

SUPPLEMENTAL MATERIAL

Table S1. Definition of covariates and outcomes

Diagnosis	ICD-10-CM code and definition	Diagnostic definition
Inclusion/exclusion criteria		
Atrial fibrillation	I48.0-48.4, I48.9	Admission or outpatient department \geq 1
Valvular atrial fibrillation	I05.0, I05.2, I05.9, Z95.2-Z95.4	Admission or outpatient department \geq 1
Comorbidities		
Hypertension	I10-I13, I15; and minimum 1 prescription of anti-hypertensive drug (thiazide, loop diuretics, aldosterone antagonist, alpha-/beta-blocker, calcium-channel blocker, angiotensin-converting enzyme inhibitor, angiotensin II receptor blocker). Or systolic/diastolic blood pressure \geq 140/90 mmHg	Admission \geq 1 or outpatient department \geq 1 Index health examination
Diabetes mellitus	E11-E14; and minimum 1 prescription of anti-diabetic drugs (sulfonylureas, metformin, meglitinides, thiazolidinediones, dipeptidyl peptidase-4 inhibitors, α -glucosidase inhibitors, and insulin). Or fasting glucose level \geq 126 mg/dL	Admission \geq 1 or outpatient department \geq 1 Index health examination
Dyslipidemia	E78 Or Total cholesterol \geq 240 mg/dL	Admission or outpatient department \geq 1 Index health examination
Heart failure	I50	Admission or outpatient department \geq 1
Prior stroke	I63, I64	Admission or outpatient department \geq 1
Vascular disease		
Prior myocardial infarction	I21, I22	Admission or outpatient department \geq 1
Peripheral artery disease	I70, I73	Admission or outpatient department \geq 1
Chronic kidney disease	Estimated glomerular filtration rate $<$ 60 ml/min/1.73m ²	Index health examination
Chronic obstructive pulmonary disease	J41-44	Admission or outpatient department \geq 1
Cancer	C00-97 and RID code (V193)	Admission or outpatient department \geq 1
Scores		

CHA₂DS₂-VASc score

Heart failure (1 point), hypertension (1 point), age ≥ 75 years (2 points), diabetes (1 point), previous stroke/systemic embolism/transient ischemic attack (2 points), vascular disease (prior MI or PAD, 1 point) and female sex (1 point)

ICD, international classification of disease; CM, clinical modification.

Table S2. Cox analyses: hazard ratios for all dementia, Alzheimer’s dementia, and vascular dementia according to the combination of healthy lifestyle behavior

Healthy lifestyle behavior score	Number	Event	IR (per 1,000 PY)	Unadjusted HR (95% CI)	Age- and sex-adjusted HR (95% CI)	Multivariable adjusted HR (95% CI)
All dementia						
0	8,709	327	9.99	1 (reference)	1 (reference)	1 (reference)
1	34,839	1,425	11.01	1.103 (0.978-1.244)	0.729 (0.646-0.822)	0.753 (0.667-0.849)
2	106,796	7,625	19.80	1.988 (1.779-2.220)	0.728 (0.650-0.816)	0.728 (0.650-0.815)
3	49,608	2,444	13.52	1.356 (1.208-1.522)	0.611 (0.543-0.687)	0.622 (0.553-0.699)
p-value				<0.001	<0.001	<0.001
Alzheimer’s dementia						
0	8,709	207	6.33	1 (reference)	1 (reference)	1 (reference)
1	34,839	1,020	7.88	1.247 (1.074-1.448)	0.802 (0.69-0.931)	0.83 (0.714-0.964)
2	106,796	5,687	14.77	2.344 (2.041-2.693)	0.804 (0.698-0.926)	0.808 (0.701-0.931)
3	49,608	1,767	9.77	1.550 (1.342-1.709)	0.665 (0.574-0.769)	0.681 (0.588-0.788)
p-value				<0.001	<0.001	<0.001
Vascular dementia						
0	8,709	88	2.69	1 (reference)	1 (reference)	1 (reference)
1	34,839	238	1.84	0.685 (0.536-0.874)	0.499 (0.391-0.638)	0.510 (0.399-0.651)
2	106,796	1,105	2.87	1.069 (0.861-1.328)	0.497 (0.396-0.622)	0.480 (0.383-0.601)
3	49,608	410	2.27	0.845 (0.671-1.063)	0.454 (0.359-0.575)	0.446 (0.352-0.565)
p-value				<0.001	<0.001	<0.001

