Online-Only Supplemental Material

Association of a Healthy Lifestyle with All-Cause and Cause-Specific Mortality Among Individuals with Type 2 Diabetes: A Prospective Study in UK Biobank

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Assessment of lifestyle factors

All information on lifestyle factors was self-reported using a touchscreen questionnaire at baseline (2006-2010). Detailed questionnaires could be obtained through the UK Biobank website (<https://biobank.ndph.ox.ac.uk/showcase/>).

- **Smoking:** Participants were asked about their current smoking status through the following question: “Do you smoke tobacco now? i. yes, on most or all days, ii. only occasionally, iii. no, or iv. prefer not to answer”. Except for those who indicated they were currently smoking on most or all days, participants were further asked about their past smoking frequency through “In the past, how often have you smoked tobacco? i. smoked on most or all days, ii. smoked occasionally, iii. just tried once or twice, iv. I have never smoked, or v. prefer not to answer”. The smoking status was then categorized into three groups (current, previous, and never).
- **Alcohol consumption:** Participants were asked about their drinking frequency through the following question: “About how often do you drink alcohol? i. daily or almost daily, ii. three or four times a week, iii. once or twice a week, iv. one to three times a month, v. special occasions only, vi. never, or vii. prefer not to answer”. Depending on their reported frequency of alcohol drinking, participants were further asked how much red wine (glasses), champagne plus white wine (glasses), beer plus cider (pints), spirits (measures), fortified wine (glasses), and other alcoholic drinks (glasses) they drank on average in a week or month. We calculated the average amount of daily alcohol intake of each participant based on a previous UK Biobank study.⁽¹⁾ Alcohol consumption status was defined by integrated information on drinking frequency and estimated intake total.
- **Physical activity:** The number of days of moderate/vigorous physical activity was recorded by asking “In a typical week, on how many days did you do 10 minutes or more of moderate physical activities like carrying light loads, cycling at a normal pace? (not include walking)” and “In a typical week, how many days did you do 10 minutes or more of vigorous physical activity? (These are activities that make you sweat or breathe hard such as fast cycling, aerobics, heavy lifting)”. According to their reported number of days, participants were further asked about the duration of moderate/vigorous physical activity through the following questions: “How many minutes did you usually spend doing moderate activities on a typical day?” and “How many minutes did you usually spend doing vigorous activities on a typical day?”. We multiplied the number of days and the duration per day to calculate the weekly total amount of moderate or vigorous physical activity, respectively.
- **Diet:** According to a previous UK Biobank study,⁽²⁾ we selected 10 food groups that have been recommended as dietary priorities for cardiometabolic health⁽³⁾ to evaluate diet qualities. A

healthy diet was defined as an adequate intake of at least half of the 10 recommended food groups. Details were shown as follows:

Diet Component	Intake Goal	Field IDs
Fruits	≥ 3 servings/day	1309-"About how many pieces of FRESH fruit would you eat per DAY?" 1319-"About how many pieces of DRIED fruit would you eat per DAY?"
Vegetables	≥ 3 servings/day	1289-"On average how many heaped tablespoons of COOKED vegetables would you eat per DAY?" 1299-"On average how many heaped tablespoons of SALAD or RAW vegetables would you eat per DAY?"
Whole grains	≥ 3 servings/day	1438-"How many slices of bread do you eat each WEEK?" 1448-"What type of bread do you mainly eat?" 1458-"How many bowls of cereal do you eat a WEEK?" 1468-"What type of cereal do you mainly eat?"
(Shell)fish	≥ 2 servings/week	1329-"How often do you eat oily fish? (e.g. sardines, salmon, mackerel, herring)" 1339-"How often do you eat other types of fish? (e.g. cod, tinned tuna, haddock)"
Dairy	≥ 2 servings/day	1408-"How often do you eat cheese? (Include cheese in pizzas, quiches, cheese sauce etc.)" 1418-"What type of milk do you mainly use?"
Vegetable oils	≥ 2 servings/day	1428-"What type of spread do you mainly use?" (Spread type) 2654-"What type of spread do you mainly use?" (Non-butter spread type details) 1438-"How many slices of bread do you eat each WEEK?"
Refined grains	≤ 2 servings/day	1438-"How many slices of bread do you eat each WEEK?" 1448-"What type of bread do you mainly eat?" 1458-"How many bowls of cereal do you eat a WEEK?" 1468-"What type of cereal do you mainly eat?"
Processed meats	≤ 1 serving/week	1349-"How often do you eat processed meats (such as bacon, ham, sausages, meat pies, kebabs, burgers, chicken nuggets)"
Unprocessed meats	≤ 2 serving/week	1359-"How often do you eat chicken, turkey or other poultry? (Do not count processed meats)" 1369-"How often do you eat beef? (Do not count processed meats)" 1379-"How often do you eat lamb/mutton? (Do not count processed meats)" 1389-"How often do you eat pork? (Do not count processed meats such as bacon or ham)"
Sugar-sweetened beverages	Don't drink	6144-"Which of the following do you NEVER eat?"

➤ Sleep duration: Total sleep duration was recorded as the number of reported hours of sleep by

asking “About how many hours sleep do you get in every 24 hours? (Please include naps)”.

- Television watching time: Time spent watching television was recorded as the number of hours watching television by asking “In a typical DAY, how many hours do you spend watching TV? (Put 0 if you do not spend any time doing it)”.
- Social connection: Participants were asked about their social connection status through the following three questions: [1] “Including yourself, how many people are living together in your household? Include those who usually live in the house such as students living away from home during term time, partners in the armed forces or professions such as pilots”; [2] “How often do you visit friends or family or have them visit you? i. almost daily, ii. 2-4 times a week, iii. about once a week, iv. about once a month, v. once every few months, vi. never or almost never, vii. no friends/family outside household, viii. do not know, or ix. prefer not to answer”; [3] “Which of the following [leisure/social activities] do you attend once a week or more often? You can select more than one: i. sports club or gym, ii. pub or social club, iii. religious group, iv. adult education class, v. other group activity, vi. none of the above, vii. prefer not to answer”. According to a previous UK Biobank study,(4) we assigned 1 point to participants reporting “living alone”, 1 point to those reporting “friends and family visit less than once a month”, and 1 point to those reporting “no participation in social activities at least weekly”. Individual scores were summed up to calculate an overall social score ranging from 0-3. We then defined the social connection status as “active” (score=0), “moderately active” (score=1), and “isolated” (score≥2) based on the social score.

