SUPPLEMENTARY DATA

Appendix 1. Detailed information on the participant selection

The UKB cohort

The UK Biobank (UKB) is a comprehensive biomedical database encompassing population health and genetic research resources. Recruiting more than 500,000 participants aged 37-73 years from 22 assessment centers across the UK between 2006 and 2010, the UKB involved participants in completing touchscreen questionnaires, undergoing physical measurements, and providing blood samples at the time of recruitment. Subsequent to the initial recruitment, multiple follow-ups have been conducted, and the database is regularly updated. The complete UKB study protocol is accessible at UKB Study Rationale. Ethical approval for the study was obtained from the North West Multi-center Research Ethics Committee (REC reference for UK Biobank 11/NW/0382), and all participants provided written informed consent. In the first stage, there were 502,367 participants from the UKB included in the screening process.

The ELSA cohort

The ELSA cohort, established jointly by UK government departments and the National Institute on Ageing, serves as a longitudinal survey focusing on ageing and quality of life among older people. Commencing in 2002, the ELSA study included participants aged ≥ 50 years residing in England. Data collected in ELSA encompassed demographics, economic/social status, health status, cognitive function, blood laboratory tests, and more. Participants underwent

follow-ups every 2 years, known as waves, for the collection of self-reported questionnaires and interviews. Biological and anthropometric data were collected at four-year intervals. In the ELSA cohort, participants from wave 4 were included, as this was the initial wave when data on sleep quality and duration were collected (n = 11 292). Exclusions were applied to those who had missing data on sleep quality assessment (n = 746) or reported hypertension at baseline (n = 4442). Finally, we included 6104 participants from the ELSA cohort.

Appendix 2. Detailed Information on the assessment of sleep quality in the in the UKB and ELSA cohort

In the UKB cohort, the evaluation of sleep quality was conducted by means of a sleep pattern questionnaire, including 5 questions. Chronotype was determined through the question, "Do you consider yourself to be: 1) definitely a 'morning' person; 2) more a 'morning' person than 'evening' person; 3) more an 'evening' person than a 'morning' person; 4) definitely an 'evening' person." Sleep duration was reported as the total hours of sleep within a 24-hour period, including naps. Insomnia symptoms were assessed by the question, "Do you have trouble falling asleep at night or do you wake up in the middle of the night?" with response options: 1) never/rarely; 2) sometimes; and 3) usually. Snoring was assessed through the question "Does your partner or a close relative or friend complain about your snoring?" with response choices: 1) yes; or 2) no. Daytime sleepiness was assessed using the question, "How likely are you to doze off or fall asleep during the daytime when you don't mean to? (eg, when working, reading, or driving)" with the following response options: 1) never/rarely; 2) sometimes; 3) often; and 4) all of the time.

An index score for the healthy sleep pattern was formulated, encompassing 5 aspects of sleep behaviors: chronotype, sleep duration, insomnia, snoring, and excessive daytime sleepiness. Healthy sleep factors were defined as having an early chronotype ("morning" or "more morning than evening"), achieving 7 to 8 hours of sleep per day, reporting never/rarely or sometimes experiencing insomnia symptoms, having no self-reported snoring, and experiencing no excessive daytime sleepiness ("never/rarely" or "sometimes"). Each sleep factor was assigned a code of 1 if it met the healthy criterion and 0 if it did not. The index score for the healthy sleep pattern was derived by summing the scores for the 5 sleep factors. A higher total score indicates a healthier sleep pattern.

Additionally, we categorized the index score into 3 groups: "healthy sleep pattern" (healthy sleep score ≥ 4), "intermediate sleep pattern" (2 ≤ healthy sleep score ≤ 3), and "poor sleep pattern" (healthy sleep score ≤ 1).

In the ELSA cohort, sleep quality was assessed using a 4-question survey, comprising a 3-item questionnaire adapted from the Jenkins Sleep Problems Scale, along with an additional question about overall sleep quality. Participants were asked about the following 4 aspects: 1) frequency of difficulty falling asleep; 2) frequency of waking up several times at night; 3) frequency of waking up feeling tired and worn out; and 4) rating of overall sleep quality. For the first 3 questions, participants indicated the frequency of each sleep problem, choosing from options such as "Not during the last month" (score = 1), "Less than once a week" (score = 2), "Once or twice a week" (score = 3), and "Three or more times a week" (score = 4). As for the fourth question, participants rated their overall sleep quality on a scale of "Very good" (score = 1), "Good" (score = 2), "Fairly bad" (score = 3), and "Very bad" (score = 4)16. The sleep quality score was computed by summing the scores for each question. Subsequently, participants were categorized into 3 groups based on their sleep quality score: good sleep quality (4 ≤ score < 8), intermediate sleep quality (8 ≤ score < 12), and poor sleep quality (12 ≤ score ≤ 16).

