Supplemental Table 1. Sleep characteristics, sociodemographic characteristics, health behaviors, and clinical characteristics overall and by race among 39,071 adult women in the Sister Study.

Sample size, N (%) 39,071 34,062 (87) 3,167 (8) 1,842 (5) Sociodemographic characteristics 54.8 ± 8.8 55.2 ± 8.8 52.4 ± 8.1 52.2 ± 8.9 Educational attainment 4HS 1 1 8 1 4HS 1 1 1 8 1 Some college 33 32 34 35 Bachelor's 53 53 57 43 Married or living as married 76 79 54 69 Single/never married 76 79 54 69 Widowed/separated/diforced 19 17 32 24 Currently working shift/irregular hours, yes 15 15 14 10 Total years worked shifts 8 9 7 7 24 22 24 Currently working shift/irregular hours, yes 8 9 7 7 7 2 4 69 7 7 7 2 4 69 1 <th< th=""><th></th><th>All</th><th>White</th><th>Black</th><th>Hispanic</th></th<>		All	White	Black	Hispanic
Age, years	Sample size, N (%)	39,071	34,062 (87)	3,167 (8)	1,842 (5)
Educational attainment	Sociodemographic characteristics				
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Diet (daily glycemic load) 84.9 + 39.1 83.7 + 36.8 94.3 ± 90.7 + 48.7					
	DIET (daily glycemic load)	84.9 ± 39.1	83.7 ± 36.8		90.7 ± 48.7

Physical activity	51.6 ± 31.4	52.1 ± 31.5	46.3 ±	50.6 ± 31.2
(Metabolic Equivalent of Task hours)	31.0 ± 31.4	32.1 ± 31.3	29.9	30.0 ± 31.2
Clinical characteristics				
Mean Waist-to-hip ratio	0.80 ± 0.08	0.80 ± 0.08	0.82 ± 0.08	0.82 ± 0.07
Waist Circumference (cm) over NHLBI guidelines (yes)	36	35	55	38
Mean BMI (kg/m²)	27.2 ± 5.8	26.9 ± 5.7	30.5 ± 6.6	27.6 ± 5.5
Menopause, yes	62	63	53	54
Hypertension, yes	37	36	55	35
Clinical depression, yes	19	20	14	22

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index. Significant hazard ratios are bolded.

Incident T2DM rate per 1000 person-years by race/ethnicity: White 4.7, Black 11.7, Hispanic/Latina 10.1.

The following variables had missing data: diet (daily glycemic load), *N* = 825, 2% [white, n=505, 2%; black, n=229, 7%; Hispanic/Latina, n=91, 5%). All other variables with missing values were ≤1% of the total sample.

Waist circumference measurements >88 cm for females was defined as exceeding guidelines per the National Heart, Lung and Blood Institute (NHLBI).

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Supplementary Table 2. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, stratified by status of shift work/irregular work hours.

