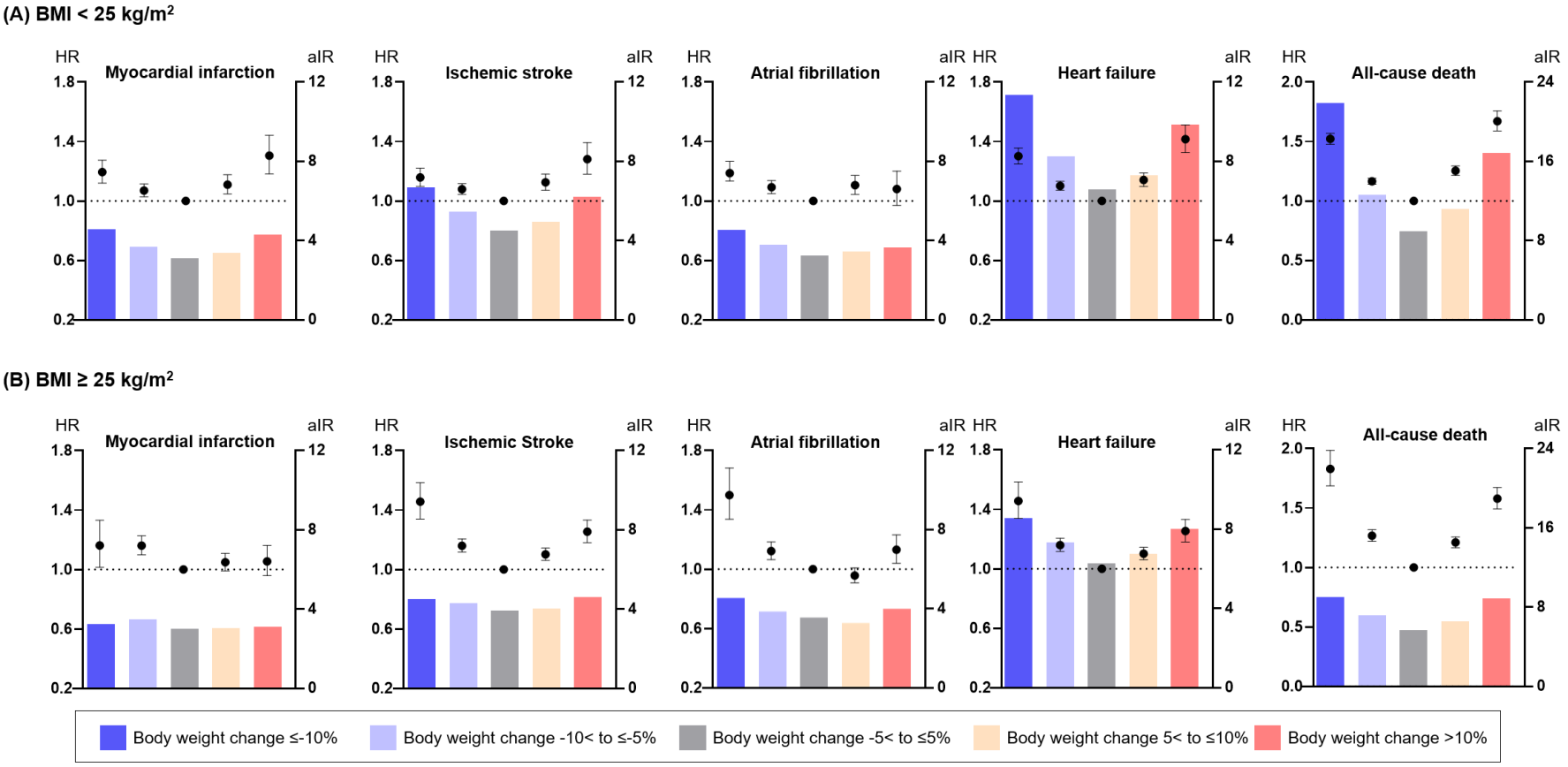
Supplemental Material



Supplemental Figure 1. Association of body weight change with myocardial infarction, ischemic stroke, atrial fibrillation, heart failure, and all-cause death according to body mass index (BMI)

After stratifying the patients into two groups, that is, patients with BMI <25 kg/m^2 (A) and those with BMI ≥25 kg/m^2 (B), the risks for myocardial

infarction, ischemic stroke, atrial fibrillation, heart failure, and all-cause death are shown. HRs with 95% CIs are presented as dot and whisker plots after adjusting for covariates*. The incidence rates for each cardiovascular event are denoted by bars.

BMI, body mass index; HR, hazard ratio; aIR, annual event incidence rate per 1,000 person-years.

*Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, and use of oral hypoglycemic agents.

