SUPPLEMENTARY DATA

Supplementary Table 1. Study design, numbers of participants with average sleep duration and change in sleep duration information, numbers eligible and numbers of outcomes

Exposure and outcomes	**Cycle 1***	**Cycle 2**	**Cycle 3**	**Cycle 4**	**Total†**
Exposure period	1985-8 to 1991-4	1991-4 to 1997-9	1997-9 to 2002-4	2002-4 to 2007-9	
All participants	8815	7870	6968	6761	30414
Average sleep duration and change in sleep duration information available	8262	6760	6151	6054	27227
As above, but excluding those with missing values in covariates	7824	5168	4719	5533	23244
Outcome follow-up period	1991-4 to 1997-9	1997-9 to 2002-4	2002-4 to 2007-9	2007-9 to 2012-13	
Diabetes outcomes					
Using fasting glucose definition:-					
Non diabetics at beginning of period	5613	4193	3840	4195	17841
Incident Type 2 diabetes during period, N (%)	137 (2.4)	149 (3.6)	163 (4.2)	125 (3.0)	574
Using OGTT definition:-					
Non diabetics at beginning of period	5545	4117	3773	-	13435
Incident Type 2 diabetes during period, N (%)	188 (3.4)	176 (4.3)	223 (5.9)		587
Using HbA1c definition:-					
Non diabetics at beginning of period	-	-	3941	4240	8181
Incident Type 2 diabetes during period, N (%)			247 (6.3)	154 (3.6)	401
Using all glycemic data‡ definition:-					
Non diabetics at beginning of period	5545	4117	3878	4238	17778
Incident Type 2 diabetes during period, N (%)	188 (3.4)	176 (4.3)	290 (7.5)	162 (3.8)	816

* Cycle 1 – average sleep duration and change in sleep duration over the exposure period, years 1985/8 to 1991/4, and incident diabetes over the outcome follow-up period, 1991/4 to 1997/9

† Total person-observations and numbers of incident cases of type 2 diabetes across all available cycles.

‡ Uses OGTT criteria for cycles 1 and 2, combined OGTT and HbA1c definitions for cycle 3 and combined fasting glucose and HbA1c definitions for cycle 4

SUPPLEMENTARY DATA

Supplementary Table 2. Association between average sleep duration and change in sleep duration and subsequent incident diabetes, defined using fasting glucose, using four data cycles[*]

Sleep duration			Adjustments			
			Age, sex	Age, sex, ethnic group	Age, sex, ethnic group, employment grade	Age, sex, ethnic group, employment grade and BMI at the beginning and end of each exposure period
	No. events	N[†]				
	(n=574)	(N=17841)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Average sleep duration among those with no change in sleep duration						
≤ 5.5 hours	65	1299	1.82 (1.34, 2.47)	1.60 (1.17, 2.18)	1.52 (1.11, 2.07)	1.38 (1.00, 1.89)
6.0 - 6.5 hours	179	5985	1.10 (0.87, 1.38)	1.07 (0.85, 1.34)	1.05 (0.83, 1.32)	0.96 (0.76, 1.21)
7 hours	130	4893	1.00 (ref[‡])	1.00 (ref[‡])	1.00 (ref[‡])	1.00 (ref[‡])
7.5 - 8.0 hours	132	4201	1.16 (0.91, 1.48)	1.13 (0.88, 1.45)	1.13 (0.88, 1.44)	1.13 (0.88, 1.45)
≥ 8.5 hours	16	362	1.58 (0.93, 2.69)	1.41 (0.83, 2.41)	1.43 (0.84, 2.44)	1.29 (0.75, 2.22)
P-value for quadratic model			0.006	0.050	0.097	0.27
Change in sleep duration						
≥2 hours decrease in sleep	26	537	1.70 (1.10, 2.64)	1.44 (0.92, 2.23)	1.42 (0.91, 2.20)	1.31 (0.83, 2.06)
≥2 hours increase in sleep	26	564	1.87 (1.21, 2.88)	1.73 (1.12, 2.67)	1.69 (1.09, 2.62)	1.51 (0.97, 2.37)

[*] 6473 participants contributed to these analyses with 24%, 21%, 10% and 45% having 1, 2, 3 and 4 cycles of data respectively

[†] Number of person-observations

[‡] Odds ratios compared to those who had 7 hours sleep on both occasions

SUPPLEMENTARY DATA

Supplementary Table 3. Association between average sleep duration and change in sleep duration and subsequent incident diabetes, defined using the OGTT criteria, using three data cycles*

Sleep duration			Adjustments			
			Age, sex	Age, sex, ethnic group	Age, sex, ethnic group, employment grade	Age, sex, ethnic group, employment grade and BMI at the beginning and end of each exposure period
	No. events	N†				
	(n=587)	(N=13435)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Average sleep duration among those with no change in sleep duration						
≤ 5.5 hours	62	897	1.51 (1.11, 2.05)	1.35 (0.99, 1.84)	1.28 (0.94, 1.75)	1.21 (0.88, 1.65)
6.0 - 6.5 hours	166	4418	0.84 (0.67, 1.05)	0.82 (0.66, 1.03)	0.80 (0.64, 1.01)	0.75 (0.60, 0.94)
7 hours	159	3736	1.00 (ref‡)	1.00 (ref‡)	1.00 (ref‡)	1.00 (ref‡)
7.5 - 8.0 hours	135	3239	0.95 (0.75, 1.20)	0.93 (0.74, 1.18)	0.93 (0.73, 1.18)	0.93 (0.73, 1.18)
≥ 8.5 hours	14	260	1.16 (0.66, 2.05)	1.08 (0.61, 1.90)	1.08 (0.61, 1.91)	0.99 (0.56, 1.76)
P-value for quadratic model			0.027	0.12	0.21	0.43
Change in sleep duration						
≥2 hours decrease in sleep	22	464	1.08 (0.68, 1.72)	0.95 (0.59, 1.51)	0.93 (0.58, 1.48)	0.86 (0.54, 1.38)
≥2 hours increase in sleep	29	421	1.68 (1.11, 2.54)	1.58 (1.04, 2.39)	1.54 (1.01, 2.34)	1.43 (0.94, 2.19)