Multivariable adjusted model included age, sex, hypertension, diabetes mellitus, dyslipidemia, heart failure, prior ischemic stroke, prior myocardial infarction, peripheral artery disease, chronic obstructive pulmonary disease, cancer, chronic kidney disease, CHA₂DS₂-VASc score, use of oral anticoagulant, antiplatelet agent, and statin, BMI, and low income.

CI, confidence interval; HR, hazard ratio; IR, incidence rate; PY, person-years.

Table S3. Sensitivity analyses: the association between HLS score and the risk of dementia according to smoking status (non-current smokers and current smokers)

Outcome	HLS	Number	Events	IR	Adjusted HR (95% CI)	p-value
Excluding current smokers						
Dementia	0	18,811	847	12.27	1 (reference)	<0.001
	1	102,509	7,475	20.25	1.030 (0.957-1.109)	
	2	49,608	2,444	13.52	0.880 (0.812-0.953)	
Among current smokers						
Dementia	0	8,709	3,27	9.99	1 (reference)	0.007
	1	16,028	5,78	9.58	0.826 (0.719-0.947)	
	2	4,287	1,50	9.35	0.769 (0.633-0.935)	

IR, per 1,000 person-years

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio; IR, incidence rate.

Table S4. Rhythm control treatment in different HLS score groups

	Total (n=199,952)	HLS 0 (n=8709)	HLS 1 (n=34839)	HLS 2 (n=106796)	HLS 3 (n=49608)	p-value
Rhythm control	50,293 (25.1%)	1,916 (22%)	8,251 (23.7%)	26,421 (24.7%)	13,705 (27.6%)	<0.001
AAD	49,473 (24.7%)	1,866 (21.4%)	8,073 (23.2%)	26,028 (24.4%)	13,506 (27.2%)	<0.001
DCC	6,067 (3.0%)	267 (3.1%)	1,073 (3.1%)	3,011 (2.8%)	1,716 (3.5%)	<0.001
RFCA	1,917 (1.0%)	44 (0.5%)	256 (0.7%)	925 (0.9%)	692 (1.4%)	<0.001

AAD, antiarrhythmic drug; DCC, direct current cardioversion; HLS, healthy lifestyle score; RFCA, radiofrequency catheter ablation.

Table S5. Sensitivity analysis: additionally adjusted rhythm control treatment

	Final model HR (95% CI)	Additionally adjusted rhythm control treatment HR (95% CI)
Dementia		
HLS 0	1 (reference)	1 (reference)
HLS 1	0.753 (0.667-0.849)	0.756 (0.67-0.853)
HLS 2	0.728 (0.65-0.815)	0.733 (0.655-0.822)
HLS 3	0.622 (0.553-0.699)	0.629 (0.559-0.707)
p-value	<0.001	<0.001
Alzheimer's dementia		
HLS 0	1 (reference)	1 (reference)
HLS 1	0.830 (0.714-0.964)	0.832 (0.716-0.967)
HLS 2	0.808 (0.701-0.931)	0.813 (0.705-0.937)
HLS 3	0.681 (0.588-0.788)	0.686 (0.593-0.795)
p-value	<0.001	<0.001
Vascular dementia		
HLS 0	1 (reference)	1 (reference)
HLS 1	0.510 (0.399-0.651)	0.512 (0.401-0.655)
HLS 2	0.480 (0.383-0.601)	0.485 (0.387-0.608)
HLS 3	0.446 (0.352-0.565)	0.453 (0.358-0.575)
p-value	<0.001	<0.001

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio.

