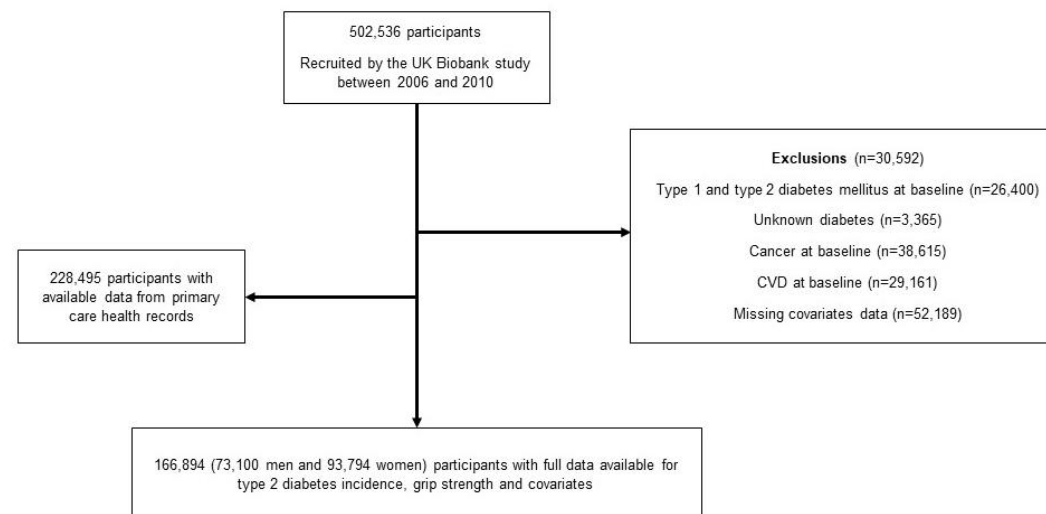


Online-Only Supplemental Material



Supplementary Figure S1. Flowchart of participants throughout the study.

Supplementary Table S1. Cut-off point for absolute and relative grip strength quintiles.

		Absolute grip strength (kg)				
Sex	Age group	Low	Middle/Low	Middle	High/Middle	Highest
Women	<56 years	<20.5	20.5 - 24	24.5 - 27	27.5 - 30.5	>30.5
	56 to 65 years	<18	18 - 21	21.5 - 24	24.5 - 27	>27.5
	>65 years	<16.5	16.5 - 19	19.5 - 22	22.5 - 25	>25
Men	<56 years	<35	35.5 - 40	40.5 - 44	44.5 - 49	>49
	56 to 65 years	<32	32 - 36.5	37 - 40.5	41 - 45	>45
	>65 years	<29	29 - 34	34.5 - 38	38.5 - 42	>42.5
		Relative grip strength (kg/kg)				
Women	<56 years	<0.275	0.276 - 0.337	0.338 - 0.391	0.392 - 0.456	>0.456
	56 to 65 years	<0.238	0.238 - 0.293	0.294 - 0.341	0.342 - 0.399	>0.399
	>65 years	<0.219	0.219 - 0.272	0.273 - 0.317	0.318 - 0.370	>0.370
Men	<56 years	>0.395	0.395 - 0.463	0.464 - 0.521	0.522 - 0.588	>0.588
	56 to 65 years	>0.364	0.364 - 0.428	0.429 - 0.483	0.484 - 0.547	>0.547
	>65 years	>0.343	0.343 - 0.404	0.405 - 0.457	0.458 - 0.519	>0.519

Data presented as kg for absolute grip strength and as kg by kg of body weight for relative grip strength.

Supplementary Table S2. Cohort characteristics by quintiles of grip strength in women.

