Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.
Supplemental Methods

Data harmonization
Data harmonization for the ACC is done centrally by the ACC Coordinating Center. Once a project proposal has been accepted by the ACC Executive Committee, the ACC Coordinating Center requests data from each participating cohort on a project-by-project basis. All cohorts relevant for a specific project (decided by the availability of exposure and outcome measures) receive an invitation to participate. The number of cohorts participating in each project varies depending on the research question and availability of data. The ACC Coordinating Center cleans and pools the collected data and provides principal investigators with access to the finalized dataset. Data can be analysed either remotely using a virtual private network, or on-site at the National Cancer Center in Tokyo. The access to ACC data requires that the principal investigator agrees to and signs a data use agreement form.

Main exposure
The main exposure of the present study was self-reported sleep duration. Three of the cohorts (the Korean Multi-Center Cancer Cohort Study (KMCC), the Singapore Chinese Health Study (SCHS), and the Takayama Study) asked about sleep duration as a categorical variable, and the remaining six cohorts (Japan Public Health Center-based prospective (JPHC) Study 1 and JPHC Study 2, Miyagi Cohort Study, Ohsaki National Health Insurance Cohort Study, Shanghai Men’s Health Study (SMHS), and SWHS) asked about sleep duration as a continuous variable.

The participants of each cohort were asked about their sleep duration as follows: Japan Public Health Center-based prospective study 1 and 2: “How many hours do you usually sleep?”; Miyagi Cohort Study: “How many hours on average do you sleep per day?”; Ohsaki National Health Insurance Cohort Study: “How many hours on average do you sleep per day?”; Takayama Study: “How long did you sleep on average during the past year? (including naptime)?”; Shanghai Men’s Health Study: “In the past year, how many hours did you sleep each day?” (including sleeping at day and night, but not including the time you woke up between two periods of sleep); Shanghai Women’s Health Study: “In the past 2 years, how many hours did you sleep each day (including sleeping during the day and night, but not including time if you woke up between two periods of sleep); Singapore Chinese Health Study: “On the average, during the last year, how many hours did you sleep in a day, including naps?”; Korean Multi-center Cancer Cohort Study: “During the past year, on average per day, how many hours of sleep have you had (including nap time)?”

Outcome ascertainment and follow-up
The outcomes of the present study were mortality from all causes (ICD-9: 001-999, ICD-10: A00-G99, I00-N99, Q00-T98, V00-Y99), CVD (ICD-9: 410-414 and 430-438, ICD-10: I20-I25 and I60-I69), cancer (ICD-9: 140-208, ICD-10: C00-C96), and other causes (mortality other than CVD or cancer).

Covariates
Age (continuous) was obtained at the start of follow-up; study area was relevant for the JPHC study; information on marital status (yes/no), body mass index (BMI; <18.5 kg/m², 18.5-24.9 kg/m², 25-29.9 kg/m², and ≥30 kg/m²), smoking status (never smoker, past smoker, or current smoker).
smoker), alcohol consumption (non-drinker/past drinker, current drinker <150g ethanol/week, and current drinker ≥150g ethanol/week), physical activity (low: once per week or < 1 hour per week; intermediate: 1-4 days per week or 1-4 hours per week; high: almost daily or ≥ 5 hours per week) according to each cohort’s questionnaire, history of diabetes, history of hypertension (prevalent hypertension, systolic blood pressure ≥ 140, or diastolic blood pressure ≥90), and menopausal status (for women only) were all based on self-reported information. For the SWHS, information on menopausal status and prevalent hypertension was derived from both the baseline questionnaire and the third follow-up survey.

**eResults. Supplemental Results**

**All-cause mortality**

Age was a statistically significant effect modifier for all-cause mortality among men (p<0.001) but not women (p=0.62). When stratifying analyses by age, younger men were at an increased risk of all-cause mortality with all sleep duration categories compared to the referent 7 hours (eTable 4). Among older men, there was an increased risk only with sleep durations of 9 hours, and ≥10 hours in both the minimally- and multivariable adjusted model. BMI was not an effect modifier for all-cause mortality in men (p=0.33) or women (p=0.67). Analyses stratified by BMI are shown in eTables 6 and 7.

**CVD mortality**

In sex-stratified analyses, neither age (men: p=0.44; women: p=0.34; eTables 4 and 5) nor BMI (men: p=0.87; women: p=0.95; eTables 6 and 7) were effect modifiers for the association between sleep duration and CVD mortality.

