

Low-risk lifestyle and health factors and risk of mortality and vascular complications in Chinese patients with diabetes

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Supplementary Methods

Data collection

Detailed information on sociodemographic factors, lifestyle factors, personal and family medical history, and current medications was obtained using a laptop-based questionnaire at baseline survey. Inquiry on tobacco smoking included current and past smoking status. Smoking frequency, type, and amount were asked for ever smokers, and the main reason for cessation was asked for former smokers. Questions about alcohol consumption included drinking frequency, beverage types, and the amount consumed on a typical drinking day. The amount of pure alcohol consumed in grams was converted according to the beverage types and volume of alcohol drunk (1). The physical activity questionnaire covered questions on type and time spent on occupational and nonoccupational activities (commuting, household, and leisure-time) during the past year. The metabolic equivalent task (MET) hours per day (MET-h/day) was calculated by multiplying the number of hours spent per day on each activity and the MET of that activity (2). Dietary intakes were assessed via a validated qualitative food frequency questionnaire, which covered 12 major food groups, such as fruits, vegetables, meat, and dairy products (3). Each food group was assessed with five frequency levels on habitual consumption during the past 12 months (daily, 4-6 days/week, 1-3 days/week, monthly, or never/rarely).

Trained staff measured weight, height, waist and hip circumference, and blood pressure (BP) and collected 10 ml of blood sample for storage and onsite testing of random blood glucose (RBG), with the time since last meal recorded. Blood mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Waist-to-hip ratio (WHR) was the ratio of waist circumference to hip circumference. BP was measured twice using a digital sphygmomanometer (Omron UA-779; Live Source) after participants had remained at rest in the seated position for at least 5 minutes. The mean of the two recorded values was used in the analyses. Prevalent hypertension was defined as measured systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg, or self-reported diagnosis of hypertension or use of antihypertensive medication at baseline. RBG level was measured following sample collection using the SureStep Plus System (Johnson & Johnson). Participants with RBG levels between 7.8 and 11.1 mmol/L were invited for an FBG test the following day. All devices were regularly maintained and calibrated to ensure consistency of the measurements.

Reference:

1. Millwood IY, Li L, Smith M, et al. Alcohol consumption in 0.5 million people from 10 diverse regions of China: prevalence, patterns and socio-demographic and health-related correlates. *Int J Epidemiol*. 2017;46(6):2103. doi:10.1093/ije/dyx210
2. Du H, Bennett D, Li L, et al. Physical activity and sedentary leisure time and their associations with BMI, waist circumference, and percentage body fat in 0.5 million adults: the China Kadoorie Biobank study. *Am J Clin Nutr*. 2013;97(3):487-496. doi:10.3945/ajcn.112.046854
3. Shen Q, Yu C, Guo Y, et al. Habitual Tea Consumption and Risk of Fracture in 0.5 Million Chinese Adults: A Prospective Cohort Study. *Nutrients*. 2018;10(11):1633. Published 2018 Nov 2. doi:10.3390/nu10111633

Supplementary Table 1. ICD-10 codes for study outcomes.

Outcomes	ICD-10 codes
Cancer	C00-C97
Macrovascular complications	
Total cardiovascular disease	I00-I25, I27-I88, I95-I99
Ischemic heart disease	I20-I25
Myocardial infarction	I21-I23
Stroke	I60, I61, I63, I64
Ischemic stroke	I63
Hemorrhagic stroke	I61
Microvascular complications	
Diabetic nephropathy	E10.2, E11.2, E12.2, E13.2, E14.2
Diabetic retinopathy	E10.3, E11.3, E12.3, E13.3, E14.3
Diabetic neuropathy	E10.4, E11.4, E12.4, E13.4, E14.4

Supplementary Table 2. Changes in lifestyle factors between baseline survey at 2004-08 and resurvey at 2013-14 according to detection methods for diabetes at baseline.

	Screen-detected diabetes	Self-reported diabetes	Total
No. of participants, n	503	534	1037
Tobacco smoking			
Stable	92.8 (90.5-95.0)	91.6 (89.4-93.8)	92.1
Worse	2.0 (0.7-3.3)	0.9 (0.1-1.7)	1.5
Better	5.2 (3.3-7.2)	7.5 (5.4-9.6)	6.5
Alcohol drinking			
Stable	90.3 (87.7-92.8)	91.0 (88.6-93.3)	90.7
Worse	5.3 (3.3-7.3)	4.4 (2.8-6.1)	4.8
Better	4.5 (2.7-6.2)	4.6 (2.9-6.3)	4.5
Eating fruits and vegetables			
Stable	74.8 (71.0-78.5)	70.7 (67.0-74.4)	72.7
Worse	9.1 (6.5-11.7)	3.9 (2.3-5.5)	6.3
Better	16.2 (12.9-19.4)	25.4 (21.8-29.0)	21.0
Physical activity, MET-h/d (SD)	-3.0 (14.3)	-3.1 (12.2)	-3.0 (13.3)
Waist-to-hip ratio			
Stable	82.4 (79.0-85.8)	78.9 (75.5-82.3)	80.5
Worse	9.7 (7.1-12.4)	12.8 (10.0-15.7)	11.4
Better	7.9 (5.5-10.3)	8.3 (6.0-10.6)	8.1

Values are adjusted for age at baseline (years), sex, and study area, where appropriate.

Participants were classified into three states: stable (maintaining low-risk or high-risk lifestyle), worse (from low-risk to high risk lifestyle) and better (from high-risk to low-risk lifestyle) according to their lifestyle change between baseline and the resurvey. Low-risk lifestyle factors were defined as: never smoking or having stopped for reasons other than illness; never drinking or current drinking <30 g/d of pure alcohol in men or <15 g/d in women (former drinkers not included); eating fruits and vegetables every day; engaging in a sex-specific median or higher level of physical activity; and having a WHR <0.90 in men and <0.85 in women.

Supplementary Table 3. Adjusted hazard ratios (95% CIs) for mortality and diabetes complications.