Characteristics	Grip strength quintiles					
	Overall	High	High/Middle	Middle	Middle/Low	Low
Women, n (%)	93,794	19,313	16,440	18,320	22,176	17,545
Age (mean, SD)	55.8 (8.0)	51.6 (7.5)	54.5 (7.8)	56.1 (7.8)	57.8 (7.4)	59 (7.2)
Townsend Deprivation Index, n (%)						
Lower deprivation	32,033 (34.2)	6,944 (36)	5,979 (36.4)	6,436 (35.1)	7,504 (33.8)	5,170 (29.5)
Middle deprivation	32,773 (34.9)	6,778 (35.1)	5,750 (35)	6,425 (35.1)	7,814 (35.2)	6,006 (34.2)
Higher deprivation	28,988 (30.9)	5,591 (29.0)	4,711 (28.7)	5,459 (29.8)	6,858 (30.9)	6,369 (36.3)
Ethnicity, n (%)						
Whites	89,757 (95.7)	18,593 (96.3)	15,866 (96.5)	17,636 (96.3)	21,284 (96)	16,378 (93.4)
Mixed	1,258 (1.3)	261 (1.4)	220 (1.3)	233 (1.3)	267 (1.2)	277 (1.6)
South Asians	1,450 (1.6)	98 (0.5)	130 (0.8)	201 (1.1)	353 (1.6)	668 (3.8)
Black	1,045 (1.1)	315 (1.6)	186 (1.1)	192 (1.1)	198 (0.9)	154 (0.9)
Chinese	284 (0.3)	46 (0.2)	38 (0.2)	58 (0.3)	74 (0.3)	68 (0.4)
Education, n (%)						
College or University degree	35,117 (45.1)	8,803 (49.6)	6,725 (46.9)	6,883 (44.9)	7,509 (42.4)	5,197 (40.6)
A levels/AS levels or equivalent	11,047 (14.2)	2,628 (14.8)	2,150 (15)	2,141 (14)	2,421 (13.7)	1,707 (13.3)
O levels/GCSEs or equivalent	22,361 (28.7)	4,455 (25.1)	3,837 (26.7)	4,452 (29)	5,519 (31.2)	4,098 (32)
SEs or equivalent/NVQ or HND or HNC	9,424 (12.1)	1,860 (10.5)	1,643 (11.5)	1,852 (12.1)	2,263 (12.8)	1,806 (14.1)
Smoking status, n (%)						
Never	57,048 (60.8)	11,663 (60.4)	10,025 (61)	11,149 (60.9)	13,540 (61.1)	10,671 (60.8)
Previous	28,669 (30.6)	5,809 (30.1)	4,983 (30.3)	5,638 (30.8)	6,874 (31)	5,365 (30.6)
Current	8,077 (8.6)	1,841 (9.5)	1,432 (8.7)	1,533 (8.4)	1,762 (8)	1,509 (8.6)
Diet and physical activity						
Process meat intake, portion/week (mean, SD)	1.6 (1.0)	1.6 (1.0)	1.6 (1.0)	1.6 (1.0)	1.6 (1.0)	1.6 (1.0)
Red meat intake, portion/week (mean, SD)	2 (1.4)	2 (1.4)	1.9 (1.3)	2 (1.3)	2 (1.3)	2 (1.4)
Fruit and vegetable intake, g/day (mean, SD)	348.4 (188.3)	344.5 (187.5)	348.5 (186.8)	349.7 (189.3)	348.1 (180.3)	351.5 (199.4)
Alcohol intake (mean, SD)	3.1 (1.5)	3 (1.4)	3 (1.5)	3.1 (1.5)	3.2 (1.5)	3.4 (1.6)
Total Sedentary time, h/day (mean, SD)	4.7 (2.0)	4.6 (2.0)	4.6 (1.9)	4.7 (2.0)	4.7 (2.0)	4.8 (2.1)
Total physical activity,	2,664.5	2,749.4	2,688	2,656.2	2,628.1	2,597.2