Construction of the weighted lifestyle score

β coefficients of each lifestyle factor were estimated using a Cox proportional hazards model that included all seven lifestyle factors (coded as binary variables) and all-cause mortality as an outcome. The model was adjusted for age, sex, ethnicity, education, Townsend deprivation index, employment, family history of diabetes, body mass index, waist-to-hip ratio, prevalent diseases, diabetes duration, glycated hemoglobin level, diabetes-related microvascular disease, and diabetes medication use. The weighted lifestyle score was constructed as follows(5): the binary lifestyle variables were multiplied by the β coefficients, summed up, divided by the sum of β coefficients, and multiplied by 7. We then categorized it into five groups based on the distribution of the simple additive lifestyle score: 1, 2, 3, 4, and 5.

References

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Table S1. International Classification of Diseases (ICD) codes used for identification of cause-specific mortality*

Cause of Death	ICD-10
Cancer	C00-C97
Cardiovascular Disease	I00-I99
Respiratory disease	J09-J98
Digestive disease	K20-K93
Neurodegenerative disease	F01-03,G122,G20,G21,G231-233,G238,G239,G30,G31

*Other mortality refers to death from other causes other than cancer, cardiovascular disease, respiratory disease, digestive disease, and neurodegenerative disease.

Table S2. Codes used in the UK Biobank study to identify prevalent diseases

Prevalent diseases	Self-reported	ICD-9	ICD-10
Cancer	20001	140-208	C00-C97
Cardiovascular Disease*	6150 (1,2,3), 20002 (1074,1075,1081,1583,1086, 1491)	410-414, 430-434, 436	I20-I25, I60-I64
Hypertension	6150 (4), 20002 (1065,1072), 6153 (2), 6177 (2)	401-405	I10-I13, I15, O10
Hyperlipidemia	20002 (1473), 6153 (1), 6177 (1)	272	E78
Depression	20002 (1286,1531)	-	F32-F34, F38-F39
Neurodegenerative disease	20002 (1259,1262,1263)	290.0-290.4, 294.1, 294.2, 331.0-331.2, 331.6-331.9, 332, 335.2	F01-03, G122, G20, G21, G231- 233, G238, G239, G30, G31
Respiratory disease†	20002 (1112,1113,1472), 6152 (6)	491, 492, 496	J40-J44, J47
Digestive disease‡	20002 (1158,1604)	571	K70-K77
Diabetes-related microvascular disease	-	2503, V420, 7910, 5845, 5846, 5847, 5848, 5849, 5859, 5869, V451, V560, V568, 2504, 2505, 3574, 3620	E112, E142, Z940, N083, R80, N391, N170, N171, N172, N178, N179, N180, N181, N182, N183, N184, N185, N188, N189, N19, Z992, Z490, Z491, Z492, E113, E143, H280, H360, E114, E144, G730, G990, G590, G632

*Contains coronary heart disease and stroke.

†Contains chronic obstructive pulmonary disease and emphysema.

‡Contains liver diseases.

Table S3. Characteristics of participants with type 2 diabetes included in or excluded from the current study

Characteristics	Excluded*	Included
No of participants	13,599	13,366
Age, years	62.0 [57.0, 66.0]	61.0 [55.0, 65.0]
Women	5,369 (39.5)	4,775 (35.7)
Ethnicity		
White British	10,791 (79.4)	10,935 (81.8)
Missing†	200 (1.5)	53 (0.4)
Townsend deprivation index	-0.7 [-2.9, 2.7]	-1.5 [-3.3, 1.6]
Missing†	22 (0.2)	21 (0.2)
Education		
College/university degree	4,126 (30.3)	5,668 (42.4)
Missing†	695 (5.1)	134 (1.0)
Employment		
Currently employed	4,364 (32.1)	6,219 (46.5)
Missing†	296 (2.2)	105 (0.8)
Family history of diabetes	5,864 (43.1)	5,988 (44.8)
BMI, kg/m ²	31.1 [27.8, 35.1]	30.6 [27.4, 34.5]
Missing†	185 (1.4)	94 (0.7)
Low waist-to-hip ratio	2033 (14.9)	2239 (16.8)
Missing†	104 (0.8)	55 (0.4)
Prevalent diseases		
Hypertension	10,111 (74.4)	8,575 (64.2)
Hyperlipidemia	10,230 (75.2)	9,083 (68.0)
Depression	1,201 (8.8)	911 (6.8)
Respiratory disease	820 (6.0)	428 (3.2)
Diabetes-related microvascular disease	552 (4.1)	272 (2.0)
Digestive disease	277 (2.0)	156 (1.2)
Neurodegenerative disease	67 (0.5)	30 (0.2)
Diabetes medication		
OAD only	6,594 (48.5)	6,458 (48.3)
Insulin	1,698 (12.5)	1,394 (10.4)
Neither	5,307 (39.0)	5,514 (41.3)
HbA1c, mmol/mol	50.0 [44.0, 57.8]	50.0 [43.9, 58.1]
HbA1c, %	6.7 [6.2, 7.4]	6.7 [6.2, 7.5]
Missing†	1,074 (7.9)	808 (6.0)
Diabetes duration, years	4.0 [1.0, 9.0]	4.0 [1.0, 8.0]
Missing†	230 (1.7)	144 (1.1)

Values are median [interquartile range] for continuous variables or numbers (percentages) for categorical variables. Abbreviations: HbA1c, glycated hemoglobin.

*Participants with missing information on lifestyle factors, or reporting implausible values (for sleep duration, television watching time, and physical activity time), or with existing cancer and cardiovascular disease at baseline were excluded.

†Values are percentages for missing variables.