**Cancer mortality**

Among men, age (p<0.001) but not BMI (p=0.88) was a statistically significant effect modifier of the association between sleep duration and cancer mortality. In age-stratified analyses, younger men had an increased risk of cancer mortality with sleep durations of ≤5 hours, 8 hours, 9 hours, and ≥10 hours in both the minimally- and multivariable adjusted models. Sleep duration was unrelated to risk of cancer mortality among older men. In women, neither age (p=0.38) nor BMI (p=0.64) were effect modifiers of the association between sleep duration and cancer mortality.

**Other-cause mortality**

In men, age (p=0.002) but not BMI (p=0.27) was a statistically significant effect modifier of the association between sleep duration and mortality from other causes. Age-stratified analyses revealed increased risks for younger men with sleep durations of ≤5 hours, 8 hours, 9 hours, and ≥10 hours in both models. Older men were at an increased risk of other-cause mortality only with sleep durations of 9 hours, and ≥10 hours in both models. Neither age (p=0.17) nor BMI (p=0.29) were effect modifiers for other-cause mortality in women.
Baseline population (n=450,532)

Excluding ineligible participants
- No information on sex (n=114)
- Missing follow-up time (n=6116)
- Negative follow-up time (n=54)
- Follow-up time = 0 (n=3)
- Unreasonable follow-up time (n=1)
- Age<18 years (n=522)

Eligible (n=443,722)

Excluding participants without information on sleep duration (n=30,445)

Participants with information on sleep duration (n=413,277)

Excluding participants with outlier values on sleep duration (n=1477)

Eligible for analyses (n=411,800)

Excluding participants with missing information on covariates (n=52,481)

Eligible for analyses (n=359,319)

Excluding participants:
- with prevalent cancer or CVD (n=26,490)
- who died in the first 5 years of follow-up (n=10,108)

Eligible for analyses (n=322,721)

eFigure 1. Flowchart of participant inclusion and exclusion

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**eTable 1. Participating cohort characteristics**