MET-hr/week (mean, SD)	(2,743)	(2,743.1)	(2,761.3)	(2,737.8)	(2,730.1)	(2,744.8)
Grip strength (kg)	23.6 (6.2)	31.9 (3)	26.9 (0.9)	23.9 (0.9)	20.5 (1.1)	14.7 (3.3)
Grip strength per body weight (kg/kg)	0.3 (0.1)	0.5 (0.1)	0.4 (0.1)	0.4 (0.1)	0.3 (0.1)	0.2 (0.1)
Sleep categories, n (%)						
Normal (7-9 h per day)	70,230 (74.9)	15,086 (78.1)	12,611 (76.7)	13,769 (75.2)	16,431 (74.1)	12,333 (70.3)
Short sleep (<7 h per day)	22,019 (23.5)	4,019 (20.8)	3,611 (22)	4,296 (23.5)	5,326 (24)	4,767 (27.2)
Long sleep (>9 h per day)	1,545 (1.7)	208 (1.1)	218 (1.3)	255 (1.4)	419 (1.9)	445 (2.5)
Adiposity						
Waist circumference, cm (mean, SD)	83.9 (11.9)	83.5 (11.9)	83 (11.6)	83.4 (11.6)	84 (11.9)	85.5 (12.4)
BMI, kg/m ² (mean, SD)	26.9 (4.9)	26.8 (5)	26.5 (4.8)	26.7 (4.8)	26.8 (4.9)	27.4 (5.2)
BMI category						
Underweight (<18.5 kg/m ²)	702 (0.8)	93 (0.5)	126 (0.8)	134 (0.7)	182 (0.8)	167 (1.0)
Normal (18.5-24.9 kg/m ²)	37,368 (39.8)	7,968 (41.3)	6,983 (42.5)	7,499 (40.9)	8,800 (39.7)	6,118 (34.9)
Overweight (25-29.9 kg/m ²)	35,145 (37.5)	7,054 (36.5)	6,140 (37.4)	6,921 (37.8)	8,319 (37.5)	6,711 (38.3)
Obese (≥ 30.0 kg/m ²)	20,579 (21.9)	4,198 (21.7)	3,191 (19.4)	3,766 (20.6)	4,875 (22)	4,549 (25.9)

Data is presented as mean and SD for continuous variables and as frequency and % for categorical variables.

BMI: body mass index, SD: standard deviation, MET: metabolic equivalent task,

Supplementary Table S3. Cohort characteristics by quintiles of grip strength in men.

Characteristics	Grip strength quintiles					
	Overall	High	High/Middle	Middle	Middle/Low	Low
Participants, n (%)	73,100	14,436	16,483	14,979	14,075	13,127
Age, years (mean, SD)	55.8 (8.2)	52.3 (7.8)	54.9 (8.0)	56.4 (8.0)	57.5 (8.0)	58.6 (7.8)
Townsend Deprivation Index , n (%)						
Lower deprivation	25,402 (34.8)	5,547 (38.4)	6,107 (37.1)	5,277 (35.2)	4,714 (33.5)	3,757 (28.6)
Middle deprivation	25,104 (34.3)	5,083 (35.2)	5,747 (34.9)	5,208 (34.8)	4,796 (34.1)	4,270 (32.5)
Higher deprivation	22,594 (30.9)	3,806 (26.4)	4,629 (28.1)	4,494 (30.0)	4,565 (32.4)	5,100 (38.9)
Ethnicity , n (%)						
Whites	69,920 (95.7)	13,982 (96.9)	15,975 (96.9)	14,429 (96.3)	13,407 (95.3)	12,127 (92.4)
Mixed	793 (1.1)	127 (0.9)	162 (1.0)	143 (1.0)	161 (1.1)	200 (1.5)
South Asians	1,500 (2.1)	103 (0.7)	173 (1.1)	259 (1.7)	342 (2.4)	623 (4.8)
Black	730 (1.0)	209 (1.5)	151 (0.9)	118 (0.8)	123 (0.9)	129 (1.0)
Chinese	157 (0.2)	15 (0.1)	22 (0.1)	30 (0.2)	42 (0.3)	48 (0.4)
Education , n (%)						
College or University degree	28,965 (47.1)	5,850 (45.1)	6,740 (47)	6,039 (48)	5,511 (48)	4,825 (47.7)
A levels/AS levels or equivalent	7,608 (12.4)	1,586 (12.2)	1,760 (12.3)	1,530 (12.2)	1,421 (12.4)	1,311 (13)
O levels/GCSEs or equivalent	13,942 (22.7)	3,048 (23.5)	3,203 (22.4)	2,807 (22.3)	2,593 (22.6)	2,291 (22.6)
SEs or equivalent/NVQ or HND or HNC	10,971 (17.8)	2,484 (19.2)	2,624 (18.3)	2,205 (17.5)	1,962 (17.1)	1,696 (16.8)
Smoking status , n (%)						
Never	37,932 (51.9)	7,833 (54.3)	8,654 (52.5)	7,689 (51.3)	7,095 (50.4)	6,661 (50.7)
Previous	26,418 (36.1)	4,881 (33.8)	5,921 (35.9)	5,543 (37.0)	5,276 (37.5)	4,797 (36.5)
Current	8,750 (12.0)	1,722 (11.9)	1,908 (11.6)	1,747 (11.7)	1,704 (12.1)	1,669 (12.7)
Diet and physical activity						
Process meat intake, portion/week (mean, SD)	2.2 (1.0)	2.2 (1.0)	2.2 (1.0)	2.2 (1.0)	2.2 (1.0)	2.2 (1.1)
Red meat intake, portion/week (mean, SD)	2.2 (1.5)	2.3 (1.4)	2.2 (1.4)	2.2 (1.5)	2.2 (1.5)	2.2 (1.6)
Fruit and vegetable intake, g/day (mean, SD)	299.2 (192.6)	299.9 (183.9)	300.1 (190.0)	300.9 (189.7)	298 (193.4)	296.8 (206.9)
Alcohol intake (mean, SD)	2.6 (1.4)	2.5 (1.3)	2.5 (1.3)	2.5 (1.4)	2.6 (1.4)	2.8 (1.5)