Table S4. Association of individual and combined emerging low-risk lifestyle factors with all-cause mortality risk among participants with different adherence to conventional low-risk lifestyle factors*

	Number of Conventional Low-risk Factors†					
	0-1		2		3-4	
	No. of Cases/ Person-Years	HR (95% CI)	No. of Cases/ Person-Years	HR (95% CI)	No. of Cases/ Person-Years	HR (95% CI)
Television watching time, hours/day						
0	19/1,222	1.11 (0.69, 1.78)	11/1,335	0.91 (0.50, 1.68)	10/775	1.62 (0.83, 3.16)
0-4	262/28,238	0.75 (0.64, 0.89)	333/37,405	1.05 (0.89, 1.25)	162/23,045	0.84 (0.66, 1.08)
≥4	373/23,509	1	267/25,001	1	124/13,036	1
Sleep duration, hours/day						
≤6	197/15,298	1	159/16,653	1	87/9,261	1
7-8	357/31,454	0.87 (0.73, 1.04)	357/39,993	0.93 (0.77, 1.13)	176/23,888	0.74 (0.57, 0.96)
≥9	100/6,218	0.96 (0.75, 1.23)	95/7,095	1.14 (0.88, 1.48)	33/3,708	0.73 (0.48, 1.11)
Social connection						
Isolated	141/8,318	1	98/6,970	1	40/3,782	1
Moderately active	302/22,940	0.78 (0.64, 0.96)	265/25,905	0.72 (0.57, 0.92)	106/13,907	0.74 (0.51, 1.08)
Active	211/21,712	0.57 (0.46, 0.72)	248/30,866	0.56 (0.44, 0.71)	150/19,168	0.75 (0.52, 1.07)
Number of emerging low-risk factors‡						
0-1	248/14,379	1	173/13,429	1	76/6,789	1
2	262/22,427	0.74 (0.62, 0.89)	249/27,320	0.79 (0.65, 0.97)	124/15,601	0.70 (0.52, 0.94)
3	144/16,164	0.63 (0.51, 0.78)	189/22,993	0.76 (0.61, 0.94)	96/14,466	0.65 (0.47, 0.88)
P for trend	<0.001		0.017		0.009	

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Conventional low-risk factors: no current smoking, regular physical activity (150+ minutes of moderate activity per week or 75+ minutes of vigorous activity per week or an equivalent combination), healthy diet (adequate intake of at least half of 10 recommended food groups), and moderate alcohol consumption (no more than 1 drink/day for women and 2 drinks/day for men).

‡Emerging low-risk factors: adequate sleep duration (7-8 hours/day), less television watching time (<4h/day), and appropriate social connection (not isolated).

Table S5. Population attributable risks (PARs) of modifiable lifestyle risk factors for all-cause mortality among individuals with type 2 diabetes

Modifiable Risk Factors and Alternative Levels	% of Participants Shifted	PAR*, %
Smoking†		
Current → previous, never	10.77	5.77 (3.88, 7.65)
Previous, current → never‡	52.96	13.88 (8.44, 19.31)
Alcohol consumption†		
Non-moderate → moderate	72.65	16.11 (9.00, 23.22)
Diet†		
<5 → ≥5 recommended components	78.97	7.91 (-0.70, 16.52)
Physical activity†		
Non-regular → regular	48.61	8.10 (3.65, 12.56)
Sleep duration†		
≤6 or ≥9 → 7-8 hours/day	38.16	5.24 (1.51, 8.98)
Television watching†		
≥4 → <4 hours/day	40.41	4.35 (0.00, 8.71)
Social connection†		
Isolated → moderately active, active	12.73	5.09 (3.08, 7.11)
Body mass index§		
<18.5 or ≥25 → 18.5-25 kg/m ²	89.47	0.96 (-13.24, 15.16)
≥30 → <30 kg/m ²	54.36	7.06 (2.03, 12.10)

*The percentage of all-cause mortality theoretically attributable to adherence to modifiable lifestyle risk factors among participants included in the current study. Population attributable risk at the median follow-up time of the study population was reported.

†Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither). Imputed covariates include ethnicity, Townsend deprivation index, education, employment, body mass index, waist-to-hip ratio, diabetes duration, and glycated hemoglobin level. Individual lifestyle risk factors were mutually adjusted: smoking (current or not), alcohol consumption (non-moderate or not), diet (<5 recommended components or not), physical activity (non-regular or not), sleep duration (inadequate or not), television watching (≥4 hours/day or not), and social connection (isolated or not).

‡Smoking was redefined as current/previous or never.

§Participants with missing information on body mass index were excluded (n=13,272). Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetic drugs only, insulin, or neither). Individual lifestyle risk factors were mutually adjusted: smoking (current or not), alcohol consumption (non-moderate or not), diet (<5 recommended components or not), physical activity (non-regular or not), sleep duration (inadequate or not), television watching (≥4 hours/day or not), social connection (isolated or not), and body mass index (<18.5/≥25 kg/m² or not; ≥30 kg/m² or not).

Table S6. Association between lifestyle score and all-cause mortality risk stratified by diabetes severity status (n=12,435)*

No. of Diabetes Severity Factors†	No. of Participants	No. of Cases/ Person-Years	HR‡ (95% CI)	P for Interaction
None	3,508	364/40,517	0.82 (0.76, 0.89)	0.738
One	4,651	499/53,573	0.82 (0.77, 0.89)	
Two	3,079	394/35,359	0.78 (0.72, 0.84)	
Three or four	1,197	206/13,488	0.77 (0.69, 0.86)	

*Participants with missing information on diabetes duration, glycated hemoglobin level, diabetes-related microvascular disease, and diabetes medication use were excluded.

†Includes four factors: glycated hemoglobin level ≥ 53 mmol/mol [7.0%], diabetes duration ≥ 10 years, had a diabetes-related microvascular disease, and diabetes medication use.

‡Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0 , 25.0 - 29.9 , or ≥ 30 kg/m²), waist-to-hip ratio ($\leq 0.85/0.90$ or $>0.85/0.90$ for women/men), and prevalent diseases (yes or no).

