Supplement 1. Supplement methods

Data source and study cohort

In Korea, there is a single health insurance system administered by the NHIS, and all data related to insurance eligibility and medical claims for all Koreans are stored in the NHIS database. The NHIS provides health checkups at least once every two years for the purpose of early detection and prevention of diseases. NHIS-HEALS was established based on 514,866 Koreans (aged 40 to 79 in 2002), who randomly selected 10% of the national health screening participants from 2002 to 2003. It includes data on regular blood tests, physical examinations, such as BMI and blood pressure, and questionnaires regarding medical history and lifestyle.

Study population

To define the prediabetes cohort, those with a history of diabetes (ICD-10: E10-E14 and ≥1 claim for antihyperglycemic medication) prior to the index date were excluded. Prediabetes is defined by the presence of IFG and/or IGT and/or A1C 5.7–6.4%, which is defined as fasting serum glucose 100 to 125mg/dL at the first health screening as IFG since the data of check-up did not contain 2h-plasma glucose value during 75g oral glucose tolerance test and A1c.(1) Regarding the prehypertension cohort, those with a history of hypertension (ICD-10: I10-I15 and ≥1 claim for an¬tihypertensive medication) prior to the index date were excluded. Prehypertension was defined as systolic pressure of 120 to 139mmHg or diastolic pressure of 80 to 89 mmHg at the first health screening.(2, 3) The antihyperglycemic medications that were considered in this study were metformin, sulfonylureas, thiazolidinediones, alpha glucosidase inhibitors, glucagon-like peptide-1 receptor agonists, Dipeptidyl peptidase 4 inhibitors, sodium-glucose cotransporter 2 inhibitors, and insulin. The

antihypertensive medications that were considered in this study were diuretics, angiotensin-converting enzyme inhibitors, beta adrenergic receptor blockers, alpha adrenergic receptor blockers, angiotensin II receptor blockers, calcium channel blockers, vasodilators and centrally acting sympatholytics.

Assessment of lifestyle changes

Change of BMI was assessed change in BMI categories (normal: < 23.0 kg/m^2, overweight: $23.0 \leq \sim < 25.0$ kg/m^2, and obesity: ≥ 25.0kg/m^2). Data on current smoking, alcohol intake, and physical activity were collected based on self-reported questionnaires. In the second health screening, compared to the previous period, whether each of the four factors worsened or improved was evaluated. For example, if an individual's BMI category changed from normal at the first screening to overweight at the second screening, he or she has been evaluated as '1 factor worsened', and if the participant continued smoking from the first to the second health screening, he or she has been evaluated as 'no change in lifestyle.' On the other hand, if the participant answered 'never' for exercise at the first health screening and answered 'exercise 2-3 times per month' at the second screening, he or she has been evaluated as '1 factor improved' (Supplementary table 1).

Statistical analysis

We estimated adjusted HR under controlling by age, income level (quantiles), current smoking status, alcohol consumption, physical activity, CCI score, BMI, systolic blood pressure, total cholesterol, fasting serum glucose level at the first health screening, and usage of statin medication prior to the index date. Charlson comorbidity Index score (CCI score) is a

tool used to predict the risk of mortality for patients based on their comorbid conditions and estimate their 10-year survival. We also assessed the impact of lifestyle changes on health risks by adjusting aspirin, antihyperglycemic drugs, or antihypertensive drugs.

Since weight change can be considered to be a result of changes in lifestyle, lifestyle effects were evaluated by considering only their current smoking status, drinking habits, and frequency of physical activity, excluding BMI level, among lifestyle factors. As a sensitivity analysis, to avoid potential reversal causality, we excluded subjects with incident outcomes that occurred within the first 2 years.