| Cohort      | JPHC I | JPHC II | Miyagi | Ohsaki | Takayama | SMHS | SWHS | SCHS | KMCC |
|-------------|--------|---------|--------|--------|----------|------|------|------|------|
| Follow-up time, mean (SD) years | 21.4 (3.5) | 18.3 (3.2) | 16.4 (3.2) | 11.5 (3.7) | 14.3 (3.2) | 9.2 (1.0) | 8.3 (0.8) | 12.0 (2.1) | 14.3 (4.2) |
| Participants | N     | %      | N     | %      | N     | %      | N     | %      | N     | %      |
| Total        | 38954 | 100    | 47904 | 100    | 31623 | 100    | 29896 | 100    | 20430 | 100    | 34453 | 100   | 58089 | 100   | 55519 | 100   | 5853 | 100  |
| Men          | 18706 | 48.0   | 22184 | 46.3   | 17423 | 55.1   | 15907 | 53.2   | 9577  | 46.9   | 34453 | 100   | 0     | 0     | 24044 | 43.3   | 1885 | 32.2 |
| Women        | 20248 | 52.0   | 25720 | 53.7   | 14200 | 44.9   | 13989 | 46.8   | 10853 | 53.1   | 34453 | 100   | 31475 | 56.7   | 3968 | 67.8 |
| Deaths       | 5544  | 14.2   | 8508  | 17.8   | 3005  | 9.5    | 3266  | 10.9   | 2630  | 12.9   | 1395  | 4.1    | 2048  | 3.5    | 6033  | 10.9   | 758  | 13.0 |
| Proportionate mortality |       |        |       |        |        |       |       |       |       |        |       |       |       |       |       |       |       |       |
| CVD          | 870   | 15.7   | 1383  | 16.3   | 543   | 18.1   | 623   | 19.1   | 436   | 16.6   | 249   | 17.9   | 421   | 20.6   | 1635  | 27.1   | 133  | 17.6 |
| Cancer       | 2339  | 42.2   | 3257  | 38.3   | 1378  | 45.9   | 1163  | 35.6   | 856   | 32.6   | 688   | 49.3   | 837   | 40.9   | 2148  | 35.6   | 230  | 30.3 |
| Other        | 2335  | 42.1   | 3868  | 45.5   | 1084  | 36.1   | 1480  | 45.3   | 1338  | 50.9   | 458   | 32.8   | 790   | 38.6   | 2250  | 37.3   | 395  | 52.1 |
| Sleep duration (Men) |       |        |       |        |       |       |       |       |       |        |       |       |       |       |       |       |       |       |
| ≤5 hours     | 578   | 3.1    | 830   | 3.7    | 503   | 2.9    | 334   | 2.1    | 266   | 2.8    | 3181  | 9.2    | -     | -     | 1923  | 8.0    | 182  | 9.7  |
| 6 hours      | 2570  | 13.7   | 3466  | 15.6   | 2508  | 14.4   | 1670  | 10.5   | 1555  | 16.2   | 8044  | 23.4   | -     | -     | 5622  | 23.4   | 425  | 22.6 |
| 7 hours      | 6170  | 33.0   | 7005  | 31.6   | 6275  | 36.0   | 4566  | 28.7   | 3896  | 40.7   | 9299  | 27.0   | -     | -     | 8042  | 33.5   | 515  | 27.3 |
| 8 hours      | 7758  | 41.5   | 8335  | 37.6   | 6673  | 38.3   | 6714  | 42.2   | 2982  | 31.1   | 10632 | 30.9   | -     | -     | 6927  | 28.8   | 549  | 29.1 |
| 9 hours      | 1157  | 6.2    | 1695  | 7.6    | 1042  | 6.0    | 1650  | 10.4   | 685   | 7.2    | 1870  | 5.4    | -     | -     | 967   | 4.0    | 114  | 6.1  |
| ≥10 hours    | 473   | 2.5    | 853   | 3.9    | 422   | 2.4    | 973   | 6.1    | 193   | 2.0    | 1427  | 4.1    | -     | -     | 563   | 2.3    | 100  | 5.3  |
| Sleep duration (Women) |       |        |       |        |       |       |       |       |       |        |       |       |       |       |       |       |       |       |
| ≤5 hours     | 1075  | 5.3    | 1203  | 4.7    | 588   | 4.1    | 603   | 4.3    | 419   | 3.9    | -     | -     | 5925  | 10.2   | 3220  | 10.2   | 531  | 13.4 |
| 6 hours      | 4059  | 20.1   | 5164  | 20.1   | 2900  | 20.4   | 2320  | 16.6   | 2677  | 24.7   | -     | -     | 12923 | 22.3   | 7419  | 23.6   | 878  | 22.1 |
| 7 hours      | 7754  | 38.3   | 9403  | 36.6   | 5865  | 41.3   | 4565  | 32.6   | 4506  | 41.5   | -     | -     | 16722 | 28.8   | 10440 | 33.2   | 1064 | 26.8 |
| 8 hours      | 6428  | 31.8   | 8140  | 31.7   | 4134  | 29.1   | 4890  | 35.0   | 2550  | 23.5   | -     | -     | 17568 | 30.2   | 8341  | 26.5   | 1058 | 26.7 |
| 9 hours      | 695   | 3.4    | 1312  | 5.1    | 534   | 3.8    | 1032  | 7.4    | 493   | 4.5    | -     | -     | 3195  | 5.5    | 1416  | 4.5    | 293  | 7.4  |
| ≥10 hours    | 237   | 1.2    | 498   | 1.9    | 179   | 1.3    | 579   | 4.1    | 208   | 1.9    | -     | -     | 1756  | 3.0    | 639   | 2.0    | 144  | 3.6  |

*Cohort characteristics are shown according to the final study population (i.e., individuals who are complete cases without any prevalent cardiovascular disease (CVD) or cancer at baseline, and who did not die within the first five years of follow-up).

Abbreviations: JPHC=Japan Public Health Center; SMHS=Shanghai Men’s Health Study; SWHS=Shanghai Women’s Health Study; SCHS=Singapore Chinese Health Study; KMCC= Korean Multi-Center Cancer Cohort.