Table S6. Subgroup analyses for Alzheimer’s dementia

Subgroup	HLS	Number	Events	IR	Adjusted HR (95% CI)	p-value	p-for- interaction
Age (years)							
<65	0	6,515	48	1.91	1 (reference)	<0.001	
	1	22,040	128	1.50	0.697 (0.500-0.972)		
	2	48,275	400	2.10	0.675 (0.495-0.920)		
	3	24,539	162	1.68	0.519 (0.371-0.726)		
65 to <75	0	1,658	91	15.07	1 (reference)	<0.001	0.751
	1	8,860	428	13.32	0.835 (0.666-1.048)		
	2	34,956	2,051	16.08	0.799 (0.645-0.990)		
	3	17,180	765	12.38	0.660 (0.529-0.824)		
≥75	0	536	68	43.42	1 (reference)	<0.001	
	1	3,939	464	39.59	0.874 (0.677-1.128)		
	2	23,565	3,236	48.40	0.867 (0.680-1.106)		
	3	7,889	840	37.06	0.732 (0.570-0.939)		
Sex							
Men	0	8,249	191	6.14	1 (reference)	<0.001	0.380
	1	29,994	830	7.46	0.835 (0.713-0.977)		
	2	57,185	2,149	10.52	0.826 (0.711-0.959)		
	3	24,989	736	8.32	0.695 (0.592-0.816)		
Women	0	460	16	10.01	1 (reference)	<0.001	
	1	4,845	190	10.51	0.656 (0.393-1.093)		
	2	49,611	3,538	19.56	0.598 (0.366-0.978)		
	3	24,619	1,031	11.16	0.501 (0.305-0.821)		
CHA₂DS₂-VASc score							
Men<2 and women <3	0	3,268	15	1.12	1 (reference)	0.093	0.484
	1	11,581	38	0.80	0.558 (0.306-1.016)		
	2	24,679	145	1.42	0.676 (0.390-1.172)		
	3	12,749	62	1.18	0.525 (0.292-0.944)		

Men\geq2 and women \geq3	0	5,441	192	9.94	1 (reference)	<0.001	
	1	23,258	982	12.00	0.850 (0.728-0.992)		
	2	82,117	5,542	19.60	0.821 (0.708-0.951)		
	3	36,859	1,705	13.27	0.689 (0.592-0.802)		
Prior ischemic stroke							
No	0	7,361	129	4.60	1 (reference)	<0.001	
	1	28,359	626	5.82	0.792 (0.654-0.957)		
	2	79,163	3,122	10.60	0.727 (0.606-0.871)		
	3	37,320	992	7.12	0.617 (0.511-0.744)		
Yes	0	1,348	78	16.7	1 (reference)	<0.001	0.664
	1	6,480	394	17.96	0.860 (0.674-1.097)		
	2	27,633	2,565	28.3	0.908 (0.722-1.142)		
	3	12,288	775	18.64	0.751 (0.593-0.951)		
OAC							
No	0	6,932	166	6.16	1 (reference)	<0.001	
	1	26,877	775	7.43	0.810 (0.685-0.959)		
	2	77,822	4,155	13.96	0.772 (0.659-0.906)		
	3	35,812	1,279	9.24	0.654 (0.555-0.772)		
Yes	0	1,777	41	7.10	1 (reference)	0.004	0.652
	1	7,962	245	9.74	0.919 (0.660-1.280)		
	2	28,974	1,532	17.52	0.953 (0.696-1.306)		
	3	13,796	488	11.49	0.791 (0.573-1.092)		

IR, per 1,000 person-years.

Adjusted for age, sex, hypertension, diabetes mellitus, dyslipidemia, heart failure, prior ischemic stroke, prior myocardial infarction, peripheral artery disease, chronic obstructive pulmonary disease, cancer, chronic kidney disease, CHA₂DS₂-VASc score, use of oral anticoagulant, antiplatelet agent, and statin, BMI, and low income.