	Mod	del I	Мос	del II	Mod	lel III	Mod	el IV
	HR (95	5% CIs)	HR (95	5% CIs)	HR (95	5% CIs)	HR (95	% Cls)
Shift work / Irregular work hours (Yes/No)	Yes	No	Yes	No	Yes	No	Yes	No
Sleep duration *								
Short Sleep ^a vs. Recommended (reference)	1.55 (1.19-2.02)	1.31 (1.18-1.46)	1.36 (1.04-1.78)	1.10 (0.99-1.23)	1.39 (1.06-1.82)	1.07 (0.96-1.20)	1.27 (0.96-1.67)	0.99 (0.89-1.11)
Time to fall asleep								
>30 minutes vs. ≤30 minutes (reference)	1.22 (0.88-1.68)	1.40 (1.24-1.58)	1.11 (0.81-1.53)	1.19 (1.05-1.34)	1.03 (0.74-1.44)	1.16 (1.02-1.31)	0.98 (0.70-1.36)	1.10 (0.97-1.25)
Frequent night awakenings								
Yes † vs. No (reference)	1.51 (1.08-2.10)	1.18 (1.03-1.36)	1.48 (1.06-2.06)	1.14 (0.99-1.32)	1.47 (1.05-2.06)	1.13 (0.98-1.31)	1.32 (0.94-1.86)	1.06 (0.92-1.22)
Napping Frequency								
≥3 times/week vs. <3 times/week (reference)	1.79 (1.25-2.57)	1.63 (1.41-1.88)	1.61 (1.12-2.31)	1.49 (1.29-1.72)	1.44 (0.99-2.09)	1.35 (1.17-1.57)	1.31 (0.90-1.91)	1.18 (1.01-1.37)
Cumulative sleep score ‡								
1 vs. 0 (reference)	1.37 (1.03-1.83)	1.25 (1.11-1.40)	1.25 (0.94-2.32)	1.12 (1.00-1.26)	1.26 (0.94-1.69)	1.07 (0.95-1.20)	1.13 (0.84-1.52)	1.02 (0.91-1.15)
2 to 4 vs. 0 (reference)	1.93 (1.39-2.69)	1.69 (1.48-1.93)	1.67 (1.19-2.33)	1.36 (1.19-1.56)	1.58 (1.12-2.22)	1.27 (1.11-1.46)	1.41 (1.00-1.99)	1.11 (0.97-1.27)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded. * Long sleep duration (>9 h) is not reported (*N* = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m²) measured at baseline

Supplementary Table 3. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for body mass index.