	All-cause mortality			Cancer mortality			Macrovascular complications			Microvascular complications		
	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)
Tobacco smoking												
Never smokers	3094	16.6	1.00	658	3.5	1.00	4564	26.8	1.00	1408	7.8	1.00
Former smokers ^a	257	23.9	1.08 (0.94-1.24)	62	5.8	0.98 (0.73-1.31)	344	36.1	1.02 (0.90-1.15)	92	8.8	1.22 (0.96-1.54)
Current smokers (cig/d)												
1-14	691	28.2	1.30 (1.18-1.43)	162	6.6	1.28 (1.04-1.58)	765	34.6	1.16 (1.06-1.27)	192	8.1	1.15 (0.97-1.37)
15-24	701	23.1	1.30 (1.17-1.45)	163	5.4	1.18 (0.95-1.47)	812	29.4	1.22 (1.11-1.34)	239	8.1	1.23 (1.03-1.47)
≥25	320	22.9	1.34 (1.17-1.54)	88	6.3	1.37 (1.04-1.80)	363	28.6	1.28 (1.13-1.45)	124	9.2	1.33 (1.06-1.65)
Alcohol drinking												
Never drinkers	3984	18.5	1.00	826	3.8	1.00	5515	28.0	1.00	1690	8.1	1.00
Former drinkers	453	30.3	1.14 (1.03-1.27)	102	6.8	1.23 (0.98-1.54)	460	34.1	1.06 (0.95-1.17)	158	11.0	1.03 (0.86-1.24)
Current drinkers (men/women, g/d)												
Less than daily or <15/30	285	14.8	0.85 (0.75-0.97)	84	4.4	1.04 (0.81-1.33)	487	28.0	0.94 (0.84-1.04)	129	6.9	0.96 (0.78-1.17)
≥15/30	341	21.4	1.11 (0.98-1.26)	121	7.6	1.51 (1.20-1.89)	386	26.5	1.01 (0.90-1.13)	78	5.0	0.72 (0.56-0.93)
Eating fruits and vegetables												
Less than daily	4313	20.3	1.00	905	4.3	1.00	5541	28.5	1.00	1690	8.2	1.00
Daily	750	14.1	0.82 (0.75-0.89)	228	4.3	0.97 (0.83-1.14)	1307	27.1	0.85 (0.80-0.91)	365	7.1	0.91 (0.80-1.03)
Physical activity (MET-h/day)												
Quartile1 (Lowest)	1653	31.2	1.00	317	6.0	1.00	1976	42.5	1.00	494	9.7	1.00
Quartile2	1676	22.4	0.80 (0.74-0.85)	383	5.1	1.01 (0.87-1.18)	2251	33.6	0.87 (0.82-0.93)	655	9.0	0.92 (0.81-1.03)
Quartile3	1006	14.7	0.66 (0.61-0.72)	247	3.6	0.87 (0.73-1.04)	1559	24.8	0.81 (0.75-0.87)	517	7.8	0.88 (0.77-1.00)
Quartile4 (Highest)	728	10.5	0.60 (0.54-0.66)	186	2.7	0.76 (0.62-0.94)	1062	16.1	0.82 (0.75-0.89)	389	5.7	0.85 (0.73-0.99)

	All-cause mortality			Cancer mortality			Macrovascular complications			Microvascular complications		
	Deaths	Deaths	HRs (95% CIs)	Deaths	Deaths	HRs (95% CIs)	Cases	Cases	HRs (95% CIs)	Cases	Cases	HRs (95% CIs)
		/PYs (/1,000)			/PYs (/1,000)			/PYs (/1,000)			/PYs (/1,000)	
Waist-to-hip ratio (men/women)												
<0.90 / 0.85	1179	19.9	1.00	275	4.6	1.00	1329	24.2	1.00	429	7.5	1.00
0.90-0.94 / 0.85-0.89	1363	16.7	0.99 (0.91-1.08)	311	3.8	0.96 (0.81-1.14)	2002	27.0	1.09 (1.02-1.18)	620	7.8	0.99 (0.87-1.13)
≥0.95 / 0.90	2521	20.2	1.10 (1.01-1.19)	547	4.4	1.08 (0.90-1.28)	3517	31.1	1.19 (1.10-1.28)	1006	8.3	1.04 (0.91-1.19)
Systolic blood pressure												
<130 mmHg	1205	13.5	1.00	333	3.7	1.00	1579	18.8	1.00	639	7.3	1.00
130-149 mmHg	1657	17.5	1.08 (1.00-1.17)	404	4.3	0.95 (0.81-1.10)	2362	27.4	1.24 (1.16-1.33)	689	7.5	1.06 (0.95-1.20)
150-169 mmHg	1276	23.1	1.26 (1.15-1.38)	274	5.0	1.00 (0.83-1.20)	1767	36.1	1.44 (1.33-1.55)	461	8.6	1.22 (1.06-1.40)
≥170 mmHg	925	34.6	1.63 (1.46-1.82)	122	4.6	0.89 (0.69-1.14)	1140	49.3	1.72 (1.56-1.89)	266	10.3	1.50 (1.25-1.79)
Diastolic blood pressure												
<80 mmHg	2617	19.4	1.00	618	4.6	1.00	3301	26.7	1.00	1086	8.3	1.00
80-99 mmHg	2130	18.0	1.05 (0.98-1.12)	475	4.0	0.98 (0.85-1.13)	3087	28.6	1.13 (1.06-1.19)	878	7.6	0.97 (0.87-1.07)
≥100 mmHg	316	25.6	1.36 (1.18-1.57)	40	3.2	0.89 (0.62-1.27)	460	42.8	1.55 (1.38-1.75)	91	7.6	0.96 (0.75-1.23)
Random blood glucose												
<10.0 mmol/L	1582	13.8	1.00	458	4.0	1.00	2524	24.1	1.00	605	5.4	1.00
10.0-12.9 mmol/L	1089	17.8	1.23 (1.14-1.34)	272	4.5	1.07 (0.91-1.25)	1547	27.7	1.13 (1.06-1.21)	386	6.5	1.26 (1.11-1.44)
13.0-15.9 mmol/L	804	21.8	1.53 (1.40-1.67)	183	5.0	1.24 (1.04-1.48)	1064	31.7	1.26 (1.17-1.35)	311	8.7	1.60 (1.39-1.85)
≥16.0 mmol/L	1588	29.9	2.07 (1.92-2.23)	220	4.1	1.08 (0.91-1.28)	1713	35.6	1.50 (1.41-1.60)	753	14.9	2.62 (2.34-2.94)

CI, confidence interval; PY, person-year; HR, hazard ratio; MET, metabolic equivalent task.

The multivariable model was adjusted for age (years), sex, education (no formal school, primary school, middle school, high school, college/ university or higher), body mass index (kg/m²), family history of diabetes (yes or no), family histories of heart attack and stroke (yes or no, only in the analyses of all-cause mortality and macrovascular complications), family history of cancer (yes or no, only in the analyses of all-cause and cancer mortality), diabetes duration (years), diabetic treatment (yes or no), statin use (yes or no) and aspirin use (yes or no). All lifestyle and health factors were included simultaneously in the same model.

*Former smoker refers to those who had stopped smoking for reasons other than illness. Those who had stopped smoking due to illness were included in daily smokers.

Supplementary Table 4. Adjusted hazard ratios (95% CIs) for mortality and diabetes complications according to detection methods for diabetes at baseline.