Table S7. Association of lifestyle score with all-cause and cause-specific mortality risk using multiple imputations with chained equations to assign missing covariate values (n=13,366)*

		Lifestyle Score					P for Trend	HR (95% CI) per Score Point
		0- 2	3	4	5	6-7		
All-cause								
No. of Cases/Person-Years	308/18,245	400/33,792	436/47,722	299/37,006	118/16,803			
HR (95% CI)	1	0.72 (0.62, 0.83)	0.57 (0.50, 0.67)	0.50 (0.43, 0.59)	0.42 (0.34, 0.52)	<0.001	0.81 (0.78, 0.84)	
Cancer								
No. of Cases/Person-Years	106/18,245	147/33,792	181/47,722	133/37,006	58/16,803			
HR (95% CI)	1	0.74 (0.58, 0.96)	0.66 (0.52, 0.84)	0.61 (0.47, 0.80)	0.57 (0.41, 0.79)	<0.001	0.87 (0.82, 0.93)	
Cardiovascular disease								
No. of Cases/Person-Years	77/18,245	86/33,792	114/47,722	69/37,006	24/16,803			
HR (95% CI)	1	0.61 (0.45, 0.84)	0.60 (0.45, 0.81)	0.46 (0.33, 0.65)	0.35 (0.22, 0.56)	<0.001	0.79 (0.73, 0.86)	
Respiratory disease								
No. of Cases/Person-Years	27/18,245	31/33,792	34/47,722	17/37,006	6/16,803			
HR (95% CI)	1	0.64 (0.38, 1.08)	0.53 (0.32, 0.89)	0.35 (0.19, 0.65)	0.25 (0.10, 0.63)	<0.001	0.73 (0.63, 0.84)	
Neurodegenerative disease								
No. of Cases/Person-Years	8/18,245	22/33,792	15/47,722	19/37,006	10/16,803			
HR (95% CI)	1	1.48 (0.65, 3.36)	0.65 (0.27, 1.57)	0.96 (0.40, 2.26)	1.00 (0.38, 2.64)	<0.001	0.94 (0.78, 1.13)	
Digestive disease†								
No. of Cases/Person-Years	25/18,245	18/33,792	21/47,722	17/53,809				
HR (95% CI)	1	0.42 (0.23, 0.78)	0.38 (0.21, 0.69)	0.27 (0.14, 0.53)		<0.001	0.67 (0.56, 0.80)	
Other								
No. of Cases/Person-Years	65/18,245	96/33,792	71/47,722	45/37,006	19/16,803			
HR (95% CI)	1	0.85 (0.62, 1.17)	0.48 (0.34, 0.68)	0.40 (0.27, 0.59)	0.35 (0.21, 0.60)	<0.001	0.74 (0.68, 0.81)	

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither). Imputed covariates include ethnicity, Townsend deprivation index, education, employment, body mass index, waist-to-hip ratio, diabetes duration, and glycated hemoglobin level.

†Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S8. Association of lifestyle score with all-cause and cause-specific mortality risk using multiple imputations with chained equations to assign missing values of exposure and covariates (n=19,244)*

		Lifestyle Score					P for Trend	HR (95% CI) per Score Point
		0-2	3	4	5	6-7		
All-cause								
No. of Cases/Person-Years	499/29,708	632/50,974	648/67,862	434/50,561	171/22,556			
HR (95% CI)	1	0.74 (0.65, 0.84)	0.60 (0.53, 0.68)	0.55 (0.48, 0.63)	0.45 (0.37, 0.54)	<0.001	0.82 (0.80, 0.85)	
Cancer								
No. of Cases/Person-Years	165/29,708	212/50,974	246/67,862	183/50,561	81/22,556			
HR (95% CI)	1	0.75 (0.60, 0.92)	0.65 (0.53, 0.80)	0.66 (0.53, 0.82)	0.60 (0.44, 0.81)	<0.001	0.88 (0.84, 0.93)	
Cardiovascular disease								
No. of Cases/Person-Years	139/29,708	154/50,974	163/67,862	110/50,561	35/22,556			
HR (95% CI)	1	0.64 (0.50, 0.81)	0.58 (0.46, 0.75)	0.49 (0.37, 0.65)	0.35 (0.24, 0.52)	<0.001	0.79 (0.74, 0.85)	
Respiratory disease								
No. of Cases/Person-Years	41/29,708	58/50,974	54/67,862	26/50,561	11/22,556			
HR (95% CI)	1	0.78 (0.48, 1.29)	0.58 (0.35, 0.96)	0.44 (0.25, 0.78)	0.36 (0.17, 0.73)	<0.001	0.77 (0.69, 0.87)	
Neurodegenerative disease								
No. of Cases/Person-Years	18/29,708	41/50,974	26/67,862	24/50,561	12/22,556			
HR (95% CI)	1	1.19 (0.66, 2.16)	0.61 (0.31, 1.18)	0.70 (0.36, 1.35)	0.67 (0.31, 1.44)	0.044	0.86 (0.75, 1.00) †	
Digestive disease‡								
No. of Cases/Person-Years	41/29,708	34/50,974	36/67,862	26/73,117				
HR (95% CI)	1	0.53 (0.32, 0.88)	0.44 (0.26, 0.73)	0.32 (0.19, 0.54)		<0.001	0.70 (0.61, 0.80)	
Other								
No. of Cases/Person-Years	95/29,708	133/50,974	123/67,862	68/50,561	29/22,556			
HR (95% CI)	1	0.88 (0.64, 1.20)	0.62 (0.47, 0.83)	0.49 (0.35, 0.70)	0.43 (0.28, 0.67)	<0.001	0.80 (0.74, 0.87)	

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither). Imputed covariates include ethnicity, Townsend deprivation index, education, employment, body mass index, waist-to-hip ratio, diabetes duration, glycated hemoglobin level, and lifestyle factors.

†P value was 0.054.