Supplemental Table 1. Definitions of comorbidities and outcomes

	ICD-10-CM codes with additional definitions		General health check-up results
Comorbidities			
Hypertension	I10-I13, I15	Admission ≥1 or outpatient clinic ≥1, and prescription of anti-hypertensive drug (thiazide, loop diuretics, aldosterone antagonist, alpha-/beta-blocker, calcium-channel blocker, angiotensin-converting enzyme inhibitor, angiotensin II receptor blocker)	Systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg
Dyslipidemia	E78	Admission or outpatient department≥1, and prescription of lipid-lowering medication (statin, ezetimibe, fenofibrate)	Fasting total cholesterol ≥240 mg/dL
Chronic kidney disease	N18, N19	Admission ≥1 or outpatient clinic ≥2	
Peripheral artery disease	I70.0, I70.1, I70.2, I70.8, I70.9	Admission ≥1 or outpatient clinic ≥2	
Chronic obstructive pulmonary disease	J41-J44		
Cancer	C00-C97		
Hyperthyroidism	E05	Admission ≥1 or outpatient clinic ≥2	
Socioeconomic status			
Low income		Composite of the lowest quartile of yearly income in addition to medicare beneficiaries	
Outcomes			

MI	I21, I22	Admission ≥1	
Ischemic stroke	I63, I64	Admission ≥1 with claims for the imaging studies (brain CT or MRI)	
Atrial fibrillation	I48	Admission ≥1 or outpatient clinic ≥2	
Heart failure	I50	Admission ≥1	

ICD-10-CM, international classification of diseases, Tenth Revision, Clinical Modification; MI, myocardial infarction

Supplemental Table 2. Association between body weight change and cardiovascular events

Body weight change	number	event	Follow-up duration	aIR*	Model 1** HR (95% CI)	p-value	Model 2** HR (95% CI)	p-value	Model 3** HR (95% CI)	p-value	Model 4** HR (95% CI)	p-value
MI												
≤-10%	47992	1286	299742.8	4.29	1.43 (1.35-1.51)	<.0001	1.32 (1.25-1.40)	<.0001	1.27 (1.19-1.34)	<.0001	1.24 (1.17-1.32)	<.0001
-10< to ≤-5%	187891	4412	1218186.5	3.62	1.19 (1.16-1.23)		1.14 (1.10-1.18)		1.12 (1.08-1.16)		1.11 (1.08-1.15)	
-5< to ≤5%	1123639	22897	7482826.4	3.06	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
5< to ≤10%	126343	2667	835618.3	3.19	1.05 (1.00-1.09)		1.12 (1.08-1.17)		1.10 (1.06-1.14)		1.08 (1.04-1.12)	
>10%	36376	844	235231.4	3.59	1.18 (1.10-1.27)		1.27 (1.19-1.37)		1.22 (1.14-1.31)		1.17 (1.09-1.25)	
Ischemic stroke												
≤-10%	47992	1851	298202.4	6.21	1.48 (1.41-1.55)	<.0001	1.28 (1.22-1.34)	<.0001	1.21 (1.15-1.27)	<.0001	1.20 (1.14-1.26)	<.0001
-10< to ≤-5%	187891	6146	1212582.5	5.07	1.20 (1.17-1.24)		1.12 (1.09-1.15)		1.09 (1.06-1.12)		1.09 (1.06-1.12)	
-5< to ≤5%	1123639	31489	7452335.6	4.23	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
5< to ≤10%	126343	3692	832082.0	4.44	1.05 (1.02-1.09)		1.14 (1.10-1.18)		1.12 (1.09-1.16)		1.10 (1.06-1.14)	
>10%	36376	1228	233917.0	5.25	1.25 (1.18-1.32)		1.33 (1.25-1.41)		1.29 (1.22-1.37)		1.24 (1.17-1.31)	
AF												
≤-10%	47992	1357	299468.5	4.53	1.35 (1.28-1.43)	<.0001	1.21 (1.14-1.27)	<.0001	1.31 (1.24-1.38)	<.0001	1.24 (1.17-1.31)	<.0001
-10< to ≤-5%	187891	4638	1217501.0	3.81	1.13 (1.10-1.17)		1.07 (1.03-1.10)		1.12 (1.08-1.15)		1.09 (1.06-1.13)	
-5< to ≤5%	1123639	25257	7472603.6	3.38	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
5< to ≤10%	126343	2795	835080.7	3.35	0.99 (0.95-1.03)		1.08 (1.03-1.12)		1.04 (1.00-1.09)		1.03 (0.99-1.08)	