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Supplement 2. Distribution pattern according to the changes in lifestyle pattern

Prehypertension Group

Lifestyle change	All				Male				Female			
	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)
4 factors worsened	42	0.05	22,778	26.6	41	0.08	15,245	28.37	1	0	7,533	23.61
3 factors worsened	575	0.67			501	0.93			74	0.23		
2 factors worsened	4,451	5.2			3,354	6.24			1,097	3.44		
1 factor worsened	17,710	20.68			11,349	21.12			6,361	19.94		
No change of lifestyle	33,602	39.24	33,602	39.24	19,440	36.17	19,440	36.17	14,162	44.4	14,162	44.4
1 factor improved	21,738	25.38	29,262	34.17	13,413	24.96	19,059	35.46	8,325	26.1	10,203	31.99
2 factors improved	6,498	7.59			4,761	8.86			1,737	5.45		
3 factors improved	975	1.14			834	1.55			141	0.44		
4 factors improved	51	0.06			51	0.09						

Prediabetes Group

Lifestyle change	All				Male				Female			
	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)	Patient (n)	Percentage (%)
4 factors worsened	27	0.05	13,667	26.13	26	0.08	9,479	27.8	1	0.01	4,188	23.01
3 factors worsened	341	0.65			301	0.88			40	0.22		
2 factors worsened	2,678	5.12			2,117	6.21			561	3.08		

1 factor worsened	10,621	20.31			7,035	20.63			3,586	19.7		
No change of lifestyle	20,417	39.04	20,417	39.04	12,292	36.05	12,292	36.05	8,125	44.64	8,125	44.64
1 factor improved	13,492	25.8			8,714	25.56			4,778	26.25		
2 factors improved	4,105	7.85	18,218	34.83	3,065	8.99	12,328	36.16	1,040	5.71	5,890	32.36
3 factors improved	582	1.11			511	1.5			71	0.39		
4 factors improved	39	0.07			38	0.11			1	0.01		

Supplement 3. Univariate analysis of total cardiovascular disease events and mortality associated with lifestyle changes between two biennial health screening periods in the prehypertension group

Outcome	Parameter	Change	Male		Female	
			Hazard ratio [95% CI]	P-value	Hazard ratio [95% CI]	P-value
MACE	Unhealthy lifestyle	Worsened	1.06 [0.98–1.15]	0.162	0.987 [0.89–1.10]	0.810
		Improved	0.986 [0.91–1.07]	0.724	0.913 [0.83–1.01]	0.076
	Unhealthy lifestyle (exclude BMI)	Worsened	1.064 [0.98–1.16]	0.136	0.886 [0.79–0.99]	0.035
		Improved	0.994 [0.92–1.08]	0.889	0.836 [0.76–0.93]	0.001
	BMI	Worsened	1.047 [0.95–1.16]	0.366	1.073 [0.94–1.23]	0.296
		Improved	1.043 [0.95–1.15]	0.400	1.048 [0.93–1.19]	0.454
	Currently smoking	Worsened	1.039 [0.91–1.19]	0.571	2.404 [1.65–3.52]	< 0.001
		Improved	0.982 [0.88–1.09]	0.741	1.926 [1.32–2.82]	0.001
	Frequency of drinking	Worsened	1.047 [0.97–1.13]	0.263	0.762 [0.65–0.89]	0.001
		Improved	1.096 [1.01–1.18]	0.020	0.96 [0.84–1.10]	0.561
	Frequency of physical activity	Worsened	0.994 [0.91–1.08]	0.889	0.956 [0.85–1.07]	0.439
		Improved	0.884 [0.82–0.96]	0.002	0.802 [0.72–0.89]	< 0.001
Non-fatal MI	Unhealthy lifestyle	Worsened	1.004 [0.87–1.17]	0.956	0.908 [0.71–1.16]	0.441
		Improved	0.951 [0.83–1.10]	0.485	0.877 [0.70–1.10]	0.256
	Unhealthy lifestyle (exclude BMI)	Worsened	1.053 [0.91–1.22]	0.495	0.88 [0.68–1.13]	0.324
		Improved	0.965 [0.84–1.11]	0.626	0.834 [0.66–1.05]	0.124
	BMI	Worsened	1.027 [0.86–1.23]	0.776	0.686 [0.48–0.98]	0.036