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| Sleep duration (h) | Person-years | Cause of death | All-cause | CVD | Cancer | Other cause |
|-------------------|--------------|----------------|-----------|-----|--------|------------|
|                   | ≤5           | 6              | 7         | 8   | 9      | ≥10        |
| Person-years      | 96,216       | 345,256        | 657,426   | 729,309 | 129,293 | 64,789     |
| No. (Events)      | 7797         | 25,860         | 45,768    | 50,570 | 9180   | 5004       |
| Model 1, HR (95% CI) | 1.16*** (1.08, 1.24) | 1.03 Reference | 1.09*** (1.05, 1.13) | 1.18*** (1.11, 1.24) | 1.43*** (1.34, 1.53) |
| Model 2, HR (95% CI) | 1.15*** (1.07, 1.23) | 1.04 Reference | 1.06*** (1.03, 1.10) | 1.13*** (1.07, 1.20) | 1.34*** (1.26, 1.44) |
| No. (Events)      | 7797         | 25,860         | 45,768    | 50,570 | 9180   | 5004       |
| Model 1, HR (95% CI) | 1.35*** (1.17, 1.56) | 1.01 Reference | 1.06 (0.97, 1.15) | 1.17* (1.03, 1.34) | 1.59*** (1.37, 1.84) |
| Model 2, HR (95% CI) | 1.32*** (1.14, 1.52) | 1.01 Reference | 1.04 (0.95, 1.13) | 1.12 (0.98, 1.28) | 1.48*** (1.27, 1.71) |
| No. (Events)      | 7797         | 25,860         | 45,768    | 50,570 | 9180   | 5004       |
| Model 1, HR (95% CI) | 1.01 (0.90, 1.13) | 1.03 (0.96, 1.11) Reference | 1.08** (1.02, 1.14) | 1.10* (1.00, 1.20) | 1.19** (1.06, 1.33) |
| Model 2, HR (95% CI) | 1.01 (0.90, 1.13) | 1.04 (0.97, 1.11) Reference | 1.06 (1.00, 1.12) | 1.06 (0.97, 1.16) | 1.12 (1.00, 1.25) |
| No. (Events)      | 7797         | 25,860         | 45,768    | 50,570 | 9180   | 5004       |
| Model 1, HR (95% CI) | 1.22*** (1.10, 1.36) | 1.04 Reference | 1.11*** (1.05, 1.17) | 1.26*** (1.16, 1.36) | 1.60*** (1.45, 1.76) |
| Model 2, HR (95% CI) | 1.20*** (1.08, 1.33) | 1.05 Reference | 1.08** (1.03, 1.15) | 1.21*** (1.11, 1.32) | 1.50*** (1.36, 1.65) |

Model 1 was adjusted for age, marital status, and study area (JPHC Study only)
Model 2 was further adjusted for body mass index, smoking, alcohol intake, physical activity, history of diabetes, and hypertension
*p<0.05, **p<0.01 vs reference
### eTable 3 HRs and CIs for mortality according to sleep duration for women

| Women (n=178,542) | | | | | |
|-------------------|---|---|---|---|
| | ≤5 | 6 | 7 | 8 | 9 | ≥10 |
| Person-years | 162,656 | 507,564 | 842,907 | 714,776 | 114,102 | 50,032 |

#### Cause of death

##### All-cause

| No. (Events) | Model 1, HR (95% CI) | Model 2, HR (95% CI) |
|--------------|----------------------|----------------------|
| 13,564 (261) | 1.10*** (1.03, 1.18) | 1.07* (1.00, 1.15) |
| 38,340 (552) | 1.07** (1.02, 1.13) | 1.06 (1.01, 1.11) |

##### CVD

| No. (Events) | Model 1, HR (95% CI) | Model 2, HR (95% CI) |
|--------------|----------------------|----------------------|
| 13,564 (261) | 1.24*** (1.08, 1.43) | 1.21** (1.05, 1.40) |
| 38,340 (552) | 1.12 (1.00, 1.25) | 1.10 (0.98, 1.23) |

##### Cancer

| No. (Events) | Model 1, HR (95% CI) | Model 2, HR (95% CI) |
|--------------|----------------------|----------------------|
| 13,564 (394) | 1.07 (0.96, 1.20) | 1.05 (0.94, 1.18) |
| 38,340 (1092) | 1.06 (0.99, 1.15) | 1.05 (0.98, 1.14) |

##### Other cause

| No. (Events) | Model 1, HR (95% CI) | Model 2, HR (95% CI) |
|--------------|----------------------|----------------------|
| 13,564 (455) | 1.06 (0.95, 1.17) | 1.02 (0.92, 1.14) |
| 38,340 (1132) | 1.06 (0.99, 1.15) | 1.05 (0.97, 1.13) |