>10%	36376	906	234950.7	3.86	1.15 (1.07-1.23)		1.23 (1.15-1.32)		1.16 (1.08-1.24)		1.15 (1.08-1.23)	
HF												
≤-10%	47992	3190	297438.3	10.72	1.73 (1.67-1.79)	<.0001	1.49 (1.44-1.54)	<.0001	1.45 (1.40-1.50)	<.0001	1.41 (1.36-1.47)	<.0001
-10< to ≤-5%	187891	9640	1212732.8	7.95	1.26 (1.23-1.29)		1.16 (1.14-1.19)		1.15 (1.13-1.18)		1.14 (1.11-1.16)	
-5< to ≤5%	1123639	48041	7457510.0	6.44	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
5< to ≤10%	126343	5826	832154.7	7.00	1.09 (1.06-1.12)		1.18 (1.15-1.21)		1.15 (1.12-1.18)		1.13 (1.10-1.16)	
>10%	36376	2048	233709.9	8.76	1.39 (1.33-1.45)		1.47 (1.41-1.54)		1.41 (1.35-1.47)		1.35 (1.30-1.42)	
Death												
≤-10%	47992	5765	302841.59	19.04	2.62 (2.55-2.70)	<.0001	2.29 (2.23-2.36)	<.0001	1.71 (1.67-1.76)	<.0001	1.87(1.82-1.92)	<.0001
-10< to ≤-5%	187891	13280	1229474.0	10.80	1.48 (1.45-1.51)		1.39 (1.36-1.41)		1.22 (1.20-1.25)		1.26 (1.24-1.29)	
-5< to ≤5%	1123639	55460	7542610.6	7.35	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
5< to ≤10%	126343	7261	842681.5	8.62	1.17 (1.15-1.20)		1.28 (1.25-1.32)		1.28 (1.25-1.31)		1.23 (1.20-1.27)	
>10%	36376	2869	237313.2	12.09	1.66 (1.59-1.72)		1.76 (1.70-1.83)		1.75 (1.69-1.82)		1.63 (1.57-1.70)	

AF, atrial fibrillation; aIR, annual event incidence rate; CI, confidence interval; HF, heart failure; HR, hazard ratio; MI, myocardial infarction

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Model 1 for univariate analyses; Model 2 adjusts age and sex; Model 3 adjusts Model 2 with previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, and regular physical activity; Model 4 adjusts Model 3 with insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2.

Supplemental Table 3. Subgroup analysis for MI according to body weight change

	Body weight change	number	event	Follow-up duration	aIR*	HR (95% CI)**	p-value
Age							
Age <65 years	≤-10%	31482	533	202695	2.63	1.17 (1.07-1.28)	
	-10< to ≤-5%	132565	2162	871963	2.48	1.07 (1.02-1.12)	
	-5< to ≤5%	846186	13140	5690131	2.31	1 (reference)	0.0002
	5< to ≤10%	97669	1512	652806	2.32	1.06 (1.00-1.11)	
	>10%	27577	422	180990	2.33	1.05 (0.95-1.16)	
Age ≥65 years	≤-10%	16510	753	97048	7.76	1.26 (1.17-1.36)	
	-10< to ≤-5%	55326	2250	346223	6.50	1.14 (1.09-1.20)	
	-5< to ≤5%	277453	9757	1792696	5.44	1 (reference)	<.0001
	5< to ≤10%	28674	1155	182812	6.32	1.11 (1.04-1.17)	
	>10%	8799	422	54241	7.78	1.29 (1.17-1.42)	
Sex							
Male	≤-10%	24075	626	148672	4.21	1.19 (1.10-1.29)	
	-10< to ≤-5%	107484	2610	693571	3.76	1.12 (1.07-1.17)	
	-5< to ≤5%	735633	15401	4899894	3.14	1 (reference)	<.0001
	5< to ≤10%	79974	1692	529052	3.20	1.06 (1.00-1.11)	
	>10%	21952	492	141618	3.47	1.11 (1.01-1.21)	
Female	≤-10%	23917	660	151071	4.37	1.27 (1.18-1.38)	<.0001
	-10< to ≤-5%	80407	1802	524615	3.43	1.10 (1.04-1.15)	