Outcome	Factor		HR [95% CI]	p	HR [95% CI]	p
		Improved	1.113 [0.94–1.32]	0.228	0.989 [0.75–1.30]	0.936
	Currently smoking	Worsened	1.073 [0.84–1.36]	0.564	2.206 [0.91–5.33]	0.079
		Improved	1.172 [0.97–1.41]	0.092	3.264 [1.69–6.32]	< 0.001
	Frequency of drinking	Worsened	0.995 [0.86–1.15]	0.947	0.915 [0.66–1.27]	0.599
		Improved	0.979 [0.85–1.13]	0.773	0.867 [0.63–1.20]	0.393
	Frequency of physical activity	Worsened	0.992 [0.86–1.15]	0.913	0.908 [0.70–1.18]	0.463
		Improved	0.894 [0.78–1.03]	0.121	0.832 [0.66–1.05]	0.121
Non-fatal stroke	Unhealthy lifestyle	Worsened	1.113 [1.01–1.23]	0.030	0.99 [0.88–1.12]	0.876
		Improved	1.024 [0.93–1.12]	0.625	0.904 [0.81–1.01]	0.077
	Unhealthy lifestyle (exclude BMI)	Worsened	1.098 [1.00–1.21]	0.058	0.891 [0.79–1.01]	0.067
		Improved	1.024 [0.93–1.12]	0.617	0.813 [0.73–0.91]	0.000
	BMI	Worsened	1.047 [0.93–1.18]	0.442	1.097 [0.95–1.27]	0.210
		Improved	1.017 [0.91–1.14]	0.779	1.051 [0.92–1.20]	0.478
	Currently smoking	Worsened	1.026 [0.88–1.20]	0.754	2.496 [1.65–3.77]	< 0.001
		Improved	0.92 [0.81–1.05]	0.218	1.461 [0.91–2.36]	0.120
	Frequency of drinking	Worsened	1.086 [0.99–1.19]	0.086	0.742 [0.62–0.89]	0.001
		Improved	1.149 [1.05–1.26]	0.003	0.967 [0.83–1.13]	0.673
	Frequency of physical activity	Worsened	0.999 [0.91–1.10]	0.977	0.962 [0.85–1.09]	0.541
		Improved	0.866 [0.79–0.95]	0.002	0.777 [0.69–0.87]	< 0.001
CVD death	Unhealthy lifestyle	Worsened	1.084 [0.79–1.48]	0.611	0.85 [0.54–1.34]	0.484
		Improved	0.891 [0.65–1.22]	0.466	0.606 [0.38–0.96]	0.033
	Unhealthy lifestyle (exclude BMI)	Worsened	1.039 [0.76–1.42]	0.810	0.69 [0.42–1.15]	0.153

			HR [95% CI]	p-value	HR [95% CI]	p-value
		Improved	0.859 [0.63–1.17]	0.332	0.69 [0.44–1.09]	0.108
	BMI	Worsened	0.856 [0.56–1.31]	0.473	1.444 [0.87–2.39]	0.154
		Improved	1.099 [0.76–1.60]	0.619	0.868 [0.49–1.55]	0.632
	Currently smoking	Worsened	1.657 [1.08–2.53]	0.020	5.004 [1.59–15.8]	0.006
		Improved	0.758 [0.47–1.23]	0.261	8.087 [3.55–18.4]	< 0.001
	Frequency of drinking	Worsened	1.084 [0.80–1.47]	0.609	0.417 [0.17–1.02]	0.056
		Improved	0.991 [0.73–1.35]	0.955	0.77 [0.40–1.48]	0.432
	Frequency of physical activity	Worsened	0.79 [0.57–1.10]	0.158	0.713 [0.43–1.19]	0.194
		Improved	0.717 [0.52–0.98]	0.038	0.439 [0.26–0.75]	0.003
All-cause death	Unhealthy lifestyle	Worsened	1.013 [0.92–1.11]	0.793	0.896 [0.76–1.06]	0.211
		Improved	0.997 [0.91–1.09]	0.947	0.816 [0.70–0.96]	0.013
	Unhealthy lifestyle (exclude BMI)	Worsened	1.092 [1.00–1.20]	0.063	0.816 [0.68–0.98]	0.026
		Improved	1.026 [0.94–1.12]	0.567	0.731 [0.62–0.86]	< 0.001
	BMI	Worsened	0.831 [0.74–0.94]	0.003	1.08 [0.88–1.33]	0.472
		Improved	0.973 [0.87–1.09]	0.636	1.144 [0.95–1.38]	0.162
	Currently smoking	Worsened	1.109 [0.96–1.28]	0.167	2.874 [1.66–4.97]	< 0.001
		Improved	0.945 [0.83–1.07]	0.377	3.979 [2.61–6.08]	< 0.001
	Frequency of drinking	Worsened	1.068 [0.98–1.17]	0.155	0.935 [0.74–1.18]	0.574
		Improved	1.115 [1.02–1.22]	0.015	0.898 [0.71–1.13]	0.354
	Frequency of physical activity	Worsened	0.844 [0.77–0.93]	< 0.001	0.869 [0.73–1.04]	0.132
		Improved	0.791 [0.72–0.86]	< 0.001	0.699 [0.59–0.83]	< 0.001