Appendix 3. Detailed Information on diagnosis of hypertension

In the UKB cohort, the diagnosis of hypertension relied on hospital admission data and cause of death registry records. Additionally, the diagnosis of hypertension was based on hospital admission data obtained from the Hospital Episode Statistics for England (up to October 31, 2022), Scottish Morbidity Record data for Scotland (up to July 31, 2021), and Patient Episode Database for Wales (up to February 28, 2018). The cause of death registry records from the National Health Service (NHS) Information Centre (England and Wales, up to 30 November 2022) and the NHS Central Register, National Records of Scotland (Scotland, up to November 30, 2022) were also used for hypertension diagnosis. Hypertension was confirmed when a medical diagnosis was present in the hospital admission data or when hypertension was listed as a cause of death in the death register. The diagnostic data were collected according to the International Classification of Diseases-Tenth Revision (ICD-10), with the code for hypertension identified as ICD I10-15.

In the ELSA cohort, participants were presented with a list of illnesses during interviews and were requested to report any physician-diagnosed illnesses they had experienced. Incident hypertension was defined as a newly reported hypertension diagnosis from wave 5 to wave 8. Participants who had reported a hypertension diagnosis at wave 4 were excluded from the analysis. Survival time was calculated as the time interval between wave 4 and the first wave when hypertension was reported. If a participant did not develop hypertension until wave 8, the survival time was computed as the interval between wave 4 and wave 8, equivalent to 8 years. If a participant was lost to follow-up but did not report cancer, the survival time was determined as the interval between wave 4 and the last wave of follow-up.

Appendix 4. Detailed Information on covariates

The UKB cohort

Covariates of this study were collected at baseline, which included age (years, continuous variable, field ID 21003), sex (male or female, field ID 31), ethnicity (white people or others, field ID 210 00), assessment centers (England/Scotland/Wales, field ID 54), household income (high: ≥ £52 000, medium: £18 000-£51 999, and low: < £18 000, field ID 738), education (college/university degree or other qualifications, field ID 6138), employment status (currently employed or not, field ID 6142), smoking (current smoking or not, field ID 20116), diet (evaluated by a healthy diet score based on intake of vegetables, fish, unprocessed red meat, and processed meat, continuous variable; field ID 1289/1299/1309/1319/1329/1339/1349/1369/1379/1389), systolic blood pressure (mmHg, continuous variable; field ID 4080/93), systolic blood pressure (mmHg, continuous variable; field ID 4079/94), history of cardiovascular disease (CVD) (yes or no; field ID 6150, ICD I00-I99), history of dyslipidemia (yes or no; field ID 20002/20003/6153/30690), history of cancer (yes or no; field ID 2453, ICD C00-C97), and the polygenic risk score (PRS) for hypertension(continuous variable or categorical variables; field ID 26244).

The evaluation of diet and sleep pattern was based on 5 dietary factors (field ID 1289, 1299, 1309, 1319, 1329, 1339, 1369, 1379, 1389, and 1349): vegetable intake of at least 4 tablespoons each day (median); fruit intake at least 3 pieces each day (median); fish intake at least twice each week (median); unprocessed red meat intake no more than twice each week (median); and processed meat intake no more than 2 each week (median). One point was given for each favorable diet factor, with the total diet score ranging from 0 to 5. Sleep pattern was evaluated by a healthy sleep score calculated from 5 factors: insomnia (field ID 1200), sleep duration (field ID 1180), chronotype (field ID 1160), daytime sleepiness (field ID 1220), and snoring (field ID 1210). Healthy sleep factors

were defined as “never/rarely or sometimes insomnia symptoms”, “sleep 7-8 hours per day”, “no self-reported snoring”, and “no excessive daytime sleepiness” (never/rarely or sometimes). Each sleep factor is coded 1 point if meeting the healthy criterion and 0 if not. Medical conditions like overall health rating, heart problems, cardiovascular disease, dyslipidemia, and cancers were collected based on touchscreen questions, verbal interviews, and the inpatient hospital system at baseline. The detailed field ID and ICD of these medical conditions are presented in **Supplementary table 1**.

The ELSA cohort

In the ELSA cohort, the covariates encompassed a comprehensive set of factors, including age, sex, wealth, education, socioeconomic classification, marital status, current smoking, alcohol consumption, BMI, physical activity, chronic pulmonary lung disease, coronary heart disease (CHD), diabetes, and high blood cholesterol. Wealth, a multifaceted variable, was defined as total nonpension wealth and categorized into fifths, comprising net financial, physical wealth, and net owner-occupied housing wealth. Education level was stratified into 4 tiers based on the highest educational qualification: *a)* no educational qualifications*; b)* qualifications at age 16 years (education to general certificate of education [GCE], O level, national vocational qualification 2); *c)* qualifications at age 18 years (education to NVQ3, GCE, A level); *d)* higher qualification (NVQ4, NVQ5, and degree). Socioeconomic status was classified into 3 groups using the National Statistics-Sociology Economic Classification (NS-SEC): managerial and professional occupations; intermediate occupations; and routine and manual occupations. Marital status was dichotomized into 2 groups: single (including never married, separated, dissolved, widowed, or divorced) and married/cohabiting. Alcohol consumption and smoking status were self-reported by participants, with an "unknown" status assigned to those who did not provide relevant information. BMI was objectively measured during the nurse visit at wave 4 and categorized into 3 groups: < 30, ≥ 30.0, and unknown. Regular

physical activity was defined as moderate/vigorous physical activity once or more times per week. Chronic pulmonary lung disease, CHD, diabetes, and high blood cholesterol were defined based on a medical history of or newly reported corresponding illnesses at wave 4.