	-5< to ≤5%	388006	7496	2582933	2.90	1 (reference)	
	5< to ≤10%	46369	975	306567	3.18	1.22 (1.10-1.36)	
	>10%	14424	352	93613	3.76	1.25 (1.12-1.39)	
Obesity							
BMI<25 kg/m^2	≤-10%	37694	1071	233715	4.58	1.19 (1.12-1.27)	
	-10< to ≤-5%	125600	2998	812379	3.69	1.07 (1.03-1.11)	
	-5< to ≤5%	579236	12017	3847750	3.12	1 (reference)	<.0001
	5< to ≤10%	56666	1259	372598	3.38	1.11 (1.05-1.18)	
	>10%	14866	407	94698	4.30	1.31 (1.18-1.44)	
BMI≥25 kg/m^2	≤-10%	10298	215	66027	3.26	1.16 (1.02-1.33)	
	-10< to ≤-5%	62291	1414	405807	3.48	1.16(1.10-1.23)	
	-5< to ≤5%	544403	10880	3635076	2.99	1 (reference)	<.0001
	5< to ≤10%	69677	1408	463020	3.04	1.05 (0.99-1.11)	
	>10%	21510	437	140534	3.11	1.05 (0.96-1.16)	
DM duration							
<5 years	≤-10%	31784	677	202236	3.35	1.26 (1.17-1.36)	
	-10< to ≤-5%	122167	2318	804226	2.88	1.13 (1.08-1.18)	
	-5< to ≤5%	755639	12488	5114483	2.44	1 (reference)	<.0001
	5< to ≤10%	89813	1480	604409	2.45	1.06 (1.01-1.12)	
	>10%	25743	465	169838	2.74	1.17 (1.07-1.29)	
≥5 years	≤-10%	16208	609	97507	6.25	1.25 (1.15-1.36)	<.0001
	-10< to ≤-5%	65724	2094	413961	5.06	1.10 (1.05-1.16)	

	-5< to ≤5%	368000	10409	2368344	4.40	1 (reference)	
	5< to ≤10%	36530	1187	231209	5.13	1.11 (1.05-1.18)	
	>10%	10633	379	65394	5.80	1.18 (1.06-1.31)	
DM medication							
Naïve	≤-10%	18068	341	115539	2.95	1.33 (1.19-1.49)	
	-10< to ≤-5%	73220	1259	485502	2.59	1.17 (1.10-1.24)	
	-5< to ≤5%	499739	7398	3414972	2.17	1 (reference)	<.0001
	5< to ≤10%	60154	860	410525	2.09	1.06 (0.99-1.14)	
	>10%	16401	285	110115	2.59	1.32 (1.17-1.49)	
OHA or insulin	≤-10%	29924	945	184204	5.13	1.21 (1.13-1.29)	
	-10< to ≤-5%	114671	3153	732684	4.30	1.09 (1.05-1.13)	
	-5< to ≤5%	623900	15499	4067855	3.81	1 (reference)	<.0001
	5< to ≤10%	66189	1807	425093	4.25	1.09 (1.04-1.15)	
	>10%	19975	559	125116	4.47	1.11 (1.02-1.21)	

aIR, annual event incidence rate; BMI, body mass index; CI, confidence interval; DM, diabetes mellitus; HR, hazard ratio; MI, myocardial infarction; OHA, oral hypoglycemic agent

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2 except the variable associated with classification in each subgroup.

Supplemental Table 4. Subgroup analysis for ischemic stroke according to body weight change

	Body weight change	number	event	Follow-up duration	aIR*	HR (95% CI)**	p-value
Age							
Age <65 years	≤-10%	31482	650	202276	3.21	1.23 (1.13-1.33)	
	-10< to ≤-5%	132565	2575	870331	2.96	1.10 (1.05-1.14)	
	-5< to ≤5%	846186	14970	5681277	2.64	1 (reference)	<.0001
	5< to ≤10%	97669	1726	651728	2.65	1.09 (1.04-1.14)	
	>10%	27577	575	180418	3.19	1.33 (1.22-1.44)	
Age ≥65 years	≤-10%	16510	1201	95926	12.52	1.20 (1.13-1.27)	
	-10< to ≤-5%	55326	3571	342252	10.43	1.08 (1.04-1.12)	
	-5< to ≤5%	277453	16519	1771058	9.33	1 (reference)	<.0001
	5< to ≤10%	28674	1966	180354	10.90	1.11 (1.06-1.17)	
	>10%	8799	653	53499	12.21	1.17 (1.09-1.27)	
Sex							
Male	≤-10%	24075	891	148041	6.02	1.16 (1.09-1.24)	
	-10< to ≤-5%	107484	3537	690918	5.12	1.07 (1.04-1.11)	
	-5< to ≤5%	735633	20908	4881281	4.28	1 (reference)	<.0001
	5< to ≤10%	79974	2283	527110	4.33	1.07 (1.03-1.12)	
	>10%	21952	731	140853	5.19	1.24 (1.16-1.34)	
Female	≤-10%	23917	960	150161	6.39	1.25 (1.17-1.34)	
	-10< to ≤-5%	80407	2609	521665	5.00	1.11 (1.06-1.16)	<.0001
	-5< to ≤5%	388006	10581	2571055	4.12	1 (reference)	