‡Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S9. Association between lifestyle score and risk of mortality from respiratory disease, neurodegenerative disease, or digestive disease among participants without the corresponding disease at baseline*

	Lifestyle Score					P for Trend	HR (95% CI) per Score Point
	0-2	3	4	5	6-7		
Respiratory disease†							
No. of Cases/Person-Years	20/17,105	27/32,420	30/46,532	15/36,272	6/16,571		
HR (95% CI)	1	0.75 (0.42, 1.33)	0.63 (0.35, 1.12)	0.41 (0.21, 0.82)	0.33 (0.13, 0.85)	0.002	0.77 (0.65-0.90)
Neurodegenerative disease‡							
No. of Cases/Person-Years	7/18,179	20/33,728	15/47,614	18/36,968	10/16,781		
HR (95% CI)	1	1.52 (0.63, 3.63)	0.71 (0.28, 1.79)	1.01 (0.41, 2.50)	1.12 (0.41, 3.06)	0.656	0.96 (0.79-1.17)
Digestive disease§							
No. of Cases/Person-Years	22/17,837	14/33,379	19/47,217	15/53,481			
HR (95% CI)	1	0.36 (0.18, 0.71)	0.37 (0.20, 0.70)	0.26 (0.13, 0.51)		<0.001	0.67 (0.55, 0.80)

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Excluding participants with the existing respiratory disease at baseline (n=428).

‡Excluding participants with the existing neurodegenerative disease at baseline (n=30).

§Excluding participants with the existing digestive disease at baseline (n=156); The lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S10. Association of lifestyle score with cause-specific mortality risk using competing risk regression*

		Lifestyle Score					P for Trend	SHR (95% CI) per Score Point
		0- 2	3	4	5	6-7		
Cancer								
No. of Cases/Person-Years	106/18,245	147/33,792	181/47,722	133/37,006	58/16,803			
SHR (95% CI)	1	0.77 (0.60, 0.99)	0.69 (0.54, 0.88)	0.64 (0.50, 0.83)	0.60 (0.43, 0.83)	0.001	0.88 (0.83, 0.94)	
Cardiovascular disease								
No. of Cases/Person-Years	77/18,245	86/33,792	114/47,722	69/37,006	24/16,803			
SHR (95% CI)	1	0.63 (0.46, 0.86)	0.63 (0.47, 0.85)	0.49 (0.35, 0.68)	0.37 (0.23, 0.59)	<0.001	0.80 (0.74, 0.87)	
Respiratory disease								
No. of Cases/Person-Years	27/18,245	31/33,792	34/47,722	17/37,006	6/16,803			
SHR (95% CI)	1	0.68 (0.41, 1.12)	0.58 (0.35, 0.96)	0.38 (0.20, 0.71)	0.28 (0.11, 0.70)	<0.001	0.74 (0.64, 0.86)	
Neurodegenerative disease								
No. of Cases/Person-Years	8/18,245	22/33,792	15/47,722	19/37,006	10/16,803			
SHR (95% CI)	1	1.57 (0.69, 3.56)	0.72 (0.29, 1.74)	1.10 (0.47, 2.57)	1.14 (0.44, 2.95)	0.73	0.97 (0.81, 1.17)	
Digestive disease†								
No. of Cases/Person-Years	25/18,245	18/33,792	21/47,722	17/53,809				
SHR (95% CI)	1	0.45 (0.25, 0.81)	0.42 (0.24, 0.73)	0.31 (0.16, 0.57)		0.001	0.69 (0.58, 0.82)	
Other								
No. of Cases/Person-Years	65/18,245	96/33,792	71/47,722	45/37,006	19/16,803			
SHR (95% CI)	1	0.90 (0.65, 1.23)	0.51 (0.36, 0.72)	0.42 (0.29, 0.63)	0.40 (0.23, 0.67)	<0.001	0.76 (0.69, 0.83)	

*Subdistribution hazard ratios were calculated in proportional subdistribution hazards regression models (Fine and Gray) after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S11. Association of lifestyle score with all-cause and cause-specific mortality risk among diagnosed type 2 diabetes patients (n=11,407)*

	Lifestyle Score					P for Trend	HR (95% CI) per Score Point
	0-2	3	4	5	6-7		
All-cause							
No. of Cases/Person-Years	262/15,110	344/28,436	383/40,602	265/32,091	107/14,594		
HR (95% CI)	1	0.72 (0.61, 0.84)	0.58 (0.49, 0.68)	0.50 (0.42, 0.60)	0.43 (0.34, 0.54)	<0.001	0.81 (0.78, 0.85)
Cancer							
No. of Cases/Person-Years	85/15,110	120/28,436	162/40,602	116/32,091	50/14,594		
HR (95% CI)	1	0.74 (0.56, 0.98)	0.72 (0.55, 0.94)	0.64 (0.48, 0.85)	0.59 (0.41, 0.84)	0.002	0.88 (0.82, 0.95)
Cardiovascular disease							
No. of Cases/Person-Years	66/15,110	78/28,436	92/40,602	61/32,091	24/14,594		
HR (95% CI)	1	0.64 (0.46, 0.89)	0.55 (0.40, 0.76)	0.45 (0.31, 0.64)	0.39 (0.24, 0.62)	<0.001	0.80 (0.73, 0.87)
Respiratory disease†							
No. of Cases/Person-Years	23/15,110	27/28,436	29/40,602	18/46,686			
HR (95% CI)	1	0.65 (0.37, 1.15)	0.53 (0.30, 0.93)	0.29 (0.15, 0.55)		<0.001	0.70 (0.59, 0.82)
Neurodegenerative disease							
No. of Cases/Person-Years	8/15,110	20/28,436	14/40,602	18/32,091	10/14,594		
HR (95% CI)	1	1.31 (0.57, 3.01)	0.57 (0.23, 1.40)	0.87 (0.36, 2.07)	0.96 (0.36, 2.54)	0.503	0.94 (0.77, 1.14)
Digestive disease†							
No. of Cases/Person-Years	20/15,110	16/28,436	20/40,602	15/46,686			
HR (95% CI)	1	0.46 (0.24, 0.90)	0.43 (0.23, 0.81)	0.28 (0.14, 0.56)		0.001	0.69 (0.57, 0.83)
Other							
No. of Cases/Person-Years	60/15,110	83/28,436	66/40,602	41/32,091	19/14,594		
HR (95% CI)	1	0.79 (0.57, 1.11)	0.48 (0.34, 0.69)	0.38 (0.25, 0.58)	0.38 (0.22, 0.64)	<0.001	0.75 (0.68, 0.82)

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S12. Association of weighted lifestyle score with all-cause and cause-specific mortality risk*