Sleep duration Short Sleep * vs. Sleep		Model I	Model II	Model III	Model IV
Short Sleep * vs. Recommended (reference) Underweight/Normal 1.63 (1.21-2.20) 1.41 (1.03-1.91) 1.34 (0.98-1.83) 1.43 (1.05-1.96) Overweight 1.15 (0.95-1.39) 0.99 (0.82-1.21) 1.00 (0.82-1.22) 1.02 (0.83-1.24) Obese 1.11 (0.97-1.25) 1.03 (0.90-1.17) 1.00 (0.88-1.15) 1.01 (0.89-1.16) Time to Fall Asleep >30 minutes vs. ≤30 minutes (reference) sminutes (reference) 1.00 (0.82-1.21) 1.00 (0.88-1.15) 1.01 (0.89-1.16) Overweight (Normal Obese 2.31 (1.69-3.17) 1.96 (1.42-2.71) 1.88 (1.35-2.62) 1.84 (1.32-2.56) Overweight (Normal Obese 1.01 (0.87-1.17) 0.97 (0.83-1.13) 0.93 (0.80-1.09) 0.94 (0.80-1.10) Frequent night awakenings Yes † vs. No (reference) 1.30 (0.88-1.92) 1.31 (0.89-1.94) 1.34 (0.91-1.99) 1.33 (0.90-1.98) Overweight (Normal Obese 1.06 (0.90-1.25) 1.04 (0.88-1.23) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1.58) 1.24 (0.97-1	Body Mass Index (kg/m²)	HR (95% Cls)	HR (95% Cls)	HR (95% Cls)	HR (95% Cls)
Name	Sleep duration				
Underweight/Normal					
Overweight Obese 1.15 (0.95-1.39) 0.99 (0.82-1.21) 1.00 (0.82-1.22) 1.02 (0.83-1.24) Obese 1.11 (0.97-1.25) 1.03 (0.90-1.17) 1.00 (0.88-1.15) 1.01 (0.89-1.16) Time to Fall Asleep >30 minutes vs. ≤30 minutes (reference) state (1.42-2.71) 1.88 (1.35-2.62) 1.84 (1.32-2.56) Underweight/Normal Obese 1.29 (1.05-1.60) 1.14 (0.92-1.41) 1.14 (0.92-1.42) 1.12 (0.90-1.39) Obese 1.01 (0.87-1.17) 0.97 (0.83-1.13) 0.93 (0.80-1.09) 0.94 (0.80-1.10) Frequent night awakenings Yes † vs. No (reference) Underweight/Normal 1.30 (0.88-1.92) 1.31 (0.89-1.94) 1.34 (0.91-1.99) 1.33 (0.90-1.98) Overweight 1.22 (0.96-1.54) 1.20 (0.94-1.53) 1.24 (0.97-1.58) 1.24 (0.97-1.59) Obese 1.06 (0.90-1.25) 1.04 (0.88-1.23) 1.02 (0.86-1.21) 1.02 (0.86-1.21) Napping Frequency ≥3 times/week vs. <3	•				
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2 to 4 vs. 0 (reference) 2.72 (1.91-3.87) 2.21 (1.53-3.18) 2.11 (1.46-3.05) 2.19 (1.51-3.16) Overweight 1 vs. 0 (reference) 1.33 (1.09-1.61) 1.20 (0.99-1.46) 1.18 (0.97-1.45) 1.21 (0.99-1.47) 2 to 4 vs. 0 (reference) 1.42 (1.12-1.80) 1.20 (0.94-1.53) 1.20 (0.94-1.53) 1.19 (0.93-1.52) Obese 1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	Underweight/Normal				
Overweight 1 vs. 0 (reference) 1.33 (1.09-1.61) 1.20 (0.99-1.46) 1.18 (0.97-1.45) 1.21 (0.99-1.47) 2 to 4 vs. 0 (reference) 1.42 (1.12-1.80) 1.20 (0.94-1.53) 1.20 (0.94-1.53) 1.19 (0.93-1.52) Obese 1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	1 vs. 0 (reference)	1.46 (1.05-2.03)	1.32 (0.95-1.85)	1.28 (0.92-1.80)	1.32 (0.94-1.85)
1 vs. 0 (reference) 1.33 (1.09-1.61) 1.20 (0.99-1.46) 1.18 (0.97-1.45) 1.21 (0.99-1.47) 2 to 4 vs. 0 (reference) 1.42 (1.12-1.80) 1.20 (0.94-1.53) 1.20 (0.94-1.53) 1.19 (0.93-1.52) Obese 1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	2 to 4 vs. 0 (reference)	2.72 (1.91-3.87)	2.21 (1.53-3.18)	2.11 (1.46-3.05)	2.19 (1.51-3.16)
2 to 4 vs. 0 (reference) 1.42 (1.12-1.80) 1.20 (0.94-1.53) 1.20 (0.94-1.53) 1.19 (0.93-1.52) Obese 1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	Overweight				
Obese 1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	1 vs. 0 (reference)	1.33 (1.09-1.61)	1.20 (0.99-1.46)	1.18 (0.97-1.45)	1.21 (0.99-1.47)
1 vs. 0 (reference) 0.97 (0.85-1.11) 0.93 (0.81-1.07) 0.89 (0.77-1.02) 0.91 (0.79-1.05)	2 to 4 vs. 0 (reference)	1.42 (1.12-1.80)	1.20 (0.94-1.53)	1.20 (0.94-1.53)	1.19 (0.93-1.52)
	Obese				
2 to 4 vs. 0 (reference) 1.19 (1.02-1.39) 1.12 (0.94-1.30) 1.03 (0.88-1.21) 1.03 (0.87-1.21)	1 vs. 0 (reference)	0.97 (0.85-1.11)	0.93 (0.81-1.07)	0.89 (0.77-1.02)	0.91 (0.79-1.05)
	2 to 4 vs. 0 (reference)	1.19 (1.02-1.39)	1.12 (0.94-1.30)	1.03 (0.88-1.21)	1.03 (0.87-1.21)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4" Model I - adjusted for age (years) at baseline

upplementary mater	ial	BMJ Open Diab Res Care
	Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m2) measured at baseline	

Supplementary Table 4. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for age category.