Model 1 was adjusted for age, marital status, and study area (JPHC Study only)
Model 2 was further adjusted for body mass index, smoking, alcohol intake, physical activity, history of diabetes, hypertension, and menopausal status

*p<0.05, **p<0.01, ***p<0.001 vs reference
## Table 4 HRs and CIs for mortality according to sleep duration in men stratified by age (younger/older than 65 years of age)

| Cause of death | Age<65 (n=124,867) | Age≥65 (n=19,312) |
|----------------|---------------------|---------------------|
|                | Sleep duration (h)  | Sleep duration (h)  |
| Person-years   | ≤5                  | ≤5                  |
|                | 80,693              | 15,523              |
|                | 307,679             | 37,577              |
|                | 601,510             | 55,916              |
|                | 653,162             | 76,147              |
|                | 108,617             | 20,676              |
|                | 50,644              | 14,145              |

### All-cause

| Model 1, HR (95% CI) | 1.47*** (244) | 1.06*** (93, 1.20) | 1.41*** (22, 1.17) | 1.06*** (93, 1.20) | 1.47*** (244) | 1.06*** (93, 1.20) | 1.41*** (22, 1.17) | 1.06*** (93, 1.20) |
|---------------------|--------------|--------------------|-------------------|--------------------|--------------|--------------------|-------------------|--------------------|
| Model 2, HR (95% CI) | 1.05*** (900) | Reference (93, 1.20) | Reference (93, 1.20) | Reference (93, 1.20) | 1.05*** (900) | Reference (93, 1.20) | Reference (93, 1.20) | Reference (93, 1.20) |

### CVD

| Model 1, HR (95% CI) | 1.55*** (244) | 1.07 (0.94, 1.21) | 1.52*** (22, 1.17) | 1.06 (0.93, 1.20) | 1.55*** (244) | 1.07 (0.94, 1.21) | 1.52*** (22, 1.17) | 1.06 (0.93, 1.20) |
|---------------------|--------------|--------------------|-------------------|--------------------|--------------|--------------------|-------------------|--------------------|
| Model 2, HR (95% CI) | 1.16*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | 1.16*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) |

### Cancer

| Model 1, HR (95% CI) | 1.19*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | 1.19*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) |
|---------------------|--------------|--------------------|-------------------|--------------------|--------------|--------------------|-------------------|--------------------|
| Model 2, HR (95% CI) | 1.16*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | 1.16*** (1731) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) |

### Other cause

| Model 1, HR (95% CI) | 1.23*** (244) | 1.07 (0.98, 1.17) | 1.20*** (22, 1.17) | 1.07 (0.98, 1.17) | 1.23*** (244) | 1.07 (0.98, 1.17) | 1.20*** (22, 1.17) | 1.07 (0.98, 1.17) |
|---------------------|--------------|--------------------|-------------------|--------------------|--------------|--------------------|-------------------|--------------------|
| Model 2, HR (95% CI) | 1.40*** (244) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | 1.40*** (244) | Reference (1.21, 1.33) | Reference (1.21, 1.33) | Reference (1.21, 1.33) |

Model 1 was adjusted for marital status, and study area (JPHC Study only).
Model 2 was further adjusted for body mass index, smoking, alcohol intake, physical activity, history of diabetes, and hypertension 
*p<0.05, **p<0.01, ***p<0.001 vs reference