MACE, major adverse cardiovascular events; BMI, body mass index; CVD, cardiovascular disease.

Supplement 4. Univariate analysis of total cardiovascular disease events and mortality associated with lifestyle change between two biennial health screening periods in the prediabetes group

Outcome	Parameter	Change	Male		Female	
			hazard ratio [95% CI]	P-value	hazard ratio [95% CI]	P-value
MACE	Unhealthy lifestyle	Worsened	1.134 [1.04–1.24]	0.005	0.934 [0.83–1.05]	0.268
		Improved	1.06 [0.98–1.15]	0.173	0.904 [0.81–1.01]	0.071
	Unhealthy lifestyle (exclude BMI)	Worsened	1.165 [1.07–1.27]	0.001	0.816 [0.72–0.93]	0.002
		Improved	1.092 [1.01–1.19]	0.037	0.862 [0.77–0.96]	0.009
	BMI	Worsened	1.095 [0.98–1.22]	0.099	1.133 [0.98–1.31]	0.090
		Improved	1.006 [0.91–1.12]	0.906	0.998 [0.87–1.14]	0.976
	Currently smoking	Worsened	1.086 [0.95–1.25]	0.244	1.006 [0.52–1.94]	0.987
		Improved	0.985 [0.87–1.11]	0.810	2.271 [1.59–3.24]	< 0.001
	Frequency of drinking	Worsened	1.065 [0.98–1.16]	0.150	0.82[0.70–0.97]	0.019
		Improved	1.109 [1.02–1.20]	0.013	0.824 [0.70–0.97]	0.019
	Frequency of physical activity	Worsened	1.047 [0.96–1.14]	0.303	0.803 [0.70–0.92]	0.002
		Improved	0.942 [0.87–1.02]	0.157	0.845 [0.75–0.95]	0.004
Non-fatal MI	Unhealthy lifestyle	Worsened	1.27 [1.07–1.50]	0.006	0.957 [0.74–1.24]	0.734
		Improved	1.174 [1.00–1.38]	0.051	0.815 [0.64–1.04]	0.094
	Unhealthy lifestyle (exclude BMI)	Worsened	1.194 [1.01–1.41]	0.040	0.759 [0.57–1.00]	0.052
		Improved	1.184 [1.01–1.39]	0.036	0.757 [0.59–0.97]	0.026
	BMI	Worsened	1.088 [0.89–1.34]	0.418	1.223 [0.91–1.65]	0.191