	5< to ≤10%	46369	1409	304972	4.62	1.15 (1.09-1.22)	
	>10%	14424	497	93064	5.34	1.23 (1.12-1.35)	
Obesity							
BMI<25 kg/m^2	≤-10%	37694	1555	232408	6.69	1.16 (1.10-1.22)	
	-10< to ≤-5%	125600	4407	807952	5.45	1.08 (1.04-1.12)	
	-5< to ≤5%	579236	17227	3829690	4.50	1 (reference)	<.0001
	5< to ≤10%	56666	1828	370603	4.93	1.13 (1.07-1.18)	
	>10%	14866	584	94071	6.21	1.28 (1.18-1.39)	
BMI≥25 kg/m^2	≤-10%	10298	296	65795	4.50	1.22 (1.09-1.37)	
	-10< to ≤-5%	62291	1739	404630	4.30	1.07 (1.02-1.12)	
	-5< to ≤5%	544403	14262	3622646	3.93	1 (reference)	<.0001
	5< to ≤10%	69677	1864	461479	4.04	1.08 (1.03-1.13)	
	>10%	21510	644	139846	4.61	1.20 (1.11-1.30)	
DM duration							
<5 years	≤-10%	31784	927	201548	4.60	1.18 (1.11-1.26)	
	-10< to ≤-5%	122167	3071	801645	3.83	1.08 (1.04-1.12)	
	-5< to ≤5%	755639	16496	5100424	3.23	1 (reference)	<.0001
	5< to ≤10%	89813	1998	602560	3.32	1.10 (1.05-1.16)	
	>10%	25743	642	169271	3.79	1.22 (1.13-1.32)	
≥5 years	≤-10%	16208	924	96654	9.56	1.25 (1.17-1.34)	
	-10< to ≤-5%	65724	3075	410937	7.48	1.10 (1.06-1.15)	<.0001
	-5< to ≤5%	368000	14993	2351912	6.37	1 (reference)	

	5< to ≤10%	36530	1694	229522	7.38	1.11 (1.06-1.17)	
	>10%	10633	586	64646	9.06	1.28 (1.18-1.39)	
DM medication							
Naïve	≤-10%	18068	489	115197	4.24	1.28 (1.17-1.40)	
	-10< to ≤-5%	73220	1728	484070	3.57	1.16 (1.10-1.22)	
	-5< to ≤5%	499739	9599	3407685	2.82	1 (reference)	<.0001
	5< to ≤10%	60154	1120	409567	2.73	1.09 (1.02-1.16)	
	>10%	16401	326	109946	2.97	1.14 (1.02-1.28)	
OHA or insulin	≤-10%	29924	1362	183005	7.44	1.17 (1.11-1.24)	
	-10< to ≤-5%	114671	4418	728512	6.06	1.06 (1.02-1.09)	
	-5< to ≤5%	623900	21890	4044650	5.41	1 (reference)	<.0001
	5< to ≤10%	66189	2572	422515	6.09	1.11 (1.06-1.15)	
	>10%	19975	902	123971	7.28	1.28 (1.19-1.36)	

aIR, annual event incidence rate; BMI, body mass index; CI, confidence interval; DM, diabetes mellitus; HR, hazard ratio

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2 except the variable associated with classification in each subgroup.

Supplemental Table 5. Subgroup analysis for AF according to body weight change

	Body weight change	number	event	Follow-up duration	aIR*	HR (95% CI)**	p-value
Age							
Age <65 years	≤-10%	31482	487	202689	2.40	1.25 (1.14-1.37)	<.0001
	-10< to ≤-5%	132565	2011	872313	2.31	1.11 (1.06-1.17)	
	-5< to ≤5%	846186	12353	5689672	2.17	1 (reference)	
	5< to ≤10%	97669	1393	652857	2.13	1.06 (1.00-1.12)	
	>10%	27577	428	180846	2.37	1.22 (1.11-1.35)	
Age ≥65 years	≤-10%	16510	870	96780	8.99	1.24 (1.16-1.33)	<.0001
	-10< to ≤-5%	55326	2627	345188	7.61	1.08 (1.04-1.13)	
	-5< to ≤5%	277453	12904	1782932	7.24	1 (reference)	
	5< to ≤10%	28674	1402	182224	7.69	1.01 (0.96-1.07)	
	>10%	8799	478	54105	8.83	1.10 (1.01-1.21)	
Sex							
Male	≤-10%	24075	708	148472	4.77	1.24 (1.15-1.34)	<.0001
	-10< to ≤-5%	107484	2817	693124	4.06	1.10 (1.06-1.14)	
	-5< to ≤5%	735633	17393	4892734	3.55	1 (reference)	
	5< to ≤10%	79974	1854	528471	3.51	1.04 (0.99-1.09)	
	>10%	21952	557	141379	3.94	1.16 (1.06-1.26)	
Female	≤-10%	23917	649	150997	4.30	1.23 (1.13-1.33)	<.0001
	-10< to ≤-5%	80407	1821	524377	3.47	1.09 (1.03-1.14)	