	Weighted Lifestyle Score Category†					P for Trend	HR (95% CI) per Score Point
	1	2	3	4	5		
All-cause							
No. of Cases/Person-Years	298/18,139	404/33,462	436/48,228	309/35,901	114/17,838		
HR (95% CI)	1	0.68 (0.58, 0.79)	0.53 (0.45, 0.61)	0.50 (0.43, 0.59)	0.34 (0.27, 0.43)	<0.001	0.79 (0.76, 0.82)
Cancer							
No. of Cases/Person-Years	114/18,139	138/33,462	185/48,228	134/35,901	54/17,838		
HR (95% CI)	1	0.60 (0.47, 0.78)	0.56 (0.44, 0.72)	0.55 (0.43, 0.71)	0.40 (0.29, 0.56)	<0.001	0.83 (0.78, 0.88)
Cardiovascular disease							
No. of Cases/Person-Years	73/18,139	93/33,462	105/48,228	72/35,901	27/17,838		
HR (95% CI)	1	0.62 (0.45, 0.85)	0.51 (0.38, 0.69)	0.47 (0.34, 0.66)	0.33 (0.21, 0.52)	<0.001	0.78 (0.72, 0.84)
Respiratory disease							
No. of Cases/Person-Years	22/18,139	32/33,462	32/48,228	20/35,901	9/17,838		
HR (95% CI)	1	0.75 (0.43, 1.30)	0.57 (0.33, 0.99)	0.50 (0.27, 0.92)	0.39 (0.18, 0.87)	0.004	0.75 (0.65, 0.86)
Neurodegenerative disease							
No. of Cases/Person-Years	7/18,139	22/33,462	17/48,228	19/35,901	9/17,838		
HR (95% CI)	1	1.41 (0.59, 3.35)	0.68 (0.28, 1.68)	0.97 (0.39, 2.39)	0.82 (0.29, 2.28)	0.413	0.93 (0.76, 1.14)
Digestive disease‡							
No. of Cases/Person-Years	20/18,139	28/33,462	14/48,228	19/53,739			
HR (95% CI)	1	0.77 (0.43, 1.39)	0.29 (0.14, 0.58)	0.35 (0.18, 0.68)		<0.001	0.69 (0.59, 0.81)
Other							
No. of Cases/Person-Years	62/18,139	91/33,462	83/48,228	48/35,901	12/17,838		
HR (95% CI)	1	0.75 (0.54, 1.05)	0.52 (0.37, 0.73)	0.42 (0.28, 0.61)	0.19 (0.10, 0.36)	<0.001	0.74 (0.68, 0.81)

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†The weighted standardized lifestyle score was grouped into five ordered categories (1-5) based on the distribution of the unweighted score; A higher level indicates higher adherence to a healthy lifestyle.

‡Category 4 and 5 were combined due to limited case numbers.

Table S13. Hazard ratio (95% confidence interval) of all-cause and cause-specific mortality risk according to lifestyle score with further inclusion of body mass index (n=13,272)*

	Lifestyle Score					P for Trend	HR (95% CI) per Score Point
	0-2	3	4	5	6-8		
All-cause							
No. of Cases/Person-Years	280/16,892	385/32,016	425/45,798	306/36,370	149/21,449		
HR (95% CI)	1	0.74 (0.63, 0.86)	0.58 (0.50, 0.68)	0.52 (0.44, 0.62)	0.42 (0.34, 0.52)	<0.001	0.82 (0.78, 0.85)
Cancer							
No. of Cases/Person-Years	100/16,892	134/32,016	185/45,798	134/36,370	70/21,449		
HR (95% CI)	1	0.70 (0.54, 0.91)	0.69 (0.53, 0.88)	0.62 (0.47, 0.81)	0.53 (0.39, 0.73)	<0.001	0.88 (0.83, 0.94)
Cardiovascular disease							
No. of Cases/Person-Years	73/16,892	80/32,016	111/45,798	70/36,370	29/21,449		
HR (95% CI)	1	0.58 (0.42, 0.80)	0.58 (0.43, 0.78)	0.45 (0.32, 0.63)	0.31 (0.20, 0.49)	<0.001	0.78 (0.72, 0.85)
Respiratory disease							
No. of Cases/Person-Years	24/16,892	31/32,016	31/45,798	21/36,370	7/21,449		
HR (95% CI)	1	0.71 (0.42, 1.22)	0.53 (0.31, 0.91)	0.45 (0.25, 0.82)	0.24 (0.10, 0.57)	<0.001	0.74 (0.64, 0.86)
Neurodegenerative disease							
No. of Cases/Person-Years	7/16,892	20/32,016	12/45,798	20/36,370	13/21,449		
HR (95% CI)	1	1.44 (0.60, 3.42)	0.57 (0.22, 1.46)	1.08 (0.45, 2.63)	1.12 (0.43, 2.89)	0.875	0.99 (0.82, 1.19)
Digestive disease							
No. of Cases/Person-Years	20/16,892	23/32,016	19/45,798	14/36,370	5/21,449		
HR (95% CI)	1	0.66 (0.36, 1.20)	0.41 (0.21, 0.78)	0.38 (0.19, 0.78)	0.23 (0.08, 0.62)	<0.001	0.70 (0.59, 0.83)
Other							
No. of Cases/Person-Years	56/16,892	97/32,016	67/45,798	47/36,370	25/21,449		
HR (95% CI)	1	0.98 (0.70, 1.36)	0.50 (0.35, 0.72)	0.44 (0.30, 0.66)	0.40 (0.24, 0.65)	<0.001	0.76 (0.69, 0.83)

*Participants with missing information on body mass index were excluded; Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), waist-to-hip ratio ($\leq 0.85/0.90$ or $>0.85/0.90$ for women/men), prevalent diseases (yes or no), diabetes duration (<1 , 1-5, 5-10, or ≥ 10 years), glycated hemoglobin level (<53 or ≥ 53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

Table S14. Association of lifestyle score with all-cause and cause-specific mortality risk, redefining low-risk alcohol consumption as no heavy drinking*