Outcome	Factor	Change	HR [95% CI]	p	HR [95% CI]	p
		Improved	0.837 [0.68–1.04]	0.106	0.899 [0.66–1.22]	0.493
	Currently smoking	Worsened	1.148 [0.88–1.49]	0.302	1.576 [0.51–4.91]	0.433
		Improved	1.169 [0.94–1.45]	0.154	3.065 [1.58–5.94]	0.001
	Frequency of drinking	Worsened	0.948 [0.80–1.12]	0.532	0.852 [0.60–1.21]	0.374
		Improved	1.036 [0.88–1.21]	0.662	0.736 [0.51–1.07]	0.104
	Frequency of physical activity	Worsened	1.079 [0.92–1.27]	0.366	0.73 [0.54–0.98]	0.037
		Improved	0.932 [0.80–1.09]	0.388	0.743 [0.58–0.95]	0.020
Non-fatal stroke	Unhealthy lifestyle	Worsened	1.11[1.00–1.23]	0.047	0.956 [0.84–1.09]	0.511
		Improved	1.026 [0.93–1.13]	0.613	0.921 [0.82–1.04]	0.189
	Unhealthy lifestyle (exclude BMI)	Worsened	1.169 [1.06–1.29]	0.003	0.828 [0.72–0.96]	0.009
		Improved	1.06 [0.96–1.17]	0.241	0.862 [0.76–0.98]	0.019
	BMI	Worsened	1.076 [0.95–1.22]	0.254	1.124 [0.96–1.32]	0.156
		Improved	1.034 [0.92–1.17]	0.583	1.023 [0.88–1.19]	0.759
	Currently smoking	Worsened	1.123 [0.96–1.32]	0.155	0.969 [0.46–2.04]	0.934
		Improved	0.938 [0.81–1.08]	0.383	2.343 [1.59–3.45]	< 0.001
	Frequency of drinking	Worsened	1.128 [1.02–1.25]	0.017	0.801 [0.67–0.96]	0.019
		Improved	1.15 [1.05–1.27]	0.004	0.818 [0.68–0.98]	0.029
	Frequency of physical activity	Worsened	1.036 [0.94–1.15]	0.494	0.827 [0.71–0.96]	0.012
		Improved	0.929 [0.84–1.02]	0.135	0.855 [0.75–0.97]	0.015
CVD death	Unhealthy lifestyle	Worsened	1.039 [0.77–1.39]	0.798	0.735 [0.50–1.20]	0.191
		Improved	0.958 [0.72–1.27]	0.766	0.794 [0.50–1.20]	0.258
	Unhealthy lifestyle (exclude BMI)	Worsened	1.027 [0.77–1.37]	0.859	0.843 [0.50–1.30]	0.466

		Improved	0.921 [0.70–1.22]	0.563	0.775 [0.50–1.20]	0.234
	BMI	Worsened	1.185 [0.83–1.68]	0.343	1.171 [0.70–2.00]	0.556
		Improved	1.256 [0.91–1.73]	0.166	1.15 [0.70–1.80]	0.559
	Currently smoking	Worsened	0.701 [0.40–1.22]	0.212	NA	NA
		Improved	0.812 [0.53–1.24]	0.339	4.583 [1.90–11.20]	0.001
	Frequency of drinking	Worsened	0.883 [0.66–1.18]	0.397	0.532 [0.30–1.10]	0.084
		Improved	0.834 [0.63–1.11]	0.213	0.568 [0.30–1.10]	0.102
	Frequency of physical activity	Worsened	0.999 [0.75–1.34]	0.997	0.911 [0.60–1.50]	0.699
		Improved	0.876 [0.66–1.16]	0.354	0.749 [0.50–1.20]	0.191
All-cause death	Unhealthy lifestyle	Worsened	1.067 [0.97–1.18]	0.205	0.969 [0.82–1.15]	0.719
		Improved	1.041 [0.95–1.14]	0.405	0.796 [0.68–0.94]	0.007
	Unhealthy lifestyle (exclude BMI)	Worsened	1.071 [0.97–1.18]	0.173	0.901 [0.75–1.08]	0.255
		Improved	1.005 [0.92–1.10]	0.925	0.715 [0.60–0.85]	< 0.001
	BMI	Worsened	0.949 [0.84–1.08]	0.423	0.839 [0.66–1.06]	0.148
		Improved	1.036 [0.92–1.16]	0.555	1.035 [0.86–1.25]	0.723
	Currently smoking	Worsened	1.044 [0.89–1.23]	0.600	1.696 [0.81–3.57]	0.164
		Improved	1.111 [0.98–1.27]	0.108	3.303 [2.14–5.09]	< 0.001
	Frequency of drinking	Worsened	1.067 [0.97–1.18]	0.183	0.813 [0.64–1.04]	0.097
		Improved	1.046 [0.95–1.15]	0.344	0.838 [0.66–1.06]	0.142
	Frequency of physical activity	Worsened	0.904 [0.82–1.00]	0.049	0.819 [0.68–0.99]	0.039
		Improved	0.836 [0.76–0.92]	< 0.001	0.574 [0.48–0.69]	< 0.001

MACE, major adverse cardiovascular events; BMI, body mass index; CVD, cardiovascular disease.