	-5< to ≤5%	388006	7864	2579870	3.05	1 (reference)	
	5< to ≤10%	46369	941	306609	3.07	1.02 (0.95-1.09)	
	>10%	14424	349	93572	3.73	1.14 (1.02-1.27)	
Obesity							
BMI<25 kg/m^2	≤-10%	37694	1059	233666	4.53	1.19 (1.11-1.27)	
	-10< to ≤-5%	125600	3080	812074	3.79	1.09 (1.05-1.14)	
	-5< to ≤5%	579236	12406	3844559	3.23	1 (reference)	<.0001
	5< to ≤10%	56666	1285	372340	3.45	1.11 (1.04-1.17)	
	>10%	14866	347	94794	3.66	1.08 (0.97-1.20)	
BMI≥25 kg/m^2	≤-10%	10298	298	65803	4.53	1.50 (1.34-1.68)	
	-10< to ≤-5%	62291	1558	405427	3.84	1.12 (1.06-1.18)	
	-5< to ≤5%	544403	12851	3628044	3.54	1 (reference)	<.0001
	5< to ≤10%	69677	1510	462741	3.26	0.96 (0.91-1.01)	
	>10%	21510	559	140157	3.99	1.13 (1.04-1.23)	
DM duration							
<5 years	≤-10%	31784	773	201963	3.83	1.20 (1.11-1.29)	
	-10< to ≤-5%	122167	2560	803553	3.19	1.05 (1.00-1.09)	
	-5< to ≤5%	755639	14893	5105815	2.92	1 (reference)	<.0001
	5< to ≤10%	89813	1733	603605	2.87	1.05 (1.00-1.11)	
	>10%	25743	557	169551	3.29	1.18 (1.08-1.28)	
≥5 years	≤-10%	16208	584	97506	5.99	1.29 (1.18-1.40)	<.0001
	-10< to ≤-5%	65724	2078	413948	5.02	1.16 (1.10-1.21)	

	-5< to ≤5%	368000	10364	2366789	4.38	1 (reference)	
	5< to ≤10%	36530	1062	231476	4.59	1.01 (0.95-1.08)	
	>10%	10633	349	65399	5.34	1.12 (1.01-1.25)	
DM medication							
Naïve	≤-10%	18068	386	115445	3.34	1.16 (1.04-1.28)	
	-10< to ≤-5%	73220	1408	485156	2.90	1.06 (1.00-1.12)	
	-5< to ≤5%	499739	8943	3409422	2.62	1 (reference)	<.0001
	5< to ≤10%	60154	1029	409949	2.51	1.07 (1.00-1.14)	
	>10%	16401	325	109997	2.95	1.24 (1.11-1.38)	
OHA or insulin	≤-10%	29924	971	184024	5.28	1.27 (1.19-1.36)	
	-10< to ≤-5%	114671	3230	732345	4.41	1.11 (1.07-1.16)	
	-5< to ≤5%	623900	16314	4063182	4.02	1 (reference)	<.0001
	5< to ≤10%	66189	1766	425132	4.15	1.02 (0.97-1.07)	
	>10%	19975	581	124954	4.65	1.11 (1.02-1.121)	

AF, atrial fibrillation; BMI, body mass index; CI, confidence interval; DM, diabetes mellitus; HR, hazard ratio

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2 except the variable associated with classification in each subgroup.

Supplemental Table 6. Subgroup analysis for HF according to body weight change

	Body weight change	number	event	Follow-up duration	aIR*	HR (95% CI)**	p-value
Age							
Age <65 years	≤-10%	31482	1156	202058	5.72	1.38 (1.30-1.47)	<.0001
	-10< to ≤-5%	132565	4103	870726	4.71	1.13 (1.10-1.17)	
	-5< to ≤5%	846186	23278	5683770	4.10	1 (reference)	
	5< to ≤10%	97669	2798	651770	4.29	1.10 (1.06-1.15)	
	>10%	27577	955	180359	5.30	1.36 (1.28-1.45)	
Age ≥65 years	≤-10%	16510	2034	95381	21.33	1.40 (1.34-1.46)	<.0001
	-10< to ≤-5%	55326	5537	342007	16.19	1.13 (1.10-1.17)	
	-5< to ≤5%	277453	24763	1773740	13.96	1 (reference)	
	5< to ≤10%	28674	3028	180385	16.79	1.14 (1.09-1.18)	
	>10%	8799	1093	53351	20.49	1.30 (1.22-1.38)	
Sex							
Male	≤-10%	24075	1487	147840	10.06	1.42 (1.35-1.50)	<.0001
	-10< to ≤-5%	107484	5298	691559	7.66	1.15 (1.12-1.19)	
	-5< to ≤5%	735633	30004	4888889	6.14	1 (reference)	
	5< to ≤10%	79974	3506	527438	6.65	1.14 (1.10-1.18)	
	>10%	21952	1130	140857.99	8.0223	1.35 (1.27-1.43)	
Female	≤-10%	23917	1703	149598.48	11.3838	1.41 (1.34-1.49)	<.0001
	-10< to ≤-5%	80407	4342	521174	8.33	1.12 (1.08-1.16)	