	Lifestyle Score					P for Trend	HR (95% CI) per Score Point
	0-2	3	4	5	6-7		
All-cause							
No. of Cases/Person-Years	197/11,050	342/26,998	456/45,459	374/43,794	192/26,267		
HR (95% CI)	1	0.70 (0.59, 0.83)	0.61 (0.52, 0.72)	0.53 (0.44, 0.63)	0.45 (0.37, 0.55)	<0.001	0.84 (0.80, 0.87)
Cancer							
No. of Cases/Person-Years	65/11,050	133/26,998	168/45,459	173/43,794	86/26,267		
HR (95% CI)	1	0.82 (0.61, 1.11)	0.66 (0.49, 0.88)	0.71 (0.53, 0.95)	0.59 (0.42, 0.82)	0.002	0.90 (0.84, 0.96)
Cardiovascular disease							
No. of Cases/Person-Years	55/11,050	70/26,998	118/45,459	88/43,794	39/26,267		
HR (95% CI)	1	0.51 (0.36, 0.73)	0.57 (0.41, 0.78)	0.44 (0.31, 0.63)	0.34 (0.22, 0.51)	<0.001	0.81 (0.75, 0.88)
Respiratory disease							
No. of Cases/Person-Years	18/11,050	28/26,998	36/45,459	22/43,794	11/26,267		
HR (95% CI)	1	0.64 (0.35, 1.17)	0.55 (0.31, 0.99)	0.36 (0.19, 0.68)	0.31 (0.14, 0.66)	<0.001	0.75 (0.65, 0.87)
Neurodegenerative disease†							
No. of Cases/Person-Years		19/38,048	22/45,459	15/43,794	18/26,267		
HR (95% CI)		1	0.94 (0.50, 1.76)	0.64 (0.32, 1.28)	1.12 (0.57, 2.20)	0.887	1.01 (0.83, 1.22)
Digestive disease‡							
No. of Cases/Person-Years	18/11,050	17/26,998	22/45,459		24/70,061		
HR (95% CI)	1	0.41 (0.21, 0.80)	0.37 (0.20, 0.70)		0.28 (0.15, 0.53)	0.001	0.71 (0.60, 0.85)
Other							
No. of Cases/Person-Years	39/11,050	77/26,998	90/45,459	58/43,794	32/26,267		
HR (95% CI)	1	0.79 (0.54, 1.17)	0.64 (0.44, 0.94)	0.44 (0.29, 0.66)	0.39 (0.24, 0.63)	<0.001	0.79 (0.72, 0.86)

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Lifestyle score was categorized into four groups (0-3, 4, 5, 6-7) due to limited case numbers.

‡Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S15. Associations between lifestyle score and all-cause mortality risk stratified by self-rated health status (n=13,306)*

Self-rated Health Status	No. of Participants	No. of Cases/ Person-Years	HR (95% CI)	P for Interaction
Poor	1,387	258/15,399	0.79 (0.71, 0.88)	0.196
Fair	5,213	634/59,689	0.81 (0.76, 0.86)	
Good	6,706	659/77,787	0.87 (0.82, 0.93)	

*Participants with missing information on self-rated health status were excluded. Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥ 30 kg/m²), waist-to-hip ratio ($\leq 0.85/0.90$ or $>0.85/0.90$ for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥ 10 years), glycated hemoglobin level (<53 or ≥ 53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

Table S16. Association of lifestyle score with all-cause and cause-specific mortality risk, excluding patients with poor self-rated health (n=11,919)*

		Lifestyle Score					P for Trend	HR (95% CI) per Score Point
		0-2	3	4	5	6-7		
All-cause								
No. of Cases/ Person-Years	196/13,493	327/28,873	385/43,603	272/35,149	113/16,358			
HR (95% CI)	1	0.81 (0.68, 0.97)	0.66 (0.56, 0.79)	0.57 (0.47, 0.69)	0.49 (0.39, 0.62)	<0.001	0.83 (0.80, 0.87)	
Cancer								
No. of Cases/ Person-Years	72/13,493	132/28,873	171/43,603	124/35,149	57/16,358			
HR (95% CI)	1	0.87 (0.65, 1.16)	0.77 (0.59, 1.02)	0.69 (0.51, 0.93)	0.66 (0.46, 0.94)	0.004	0.89 (0.83, 0.95)	
Cardiovascular disease								
No. of Cases/ Person-Years	48/13,493	67/28,873	100/43,603	64/35,149	23/16,358			
HR (95% CI)	1	0.68 (0.47, 0.99)	0.71 (0.50, 1.01)	0.56 (0.38, 0.82)	0.43 (0.26, 0.72)	0.001	0.84 (0.76, 0.92)	
Respiratory disease								
No. of Cases/ Person-Years	14/13,493	22/28,873	24/43,603	12/35,149	6/16,358			
HR (95% CI)	1	0.77 (0.39, 1.51)	0.61 (0.31, 1.18)	0.38 (0.17, 0.84)	0.39 (0.15, 1.04)	0.006	0.77 (0.65, 0.93)	
Neurodegenerative disease								
No. of Cases/ Person-Years	6/13,493	21/28,873	14/43,603	17/35,149	10/16,358			
HR (95% CI)	1	1.64 (0.65, 4.13)	0.65 (0.25, 1.74)	0.89 (0.34, 2.34)	1.05 (0.37, 3.00)	0.373	0.92 (0.75, 1.12)	
Digestive disease†								
No. of Cases/ Person-Years	14/13,493	10/28,873	17/43,603	15/51,507				
HR (95% CI)	1	0.35 (0.16, 0.80)	0.43 (0.21, 0.88)	0.32 (0.15, 0.68)		0.016	0.73 (0.59, 0.90)	
Other								
No. of Cases/ Person-Years	42/13,493	75/28,873	59/43,603	41/35,149	16/16,358			
HR (95% CI)	1	0.89 (0.61, 1.31)	0.50 (0.33, 0.75)	0.42 (0.27, 0.66)	0.33 (0.18, 0.60)	<0.001	0.73 (0.66, 0.81)	

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case number.