Supplement 5. Multivariate analysis of all-cause death, non-fatal MI, and non-fatal stroke associated with lifestyle change between two biennial health screening periods in the prehypertension group

Outcome	Parameter	Change	Male		Female	
			Adjusted hazard ratio [95% CI]	P-value	Adjusted hazard ratio [95% CI]	P-value
All-cause death	Unhealthy lifestyle	Worsened	1.11 [1.00–1.22]	0.043	1.0 [0.84–1.22]	0.889
		Improved	0.96 [0.88–1.05]	0.372	0.92 [0.78–1.09]	0.348
	Unhealthy lifestyle (exclude BMI)	Worsened	1.20 [1.09–1.32]	< 0.001	1.00 [0.81–1.23]	0.961
		Improved	0.93 [0.85–1.02]	0.139	0.83 [0.70–0.99]	0.04
	BMI	Worsened	0.80 [0.71–0.91]	< 0.001	1.03 [0.83–1.29]	0.775
		Improved	1.19 [1.05–1.35]	0.007	1.25 [1.01–1.54]	0.039
	Currently smoking	Worsened	1.53 [1.31–1.78]	< 0.001	1.61 [0.91–2.86]	0.101
		Improved	0.72 [0.63–0.83]	< 0.001	1.25 [0.72–2.16]	0.421
	Frequency of drinking	Worsened	1.15 [1.04–1.26]	0.006	1.12 [0.88–1.43]	0.358
		Improved	1.02 [0.92–1.13]	0.687	1.00 [0.70–1.43]	0.991
	Frequency of physical activity	Worsened	1.00 [0.92–1.13]	0.996	1.23 [0.93–1.62]	0.148
		Improved	0.91 [0.83–1.00]	0.043	0.91 [0.77–1.09]	0.301
Non-fatal MI	Unhealthy lifestyle	Worsened	1.05 [0.90–1.22]	0.571	0.97]0.74–1.27]	0.826
		Improved	0.91 [0.78–1.05]	0.183	0.89 [0.71–1.13]	0.339
	Unhealthy lifestyle (exclude BMI)	Worsened	1.07 [0.92–1.25]	0.384	0.95 [0.70–1.28]	0.72
		Improved	0.94 [0.81–1.09]	0.395	0.89 [0.70–1.14]	0.349
	BMI	Worsened	1.16 [0.96–1.41]	0.132	0.71 [0.49–1.05]	0.066

		Improved	1.05 [0.85–1.23]	0.809	0.81 [0.60–1.11]	0.187
	Currently smoking	Worsened	1.45 [1.12–1.88]	0.005	1.71 [0.70–4.14]	0.236
		Improved	0.85 [0.70–1.03]	0.105	0.82 [0.37–1.81]	0.624
	Frequency of drinking	Worsened	1.02 [0.88–1.19]	0.796	1.11 [0.79–1.56]	0.556
		Improved	1.16 [0.98–1.37]	0.089	1.04 [0.62–1.66]	0.957
	Frequency of physical activity	Worsened	0.95 [0.80–1.14]	0.605	1.10 [0.76–1.60]	0.622
		Improved	0.92 [0.79–1.06]	0.232	0.98 [0.78–1.25]	0.888
Non-fatal stroke	Unhealthy lifestyle	Worsened	1.20 [1.09–1.33]	< 0.001	1.10 [0.97–1.25]	0.155
		Improved	0.94 [0.85–1.03]	0.185	0.93 [0.83–1.05]	0.246
	Unhealthy lifestyle (exclude BMI)	Worsened	1.15 [1.04–1.27]	0.007	1.04 [0.90–1.20]	0.603
		Improved	0.94 [0.85–1.03]	0.178	0.88 [0.78–0.99]	0.038
	BMI	Worsened	1.14 [1.01–1.29]	0.042	1.10 [0.94–1.28]	0.229
		Improved	0.95 [0.84–1.08]	0.445	1.00 [0.86–1.16]	0.982
	Currently smoking	Worsened	1.31 [1.11–1.54]	0.002	1.72 [1.13–2.62]	0.012
		Improved	0.77 [0.67–0.89]	< 0.001	0.57 [0.32–1.00]	0.052
	Frequency of drinking	Worsened	1.13 [1.02–1.24]	0.018	0.90 [0.75–1.08]	0.266
		Improved	1.08 [0.97–1.20]	0.145	1.13 [0.88–1.46]	0.333
	Frequency of physical activity	Worsened	1.15 [1.02–1.30]	0.022	1.24 [1.03–1.49]	0.021
		Improved	0.91 [0.82–1.00]	0.039	0.89 [0.79–1.00]	0.057
CVD death	Unhealthy lifestyle	Worsened	1.13 [0.82–1.56]	0.453	1.10 [0.67–1.80]	0.712
		Improved	0.89 [0.65–1.23]	0.478	0.76 [0.47–1.24]	0.278
	Unhealthy lifestyle (exclude BMI)	Worsened	1.07 [0.77–1.48]	0.696	0.95 [0.52–1.74]	0.857