	Model II	Model III	Model IV
Age Category	HR (95% Cls)	HR (95% Cls)	HR (95% Cls)
Sleep duration			
Short Sleep * vs. Recommended (reference)			
35-44	1.49 (1.08-2.06)	1.44 (1.03-2.00)	1.30 (0.93-1.81)
45-54	1.20 (1.02-1.41)	1.17 (0.99-1.38)	1.06 (0.89-1.25)
55-64	1.06 (0.90-1.26)	1.00 (0.84-1.19)	0.92 (0.77-1.09)
65+	1.14 (0.87-1.48)	1.13 (0.87-1.48)	1.13 (0.86-1.48)
Time to Fall Asleep			
>30 minutes vs. ≤30 minutes (reference)			
35-44	0.97 (0.64-1.45)	0.92 (0.61-1.40)	0.82 (0.54-1.25)
45-54	1.26 (1.04-1.52)	1.17 (0.96-1.42)	1.11 (0.91-1.34)
55-64	1.07 (0.88-1.30)	1.05 (0.86-1.28)	0.97 (0.80-1.18)
65+	1.48 (1.12-1.95)	1.43 (1.08-1.89)	1.43 (1.08-1.90)
Frequent night awakenings			
Yes † vs. No (reference)			
35-44	1.17 (0.72-1.90)	1.15 (0.69-1.90)	1.03 (0.62-1.71)
45-54	1.41 (1.15-1.73)	1.37 (1.11-1.68)	1.20 (0.98-1.48)
55-64	0.96 (0.77-1.20)	0.97 (0.78-1.21)	0.94 (0.75-1.18)
65+	1.29 (0.95-1.76)	1.29 (0.95-1.77)	1.25 (0.92-1.71)
Napping Frequency			
≥3 times/week vs. <3 times/week (reference)			
35-44	2.06 (1.33-3.19)	1.71 (1.08-2.73)	1.50 (0.94-2.42)
45-54	1.62 (1.29-2.04)	1.45 (1.14-1.83)	1.20 (0.94-1.53)
55-64	1.46 (1.16-1.82)	1.34 (1.06-1.69)	1.12 (0.89-1.41)
65+	1.28 (0.95-1.72)	1.25 (0.93-1.68)	1.14 (0.84-1.54)
Cumulative sleep score ‡ 35-44			
1 vs. 0 (reference)	1.36 (0.97-1.92)	1.32 (0.93-1.88)	1.16 (0.81-1.66)
2 to 4 vs. 0 (reference)	1.62 (1.07-2.47)	1.42 (0.91-2.21)	1.22 (0.78-1.90)
45-54	, ,	,	,
1 vs. 0 (reference)	1.15 (0.96-1.38)	1.11 (0.92-1.33)	1.04 (0.86-1.25)
2 to 4 vs. 0 (reference)	1.60 (1.31-1.96)	1.46 (1.18-1.79)	1.20 (0.98-1.48)
55-64			
1 vs. 0 (reference)	1.12 (0.95-1.34)	1.05 (0.88-1.26)	0.98 (0.82-1.16)
2 to 4 vs. 0 (reference)	1.17 (0.94-1.44)	1.10 (0.87-1.36)	0.94 (0.76-1.16)
65+			
1 vs. 0 (reference)	1.07 (0.81-1.42)	1.04 (0.79-1.38)	1.02 (0.77-1.36)
2 to 4 vs. 0 (reference)	1.61 (1.19-2.17)	1.58 (1.17-2.13)	1.50 (1.11-2.03)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

^{*} Long sleep duration (>9 h) is not reported (N = 356).

- † Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.
- ‡ Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"
- Model II further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)
- Model III further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)
- Model IV further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m2) measured at baseline

Supplementary Table 5. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for sleep medication use.