	All-cause mortality			Cancer mortality			Macrovascular complications			Microvascular complications		
	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)
Screen-detected diabetes (n =12,977)												
Lifestyle factors												
Non-current smoking	1361	13.9	0.80 (0.71-0.91)	352	3.6	0.91 (0.73-1.15)	2098	23.1	0.90 (0.81-1.00)	422	4.4	1.17 (0.90-1.51)
Non-excessive alcohol drinking	1784	15.1	0.78 (0.68-0.88)	442	3.7	0.63 (0.50-0.80)	2587	23.6	0.84 (0.75-0.95)	500	4.3	1.15 (0.85-1.56)
Eating fruits and vegetables daily	342	12.1	0.86 (0.75-0.98)	121	4.3	1.06 (0.85-1.34)	600	23.0	0.83 (0.75-0.92)	111	4.0	0.91 (0.72-1.16)
Actively engaging in physical activity	841	11.0	0.71 (0.64-0.78)	247	3.2	0.81 (0.67-0.98)	1260	17.4	0.91 (0.84-0.99)	269	3.6	0.80 (0.66-0.97)
WHR<0.90 (men) or 0.85 (women)	547	18.1	0.87 (0.77-0.97)	160	5.3	1.01 (0.81-1.25)	577	20.3	0.82 (0.74-0.91)	109	3.7	0.83 (0.65-1.04)
Health factors												
Blood pressure<130/80 mmHg	421	12.2	0.81 (0.72-0.90)	139	4.0	1.08 (0.89-1.32)	495	15.1	0.63 (0.57-0.69)	130	3.8	0.85 (0.69-1.04)
Random blood glucose<10.0/7.0 mmol/L	134	12.7	0.70 (0.58-0.84)	47	4.5	1.07 (0.78-1.46)	241	25.2	0.80 (0.70-0.91)	20	1.9	0.46 (0.29-0.73)
Self-reported diabetes (n =13,027)												
Lifestyle factors												
Non-current smoking	1990	20.1	0.77 (0.70-0.86)	368	3.7	0.70 (0.56-0.88)	2810	31.5	0.81 (0.74-0.89)	1078	11.4	0.77 (0.66-0.89)

	All-cause mortality			Cancer mortality			Macrovascular complications			Microvascular complications		
	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Deaths	Deaths /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)
Non-excessive alcohol drinking	2485	21.3	0.92 (0.82-1.04)	468	4.0	0.89 (0.69-1.15)	3415	32.6	1.01 (0.91-1.13)	1319	11.8	1.07 (0.89-1.27)
Eating fruits and vegetables daily	408	16.4	0.79 (0.70-0.88)	107	4.3	0.89 (0.71-1.12)	707	31.8	0.87 (0.79-0.95)	254	10.7	0.93 (0.80-1.07)
Actively engaging in physical activity	893	14.6	0.73 (0.67-0.80)	186	3.0	0.84 (0.69-1.02)	1361	24.2	0.87 (0.81-0.93)	637	10.9	0.95 (0.85-1.07)
WHR<0.90 (men) or 0.85 (women)	632	21.7	0.94 (0.85-1.04)	115	3.9	0.94 (0.75-1.18)	752	28.3	0.88 (0.80-0.96)	320	11.5	0.97 (0.84-1.11)
Health factors												
Blood pressure<130/80 mmHg	595	16.1	0.79 (0.72-0.87)	143	3.9	1.11 (0.91-1.35)	801	23.5	0.73 (0.67-0.79)	390	11.0	0.91 (0.80-1.02)
Random blood glucose<10.0/7.0 mmol/L	814	15.5	0.61 (0.56-0.66)	211	4.0	0.87 (0.73-1.04)	1330	28.1	0.81 (0.75-0.86)	365	7.2	0.54 (0.48-0.61)

CI, confidence interval; PY, person-year; HR, hazard ratio; WHR, waist-to-hip ratio.

The multivariable model was adjusted for age (years), sex, education (no formal school, primary school, middle school, high school, college/ university or higher), body mass index (kg/m²), family history of diabetes (yes or no), family histories of heart attack and stroke (yes or no, only in the analyses of all-cause mortality and macrovascular complications), family history of cancer (yes or no, only in the analyses of all-cause and cancer mortality), diabetes duration (years), diabetic treatment (yes or no), statin use (yes or no) and aspirin use (yes or no). All lifestyle and health factors were included simultaneously in the same model.

Low-risk lifestyle factors were defined as: never smoking or having stopped for reasons other than illness; never drinking or current drinking <30 g/d of pure alcohol in men or <15 g/d in women (former drinkers not included); eating fruits and vegetables every day; engaging in a sex-specific median or higher level of physical activity; and having a WHR <0.90 in men and <0.85 in women.

Low-risk health factors were defined as: systolic blood pressure <130 mmHg and diastolic blood pressure <80 mmHg; and random blood glucose <10.0 mmol/L (fasting for <8 hours) or <7.0 mmol/L (fasting for ≥8 hours).

Supplementary Table 5. Adjusted hazard ratios (98.75% CIs) for mortality and diabetes complications.

	All-cause mortality	Cancer mortality	Macrovascular complications	Microvascular complications
	HRs (98.75% CIs)	HRs (98.75% CIs)	HRs (98.75% CIs)	HRs (98.75% CIs)
Lifestyle factors				
Non-current smoking	0.79 (0.71-0.87)	0.79 (0.64-0.97)	0.84 (0.77-0.92)	0.87 (0.73-1.03)
Non-excessive alcohol drinking	0.86 (0.77-0.96)	0.74 (0.60-0.92)	0.94 (0.84-1.04)	1.08 (0.89-1.32)
Eating fruits and vegetables daily	0.82 (0.74-0.92)	0.97 (0.79-1.19)	0.86 (0.79-0.93)	0.92 (0.79-1.08)
Actively engaging in physical activity	0.71 (0.65-0.77)	0.83 (0.69-0.98)	0.87 (0.82-0.94)	0.89 (0.79-1.01)
WHR<0.90 (men) or 0.85 (women)	0.91 (0.83-1.01)	0.97 (0.80-1.18)	0.85 (0.78-0.92)	0.93 (0.80-1.08)
Health factors				
Blood pressure<130/80 mmHg	0.80 (0.73-0.88)	1.09 (0.91-1.31)	0.69 (0.63-0.74)	0.89 (0.78-1.02)
Random blood glucose<10.0/7.0mmol/L	0.65 (0.59-0.72)	0.92 (0.76-1.10)	0.82 (0.76-0.88)	0.57 (0.50-0.66)

HR, hazard ratio; CI, confidence interval.

Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models.

Supplementary Table 6. Adjusted hazard ratios (95% CIs) for major macrovascular complications.

	Major coronary events			Ischemic stroke			Hemorrhagic stroke		
	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)
Lifestyle factors									
Non-current smoking	889	4.5	0.63 (0.54-0.74)	3714	20.5	0.90 (0.83-0.98)	611	3.1	0.97 (0.81-1.17)
Non-excessive alcohol drinking	1154	4.9	1.05 (0.87-1.26)	4478	20.7	0.94 (0.85-1.03)	773	3.3	0.96 (0.77-1.19)
Eating fruits and vegetables daily	256	4.9	0.80 (0.69-0.93)	1041	21.3	0.88 (0.82-0.95)	95	1.8	0.71 (0.57-0.90)
Actively engaging in physical activity	407	3.0	0.82 (0.72-0.94)	1967	15.2	0.88 (0.83-0.94)	379	2.8	0.83 (0.72-0.97)
WHR<0.90 (men) or 0.85 (women)	254	4.3	0.81 (0.70-0.94)	954	17.2	0.83 (0.77-0.89)	206	3.5	1.09 (0.91-1.30)
Health factors									
Blood pressure<130/80 mmHg	228	3.2	0.69 (0.60-0.80)	1006	14.9	0.71 (0.67-0.77)	107	1.5	0.43 (0.35-0.53)
Random blood glucose<10.0/7.0mmol/L	268	4.3	0.70 (0.61-0.81)	1209	21.0	0.84 (0.79-0.90)	189	3.0	0.83 (0.70-0.98)

CI, confidence interval; PY, person-year; HR, hazard ratio; WHR, waist-to-hip ratio.