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio; IR, incidence rate; OAC, oral anticoagulant.

Table S7. Subgroup analyses for Vascular dementia

Subgroup	HLS	Number	Events	IR	Adjusted HR (95% CI)	p-value	p-for- interaction
Age (years)							
<65	0	6,515	35	1.39	1 (reference)	<0.001	
	1	22,040	68	0.79	0.526 (0.350-0.792)		
	2	48,275	152	0.80	0.431 (0.294-0.631)		
	3	24,539	65	0.67	0.354 (0.231-0.544)		
65 to <75	0	1,658	34	5.63	1 (reference)	0.002	0.528
	1	8,860	104	3.24	0.552 (0.374-0.813)		
	2	34,956	458	3.59	0.517 (0.361-0.740)		
	3	17,180	202	3.27	0.496 (0.342-0.721)		
≥75	0	536	19	12.13	1 (reference)	0.015	
	1	3,939	66	5.63	0.464 (0.278-0.773)		
	2	23,565	495	7.40	0.494 (0.309-0.790)		
	3	7,889	143	6.31	0.456 (0.281-0.742)		
Sex							
Men	0	8,249	83	2.67	1 (reference)	<0.001	
	1	29,994	197	1.77	0.508 (0.392-0.657)		
	2	57,185	469	2.30	0.491 (0.387-0.623)		
	3	24,989	194	2.19	0.474 (0.365-0.615)		
Women	0	460	5	3.13	1 (reference)	0.046	0.665
	1	4,845	41	2.27	0.473 (0.187-1.198)		
	2	49,611	636	3.52	0.384 (0.159-0.929)		
	3	24,619	216	2.34	0.351 (0.144-0.854)		
CHA₂DS₂-VASc score							
Men<2 and women <3	0	3,268	11	0.82	1 (reference)	0.063	0.722
	1	11,581	21	0.44	0.479 (0.230-0.995)		
	2	24,679	54	0.53	0.474 (0.242-0.931)		
	3	12,749	21	0.40	0.352 (0.164-0.756)		

Men≥2 and women ≥3	0	5,441	77	3.99	1 (reference)	<0.001	0.340
	1	23,258	217	2.65	0.519 (0.400-0.673)		
	2	82,117	1,051	3.72	0.487 (0.383-0.619)		
	3	36,859	389	3.03	0.457 (0.356-0.588)		
Prior ischemic stroke							
No	0	7,361	47	1.68	1 (reference)	<0.001	0.340
	1	28,359	123	1.14	0.495 (0.353-0.694)		
	2	79,163	532	1.81	0.475 (0.348-0.649)		
	3	37,320	194	1.39	0.425 (0.305-0.591)		
Yes	0	1,348	41	8.78	1 (reference)	<0.001	0.340
	1	6,480	115	5.24	0.519 (0.363-0.742)		
	2	27,633	573	6.32	0.476 (0.343-0.661)		
	3	12,288	216	5.2	0.453 (0.322-0.638)		
OAC							
No	0	6,932	70	2.60	1 (reference)	<0.001	0.460
	1	26,877	174	1.67	0.480 (0.363-0.634)		
	2	77,822	749	2.52	0.422 (0.327-0.546)		
	3	35,812	274	1.98	0.398 (0.303-0.522)		
Yes	0	1,777	18	3.12	1 (reference)	0.263	0.460
	1	7,962	64	2.54	0.637 (0.377-1.076)		
	2	28,974	356	4.07	0.691 (0.426-1.122)		
	3	13,796	136	3.20	0.625 (0.379-1.029)		

IR, per 1,000 person-years.

Adjusted for age, sex, hypertension, diabetes mellitus, dyslipidemia, heart failure, prior ischemic stroke, prior myocardial infarction, peripheral artery disease, chronic obstructive pulmonary disease, cancer, chronic kidney disease, CHA₂DS₂-VAsc score, use of oral anticoagulant, antiplatelet agent, and statin, BMI, and low income.