	Mod	del I	Мос	del II	Mod	lel III	Mod	lel IV
	HR (95	5% CIs)	HR (95% CIs)		HR (95% Cls)		HR (95% CIs)	
Sleep Medication Use (Yes/No)	Yes	No	Yes	No	Yes	No	Yes	No
Sleep duration *								
Short Sleep vs. Recommended (reference)	1.14 (0.85-1.51)	1.37 (1.23-1.52)	1.04 (0.77-1.39)	1.15 (1.03-1.28)	1.02 (0.76-1.38)	1.12 (1.01-1.26)	0.99 (0.73-1.34)	1.03 (0.92-1.15)
Time to fall asleep								
>30 minutes vs. ≤30 minutes (reference)	1.44 (1.09-1.90)	1.33 (1.17-1.51)	1.34 (1.01-1.77)	1.13 (0.99-1.28)	1.31 (0.99-1.74)	1.09 (0.96-1.25)	1.25 (0.94-1.66)	1.03 (0.91-1.18)
Frequent night awakenings								
Yes † vs. No (reference)	0.89 (0.62-1.28)	1.27 (1.11-1.46)	0.87 (0.61-1.25)	1.24 (1.08-1.42)	0.89 (0.62-1.27)	1.23 (1.07-1.41)	0.88 (0.61-1.27)	1.12 (0.97-1.29)
Napping Frequency								
≥3 times/week vs. <3 times/week (reference)	1.55 (1.07-2.24)	1.66 (1.43-1.91)	1.49 (1.03-2.15)	1.50 (1.30-1.73)	1.39 (0.95-2.02)	1.35 (1.17-1.57)	1.27 (0.87-1.86)	1.19 (1.02-1.38)
Cumulative sleep score ‡								
1 vs. 0 (reference)	1.28 (0.93-1.75)	1.26 (1.12-1.41)	1.22 (0.89-1.67)	1.12 (1.00-1.25)	1.24 (0.87-1.75)	1.07 (0.95-1.20)	1.17 (0.85-1.61)	1.01 (0.90-1.14)
2 to 4 vs. 0 (reference)	1.41 (1.01-1.98)	1.75 (1.54-2.00)	1.27 (0.90-1.79)	1.41 (1.23-1.61)	1.24 (0.91-1.71)	1.32 (1.15-1.51)	1.13 (0.80-1.61)	1.13 (0.99-1.30)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m²) measured at baseline

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Supplementary Table 6. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for type 2 diabetes incidence starting one year after baseline.

	Мо	del I	Mod	Model II Mode		del III	Model IV	
	HR (95	5% CIs)	HR (95	5% CIs)	HR (9	5% CIs)	HR (95	5% CIs)
Incidence Starting at One Year from Baseline (Yes/No)	1 year	Baseline						
Sleep duration * Short Sleep vs. Recommended (reference)	1.36 (1.23-1.51)	1.34 (1.21-1.48)	1.15 (1.03-1.28)	1.13 (1.02-1.26)	1.13 (1.01-1.26)	1.11 (1.00-1.23)	1.03 (0.93-1.15)	1.03 (0.92-1.14)
Time to fall asleep >30 minutes vs. ≤30 minutes (reference)	1.34 (1.19-1.51)	1.36 (1.21-1.53)	1.16 (1.02-1.31)	1.18 (1.05-1.32)	1.14 (1.00-1.29)	1.14 (1.01-1.28)	1.07 (0.94-1.21)	1.08 (0.96-1.22)
Frequent night awakenings Yes † vs. No (reference)	1.22 (1.07-1.39)	1.22 (1.07-1.39)	1.18 (1.03-1.35)	1.19 (1.04-1.35)	1.17 (1.02-1.34)	1.18 (1.03-1.34)	1.07 (0.93-1.23)	1.09 (0.95-1.24)
Napping Frequency ≥3 times/week vs. <3 times/week (reference)	1.60 (1.39-1.85)	1.64 (1.44-1.88)	1.46 (1.27-1.69)	1.50 (1.31-1.72)	1.34 (1.15-1.55)	1.36 (1.19-1.57)	1.16 (1.00-1.35)	1.20 (1.04-1.37)
Cumulative sleep score ‡								
1 vs. 0 (reference)	1.27 (1.14-1.42)	1.26 (1.13-1.40)	1.14 (1.02-1.28)	1.14 (1.02-1.27)	1.10 (0.98-1.23)	1.09 (0.98-1.22)	1.03 (0.92-1.16)	1.04 (0.93-1.15)
2 to 4 vs. 0 (reference)	1.70 (1.50-1.93)	1.71 (1.51-1.93)	1.38 (1.21-1.58)	1.40 (1.23-1.58)	1.31 (1.14-1.50)	1.31 (1.15-1.49)	1.12 (0.98-1.29)	1.14 (1.00-1.30)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m2) measured at baseline