Table 1 of the supplementary data. Information about all variables used for adjustment

Variables	Field ID/ICD-10 codes
Exposure	
Sleep duration	Field ID 1160
Getting up in morning	Field ID 1170
Morning/evening person (chronotype)	Field ID 1180
Daytime nap	Field ID 1190
Sleeplessness/insomnia	Field ID 1200
Snoring	Field ID 1210
Daytime dozing/sleeping	Field ID 1220
Covariates	
Age	Field ID 21003
Sex	Field ID 31
Ethnicity	Field ID 21000
Assessment center	Field ID 54
Household income	Field ID 738
Townsend Deprivation Index at recruitment	Field ID 22189
Current employment status	Field ID 6142
Educational level	Field ID 6138
Smoking status	Field ID 20116
Overall health rating	Field ID 2178
Healthy diet score	Field ID 1289/1299/1309/1319/1329/1339/1349/1369/1379/1389
Body mass index	Field ID 21001

Systolic blood pressure	Field ID 4080/93
Diastolic blood pressure	Field ID 4079/94
Cardiovascular disease	Field ID 6150, ICD I00-I99
Chronic lung disease	Field ID 6152
Cancer	Field ID 2453, ICD C00-C97
Medication for cholesterol, blood pressure, or diabetes	Field ID 6177,6153
Medication for pain relief, constipation, heartburn	Field ID 6154
Statin	Field ID 20003
PRS for hypertension	Field ID 26245
Outcome	
Hypertension	Field ID 6150, ICD I10-I15

PRS, polygenic risk score.

Table 2 of the supplementary data. Covariates with missing rate ≥ 5%

Covariates	Number (%)
UKB cohort	
Household income	77 136 (15.3)
SBP	34 438 (6.38)
DBP	34 425 (6.8)
ELSA cohort	
Wealth	868(7.7)
Current smoking	805(7.1)
Alcohol consumption	816(7.2)
BMI	1272(11.3)
FBG	3623(32.1)
Hba1c	2294(20.3)

BMI, body mass index; HbA1c, glycosylated hemoglobin, type A1C; FBG, fasting blood glucose.

Table 3 of the supplementary data. Baseline characteristics grouped by sleep quality in the ELSA cohort

Characteristics	Total (n = 6104)	Good quality (n = 2447)	Intermediate quality (n = 2433)	Poor quality (n = 1224)	*P*
Demographics					
Age, y	63.09 ± 9.87	63.08 ± 10.02	63.62 ± 9.81	62.05 ± 9.60	< .001
Sex					< .001
Male	2655 (43.5)	1249 (51.0)	1052 (43.2)	354 (28.9)	
Female	3449 (56.5)	1198 (49.0)	1381 (56.8)	870 (71.1)	
Marital status					< .001
Single	1734 (28.4)	638 (26.1)	692 (28.4)	404 (33.0)	
Married/cohabiting	4370 (71.6)	1809 (73.9)	1741 (71.6)	820 (67.0)	
Education					< .001
Degree	1859 (30.5)	794 (32.4)	740 (30.4)	325 (26.6)	
Qualifications to age 18 y	1474 (24.1)	630 (25.7)	584 (24.0)	260 (21.2)	
Qualifications to age 16 y	1401 (23.0)	529 (21.6)	596 (24.5)	276 (22.5)	
No qualifications	1370 (22.4)	494 (20.2)	513 (21.1)	363 (29.7)	
Wealth					< .001
Lowest fifth (median £1833)	798 (13.1)	257 (10.5)	301 (12.4)	240 (19.6)	
2nd fifth (median £112 000)	943 (15.4)	328 (13.4)	379 (15.6)	236 (19.3)	
3rd fifth (median £188 399)	1036 (17.0)	425 (17.4)	406 (16.7)	205 (16.7)	
4th fifth (median £285 000)	1153 (18.9)	472 (19.3)	498 (20.5)	183 (15.0)	
Highest fifth (median £522 500)	1306 (21.4)	598 (24.4)	526 (21.6)	182 (14.9)	

Health behaviors					
Physical activity					< .001
Low	1494 (24.5)	484 (19.8)	555 (22.8)	455 (37.2)	
High	4610 (75.5)	1963 (80.2)	1878 (77.2)	769 (62.8)	
Sleep duration, h	6.88 (1.27)	7.27 (0.97)	7.00 (1.13)	5.87 (1.50)	< .001
Current smoking					< .001
Yes	950 (15.6)	375 (15.3)	334 (13.7)	241 (19.7)	
No	4349 (71.2)	1775 (72.5)	1748 (71.8)	826 (67.5)	
Comorbidities					
Diagnosis of diabetes	296 (4.8)	97 (4.0)	121 (5.0)	78 (6.4)	.006
Diagnosis of stroke	112 (1.8)	35 (1.4)	53 (2.2)	24 (2.0)	.141
Diagnosis of hyperlipidemia	1378 (22.6)	472 (19.3)	588 (24.2)	318 (26.0)	< .001
Diagnosis of chronic lung disease	319 (5.2)	77 (3.1)	128 (5.3)	114 (9.3)	< .001
Diagnosis of cancer	453 (7.4)	144 (5.9)	207 (8.5)	102 (8.3)	.001
Measurements					
Obesity	1198 (19.6)	427 (17.4)	502 (20.6)	269 (22.0)	< .001

Data are presented as mean ± SD for continuous variables and No. (%)for categorical variables. *P* values show results from chi square tests that compare baseline differences.