		Improved	0.85 [0.62–1.17]	0.32	0.93 [0.58–1.51]	0.773
	BMI	Worsened	0.81 [0.52–1.26]	0.348	1.60 [0.94–2.71]	0.082
		Improved	1.05 [0.69–1.61]	0.817	0.94 [0.49–1.78]	0.845
	Currently smoking	Worsened	2.41 [1.53–3.78]	< 0.001	1.68 {0.41–6.86]	0.469
		Improved	0.56 [0.34–0.92]	0.023	2.70 [0.76–9.63]	0.125
	Frequency of drinking	Worsened	1.10 [0.80–1.52]	0.549	0.54 [0.22–1.35]	0.186
		Improved	1.04 [0.72–1.50]	0.834	0.82 [0.27–2.49]	0.72
	Frequency of physical activity	Worsened	0.83 [0.55–1.27]	0.391	0.99 {0.43–2.30]	0.986
		Improved	0.83 [0.61–1.14]	0.258	0.66 [0.39–1.14]	0.138

BMI, body mass index; CVD, cardiovascular disease.

Supplement 6. Multivariate analysis of all-cause death, non-fatal MI, and non-fatal stroke associated with lifestyle change between two biennial health screening periods in the prediabetes group

Outcome	Parameter	Change	Male		Female	
			Adjusted hazard ratio [95% CI]	P-value	Adjusted hazard ratio [95% CI]	P-value
All-cause death	Unhealthy lifestyle	Worsened	1.18 [1.06–1.31]	0.002	1.10 [0.91–1.33]	0.325
		Improved	1.04 [0.95–1.15]	0.397	0.56 [0.72–1.02]	0.076
	Unhealthy lifestyle (exclude BMI)	Worsened	1.19 [1.08–1.32]	< 0.001	1.10 [0.89–1.35]	0.395
		Improved	0.97 [0.88–1.06]	0.471	0.80 [0.67–0.96]	0.017
	BMI	Worsened	0.88 [0.76–1.00]	0.056	0.86 [0.67–1.10]	0.224
		Improved	1.21 [1.06–1.37]	0.004	1.00 [0.81–1.24]	0.968
	Currently smoking	Worsened	1.55 [1.31–1.84]	< 0.001	1.18 [0.56–2.49]	0.664
		Improved	0.89 [0.77–1.02]	0.102	0.98 [0.58–1.65]	0.931
	Frequency of drinking	Worsened	1.10 [0.99–1.22]	0.072	0.96 [0.74–1.23]	0.724
		Improved	1.03 [0.92–1.14]	0.648	0.87 [0.60–1.27]	0.475
	Frequency of physical activity	Worsened	1.11 [0.97–1.26]	0.133	1.13 [0.83–1.52]	0.436
		Improved	0.96 [0.87–1.06]	0.433	0.75 [0.62–0.91]	0.003
Non-fatal MI	Unhealthy lifestyle	Worsened	1.35 [1.13–1.61]	< 0.001	1.16 [0.88–1.53]	0.294
		Improved	1.17 [0.99–1.38]	0.066	0.86 [0.67–1.10]	0.219
	Unhealthy lifestyle (exclude BMI)	Worsened	1.24 [1.04–1.47]	0.018	0.94 0.68–1.30]	0.688
		Improved	1.20 [1.02–1.41]	0.03	0.84 [0.65–1.09]	0.199
	BMI	Worsened	1.21 [0.98–1.51]	0.08	1.33 [0.97–1.82]	0.082