* 5996 participants contributed to these analyses with 31%, 13% and 56% having 1, 2 and 3 cycles of data respectively

‡ Number of person-observations

‡ Odds ratios compared to those who had 7 hours sleep on both occasions

SUPPLEMENTARY DATA

Supplementary Table 4. Association between average sleep duration and change in sleep duration and subsequent incident diabetes, defined using $HbA1_c$, using two data cycles[*]

Sleep duration			Adjustments			
			Age, sex	Age, sex, ethnic group	Age, sex, ethnic group, employment grade	Age, sex, ethnic group, employment grade and BMI at the beginning and end of each exposure period
	No. events	N[†]				
	(n=401)	(N=8181)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Average sleep duration among those with no change in sleep duration						
≤ 5.5 hours	47	764	1.80 (1.24, 2.62)	1.58 (1.08, 2.32)	1.51 (1.03, 2.21)	1.36 (0.92, 2.00)
6.0 - 6.5 hours	150	3024	1.41 (1.07, 1.87)	1.36 (1.03, 1.81)	1.35 (1.01, 1.78)	1.28 (0.96, 1.71)
7 hours	78	2157	1.00 (ref[‡])	1.00 (ref[‡])	1.00 (ref[‡])	1.00 (ref[‡])
7.5 - 8.0 hours	88	1685	1.42 (1.04, 1.95)	1.39 (1.02, 1.91)	1.40 (1.02, 1.92)	1.42 (1.03, 1.96)
≥ 8.5 hours	10	176	1.53 (0.78, 3.02)	1.38 (0.69, 2.74)	1.40 (0.71, 2.79)	1.35 (0.68, 2.70)
P-value for quadratic model			0.058	0.22	0.33	0.68
Change in sleep duration						
≥2 hours decrease in sleep	12	152	2.18 (1.16, 4.12)	1.87 (0.98, 3.56)	1.87 (0.98, 3.56)	1.81 (0.93, 3.53)
≥2 hours increase in sleep	16	223	2.24 (1.28, 3.92)	1.99 (1.13, 3.53)	1.95 (1.11, 3.46)	1.76 (0.99, 3.15)

[*] 4923 participants contributed to these analyses with 34% and 66% having 1 and 2 cycles of data respectively

[†] Number of person-observations

[‡] Odds ratios compared to those who had 7 hours sleep on both occasions

SUPPLEMENTARY DATA

Supplementary Table 5. Age and sex adjusted associations between average sleep duration and change in sleep duration and subsequent incident diabetes among all participants, including those with missing data on the other covariates controlled for in the main analyses

Sleep duration	**Definition of incident diabetes**			
	Participant report of doctor-diagnosed diabetes or diabetes defined using all glycemic data[*]	Participant report of doctor-diagnosed diabetes or high fasting glucose	Participant report of doctor-diagnosed diabetes or high 2-hour postload glucose	Participant report of doctor-diagnosed diabetes or high HbA1c
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
No. incident diabetes events	921	638	676	458
Number of person-observations	19434	19513	14984	9114
Average sleep duration among those with no change in sleep duration				
≤ 5.5 hours	1.52 (1.19, 1.95)	1.80 (1.34, 2.42)	1.47 (1.10, 1.96)	1.61 (1.13, 2.29)
6.0 - 6.5 hours	0.99 (0.83, 1.19)	1.10 (0.88, 1.37)	0.87 (0.70, 1.07)	1.33 (1.03, 1.73)
7 hours	1.00 (ref[†])	1.00 (ref[†])	1.00 (ref[†])	1.00 (ref[†])
7.5 - 8.0 hours	1.01 (0.83, 1.23)	1.23 (0.97, 1.55)	0.98 (0.79, 1.23)	1.37 (1.03, 1.83)
≥ 8.5 hours	1.29 (0.83, 1.99)	1.59 (0.96, 2.64)	1.37 (0.84, 2.24)	1.48 (0.80, 2.76)
P-value for quadratic model	0.002	0.005	0.017	0.14
Change in sleep duration				
≥2 hours decrease in sleep	1.52 (1.07, 2.18)	1.73 (1.15, 2.60)	1.25 (0.83, 1.88)	1.94 (1.06, 3.56)
≥2 hours increase in sleep	1.74 (1.24, 2.45)	1.84 (1.21, 2.79)	1.47 (1.10, 1.96)	1.89 (1.11, 3.23)

[*] Odds ratios compared to those who had no change in sleep duration and had an average 7 hours sleep

[†] Uses OGTT criteria for cycles 1 and 2, combined OGTT and HbA1c definitions for cycle 3 and combined fasting glucose and HbA1c definitions for cycle 4