Table 4 of the supplementary data. Baseline characteristics between participants with and without hypertension during follow-up in the UKB cohort

Characteristics	All (n = 284250)	Non-hypertension (n = 233 915)	Hypertension (n = 50 335)	*P*
Age, y	55.34 ± 8.16	54.55 ± 8.09	58.99 ± 7.44	< .001
Male sex	119 648 (42.1)	94 490 (40.4)	25158(50.0)	< .001
Assessment center				
England	252 075 (88.7)	205 869 (88.0)	46206(91.8)	< .001
Scotland	20 621 (7.3)	18 152 (7.8)	2469(4.9)	
Wales	11 554 (4.1)	9894 (4.2)	1660(3.3)	
Employed	180 845 (63.6)	155 808 (66.6)	25037(49.7)	< .001
Townsend	−1.53 (2.95)	−1.57 (2.93)	−1.35− (3.04)	< .001
Ethnicity, white	272 032 (95.7)	223 949 (95.7)	48 083(95.5)	.033
Higher education	100 731 (35.4)	87 241 (37.3)	13 490(26.8)	< .001
Household income, £				
< 18 000	44 867 (15.8)	33 682 (14.4)	11 185(22.2)	< .001
18 000 to 30 999	60 171 (21.2)	48 217 (20.6)	11 954(23.7)	
31 000 to 51 999	69 256 (24.4)	58 479 (25.0)	10 777(21.4)	
52 000 to 100 ^{0}00	59 053 (20.8)	51 854 (22.2)	7199(14.3)	
> 100 000	16 414 (5.8)	14 732 (6.3)	1682(3.3)	
Unknown	34 489 (12.1)	26 951 (11.5)	7538(15.0)	
BMI	26.64 ± 4.36	26.31 ± 4.20	28.17 ± 4.74	< .001
*Obesity**	53 000 (18.6)	38 243 (16.3)	14 757(29.3)	< .001
Current smoker	29 867 (10.5)	23 675 (10.1)	6192(12.3)	< .001
HDS	2.47 ± 1.09	2.46 ± 1.09	2.54 ± 1.12	< .001
SBP, mmHg	136.26 ± 17.96	133.76 ± 16.58	147.88 ± 19.49	< .001
DBP, mmHg	80.72 ± 9.87	79.69 ± 9.37	85.53 ± 10.70	< .001
Overall health rating				

Excellent	58 300 (20.5)	51 571 (22.0)	6729 (13.4)	< .001
Good	171 770 (60.4)	142 370 (60.9)	29 400 (58.4)	
Fair	46 665 (16.4)	34 789 (14.9)	11 876 (23.6)	
Poor	7515 (2.6)	5185 (2.2)	2330 (4.6)	
Cardiac problems	14 948 (5.3)	7661 (3.3)	7287(14.5)	< .001
History of CHD	6179 (2.2)	3031 (1.3)	3148 (6.3)	< .001
History of cancer	20 351 (7.2)	15 882 (6.8)	4469 (8.9)	< .001
History of DLP	18 780 (6.6)	12 722 (5.4)	6058 (12.0)	< .001
History of DM	6771 (2.4)	3878 (1.7)	2893 (5.7)	< .001
Treatment for DM	820 (0.3)	413 (0.2)	407 (0.8)	< .001
Taking aspirin	22 604 (8.0)	14 832 (6.3)	7772 (15.4)	< .001
Taking a statin	21 410 (7.5)	13 255 (5.7)	8155 (16.2)	< .001
Sleep duration, h/d	7.17 ± 1.04	7.17 ± 1.02	7.15 ± 1.14	< .001

CVD, cardiovascular disease; DBP, diastolic blood pressure; DM, diabetes mellitus; DLP, dyslipidemia; SBP, systolic blood pressure; Townsend, Townsend Deprivation Index at recruitment; UKB, UK Biobank.

Data are presented as mean ± standard error for continuous variables or No. (%)for categorical variables. *P* values show results from chi-square tests that compare baseline differences.

*Obesity: BMI ≥ 30 kg/m^2.

Table 5 of the supplementary data. Association between different sleep qualities and hypertension by HT-PRS tertiles

	Sleep quality	HR (95%CI)	*P*
Low HT-PRS	Healthy sleep quality	1(reference)	-
	Intermediate sleep quality	1.108(1.069,1.149)	<.001
	Poor sleep quality	1.233(1.11,1.369)	<.001
Intermediate HT-PRS	Healthy sleep quality	1(reference)	-
	Intermediate sleep quality	1.092(1.058,1.127)	<.001
	Poor sleep quality	1.383(1.262,1.514)	<.001
High HT-PRS	Healthy sleep quality	1(reference)	-
	Intermediate sleep quality	1.106(1.075,1.138)	<.001
	Poor sleep quality	1.234(1.134,1.344)	<.001
	P for interaction = .067		

HT-PRS, polygenic risk score for hypertension.