The multivariable model was adjusted for age (years), sex, education (no formal school, primary school, middle school, high school, college/ university or higher), body mass index (kg/m²), family history of diabetes (yes or no), family history of heart attack (yes or no, only in the analyses of major coronary events) and family history of stroke (yes or no, only in the analyses of ischemic stroke and hemorrhagic stroke), diabetes duration (years), diabetic treatment (yes or no), statin use (yes or no) and aspirin use (yes or no). All lifestyle and health factors were included simultaneously in the same model.

Please refer to Supplementary Table 4 for the definitions of low-risk factors.

Supplementary Table 7. Adjusted hazard ratios (95% CIs) for major microvascular complications.

	Diabetic nephropathy			Diabetic retinopathy			Diabetic neuropathy		
	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)	Cases	Cases /PYs (/1,000)	HRs (95% CIs)
Lifestyle factors									
Non-current smoking	530	2.7	0.89 (0.72-1.09)	601	3.1	1.05 (0.84-1.31)	647	3.3	0.88 (0.72-1.07)
Non-excessive alcohol drinking	665	2.9	1.00 (0.80-1.27)	699	3.0	1.10 (0.85-1.42)	789	3.4	1.18 (0.93-1.49)
Eating fruits and vegetables daily	128	2.4	0.83 (0.68-1.03)	158	3.0	0.96 (0.79-1.16)	163	3.1	0.93 (0.77-1.13)
Actively engaging in physical activity	313	2.3	0.77 (0.65-0.90)	337	2.5	0.86 (0.73-1.01)	417	3.1	1.00 (0.86-1.16)
WHR<0.90 (men) or 0.85 (women)	188	3.2	1.04 (0.86-1.25)	164	2.8	0.91 (0.75-1.10)	185	3.2	0.95 (0.79-1.13)
Health factors									
Blood pressure<130/80 mmHg	174	2.5	0.78 (0.65-0.93)	176	2.5	0.73 (0.62-0.87)	271	3.9	1.18 (1.02-1.37)
Random blood glucose<10.0/7.0mmol/L	139	2.2	0.54 (0.45-0.65)	141	2.3	0.58 (0.48-0.69)	182	2.9	0.65 (0.55-0.77)

CI, confidence interval; PY, person-year; HR, hazard ratio; WHR, waist-to-hip ratio.

The multivariable model was adjusted for age (years), sex, education (no formal school, primary school, middle school, high school, college/ university or higher), body mass index (kg/m²), family history of diabetes (yes or no), diabetes duration (years), diabetic treatment (yes or no), statin use (yes or no) and aspirin use (yes or no). All lifestyle and health factors were included simultaneously in the same model.

Please refer to Supplementary Table 4 for the definitions of low-risk factors.

Supplementary Table 8. Adjusted hazard ratios (95% CIs) for mortality and diabetes complications according to number of low-risk lifestyle factors.

Outcomes	Number of low-risk lifestyle factors				Per 1-number increment	P_{trend}
	0-1	2	3	4-5		
All-cause mortality						<0.001
Deaths	979	2167	1526	391	-	
Deaths/PYs(/1,000)	31.3	23.7	14.9	9.7	-	
HRs	1.00	0.78	0.63	0.50	0.82	
(95% CIs)		(0.72-0.85)	(0.57-0.69)	(0.44-0.57)	(0.79-0.84)	
Cancer mortality						<0.001
Deaths	239	418	369	107	-	
Deaths/PYs(/1,000)	7.6	4.6	3.6	2.7	-	
HRs	1.00	0.73	0.68	0.55	0.85	
(95% CIs)		(0.61-0.86)	(0.57-0.82)	(0.43-0.71)	(0.80-0.91)	
Macrovascular complications						<0.001
Cases	1065	2792	2315	676	-	
Cases/PYs(/1,000)	38.4	33.9	24.5	17.9	-	
HRs	1.00	0.83	0.76	0.60	0.88	
(95% CIs)		(0.77-0.89)	(0.70-0.82)	(0.54-0.67)	(0.85-0.90)	
Microvascular complications						0.019
Cases	291	784	747	233	-	
Cases/PYs(/1,000)	9.6	8.9	7.5	5.9	-	
HRs	1.00	0.89	0.84	0.75	0.94	
(95% CIs)		(0.76-1.03)	(0.72-0.99)	(0.62-0.91)	(0.89-0.99)	
Major coronary events						<0.001
Cases	242	568	403	101	-	
Cases/PYs(/1,000)	7.8	6.3	3.9	2.5	-	
HRs	1.00	0.73	0.62	0.43	0.81	
(95% CIs)		(0.62-0.86)	(0.52-0.75)	(0.33-0.55)	(0.76-0.86)	
Ischemic stroke						<0.001
Cases	768	2032	1761	531	-	
Cases/PYs(/1,000)	27.2	24.4	18.5	14.0	-	
HRs	1.00	0.85	0.79	0.63	0.89	
(95% CIs)		(0.77-0.93)	(0.72-0.87)	(0.56-0.71)	(0.86-0.92)	
Hemorrhagic stroke						0.068
Cases	147	367	316	66	-	
Cases/PYs(/1,000)	4.7	4.0	3.1	1.6	-	
HRs	1.00	0.92	0.91	0.72	0.93	
(95% CIs)		(0.75-1.13)	(0.73-1.14)	(0.52-0.98)	(0.86-1.01)	
Diabetic nephropathy						0.019
Cases	135	296	252	88	-	
Cases/PYs(/1,000)	4.3	3.3	2.5	2.2	-	
HRs	1.00	0.81	0.71	0.71	0.91	
(95% CIs)		(0.65-1.01)	(0.56-0.90)	(0.53-0.96)	(0.83-0.98)	
Diabetic retinopathy						0.327
Cases	91	296	301	93	-	
Cases/PYs(/1,000)	2.9	3.3	3.0	2.3	-	
HRs	1.00	1.00	0.99	0.80	0.96	
(95% CIs)		(0.77-1.29)	(0.76-1.28)	(0.58-1.11)	(0.88-1.04)	

Outcomes	Number of low-risk lifestyle factors				Per 1-number increment	P_{trend}
	0-1	2	3	4-5		
Diabetic neuropathy						0.788
Cases	111	333	349	95	-	
Cases/PYs(/1,000)	3.6	3.7	3.5	2.4	-	
HRs	1.00	1.07	1.12	0.86	0.99	
(95% CIs)		(0.85-1.34)	(0.88-1.42)	(0.63-1.16)	(0.91-1.07)	

CI, confidence interval; PY, person-year; HR, hazard ratio.

Please refer to Supplementary Table 4 for the definitions of low-risk lifestyle factors and covariates adjusted in the models. Models were further adjusted for systolic blood pressure (mmHg) and random blood glucose (mmHg).

Supplementary Table 9. Adjusted hazard ratios (95% CIs) for mortality and diabetes complications according to number of low-risk health factors.