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Supplementary Table 7. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for baseline menopausal status.

	Мос	del I	Мос	del II	Mod	lel III	Mod	lel IV
	HR (95	5% CIs)						
Menopausal status	Post	Pre	Post	Pre	Post	Pre	Post	Pre
Sleep duration * Short Sleep vs. Recommended (reference)	1.22 (1.08-1.38)	1.59 (1.34-1.89)	1.07 (0.94-1.21)	1.27 (1.07-1.52)	1.06 (0.93-1.20)	1.22 (1.01-1.46)	0.98 (0.86-1.11)	1.11 (0.93-1.34)
Time to fall asleep >30 minutes vs. ≤30 minutes (reference)	1.32 (1.15-1.51)	1.44 (1.17-1.77)	1.18 (1.02-1.35)	1.16 (0.94-1.44)	1.16 (1.01-1.34)	1.08 (0.86-1.34)	1.09 (0.95-1.26)	1.04 (0.84-1.30)
Frequent night awakenings Yes † vs. No (reference) Napping Frequency	1.13 (0.97-1.32)	1.43 (1.13-1.81)	1.12 (0.96-1.31)	1.32 (1.04-1.68)	1.12 (0.96-1.31)	1.30 (1.02-1.66)	1.04 (0.89-1.22)	1.20 (0.94-1.53)
≥3 times/week vs. <3 times/week (reference)	1.54 (1.32-1.81)	1.88 (1.47-2.40)	1.44 (1.22-1.68)	1.60 (1.25-2.05)	1.32 (1.12-1.56)	1.43 (1.10-1.84)	1.16 (0.98-1.36)	1.23 (0.95-1.60)
Cumulative sleep score ‡								
1 vs. 0 (reference)	1.18 (1.03-1.34)	1.45 (1.21-1.74)	1.09 (0.96-1.24)	1.22 (1.01-1.47)	1.03 (0.91-1.18)	1.22 (0.99-1.46)	0.98 (0.86-1.13)	1.13 (0.93-1.37)
2 to 4 vs. 0 (reference)	1.52 (1.32-1.77)	2.12 (1.71-2.64)	1.30 (1.12-1.51)	1.61 (1.29-2.01)	1.24 (1.07-1.45)	1.43 (1.14-1.81)	1.10 (0.94-1.28)	1.25 (0.99-1.58)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m2) measured at baseline

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Supplementary Table 8. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep, with a sensitivity analysis for baseline clinical depression.