Model 1: adjusted for age, sex, and race/ethnicity. Model 2: Model 1+ assessment center, Townsend Deprivation index, household income, educational level, employment status, smoking status, obesity, overall health rating, heart problems, and healthy diet score. Model 3: Model 2 + history of coronary heart disease, dyslipidemia, cancer, diabetes, treatment of diabetes, and aspirin or statin use.

Table 6 of the supplementary data. Cox proportional hazards models for associations between sleep duration at baseline and the risk of hypertension in the UKB cohort

			Crude		Model 1		Model 2		Model 3	
Sleep duration	N	Cases/person-y	HR (95%CI)	*P*	HR (95%CI)	*P*	HR (95%CI)	*P*	HR (95%CI)	*P*
7-8 h/d	199 082	32 995/2 589 059	1(reference)	-	1(reference)	-	1(reference)	-	1(reference)	-
<7 h/d	65 658	13 122/835 659	1.234(1.209,1.259)	< .001	1.228(1.203,1.253)	< .001	1.093(1.071,1.116)	< .001	1.098(1.076,1.121)	< .001
> 8 h/d	19 510	4218/245 734	1.351(1.308,1.395)	< .001	1.192(1.154,1.231)	<.001	1.031(0.998,1.065)	.065	1.018(0.985,1.052)	.281
P for trend			.645		< .001		<.001		<.001	

BMI, body mass index; PRS, polygenic risk score.

Model 1: adjusted for age, sex, and race/ethnicity. Model 2: Model 1 + assessment center, Townsend Deprivation Index, household income, educational level, employment status, smoking status, obesity, overall health rating, heart problems, and healthy diet score. Model 3: Model 2 + history of coronary heart disease, dyslipidemia, cancer, diabetes, treatment of diabetes, statin or aspirin use, and the PRS for hypertension.

Table 7 of the supplementary data. Subgroup analyses of the associations between sleep pattern and the risk of hypertension in the UKB cohort

Subgroup	No. cases/Total	Model 3			*P* for interaction
		Healthy sleep pattern	Intermediate sleep pattern	Poor sleep pattern	
Age, y					< .001
< 65	36 554/24 142	1.00 [Reference]	1.116 (1.092,1.14)	1.268 (1.193,1.347)	
⩾ 65	13 781/43 108	1.00 [Reference]	1.065(1.029,1.103)	1.275 (1.139,1.427)	
Sex					.089
Female	25 177/164 602	1.00 [Reference]	1.107(1.0709,1.1299)	1.2273(1.138,1.3239)	
Male	25 158/119 648	1.00 [Reference]	1.100(1.0722,1.1285)	1.3062(1.2115,1.4083)	
Ethnicity					.065
White	48 083/272 032	1.00 [Reference]	1.109 (1.088,1.129)	1.284 (1.215,1.357)	
Other	2252/12 218	1.00 [Reference]	1.009 (0.925,1.1)	1.153 (0.926,1.436)	
BMI					.032
< 30 kg/m^2	35 578/231 250	1.00 [Reference]	1.002 (0.994,1.011)	1.053 (1.019,1.089)	
≥ 30 kg/m^2	14 757/53 000	1.00 [Reference]	1.002 (0.994,1.011)	1.053 (1.019,1.089)	
High household income					< .001
Yes	8881/75 467	1.00 [Reference]	1.067 (1.035,1.099)	1.033 (0.999,1.069)	
No	41 454/208 783	1.00 [Reference]	1.067 (1.035,1.099)	1.217 (1.121,1.32)	
College/university degree					< .001
Yes	134 90/100 731	1.00 [Reference]	0.997 (0.986,1.008)	0.988 (0.951,1.025)	
No	368 45/183 519	1.00 [Reference]	1.081 (1.058,1.104)	1.241 (1.168,1.319)	
Currently employed					< .001
Yes	25 037/180 845	1.00 [Reference]	1.126 (1.097,1.156)	1.324 (1.225,1.432)	

No	25 298/103 405	1.00 [Reference]	1.077 (1.05,1.106)	1.239 (1.152,1.333)	
Currently smoking					.154
Yes	6192/29 867	1.00 [Reference]	1.087 (1.032,1.145)	1.230 (1.085,1.394)	
No	44 143/254 383	1.00 [Reference]	1.105 (1.084,1.127)	1.289 (1.215,1.367)	
Healthy diet score					.191
< 4	40,813/236,756	1.00 [Reference]	1.090 (1.045,1.136)	1.306 (1.153,1.48)	
⩾ 4	9522/47 494	1.00 [Reference]	1.107 (1.085,1.13)	1.268 (1.195,1.345)	
Dyslipidemia					.056
Yes	6058/18 780	1.00[Reference]	1.056 (1.002,1.112)	1.242 (1.082,1.426)	
No	44 277/265 470	1.00[Reference]	1.108 (1.087,1.13)	1.275 (1.203,1.351)	
Cancer					.293
Yes	4469/20 351	1.00[Reference]	1.081 (1.017,1.149)	1.335 (1.129,1.577)	
No	45 866/263 899	1.00[Reference]	1.106 (1.085,1.127)	1.265 (1.196,1.339)	

BMI, body mass index; CHD, coronary heart disease; PRS, polygenic risk score.