	-5< to ≤5%	388006	18037	2568621	7.02	1 (reference)	
	5< to ≤10%	46369	2320	304717	7.61	1.10 (1.06-1.15)	
	>10%	14424	918	92852	9.89	1.34 (1.26-1.43)	
Obesity							
BMI<25 kg/m^2	≤-10%	37694	2630	231867	11.34	1.30 (1.25-1.36)	
	-10< to ≤-5%	125600	6676	808505	8.26	1.10 (1.07-1.13)	
	-5< to ≤5%	579236	25291	3834639	6.60	1 (reference)	<.0001
	5< to ≤10%	56666	2708	371034	7.30	1.14 (1.10-1.19)	
	>10%	14866	928	94198	9.85	1.42 (1.33-1.51)	
BMI≥25 kg/m^2	≤-10%	10298	560	65572	8.54	1.46 (1.34-1.58)	
	-10< to ≤-5%	62291	2964	404228.25	7.33	1.16 (1.12-1.21)	
	-5< to ≤5%	544403	22750	3622872	6.28	1 (reference)	<.0001
	5< to ≤10%	69677	3118	461121	6.76	1.10 (1.06-1.14)	
	>10%	21510	1120	139511	8.03	1.25 (1.18-1.33)	
DM duration							
<5 years	≤-10%	31784	1624	201158	8.07	1.42 (1.35-1.49)	
	-10< to ≤-5%	122167	4888	801849	6.10	1.15 (1.12-1.19)	
	-5< to ≤5%	755639	24915	5104253	4.88	1 (reference)	<.0001
	5< to ≤10%	89813	3157	602701	5.24	1.15 (1.11-1.19)	
	>10%	25743	1054	169136	6.23	1.34 (1.26-1.43)	
≥5 years	≤-10%	16208	1566	96280	16.27	1.45 (1.37-1.52)	<.0001
	-10< to ≤-5%	65724	4752	410884	11.57	1.13 (1.10-1.17)	

	-5< to ≤5%	368000	23126	2353257	9.83	1 (reference)	
	5< to ≤10%	36530	2669	229453	11.63	1.11 (1.07-1.16)	
	>10%	10633	994	64574	15.39	1.38 (1.29-1.47)	
DM medication							
Naïve	≤-10%	18068	831	115077	7.22	1.52 (1.41-1.63)	
	-10< to ≤-5%	73220	2557	484470	5.28	1.18 (1.13-1.23)	
	-5< to ≤5%	499739	14262	3409882	4.18	1 (reference)	<.0001
	5< to ≤10%	60154	1770	409641	4.32	1.15 (1.09-1.20)	
	>10%	16401	588	109848	5.35	1.40 (1.29-1.52)	
OHA or insulin	≤-10%	29924	2359	182362	12.94	1.38 (1.32-1.44)	
	-10< to ≤-5%	114671	7083	728263	9.73	1.12 (1.09-1.15)	
	-5< to ≤5%	623900	33779	4047628	8.35	1 (reference)	<.0001
	5< to ≤10%	66189	4056	422513	9.60	1.12 (1.09-1.16)	
	>10%	19975	1460	123862	11.79	1.33 (1.26-1.40)	

aIR, annual incidence rate; BMI, body mass index; CI, confidence interval; DM, diabetes mellitus; HF, heart failure; HR, hazard ratio

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2 except the variable associated with classification in each subgroup.

Supplemental Table 7. Subgroup analysis for death according to body weight change