Table S17. Association of lifestyle score with all-cause and cause-specific mortality risk, excluding deaths that occurred within the first 2 or 4 years of follow-up*

[illegible]

No. of Cases/ Person-Years	24/18,116	29/33,645	30/47,548	15/36,881	5/16,784		
HR (95% CI)	1	0.65 (0.38, 1.12)	0.50 (0.29, 0.87)	0.33 (0.17, 0.64)	0.23 (0.08, 0.60)	<0.001	0.71 (0.61, 0.83)
Neurodegenerative disease							
No. of Cases/ Person-Years	8/18,116	22/33,645	14/47,548	19/36,881	10/16,784		
HR (95% CI)	1	1.47 (0.65, 3.35)	0.60 (0.24, 1.45)	0.96 (0.40, 2.26)	1.01 (0.38, 2.65)	0.492	0.94 (0.78, 1.14)
Digestive disease†							
No. of Cases/ Person-Years	22/18,116	13/33,645	18/47,548		13/53,665		
HR (95% CI)	1	0.33 (0.17, 0.67)	0.35 (0.18, 0.66)		0.21 (0.10, 0.44)	<0.001	0.64 (0.52, 0.77)
Other							
No. of Cases/ Person-Years	50/18,116	87/33,645	60/47,548	40/36,881	15/16,784		
HR (95% CI)	1	0.99 (0.70, 1.41)	0.52 (0.36, 0.77)	0.45 (0.29, 0.69)	0.35 (0.19, 0.63)	<0.001	0.75 (0.67, 0.82)

*Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), prevalent diseases (yes or no), diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither).

†Lifestyle score was categorized into four groups (0-2, 3, 4, 5-7) due to limited case numbers.

Table S18. Association between lifestyle score and incident neurodegenerative disease among individuals with type 2 diabetes (n=13,336)*

Overall lifestyle†	No. of Cases/ Person-Years	HR (95%CI)‡		
		Model1	Model2	Model3
0-2	66/17,847	1	1	1
3	127/33,063	1.04 (0.77, 1.40)	1.04 (0.77, 1.41)	1.03 (0.76, 1.39)
4	140/46,820	0.81 (0.60, 1.09)	0.82 (0.61, 1.11)	0.82 (0.61, 1.11)
5	106/36,391	0.79 (0.58, 1.08)	0.81 (0.59, 1.11)	0.81 (0.59, 1.11)
6-7	44/16,510	0.66 (0.45, 0.98)	0.68 (0.46, 1.01)	0.68 (0.46, 1.00)
P value for trend		0.005	0.009	0.01
Per score point		0.90 (0.84, 0.96)	0.90 (0.84, 0.96)	0.91 (0.84, 0.97)

*Participants with the existing neurodegenerative disease at baseline were excluded.

†Low-risk lifestyle factors: no current smoking, regular physical activity (150+ minutes of moderate activity per week or 75+ minutes of vigorous activity per week or an equivalent combination), healthy diet (adequate intake of at least half of 10 recommended food groups), moderate alcohol consumption (no more than 1 drink/day for women and 2 drinks/day for men), adequate sleep duration (7-8 hours/day), less television watching time (<4h/day), and appropriate social connection (not isolated).

‡Hazard ratios were calculated in Cox proportional hazards model: Model 1, adjusted for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), and APOE ε4 carrier (0, 1, 2 or missing); Model 2, further adjusted for body mass index (<25.0, 25.0-29.9, or ≥30 kg/m²), waist-to-hip ratio (≤0.85/0.90 or >0.85/0.90 for women/men), and prevalent diseases (yes or no) based on model 1; Model 3, further adjusted for diabetes duration (<1, 1-5, 5-10, or ≥10 years), glycated hemoglobin level (<53 or ≥53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither) based on model 2.

Figure S1. Flowchart of participants included in the analysis. *Diagnostic thresholds were defined according to the 2020 American Diabetes Association guideline. †Self-reported medical history and medication data were used to assign prevalent diabetes and type according to the algorithms. ‡Cases were classified using ICD-9/ICD-10 codes: diabetes (250/E10-E14), type 2 diabetes (250.00, 250.10, 250.20, 250.90/E11), and type 1 diabetes (250.01, 250.11, 250.21, 250.91/E10). §We assumed that undiagnosed cases were type 2 diabetes because the age of participants in the UK Biobank at blood collection was ≥ 37 years old. Abbreviations: HbA1c, glycated hemoglobin.

Figure S2. The nVenn quasi-proportional diagrams of overlapping individuals with diabetes across different identification sources in the UKB study. (A) Patients identifying through self-reported medical history and medication data. (B) Patients identifying through hospital inpatient records. (C) Patients with subtype information of diabetes identifying through self-reported data and hospital inpatient records. (D) Undiagnosed patients identifying using self-reported data, hospital inpatient records, and blood biochemistry data. S1 = self-reported data; S2 = hospital inpatient records.

Figure S3. Risk of all-cause mortality according to the conventional and emerging low-risk lifestyle factors. Hazard ratios were calculated in Cox proportional hazards model after adjusting for age (years), sex (women or men), ethnicity (white British or other), education (college/university degree or other), Townsend deprivation index (quintiles), employment (currently employed or not), family history of diabetes (yes or no), body mass index (<25.0 , $25.0-29.9$, or ≥ 30 kg/m^2), waist-to-hip ratio ($\leq 0.85/0.90$ or $>0.85/0.90$ for women/men), prevalent diseases (yes or no), diabetes duration (<1 , $1-5$, $5-10$, or ≥ 10 years), glycated hemoglobin level (<53 or ≥ 53 mmol/mol [7.0%]), diabetes-related microvascular disease (yes or no), and diabetes medication use (oral antidiabetes drug only, insulin, or neither); Conventional low-risk factors: no current smoking, regular physical activity (150+ minutes of moderate activity per week or 75+ minutes of vigorous activity per week or an equivalent combination), healthy diet (adequate intake of at least half of 10 recommended food groups), and moderate alcohol consumption (no more than 1 drink/day for women and 2 drinks/day for men); Emerging low-risk factors: adequate sleep duration (7-8 hours/day), less television watching time ($<4\text{h/day}$), and appropriate social connection (not isolated).

Figure S4. Point estimates of the adjusted population attributable risk of all-cause mortality and the corresponding 95% CIs for participants adopting 0-5 low-risk lifestyle factors. Abbreviations: PAR, population attributable risk.