Model 1: adjusted for age, sex, and race/ethnicity. Model 2: Model 1+ assessment center, Townsend Deprivation Index, household income, educational level, employment status, smoking status, obesity, overall health rating, heart problems, and healthy diet score. Model 3: Model 2 + history of coronary heart disease, dyslipidemia, cancer, diabetes, treatment of diabetes, aspirin or statin use, and the PRS for hypertension.

Table 8 of the supplementary data. Association of sleep pattern with long-term risk of hypertension after exclusion of individuals with cancer in the UKB cohort (n = 263 899)

	No.	Cases/person-y	Model 3 HR (95%CI)	*P*
Sleep pattern				
Healthy sleep pattern	160 660	25 011/2 101 173	1.00[Reference]	
Intermediate sleep pattern	98 198	19 537/1 252 097	1.106 (1.085,1.127)	< .001
Poor sleep pattern	5041	1318/61 889	1.265 (1.196,1.339)	< .001

BMI, body mass index; PRS, polygenic risk score.

Model 1: adjusted for age, sex, and race/ethnicity. Model 2: Model 1+ assessment center, Townsend Deprivation Index, household income, educational level, employment status, smoking status, obesity, overall health rating, heart problems, and healthy diet score. Model 3: Model 2 + history of coronary heart disease, dyslipidemia, cancer, diabetes, treatment of diabetes, aspirin or statin use, and the PRS for hypertension.

Table 9 of the supplementary data. Association of sleep pattern with long-term risk of hypertension after exclusion of individuals with hypertension occurring within the first year of follow-up in the UKB cohort (n = 281 337)

	N	Cases/person-years	Model3 HR (95%CI)	*P*
Sleep pattern				
Healthy sleep pattern	171 040	25 877/2 252 063	1.00 [Reference]	
Intermediate sleep pattern	104 862	20 157/1 349 694	1.106 (1.085,1.127)	< .001
Poor sleep pattern	5435	1388/67 425	1.294 (1.225,1.367)	< .001

BMI, body mass index; PRS, polygenic risk score.

Model 1: adjusted for age, sex, and race/ethnicity. Model 2: Model 1 + assessment center, Townsend Deprivation Index, household income, educational level, employment status, smoking status, obesity, overall health rating, heart problems, and healthy diet score. Model 3: Model 2 + history of coronary heart disease, dyslipidemia, cancer, diabetes, treatment of diabetes, aspirin or statin use, and the PRS for hypertension.

Table 10 of the supplementary data. Subgroup analyses of the associations between sleep quality and the risk of hypertension in the ELSA cohort

Subgroup	Participants/total	Model3			*P* for interaction
		Good (n = 2447)	Intermediate (n = 2433)	Poor (n = 1224)	
Age, y					.999
< 65	249/3768	1.00	1.096 (0.857,1.403)	1.592 (1.212,2.09)	
⩾ 65	271/2336	1.00	1.014 (0.782,1.315)	0.889 (0.615,1.285)	
Sex					.999
Male	317/2655	1.00	1.025 (0.803,1.306)	1.328 (0.96,1.837)	
Female	315/3449	1.00	1.075 (0.824,1.403)	1.258 (0.94,1.685)	
Smoking status					.999
Never	85/950	1.00	0.750 (0.449,1.251)	1.012 (0.583,1.756)	
Former/current	445/4349	1.00	1.166 (0.943,1.443)	1.335 (1.034,1.723)	
Unknown	102/805	1.00	0.756 (0.487,1.173)	0.851 (0.496,1.461)	
BMI, kg/m^2					.999
< 30	342/3634	1.00	0.829 (0.65,1.057)	1.178 (0.887,1.565)	
⩾ 30	196/1198	1.00	1.381 (0.995,1.919)	1.202 (0.802,1.801)	
Unknown	94/1272	1.00	1.070 (0.669,1.712)	1.162 (0.678,1.99)	
Physical activity					
High	275/4610	1.00	0.972 (0.793,1.19)	1.184 (0.912,1.537)	.092
Low	464/1494	1.00	1.429 (0.967,2.112)	1.429 (0.967,2.112)	
CHD or stroke					.674

Yes	29/452	1.00	2.910	(1.059,7.998)	1.189 (0.318,4.439)	
No	603/5652	1.00	1.001	(0.834,1.203)	1.292 (1.039,1.606)	
Hyperlipidemia						.214
Yes	136/1378	1.00	1.093	(0.894,1.337)	1.345 (1.057,1.712)	
No	496/4726	1.00	0.866	(0.585,1.281)	1.006 (0.632,1.603)	
Cancer						.107
Yes	36/453	1.00	0.592	(0.279,1.253)	0.582 (0.227,1.489)	
No	596/5651	1.00	1.078	(0.896,1.296)	1.326 (1.064,1.652)	

NS-SEC, National Statistics-Sociology Economic Classification.

Model 1: age, sex, wealth, education, NS-SEC and marital status. Model 2 additionally adjusted for lifestyle factors including current smoking, BMI ≥ 30 kg/m², alcohol intake, and regular physical activity. Model 3 adjusted for all the covariates in model 2 plus history of coronary heart disease, dyslipidemia, cancer, chronic lung disease, diabetes, and stroke.

