Insurance Service of Korea.

[Annex No. 1] <Front>

National Screening Program

Regular checkup Life cycle-based checkup

* Answers must be provided for all questions so the information will be reported correctly.

First Name		Residential ID No.		Telephone	Home	
Given Name					Mobile phone	
Current address					Zip code	-
					E-mail	

*** These are questions about your medical history.**

* Please answer the following questions about your present condition by ticking the appropriate box.

1. Have you ever been diagnosed by a doctor with any of the following diseases (Box a) or are you currently taking any medication (Box b)?

Disease	Brain stroke / paralysis	Heart disease (cardiac infarction / angina)	High blood pressure	Diabetes	Dyslipidemia	Tuberculosis	Others (including cancer)
a							
b							

2. Has anyone in your family died from or gotten any of the following diseases?

Disease	Brain stroke / paralysis	Heart disease (cardiac infarction / angina)	High blood pressure	Diabetes	Others (including cancer)
Yes					

3. Are you a Hepatitis B virus antigen carrier? ① Yes ② No ③ No idea

*** These are questions about smoking.**

4. Please answer the following questions about your present condition by ticking the appropriate box.

4-1. Have you ever smoked over 5 packs of tobacco (100 cigarettes) in your life?

- ① No, I never smoked. (☞ Go to Question 5) ② Yes, I used to smoke but I stopped. (☞ Go to Question 4-2)
 ③ Yes, I'm still smoking (☞ Go to Question 4-3)

4-2. If you used to smoke but stopped, please answer the following.

For how many years had you smoked?	Total _____ years
How many cigarettes in a typical day did you smoke before you stopped?	_____ cigarettes

4-3. If you are still smoking, please answer the following.

How long have you been smoking?	Total _____ years
How many cigarettes on average do you smoke on a regular day?	_____ cigarettes

*** These are questions about drinking.**

5. Please answer the following questions about your current drinking habit by ticking the appropriate box.

5-1. How many times a week do you drink alcohol?

- 0 1 2 3 4 5 6 7

5-2. When you drink, how much do you usually drink on a regular day? (_____ glass(es))

(☞ No matter what kind of liquor it may be, each glass will be considered as 1 glass. However, 1 can of beer (355 cc) is equal to 1.6 glasses of beer.)

*** These are questions about exercising.**

6. These are questions about your physical activity for the last week. Please answer the following questions by ticking the appropriate box.

6-1. During the last week, how many days did you exercise vigorously for over 20 minutes until you were almost out of breath? (example: running, aerobics, high-speed cycling, mountain hiking, etc.)

0 1 2 3 4 5 6 7

6-2. During the last week, how many days did you exercise in a moderate level for more than 30 minutes until you had to breathe a little faster than usual? (example: fast walking, tennis, bicycle riding, cleaning, etc.) * Except the relevant answer from 6-1

0 1 2 3 4 5 6 7

6-3. During the last week, how many days did you walk for a total of 30 minutes or more in a day, including separate 10-minute walks? (example: light exercise, walk for work or for leisure, etc.)

* Please exclude exercises you answered in 6-1 and 6-2

0 1 2 3 4 5 6 7

*** These are questions about cognitive functions. (Only answer if you are 66, 70, or 74 years old.)**
(If a family member accompanied you, please let him/her answer the questions. If not, answer the following questions by yourself.)

7. Please answer the following questions about your current cognitive condition compared to last year by ticking the appropriate box.

7-1. Compared to friends or other people, your memory is worse than others.

① No ② Occasionally ③ Yes

7-2. Your memory is worse compared to last year.

① No ② Occasionally ③ Yes

7-3. You experience problems related to your memory when handling important matters.

① No ② Occasionally ③ Yes

7-4. Has anyone noticed that you have a short memory?

① No ② Occasionally ③ Yes

7-5. Do you experience difficulties in performing daily chores that you used to do well before?

① No ② Occasionally ③ Yes

*** Emotional status (Only answer if you are 40 years old.)**

8. Please identify how many times you experienced the following during the last week by ticking the appropriate box.

During the last week, I	Hardly ever (less than 1 day)	Not too often (couple of days)	Sometimes (more than 3 days)	Always (over 5 days)
8-1. Was annoyed and bothered by things that were not there before.				
8-2. Did not want to eat and even lost appetite.				
8-3. Felt sad even when someone tried to help me out.				
8-4. Felt depressed.				

* Please complete this form with Annex No. 2 only 66 years old.