Outcomes	Number of low-risk health factors			Per 1-number increment	P_{trend}
	0	1	2		
All-cause mortality					<0.001
Deaths	3295	1572	196	-	
Deaths/PYs(/1,000)	21.9	16.3	10.3	-	
HRs (95% CIs)	1.00	0.75 (0.70-0.79)	0.49 (0.42-0.57)	0.73 (0.69-0.76)	
Cancer mortality					0.855
Deaths	659	408	66	-	
Deaths/PYs(/1,000)	4.4	4.2	3.5	-	
HRs (95% CIs)	1.00	1.05 (0.92-1.19)	0.95 (0.73-1.23)	1.01 (0.91-1.11)	
Macrovascular complications					<0.001
Cases	4337	2155	356	-	
Cases/PYs(/1,000)	31.8	24.4	20.1	-	
HRs (95% CIs)	1.00	0.75 (0.71-0.79)	0.58 (0.52-0.64)	0.75 (0.72-0.79)	
Microvascular complications					<0.001
Cases	1258	689	108	-	
Cases/PYs(/1,000)	8.6	7.4	5.8	-	
HRs (95% CIs)	1.00	0.73 (0.66-0.80)	0.51 (0.42-0.62)	0.72 (0.67-0.78)	
Major coronary events					<0.001
Cases	863	406	45	-	
Cases/PYs(/1,000)	5.8	4.2	2.4	-	
HRs (95% CIs)	1.00	0.74 (0.66-0.84)	0.40 (0.30-0.55)	0.70 (0.63-0.77)	
Ischemic stroke					<0.001
Cases	3167	1635	290	-	
Cases/PYs(/1,000)	23.0	18.3	16.2	-	
HRs (95% CIs)	1.00	0.77 (0.73-0.82)	0.62 (0.55-0.70)	0.78 (0.74-0.82)	
Hemorrhagic stroke					<0.001
Cases	623	250	23	-	
Cases/PYs(/1,000)	4.2	2.6	1.2	-	
HRs (95% CIs)	1.00	0.65 (0.56-0.75)	0.33 (0.22-0.50)	0.62 (0.55-0.71)	
Diabetic nephropathy					<0.001
Cases	492	245	34	-	
Cases/PYs(/1,000)	3.3	2.6	1.8	-	
HRs (95% CIs)	1.00	0.67 (0.57-0.78)	0.40 (0.28-0.58)	0.65 (0.58-0.74)	
Diabetic retinopathy					<0.001
Cases	495	255	31	-	
Cases/PYs(/1,000)	3.3	2.7	1.6	-	
HRs (95% CIs)	1.00	0.69 (0.59-0.80)	0.37 (0.26-0.53)	0.65 (0.58-0.74)	
Diabetic neuropathy					0.042
Cases	495	333	60	-	
Cases/PYs(/1,000)	3.3	3.5	3.2	-	
HRs (95% CIs)	1.00	0.92 (0.79-1.06)	0.76 (0.58-1.00)	0.89 (0.80-1.00)	

CI, confidence interval; PY, person-year; HR, hazard ratio.

Please refer to Supplementary Table 4 for the definitions of low-risk health factors and covariates adjusted in the models. Models were further adjusted for tobacco smoking (non-smokers, former smokers who quit smoking for a non-illness reason, current smokers and former smokers who quit smoking due to illness: 1-14, 15-24, or ≥ 25 cigarettes or equivalent per day), alcohol consumption (never drinkers, former drinkers, current drinkers: less than daily or drinking < 30 g/d of pure alcohol in men or < 15 g/d in women, drinking ≥ 30 g/d of pure alcohol in men or ≥ 15 g/d in women), intake frequency of fresh fruits and vegetables (days/week: calculated by assigning participants to the midpoint of their consumption category), physical activity (MET-hours/day), and waist-hip ratio.

Supplementary Table 10. Adjusted hazard ratios (95% CIs) for mortality and diabetes complications according to number of low-risk factors.

Outcomes	Number of low-risk factors					Per 1-number increment	P_{trend}
	0-1	2	3	4-5	6-7		
All-cause mortality							<0.001
Deaths	678	1718	1679	964	24	-	
Deaths/PYs (/1,000)	32.7	27.1	18.6	11.3	4.0	-	
HRs (95% CIs)	1.00	0.82 (0.75-0.90)	0.64 (0.58-0.70)	0.44 (0.39-0.49)	0.19 (0.13-0.29)	0.78 (0.76-0.80)	
Cancer mortality							<0.001
Deaths	151	346	348	277	11	-	
Deaths/PYs (/1,000)	7.3	5.5	3.8	3.3	1.8	-	
HRs (95% CIs)	1.00	0.89 (0.73-1.08)	0.73 (0.60-0.90)	0.69 (0.55-0.86)	0.50 (0.27-0.93)	0.90 (0.85-0.95)	
Macrovascular complications							<0.001
Cases	764	2081	2340	1585	78	-	
Cases/PYs (/1,000)	42.0	36.7	28.4	20.0	13.7	-	
HRs (95% CIs)	1.00	0.79 (0.72-0.86)	0.68 (0.63-0.75)	0.51 (0.46-0.56)	0.34 (0.27-0.43)	0.83 (0.81-0.85)	
Microvascular complications							<0.001
Cases	195	585	715	537	23	-	
Cases/PYs (/1,000)	9.7	9.6	8.2	6.5	3.9	-	
HRs (95% CIs)	1.00	0.87 (0.74-1.04)	0.77 (0.65-0.92)	0.58 (0.48-0.70)	0.33 (0.21-0.51)	0.85 (0.82-0.89)	
Major coronary events							<0.001
Cases	167	442	455	242	8	-	
Cases/PYs (/1,000)	8.2	7.0	5.1	2.9	1.3	-	
HRs (95% CIs)	1.00	0.75 (0.62-0.91)	0.63 (0.52-0.77)	0.40 (0.32-0.49)	0.19 (0.09-0.40)	0.77 (0.73-0.81)	
Ischemic stroke							<0.001
Cases	540	1509	1740	1239	64	-	
Cases/PYs (/1,000)	29.1	26.3	20.9	15.5	11.2	-	
HRs (95% CIs)	1.00	0.82 (0.74-0.91)	0.73 (0.65-0.81)	0.56 (0.50-0.62)	0.37 (0.28-0.49)	0.85 (0.83-0.87)	
Hemorrhagic stroke							<0.001
Cases	117	276	333	164	6	-	
Cases/PYs (/1,000)	5.7	4.4	3.7	1.9	1.0	-	
HRs (95% CIs)	1.00	0.77 (0.61-0.96)	0.74 (0.58-0.93)	0.48 (0.37-0.63)	0.33 (0.14-0.76)	0.81 (0.76-0.87)	
Diabetic nephropathy							<0.001
Cases	92	239	251	178	11	-	
Cases/PYs	4.5	3.8	2.8	2.1	1.8	-	

Outcomes	Number of low-risk factors					Per 1-number increment	<i>P</i> _{trend}
	0-1	2	3	4-5	6-7		
(/1,000)							
HRs	1.00	0.83	0.65	0.46	0.36	0.81	
(95% CIs)		(0.64-1.07)	(0.50-0.85)	(0.35-0.61)	(0.19-0.68)	(0.75-0.86)	
Diabetic retinopathy							<0.001
Cases	66	225	270	210	10	-	
Cases/PYs	3.2	3.6	3.0	2.5	1.7	-	
(/1,000)							
HRs	1.00	0.91	0.78	0.58	0.33	0.84	
(95% CIs)		(0.68-1.22)	(0.58-1.04)	(0.43-0.79)	(0.16-0.65)	(0.78-0.90)	
Diabetic neuropathy							0.077
Cases	73	221	323	261	10	-	
Cases/PYs	3.6	3.5	3.6	3.1	1.7	-	
(/1,000)							
HRs	1.00	0.98	1.05	0.88	0.47	0.95	
(95% CIs)		(0.74-1.29)	(0.80-1.37)	(0.66-1.17)	(0.24-0.93)	(0.89-1.01)	

CI, confidence interval; PY, person-year; HR, hazard ratio.

Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models.

Supplementary Table 11. Sensitivity analysis for the association of mortality and diabetes complications after excluding cases identified during the first two years of follow-up.

	All-cause mortality		Cancer mortality		Macrovascular complications		Microvascular complications	
	deaths	HRs (95% CIs)	deaths	HRs (95% CIs)	cases	HRs (95% CIs)	cases	HRs (95% CIs)
Number of low-risk factors								
0-1	587	1.00	125	1.00	649	1.00	173	1.00
2	1538	0.83 (0.75-0.92)	302	0.91 (0.74-1.14)	1812	0.80 (0.73-0.88)	519	0.88 (0.73-1.05)
3	1509	0.65 (0.58-0.72)	310	0.77 (0.61-0.96)	2051	0.69 (0.63-0.76)	618	0.76 (0.63-0.91)
4-5	855	0.44 (0.39-0.49)	236	0.69 (0.54-0.88)	1425	0.52 (0.47-0.58)	481	0.59 (0.49-0.72)
6-7	21	0.19 (0.12-0.29)	10	0.52 (0.27-1.01)	75	0.36 (0.28-0.46)	20	0.32 (0.20-0.52)
Number of low-risk lifestyle factors								
0-1	849	1.00	197	1.00	910	1.00	260	1.00
2	1927	0.79 (0.72-0.86)	367	0.76 (0.63-0.92)	2435	0.84 (0.77-0.91)	692	0.88 (0.76-1.03)
3	1387	0.65 (0.59-0.72)	326	0.72 (0.59-0.88)	2053	0.76 (0.70-0.83)	651	0.83 (0.71-0.98)
4-5	347	0.51 (0.44-0.58)	93	0.57 (0.44-0.75)	614	0.61 (0.55-0.69)	208	0.76 (0.62-0.93)
Number of low-risk health factors								
0	2960	1.00	580	1.00	3787	1.00	1105	1.00
1	1379	0.72 (0.68-0.77)	349	1.01 (0.88-1.16)	1901	0.75 (0.71-0.80)	608	0.73 (0.66-0.81)
2	171	0.46 (0.40-0.54)	54	0.87 (0.65-1.15)	324	0.59 (0.52-0.66)	98	0.52 (0.42-0.65)

HR, hazard ratio; CI, confidence interval.

Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models. The analyses of lifestyle factors were further adjusted for systolic blood pressure (mmHg) and random blood glucose (mmHg). The analyses of health factors were further adjusted for tobacco smoking (non-smokers, former smokers who quit smoking for a non-illness reason, current smokers and former smokers who quit smoking due to illness: 1-14, 15-24, or ≥ 25 cigarettes or equivalent per day), alcohol consumption (never drinkers, former drinkers, current drinkers: less than daily or drinking < 30 g/d of pure alcohol in men or < 15 g/d in women, drinking ≥ 30 g/d of pure alcohol in men or ≥ 15 g/d in women), intake frequency of fresh fruits and vegetables (days/week: calculated by assigning participants to the midpoint of their consumption category), physical activity (MET-hours/day), and waist-hip ratio.

Supplementary Table 12. Sensitivity analysis for the association of mortality and diabetes complications with further adjustment for prevalent hypertension.

	All-cause mortality		Cancer mortality		Macrovascular complications		Microvascular complications	
	deaths	HRs (95% CIs)	deaths	HRs (95% CIs)	cases	HRs (95% CIs)	cases	HRs (95% CIs)
Number of low-risk factors								
0-1	678	1.00	151	1.00	764	1.00	195	1.00
2	1718	0.83 (0.75-0.91)	346	0.88 (0.72-1.08)	2081	0.79 (0.73-0.87)	585	0.88 (0.74-1.04)
3	1679	0.65 (0.59-0.72)	348	0.73 (0.59-0.90)	2340	0.71 (0.65-0.78)	715	0.78 (0.66-0.93)
4-5	964	0.47 (0.42-0.52)	277	0.68 (0.54-0.85)	1585	0.57 (0.52-0.63)	537	0.60 (0.50-0.72)
6-7	24	0.21 (0.14-0.32)	11	0.48 (0.26-0.91)	78	0.42 (0.33-0.53)	23	0.35 (0.22-0.55)
Number of low-risk lifestyle factors								
0-1	979	1.00	239	1.00	1065	1.00	291	1.00
2	2167	0.78 (0.72-0.85)	418	0.73 (0.61-0.86)	2792	0.83 (0.77-0.89)	784	0.89 (0.76-1.03)
3	1526	0.63 (0.57-0.69)	369	0.68 (0.57-0.82)	2315	0.76 (0.70-0.82)	747	0.85 (0.73-0.99)
4-5	391	0.50 (0.44-0.57)	107	0.55 (0.43-0.71)	676	0.60 (0.54-0.67)	233	0.75 (0.62-0.91)
Number of low-risk health factors								
0	3295	1.00	659	1.00	4337	1.00	1258	1.00
1	1572	0.79 (0.74-0.84)	408	1.04 (0.91-1.19)	2155	0.84 (0.80-0.89)	689	0.74 (0.67-0.82)
2	196	0.54 (0.47-0.63)	66	0.94 (0.71-1.23)	356	0.73 (0.65-0.82)	108	0.53 (0.43-0.65)

HR, hazard ratio; CI, confidence interval.