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| Cause of death | Age<65 (n=147,786) | Age≥65 (n=30,756) |
|----------------|-------------------|------------------|
|                | Sleep duration (h) | Sleep duration (h) |
|                | ≤5    | 6       | 7       | 8       | 9       | ≥10     | ≤5    | 6       | 7       | 8       | 9       | ≥10     |
| Person-years   | 125,159 | 435,493 | 753,027 | 617,505 | 89,585  | 36,317  | 37,497 | 72,072  | 89,880  | 97,271  | 24,517  | 13,714  |
| Cause of death |                   |                   |         |         |         |         |       |         |         |         |         |         |
| All-cause      |                   |                   |         |         |         |         |       |         |         |         |         |         |
| No. Events     | 9806 (515) | 31,363 (1624) | 52,156 (2740) | 44,616 (2602) | 6844 (444) | 3001 (232) | 3758 (595) | 6977 (1152) | 8163 (1343) | 8493 (1646) | 2126 (503) | 1239 (372) |
| Model 1, HR (95% CI) | 1.23*** (1.12, 1.35) | 1.06 (0.90, 1.13) | Reference | 1.19*** (1.12, 1.25) | 1.44*** (1.31, 1.60) | 1.96*** (1.71, 2.24) | 1.13* (1.03, 1.25) | 1.11** (1.03, 1.20) | 1.13*** (1.05, 1.21) | 1.14*** (1.21, 1.49) | 1.84*** (1.64, 2.06) |
| Model 2, HR (95% CI) | 1.14** (1.03, 1.25) | 1.04 (0.98, 1.11) | Reference | 1.12*** (1.07, 1.18) | 1.28*** (1.16, 1.41) | 1.70*** (1.48, 1.94) | 1.11* (1.00, 1.22) | 1.10* (1.02, 1.19) | 1.11** (1.03, 1.20) | 1.28*** (1.16, 1.42) | 1.76*** (1.57, 1.98) |
| CVD            |                   |                   |         |         |         |         |       |         |         |         |         |         |
| No. Events     | 9806 (91) | 31,363 (272) | 52,156 (457) | 44,616 (483) | 6844 (93) | 3001 (45) | 3758 (170) | 6977 (280) | 8163 (293) | 8493 (402) | 2126 (132) | 1239 (76) |
| Model 1, HR (95% CI) | 1.27* (1.01, 1.59) | 1.06 (0.91, 1.23) | Reference | 1.33*** (1.17, 1.51) | 1.80*** (1.44, 2.25) | 2.26*** (1.66, 3.07) | 1.42*** (1.17, 1.72) | 1.21* (1.03, 1.43) | 1.29*** (1.11, 1.50) | 1.66*** (1.35, 2.04) | 1.76*** (1.36, 2.26) |
| Model 2, HR (95% CI) | 1.13 (0.90, 1.41) | 1.04 (0.89, 1.21) | Reference | 1.23** (1.08, 1.39) | 1.51*** (1.21, 1.89) | 1.80*** (1.33, 2.46) | 1.39*** (1.15, 1.68) | 1.20* (1.02, 1.41) | 1.27** (1.09, 1.48) | 1.56** (1.27, 1.92) | 1.65** (1.28, 2.13) |
| Cancer         |                   |                   |         |         |         |         |       |         |         |         |         |         |
| No. Events     | 9806 (233) | 31,363 (745) | 52,156 (1290) | 44,616 (1091) | 6844 (141) | 3001 (85) | 3758 (161) | 6977 (347) | 8163 (377) | 8493 (422) | 2126 (105) | 1239 (69) |
| Model 1, HR (95% CI) | 1.17* (1.02, 1.35) | 1.03 (0.94, 1.12) | Reference | 1.05 (0.97, 1.14) | 0.97 (0.82, 1.16) | 1.50*** (1.20, 1.87) | 1.05 (0.88, 1.27) | 1.17* (1.01, 1.36) | Reference | 1.03 (0.90, 1.19) | 1.03 (0.83, 1.28) | 1.27 (0.98, 1.65) |
| Model 2, HR (95% CI) | 1.11 (0.97, 1.28) | 1.02 (0.93, 1.11) | Reference | 1.02 (0.94, 1.11) | 0.91 (0.76, 1.08) | 1.39** (1.12, 1.74) | 1.05 (0.87, 1.27) | 1.17* (1.01, 1.35) | Reference | 1.03 (0.89, 1.18) | 1.00 (0.81, 1.25) | 1.25 (0.96, 1.61) |
| Other cause    |                   |                   |         |         |         |         |       |         |         |         |         |         |
| No. Events     | 9806 (191) | 31,363 (607) | 52,156 (993) | 44,616 (1028) | 6844 (210) | 3001 (102) | 3758 (264) | 6977 (673) | 8163 (822) | 8493 (266) | 2126 (227) | 1239 (227) |
| Model 1, HR (95% CI) | 1.29*** (1.10, 1.51) | 1.10 (1.01, 1.22) | Reference | 1.29*** (1.19, 1.41) | 1.89*** (1.63, 2.20) | 2.43*** (1.98, 2.99) | 1.05 (0.91, 1.21) | 1.04 (0.92, 1.16) | Reference | 1.11* (1.00, 1.23) | 1.37*** (1.19, 1.58) | 2.15*** (1.85, 2.50) |
| Model 2, HR (95% CI) | 1.17 (1.00, 1.36) | 1.08 (0.98, 1.20) | Reference | 1.20*** (1.10, 1.31) | 1.62*** (1.39, 1.88) | 2.00*** (1.63, 2.45) | 1.01 (0.87, 1.17) | 1.02 (0.91, 1.15) | Reference | 1.09 (0.98, 1.21) | 1.31*** (1.13, 1.51) | 2.06*** (1.76, 2.39) |