	Body weight change	number	event	Follow-up duration	aIR*	HR (95% CI)**	p-value
Age							
Age <65 years	≤-10%	31482	1711	204061	8.39	1.93 (1.84-2.03)	<.0001
	-10< to ≤-5%	132565	4693	877957	5.35	1.30 (1.26-1.34)	
	-5< to ≤5%	846186	22139	5726305	3.88	1 (reference)	
	5< to ≤10%	97669	2911	656960	4.43	1.25 (1.20-1.30)	
	>10%	27577	1078	182090	5.92	1.67 (1.57-1.78)	
Age ≥65 years	≤-10%	16510	4054	98780	41.04	1.76 (1.71-1.82)	<.0001
	-10< to ≤-5%	55326	8587	351517	24.43	1.22 (1.19-1.25)	
	-5< to ≤5%	277453	33321	1816306	18.35	1 (reference)	
	5< to ≤10%	28674	4350	185721	23.42	1.20 (1.16-1.24)	
	>10%	8799	1791	55223	32.43	1.52 (1.45-1.59)	
Sex							
Male	≤-10%	24075	3495	150197	23.27	1.88 (1.82-1.95)	<.0001
	-10< to ≤-5%	107484	9167	700342	13.09	1.28 (1.25-1.31)	
	-5< to ≤5%	735633	41507	4940723	8.40	1 (reference)	
	5< to ≤10%	79974	5271	533513	9.88	1.24 (1.20-1.27)	
	>10%	21952	1929	142818	13.51	1.61 (1.54-1.69)	
Female	≤-10%	23917	2270	152645	14.87	1.80 (1.72-1.88)	<.0001
	-10< to ≤-5%	80407	4113	529132	7.77	1.21 (1.17-1.25)	

	-5< to ≤5%	388006	13953	2601888	5.36	1 (reference)	
	5< to ≤10%	46369	1990	309169	6.44	1.22 (1.17-1.28)	
	>10%	14424	940	94496	9.95	1.62 (1.51-1.73)	
Obesity							
BMI<25 kg/m^2	≤-10%	37694	5166	236268	21.87	1.52 (1.48-1.57)	
	-10< to ≤-5%	125600	10359	819839	12.64	1.17 (1.14-1.19)	
	-5< to ≤5%	579236	34774	3878130	8.98	1 (reference)	<.0001
	5< to ≤10%	56666	4212	375750	11.21	1.25 (1.21-1.30)	
	>10%	14866	1611	95650	16.84	1.67 (1.59-1.76)	
BMI≥25 kg/m^2	≤-10%	10298	599	66573	9.00	1.83 (1.69-1.98)	
	-10< to ≤-5%	62291	2921	409635	7.13	1.27 (1.22-1.32)	
	-5< to ≤5%	544403	20686	3664480	5.65	1 (reference)	<.0001
	5< to ≤10%	69677	3049	466931	6.53	1.21 (1.17-1.26)	
	>10%	21510	1258	141663	8.88	1.58 (1.49-1.67)	
DM duration							
<5 years	≤-10%	9333	3147	203896	15.43	1.82 (1.75-1.89)	
	-10< to ≤-5%	36928	7087	810378	8.75	1.24 (1.21-1.28)	
	-5< to ≤5%	267877	30601	5148571	5.94	1 (reference)	<.0001
	5< to ≤10%	37202	4188	608465	6.88	1.26 (1.22-1.30)	
	>10%	10242	1597	171070	9.34	1.62 (1.54-1.70)	
≥5 years	≤-10%	38659	2618	98945	26.46	1.92 (1.84-2.00)	<.0001
	-10< to ≤-5%	150963	6193	419096	14.78	1.28 (1.25-1.32)	

	-5< to ≤5%	855762	24859	2394040	10.38	1 (reference)	
	5< to ≤10%	89141	3073	234216	13.12	1.21 (1.17-1.26)	
	>10%	26134	1272	66243	19.20	1.66 (1.57-1.76)	
DM medication							
Naïve	≤-10%	18068	1746	116382	15.00	1.99 (1.89-2.09)	
	-10< to ≤-5%	73220	3976	488818	8.13	1.30 (1.25-1.34)	
	-5< to ≤5%	499739	18129	3434868	5.28	1 (reference)	<.0001
	5< to ≤10%	60154	2462	412834	5.96	1.28 (1.23-1.34)	
	>10%	16401	938	110836	8.46	1.68 (1.58-1.80)	
OHA or insulin	≤-10%	29924	4019	186460	21.55	1.82 (1.76-1.88)	
	-10< to ≤-5%	114671	9304	740656	12.56	1.25 (1.22-1.28)	
	-5< to ≤5%	623900	37331	4107743	9.09	1 (reference)	<.0001
	5< to ≤10%	66189	4799	429848	11.16	1.21 (1.17-1.25)	
	>10%	19975	1931	126478	15.27	1.60 (1.53-1.67)	

aIR, annual event incidence rate; BMI, body mass index; CI, confidence interval; DM, diabetes mellitus; HR, hazard ratio

*Annual event incidence rates were calculated per 1,000 patient-years from baseline population

**Adjusted for age, sex, previous history of hypertension, dyslipidemia, cancer, hyperthyroidism, chronic kidney disease, peripheral artery disease, chronic obstructive pulmonary disease, income level, smoking status, drinking habit, regular physical activity, insulin medication, use of oral hypoglycemic agents, and body mass index ≥ 25 kg/m^2 except the variable associated with classification in each subgroup.