Total Sedentary time, h/day (mean, SD)	5.4 (2.4)	5.5 (2.5)	5.4 (2.4)	5.4 (2.4)	5.4 (2.4)	5.4 (2.5)
Total physical activity, MET-hr/week (mean, SD)	3,198.1 (3,435.1)	3,367 (3,536.7)	3,282.7 (3,467.6)	3,197.4 (3,374.6)	3,118.8 (3,351.8)	2,981.1 (3,421.8)
Grip strength (kg)	40.1 (8.7)	52.3 (4.4)	44.3 (1.6)	39.5 (1.2)	35 (1.4)	27.5 (4.5)
Grip strength per body weight (kg/kg)	0.5 (0.1)	0.6 (0.1)	0.5 (0.1)	0.5 (0.1)	0.4 (0.1)	0.3 (0.1)
Sleep categories, n (%)						
Normal (7-9 h per day)	54,251 (74.2)	10,871 (75.3)	12,364 (75.0)	11,199 (74.8)	10,450 (74.3)	9,367 (71.4)
Short sleep (<7 h per day)	17,935 (24.5)	3,463 (24.0)	3,962 (24.0)	3,601 (24.0)	3,426 (24.3)	3,483 (26.5)
Long sleep (>9 h per day)	914 (1.3)	102 (0.7)	157 (1.0)	179 (1.2)	199 (1.4)	277 (2.1)
Adiposity						
Waist circumference, cm (mean, SD)	96 (10.7)	96.5 (10.3)	95.7 (10.4)	95.6 (10.7)	95.7 (10.8)	96.4 (11.3)
BMI, kg/m ² (mean, SD)	27.5 (4.0)	28.1 (3.9)	27.5 (3.8)	27.4 (3.9)	27.3 (4.0)	27.4 (4.3)
BMI category						
Underweight (<18.5 kg/m ²)	175 (0.2)	8 (0.1)	16 (0.1)	31 (0.2)	37 (0.3)	83 (0.6)
Normal (18.5-24.9 kg/m ²)	19,297 (26.4)	2,967 (20.6)	4,222 (25.6)	4,141 (27.7)	4,134 (29.4)	3,833 (29.2)
Overweight (25-29.9 kg/m ²)	37,045 (50.7)	7,706 (53.4)	8,591 (52.1)	7,624 (50.9)	6,924 (49.2)	6,200 (47.2)
Obese (≥ 30.0 kg/m ²)	16,583 (22.7)	3,755 (26)	3,654 (22.2)	3,183 (21.3)	2,980 (21.2)	3,011 (22.9)

Data is presented as mean and SD for continuous variables and as frequency and % for categorical variables.

BMI: body mass index, SD: standard deviation, MET: metabolic equivalent task,

Supplementary Table S4. Advance Rate Period (RAP) for incidence T2DM in men and women by quintiles of relative handgrip strength.

	<i>RAP for T2DM Incidence (95% CI)</i>	
	Women	Men
Highest (Ref.)	Ref.	Ref.
Higher-Middle	8.6 (-0.7; 15.4)	12.1 (5.0; 16.5)
Middle	11.3 (3.6; 17.4)	19.8 (15.6; 22.4)
Middle-Lower	20.4 (17.0; 25.2)	22.4 (19.1;24.4)
Lowest	23.0 (20.7; 27.5)	34.5 (35.2; 34.0)

Estimated based on RR shown in Figure 2 for model 2.