Model 1 was adjusted for marital status, and study area (JPHC Study only)
Model 2 was further adjusted for body mass index, smoking, alcohol intake, physical activity, history of diabetes, hypertension, and menopause
* p<0.05, ** p<0.01, *** p<0.001 vs reference

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| Cause of death | All-cause | CVD | Cancer | Other cause |
|----------------|-----------|-----|--------|-------------|
| No. (Events) | Model 1, HR (95% CI) | Model 2, HR (95% CI) | Model 1, HR (95% CI) | Model 2, HR (95% CI) |
| Person-years | ≤5 | 6 | 7 | 8 | 9 | ≥10 | ≤5 | 6 | 7 | 8 | 9 | ≥10 |
| 67,128 | 242,560 | 480,866 | 541,919 | 98,183 | 48,035 | 29,089 | 102,697 | 176,560 | 187,390 | 31,110 | 16,754 |
| All-cause | 1.21*** (1.12, 1.30) | 1.03 | 1.09*** (1.05, 1.14) | 1.19*** (1.12, 1.27) | 1.46*** (1.35, 1.57) | 1.03 | 1.04 | 1.07 | 1.11 | 1.34*** (1.09, 1.16) | 1.54*** (1.16, 1.54) |
| CVD | 1.20*** (1.11, 1.30) | 1.04 | 1.07** (1.02, 1.11) | 1.15** (1.08, 1.22) | 1.37*** (1.28, 1.48) | 1.03 | 1.03 | 1.07 | 1.10 | 1.30*** (1.12, 1.49) |
| Cancer | 1.38*** (1.17, 1.63) | 1.02 | 1.04 (0.94, 1.14) | 1.14 (0.98, 1.32) | 1.52*** (1.28, 1.80) | 1.18 | 1.01 | 1.03 | 1.05 | 1.36 |
| Other cause | 1.00 (0.90, 1.15) | 1.04 (0.97, 1.13) | 1.05 (0.99, 1.12) | 1.09 (0.99, 1.20) | 1.13 (1.00, 1.28) | 0.98 (0.78, 1.23) | 1.02 (0.89, 1.17) | 1.06 (0.95, 1.19) | 1.05 (0.78, 1.40) | 1.08 (0.85, 1.36) |

Model 1 was adjusted for age, marital status, and study area (JPHC Study only)
Model 2 was further adjusted for smoking, alcohol intake, physical activity, history of diabetes, and hypertension
*p<0.05, **p<0.01, ***p<0.001 vs reference

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Table 7 HRs and CIs for mortality for women according to sleep duration stratified by body mass index (BMI)

| Cause of death | BMI<25 kg/m² (n=128,141) | BMI≥25 kg/m² (n=50,401) |
|----------------|----------------------------|-------------------------|
|                | Sleep duration (h)         | Sleep duration (h)      |
| Person-years   | ≤5 | 6 | 7 | 8 | 9 | ≥10 | ≤5 | 6 | 7 | 8 | 9 | ≥10 |
|                | 114,992 | 368,230 | 623,034 | 513,049 | 78,636 | 32,591 | 47,664 | 139,334 | 219,873 | 201,727 | 35,466 | 17,441 |
| Cause of death | All-cause | | | | | | | | | | | |
| No. Events     | 9563 | 27,599 | 44,223 | 37,833 | 6163 | 2760 | 4001 | 10,741 | 16,996 | 15,276 | 2807 | 1480 |
| Model 1 HR     | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) | 1.01 (1.00, 1.13) |
| Model 2 HR     | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) | 1.08 (0.99, 1.17) |
| CVD            | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) |
| Cancer         | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) | 1.28 (0.98, 1.28) |
| Other cause    | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) | 1.17 (0.89, 1.05) |

Model 1 was adjusted for age, marital status, and study area (JPHC Study only).
Model 2 was further adjusted for smoking, alcohol intake, physical activity, history of diabetes, hypertension, and menopausal status
*p<0.05, **p<0.01, ***p<0.001 vs reference

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