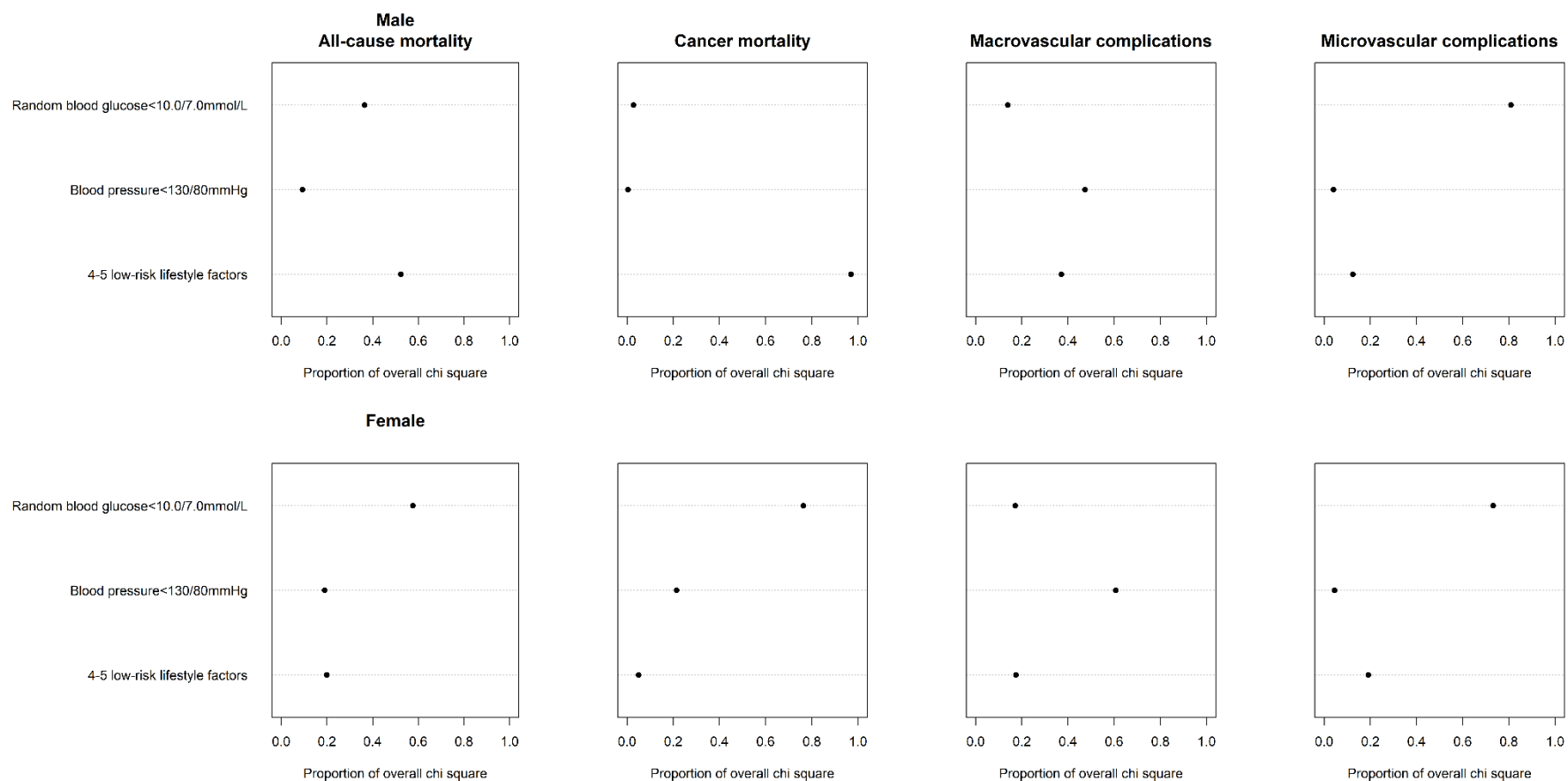
Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models. The analyses of lifestyle factors were further adjusted for systolic blood pressure (mmHg) and random blood glucose (mmHg). The analyses of health factors were further adjusted for tobacco smoking (non-smokers, former smokers who quit smoking for a non-illness reason, current smokers and former smokers who quit smoking due to illness: 1-14, 15-24, or ≥ 25 cigarettes or equivalent per day), alcohol consumption (never drinkers, former drinkers, current drinkers: less than daily or drinking < 30 g/d of pure alcohol in men or < 15 g/d in women, drinking ≥ 30 g/d of pure alcohol in men or ≥ 15 g/d in women), intake frequency of fresh fruits and vegetables (days/week: calculated by assigning participants to the midpoint of their consumption category), physical activity (MET-hours/day), and waist-hip ratio.

Supplementary Table 13. Sensitivity analysis for the association of mortality and diabetes complications according to different cut-off values for blood pressure.

	All-cause mortality		Cancer mortality		Macrovascular complications		Microvascular complications	
	deaths	HRs (95% CIs)	deaths	HRs (95% CIs)	cases	HRs (95% CIs)	cases	HRs (95% CIs)
≥120/80 mmHg	4528	1.00	986	1.00	6239	1.00	1759	1.00
<120/80 mmHg	535	0.88 (0.80-0.96)	147	1.12 (0.94-1.34)	609	0.63 (0.58-0.68)	296	0.98 (0.86-1.11)
≥140/80 mmHg	3503	1.00	727	1.00	4828	1.00	1339	1.00
<140/80 mmHg	1560	0.79 (0.74-0.84)	406	1.04 (0.92-1.18)	2020	0.71 (0.67-0.75)	716	0.86 (0.78-0.95)
≥120/80 mmHg	4580	1.00	996	1.00	6302	1.00	1787	1.00
<120/80 mmHg (untreated) ^a	483	0.85 (0.77-0.94)	137	1.12 (0.93-1.35)	546	0.60 (0.55-0.66)	268	0.95 (0.83-1.08)
≥130/80 mmHg	4185	1.00	876	1.00	5773	1.00	1599	1.00
<130/80 mmHg (untreated) ^a	878	0.78 (0.73-0.84)	257	1.13 (0.98-1.31)	1075	0.64 (0.60-0.68)	456	0.87 (0.78-0.97)
≥140/80 mmHg	3784	1.00	788	1.00	5278	1.00	1437	1.00
<140/80 mmHg (untreated) ^a	1279	0.77 (0.72-0.82)	345	1.05 (0.92-1.20)	1570	0.64 (0.61-0.68)	618	0.88 (0.80-0.97)