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio; IR, incidence rate; OAC, oral anticoagulant.

Table S8. Exploratory analyses: the risk of dementia between HLS 1 and HLS 2 or 3

Outcomes	HLS	Number	Events	IR	Adjusted HR (95% CI)	p-value
All dementia	1	34,839	1,425	11.01	1 (reference)	0.010
	2,3	156,404	10,069	17.79	0.926 (0.874-0.982)	

IR, per 1,000 person-years

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio; IR, incidence rate.

Table S9. Exploratory analyses: the risk of dementia between HLS 1, 2 and 3

Outcomes	HLS	Number	Events	IR	Adjusted HR (95% CI)	p-value	p-for-trend
All dementia	1	34,839	1,425	11.01	1 (reference)	<0.001	<0.001
	2	106,796	7,625	19.80	0.968 (0.912-1.027)		
	3	49,608	2,444	13.52	0.826 (0.773-0.884)		

IR, per 1,000 person-years

CI, confidence interval; HLS, healthy lifestyle behavior score; HR, hazard ratio; IR, incidence rate.

Table S10. The association between exercise amount/intensity and the risk of dementia

Exercise intensity/dose	Number	Events	IR	Adjusted HR (95% CI)
[MPA or VPA per 3-7 d/week]				
Non-exerciser	147,417	9,845	18.42	1 (reference)
MPA, 3-7 d/week	19,039	796	11.54	0.810 (0.754-0.871)
VPA, 3-7 d/week	33,496	1,180	9.47	0.781 (0.735-0.831)
p-value				<0.001
[MPA or VPA per 5-7 d/week]				
Non-exerciser	175,382	10,780	16.90	1 (reference)
Moderate intensity exercise, 5-7 d/week	9,688	443	12.69	0.848 (0.771-0.933)
Vigorous intensity exercise, 5-7 d/week	14,882	598	10.80	0.796 (0.733-0.865)
p-value				<0.001
[Exercise doses stratified by the frequency of MVPA]				
Non-exerciser	108,380	8,416	21.65	1 (reference)
MVPA 1-2/week	39,037	1,429	9.80	0.832 (0.786-0.880)
MVPA 3-4/week	27,965	935	9.05	0.763 (0.713-0.818)
MVPA 5-6/week	14,764	533	9.86	0.754 (0.691-0.824)
MVPA ≥7/week	9,806	508	14.04	0.785 (0.717-0.859)
p-value				<0.001
[Exercise doses stratified by MET-min/week]				
Non-exerciser	53,173	4,643	24.05	1 (reference)
0 to <500 MET-min/week	55,144	3,055	15.13	0.869 (0.830-0.910)

500-999 MET-min/week	55,494	2,784	13.85	0.840 (0.801-0.881)
1000-1499 MET-min/week	22,651	819	9.91	0.739 (0.686-0.797)
≥1500 MET-min/week	13,490	520	10.55	0.720 (0.656-0.789)
p-value				<0.001

IR, per 1,000 person-years

CI, confidence interval; d, day; HR, hazard ratio; IR, incidence rate; MPA, moderate-intensity physical activity; MVPA, moderate to vigorous physical activity; MET, metabolic equivalent task; VPA, vigorous-intensity physical activity.