Table 11 of the supplementary data. Association of sleep quality with long-term risk of hypertension after exclusion of individuals with cancer in the ELSA cohort (n = 5651)

	No.	Cases/person-y	Model 3 HR (95%CI)	*P*
Sleep pattern				
Good sleep quality	2303	226/17 826	1.00 [Reference]	
Intermediate sleep quality	2226	232/17 260	1.078 (0.896,1.296)	.426
Poor sleep quality	1122	138/8646	1.326 (1.064,1.652)	.012

NS-SEC, National Statistics-Sociology Economic Classification.

Model 1: age, sex, wealth, education, NS-SEC and marital status. Model 2 additionally adjusted for lifestyle factors including current smoking, BMI≥ 30 kg/m², alcohol intake, and regular physical activity. Model 3 adjusted for all the covariates in model 2 plus history of coronary heart disease, dyslipidemia, cancer, chronic lung disease, diabetes, and stroke.

Table 12 of the supplementary data. Association of sleep quality with long-term risk of hypertension after exclusion of individuals with hypertension occurring within the first 4 years of follow-up in the ELSA cohort (n = 5794)

	N	Cases/person-years	Model 3 HR (95%CI)	*P*
Sleep pattern				
Good sleep quality	2318	112/18 420	1.00[Reference]	
Intermediate sleep quality	2322	135/18 434	1.238(0.962,1.594)	.097
Poor sleep quality	1154	75/9164	1.413(1.042,1.916)	.026

NS-SEC, National Statistics-Sociology Economic Classification.

Model 1: age, sex, wealth, education, NS-SEC, and marital status. Model 2 additionally adjusted for lifestyle factors including current smoking, BMI ≥ 30 kg/m², alcohol intake, and regular physical activity. Model 3 adjusted for all the covariates in model 2 plus history of coronary heart disease, dyslipidemia, cancer, chronic lung disease, diabetes, and stroke.

Figure 1 of the supplementary data. Flow chart of the UKB cohort.

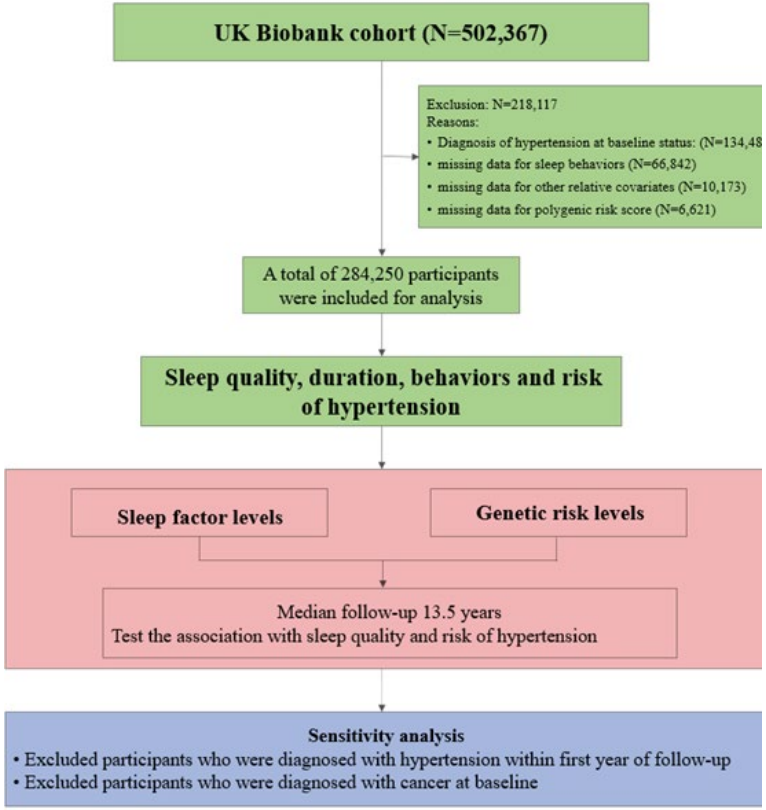
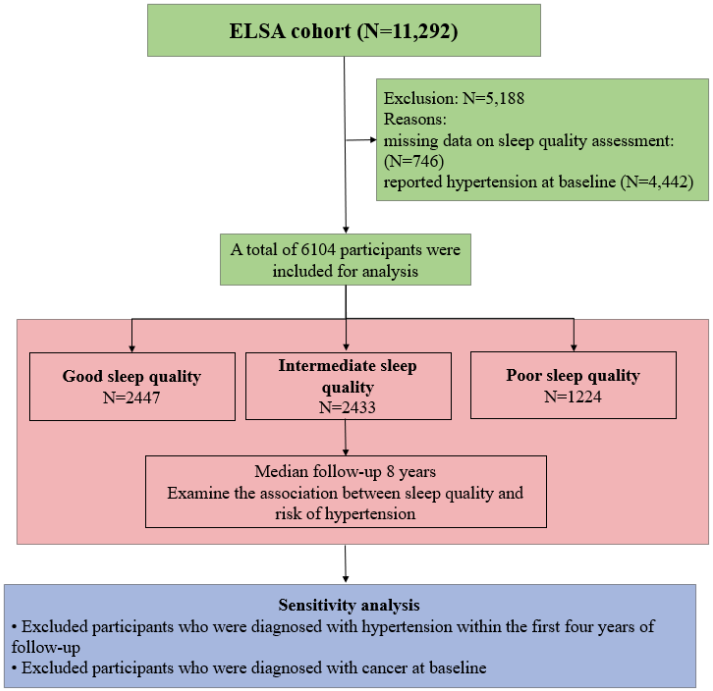