		Improved	0.76 [0.60–0.95]	0.016	0.86 [0.62–1.18]	0.339
	Currently smoking	Worsened	1.55 [1.17–2.04]	0.002	1.34 [0.43–4.17]	0.619
		Improved	0.92 [0.73–1.16]	0.487	1.24 [0.53–2.90]	0.621
	Frequency of drinking	Worsened	0.97 [0.81–1.15]	0.695	0.99 [0.69–1.42]	0.963
		Improved	1.23 [1.03–1.47]	0.024	0.93 [0.54–1.62]	0.804
	Frequency of physical activity	Worsened	1.20 [0.97–1.47]	0.088	0.94 [0.60–1.46]	0.779
		Improved	0.96 [0.81–1.13]	0.596	0.88 [0.68–1.13]	0.32
Non-fatal stroke	Unhealthy lifestyle	Worsened	1.21 [1.09–1.34]	< 0.001	1.10 [0.95–1.27]	0.212
		Improved	1.01 [0.92–1.12]	0.825	0.97 [0.86–1.11]	0.686
	Unhealthy lifestyle (exclude BMI)	Worsened	1.23 [1.11–1.37]	< 0.001	0.96 [0.82–1.14]	0.658
		Improved	1.04 [0.95–1.15]	0.398	0.97 [0.85–1.10]	0.631
	BMI	Worsened	1.15 [1.01–1.32]	0.041	1.23 [1.03–1.46]	0.02
		Improved	0.96 [0.84–1.09]	0.506	0.95 [0.81–1.12]	0.539
	Currently smoking	Worsened	1.40 [1.19–1.66]	< 0.001	0.85 [0.40–1.79]	0.667
		Improved	0.93 [0.80–1.09]	0.388	1.11 [0.68–1.82]	0.682
	Frequency of drinking	Worsened	1.15 [1.03–1.27]	0.011	0.94 [0.77–1.14]	0.498
		Improved	1.18 [1.06–1.32]	0.003	1.03 [0.77–1.38]	0.847
	Frequency of physical activity	Worsened	1.22 [1.07–1.38]	0.003	1.07 [0.86–1.34]	0.536
		Improved	0.97 [0.87–1.07]	0.483	1.04 [0.88–1.15]	0.93
CVD death	Unhealthy lifestyle	Worsened	1.13 [0.83–1.53]	0.429	0.88 [0.53–1.45]	0.609
		Improved	0.96 [0.72–1.27]	0.759	0.98 [0.64–1.49]	0.918
	Unhealthy lifestyle (exclude BMI)	Worsened	1.10 [0.81–1.49]	0.54	1.06 [0.61–1.84]	0.841

		Improved	0.90 [0.67–1.19]	0.448	1.10 [0.70–1.71]	0.689
	BMI	Worsened	1.17 [0.81–1.70]	0.407	1.34 [0.76–2.36]	0.317
		Improved	1.27 [0.89–1.82]	0.191	1.17 [0.71–1.93]	0.55
	Currently smoking	Worsened	1.24 [0.70–2.20]	0.471	N/A	N/A
		Improved	0.61 [0.39–0.96]	0.032	2.30 [0.62–8.57]	0.216
	Frequency of drinking	Worsened	0.87 [0.63–1.18]	0.368	0.66 [0.32–1.37]	0.26
		Improved	0.80 [0.58–1.11]	0.183	0.65 [0.22–1.88]	0.424
	Frequency of physical activity	Worsened	1.16 [0.80–1.70]	0.435	1.88 [0.78–4.55]	0.16
		Improved	1.07 [0.80–1.42]	0.665	1.13 [0.73–1.76]	0.587

MACE, major adverse cardiovascular events; BMI, body mass index; CVD, cardiovascular disease.