	Mod	del I	Mod	del II	Mod	lel III	Mod	lel IV
	HR (95	5% CIs)						
Depression Status	Yes	No	Yes	No	Yes	No	Yes	No
Sleep duration *								
Short Sleep vs. Recommended (reference)	1.18 (0.96-1.46)	1.40 (1.25-1.56)	1.00 (0.80-1.24)	1.18 (1.05-1.32)	0.97 (0.78-1.21)	1.16 (1.03-1.30)	0.91 (0.73-1.14)	1.06 (0.94-1.19)
Time to fall asleep								
>30 minutes vs. ≤30 minutes (reference)	1.32 (1.07-1.63)	1.31 (1.15-1.51)	1.19 (0.96-1.48)	1.12 (0.97-1.29)	1.12 (0.90-1.40)	1.12 (0.97-1.28)	1.13 (0.90-1.41)	1.05 (0.91-1.21)
Frequent night awakenings								
Yes † vs. No (reference)	1.00 (0.77-1.30)	1.28 (1.10-1.48)	0.93 (0.71-1.21)	1.26 (1.09-1.46)	0.95 (0.73-1.25)	1.25 (1.07-1.45)	0.89 (0.68-1.16)	1.15 (0.99-1.34)
Napping Frequency								
≥3 times/week vs. <3 times/week (reference)	1.54 (1.20-1.96)	1.62 (1.38-1.90)	1.47 (1.15-1.88)	1.45 (1.24-1.71)	1.32 (1.02-1.71)	1.34 (1.14-1.58)	1.21 (0.93-1.56)	1.20 (1.01-1.41)
Cumulative sleep score ‡								
1 vs. 0 (reference)	1.26 (1.01-1.56)	1.25 (1.10-1.41)	1.14 (0.91-1.42)	1.12 (0.99-1.26)	1.12 (0.89-1.40)	1.07 (0.94-1.22)	1.08 (0.86-1.35)	1.01 (0.89-1.14)
2 to 4 vs. 0 (reference)	1.43 (1.12-1.83)	1.76 (1.53-2.21)	1.20 (0.93-1.54)	1.42 (1.23-1.64)	1.10 (0.85-1.42)	1.37 (1.18-1.58)	1.01 (0.78-1.31)	1.19 (1.02-1.38)

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m2) measured at baseline

^{*} Long sleep duration (>9 h) is not reported (N = 356).

[†] Frequent night awakenings was classified as "No" if participant reported waking up while sleeping less than 3 times per week and "Yes" if participant reported waking up while sleeping more than 3 times per night/day for more than 3 nights/days per week.

[‡] Cumulative sleep score was calculated by summing each participant's "yes" response for each sleep characteristic. Scores range from 0 to 4, with poor sleep characteristics being combined into the category "2 to 4"

Supplemental Table 9. Hazard ratios (95% CI) for type 2 diabetes risk among 39,071 adult women in the Sister Study, with women with poor sleep compared to women with recommended sleep.

	_	Model I	Model II	Model III	Model IV	Model V
	n	HR (95% Cls)	HR (95% Cls)	HR (95% CIs)	HR (95% CIs)	HR (95% CIs)
Napping Frequency						
≥3 times/week vs. <3 times/week (reference)	3,681 35,390	1.65 (1.45-1.89)	1.50 (1.32-1.72)	1.36 (1.18-1.56)	1.19 (1.04-1.37)	1.30 (1.13-1.49)
Napping Frequency						
≥3 times per week	3,681	1.94 (1.67-2.26)	1.80 (1.55-2.10)	1.62 (1.38-1.89)	1.33 (1.14-1.56)	1.53 (1.30-1.79)
≥once per month and <3 times per week	13,624	1.41 (1.25-1.58)	1.43 (1.27-1.61)	1.38 (1.22-1.55)	1.20 (1.07-1.36)	1.35 (1.20-1.52)
< once per month	8,540	1.09 (0.95-1.25)	1.16 (1.01-1.33)	1.18 (1.02-1.36)	1.12 (0.97-1.29)	1.17 (1.01-1.34)
Never (reference)	13,226	,	•		,	

HR = hazard ratio, CI = confidence interval, HS=high school, GED=general education diploma, BMI=body mass index, MET=metabolic equivalent of task. Significant hazard ratios are bolded.

Model I - adjusted for age (years) at baseline

Model II - further adjusted for race/ethnicity, educational attainment (<HS, HS/GED, some college, ≥bachelor's degree), marital status, and status of shift work/irregular hours (yes/no)

Model III - further adjusted for smoking status (current, past, never), alcohol consumption (current, past, never), diet (daily glycemic load), and physical activity (MET hours)

Model IV - further adjusted for hypertension, waist-to-hip ratio (WHR), and BMI (kg/m²) measured at baseline

Model V - without WHR and BMI

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