Figure 2 of the supplementary data. Study flow chart of ELSA cohort



Study flow chart. A total of 11 292 participants from ELSA cohort in wave 4 (2008-2009) were screened. After exclusion of participants with cancer at baseline (n = 746), with missing data on sleep quality (n = 4442), a total of 6104 participants were included for analysis. Participants were divided into 3 groups according to sleep quality and followed up over 8 years.

Figure 3 of the supplementary data. K-M plots for the risk of incidence hypertension in groups of sleep quality among patients from UKB cohort.

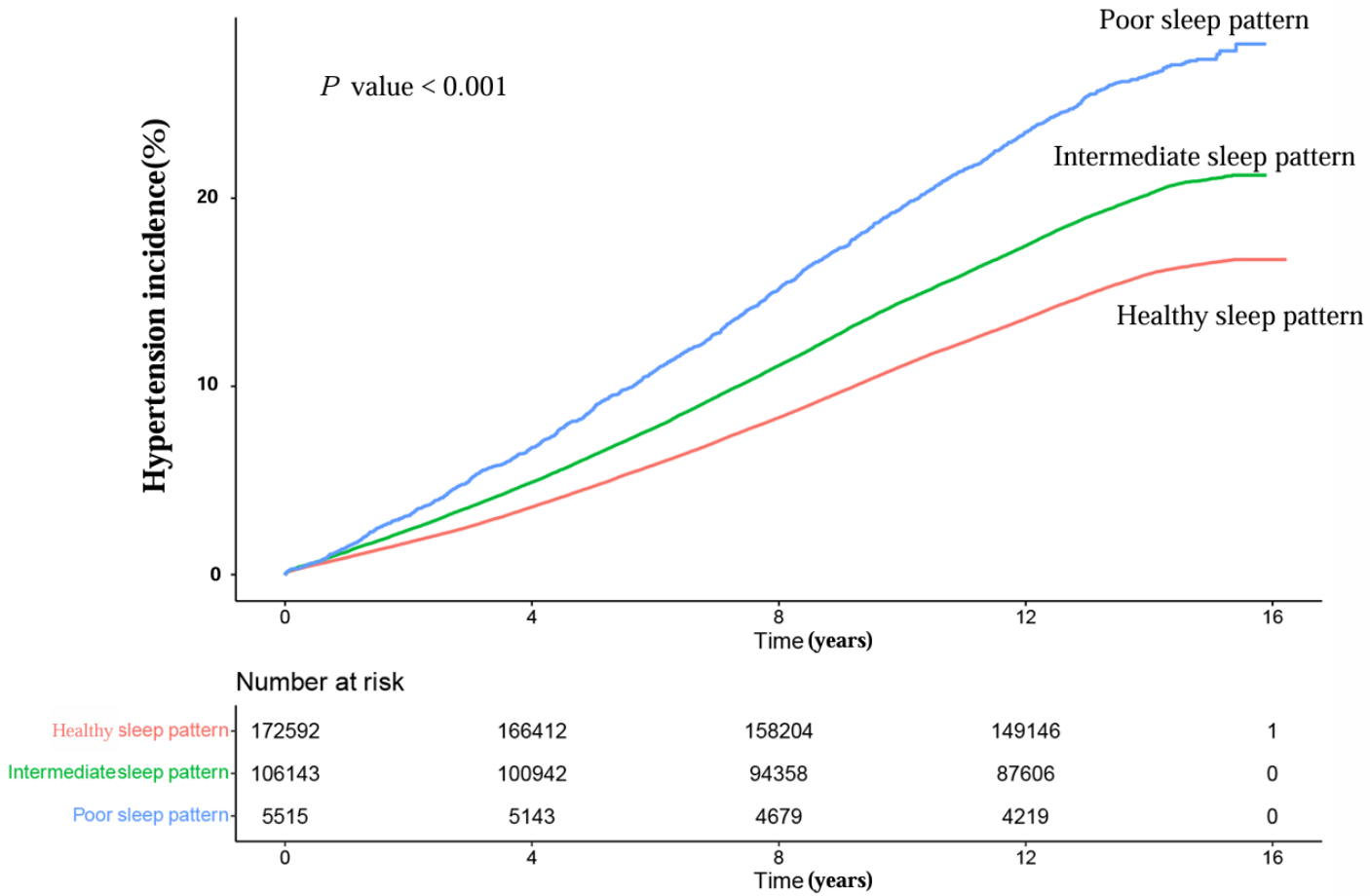


Figure 4 of the supplementary data. Dose-response relationship between healthy sleep score and risk of incidence hypertension from the UKB cohort (Model 3).