Table S11. Univariable and multivariable HRs for the risk of dementia

Variable	Unadjusted HR (95% CI)	p-value	Adjusted HR (95% CI)	p-value
Age (years)	1.128 (1.125-1.130)	<0.001	1.106 (1.103-1.110)	<0.001
Male	1.714 (1.654-1.778)	<0.001	1.199 (1.132-1.269)	<0.001
BMI (kg/m²)	0.928 (0.923-0.934)	<0.001	0.968 (0.963-0.974)	<0.001
CHA₂DS₂-VASc	1.621 (1.606-1.635)	<0.001	1.077 (1.041-1.114)	<0.001
SBP (mmHg)		<0.001		0.671
<120	1 (reference)		1 (reference)	
120 to <130	1.102 (1.047-1.161)		0.974 (0.925-1.026)	
130 to <140	1.256 (1.195-1.319)		0.975 (0.927-1.025)	
≥140	1.605 (1.526-1.689)		0.973 (0.923-1.025)	
Diabetes	1.545 (1.485-1.607)	<0.001	1.152 (1.093-1.215)	<0.001
Dyslipidemia	1.204 (1.161-1.248)	<0.001	0.982 (0.942-1.024)	0.399
Heart failure	2.027 (1.954-2.103)	<0.001	1.061 (1.007-1.117)	0.026
Prior MI	1.479 (1.406-1.556)	<0.001	1.034 (0.977-1.094)	0.243
Prior stroke	2.998 (2.892-3.109)	<0.001	1.509 (1.401-1.627)	<0.001
PAD	1.703 (1.637-1.771)	<0.001	1.064 (1.012-1.119)	0.015
COPD	1.767 (1.699-1.839)	<0.001	1.113 (1.069-1.159)	<0.001
Cancer	0.932 (0.860-1.011)	0.091	0.918 (0.846-0.997)	0.041
CKD	2.470 (2.376-2.568)	<0.001	1.140 (1.095-1.186)	<0.001
Low income	1.088 (1.038-1.139)	0.004	1.135 (1.084-1.190)	<0.001
OAC	1.339 (1.286-1.395)	<0.001	1.029 (0.987-1.074)	0.181
Antiplatelet	1.353 (1.303-1.406)	<0.001	1.028 (0.987-1.072)	0.183
Statin	1.240 (1.185-1.298)	<0.001	0.973 (0.921-1.027)	0.313
Smoking		<0.001		<0.001
non	1 (reference)		1 (reference)	
ex-smoker	0.603 (0.575-0.632)		0.969 (0.916-1.024)	
current smoker	0.489 (0.459-0.521)		1.237 (1.153-1.329)	
Alcohol		<0.001		<0.001
non	1 (reference)		1 (reference)	

mild	0.396 (0.378-0.416)		0.876 (0.830-0.925)	
moderate	0.566 (0.393-0.815)		1.196 (0.829-1.724)	
heavy	0.745 (0.240-2.309)		1.760 (0.567-5.462)	
Exercise		<0.001		<0.001
non	1 (reference)		1 (reference)	
regular PA	0.573 (0.543-0.604)		0.805 (0.763-0.849)	

BMI, body mass index; CI, confidence interval; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; HR, hazard ratio; MI, myocardial infarction; OAC, oral anticoagulant; PA, physical activity; PAD, peripheral artery disease; SBP, systolic blood pressure.

Table S12. Baseline characteristics of patients with and without the national health examinations within 2-year

	Total (n=576,077)	Patients receiving health examinations within 2-year after AF diagnosis (n=209,880)	Patients not receiving health examinations within 2-year after AF diagnosis (n=366,197)	p-value
Age, years	66.82±15.6	63.73±12.7	68.6±16.7	<0.001
Male	309,043 (53.7)	124,614 (59.4)	184,429 (50.4)	<0.001
Low income	131,093 (22.8)	37,359 (17.8)	93,734 (25.6)	<0.001
Heart failure	171,455 (29.8)	51,053 (24.3)	120,402 (32.9)	<0.001
Prior stroke	124,644 (21.6)	31,039 (14.8)	93,605 (25.6)	<0.001
Prior MI	43,699 (7.6)	11,622 (5.5)	32,077 (8.8)	<0.001
PAD	121,433 (21.1)	45,694 (21.8)	75,739 (20.7)	<0.001
COPD	146,235 (25.4)	42,303 (20.2)	103,932 (28.4)	<0.001
Cancer	59,348 (10.3)	12,035 (5.7)	47,313 (12.9)	<0.001

COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PAD, peripheral artery disease.