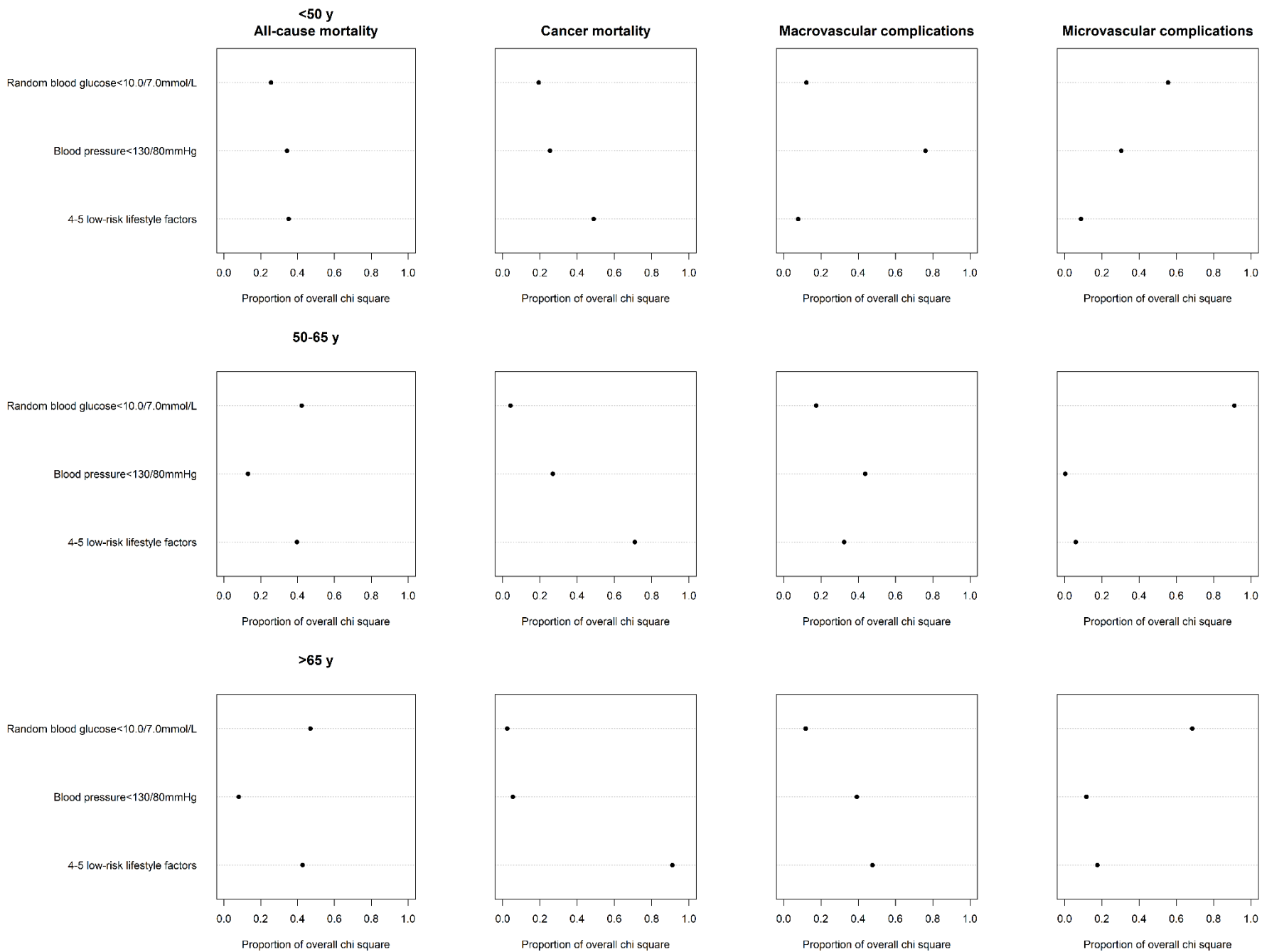
HR, hazard ratio; CI, confidence interval. Models were adjusted for the same variables in Supplementary Table 4, as appropriate.

^aExcluding prevalent hypertension participants.



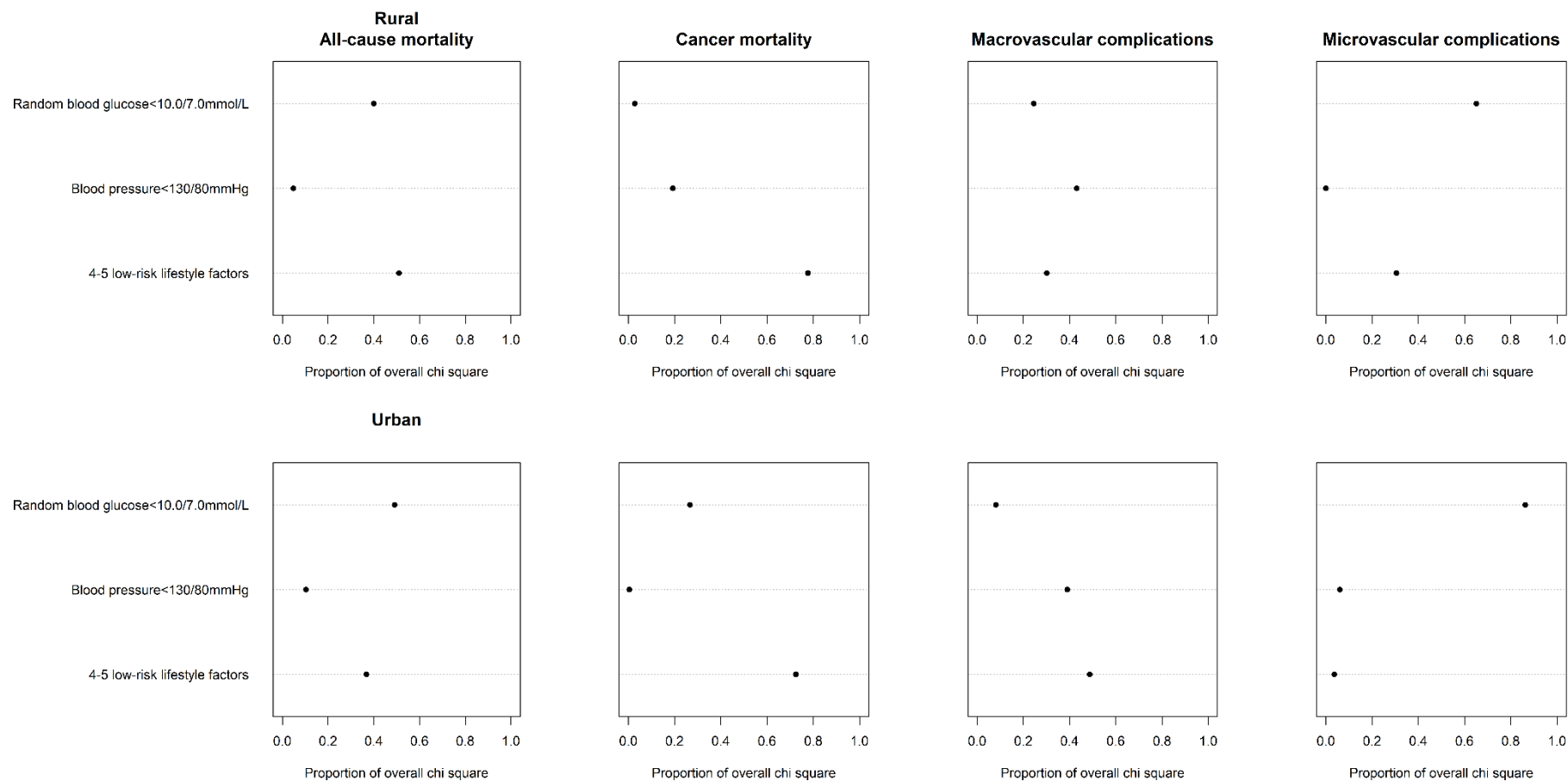
Supplementary Figure 1. Relative importance of lifestyle and health factors for risks of mortality and diabetes complications according to sex categories.

The relative importance of each low-risk factors was measured by estimating explained log-likelihood, with larger proportion of overall chi-square indicating greater importance. Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models.



Supplementary Figure 2. Relative importance of lifestyle and health factors for risks of mortality and diabetes complications according to age categories.

Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the models.



Supplementary Figure 3. Relative importance of lifestyle and health factors for risks of mortality and diabetes complications according to region categories.

Please refer to Supplementary Table 4 for the definitions of low-risk factors and covariates adjusted in the model