## **Supplementary tables**

**Supplementary Table 1.** Baseline characteristics of participants included in the analysed sample compared with those who were excluded

analysed sample compared with those			
	Excluded	Included	р
	(n=3007)	( <i>n</i> =6425)	
Age in years, mean (SD)	65.60 (13.28)	65.88 (9.34)	0.229
Sex, % (n)			
Men	40.7 (1223)	45.2 (2902)	<0.001
Women	59.3 (1784)	54.8 (3523)	-
Ethnicity, % (n)			
White	95.0 (2847)	98.8 (6345)	< 0.001
Non-white	5.0 (149)	1.2 (80)	-
Wealth quintile, % (n)			
1 (poorest)	28.8 (643)	14.6 (940)	< 0.001
2	24.0 (536)	18.5 (1188)	_
3	18.0 (403)	20.8 (1338)	_
4	15.3 (341)	22.3 (1432)	-
5 (richest)	14.0 (313)	23.8 (1527)	-
Alcohol intake, % (n)	, ,	, ,	
Never/rarely	23.6 (406)	18.9 (1213)	< 0.001
Regularly	42.4 (728)	45.3 (2909)	-
Frequently	34.0 (585)	35.8 (2303)	-
BMI, mean (SD)	17.72 (14.48)	27.91 (4.87)	<0.001
Fair/poor self-rated health <sup>1</sup> , % (n)	35.1 (1008)	24.5 (1575)	<0.001
Limiting long-standing illness <sup>1</sup> , % (n)	40.9 (1230)	32.9 (2111)	<0.001
Coronary heart disease <sup>1</sup> , % (n)	9.9 (299)	8.6 (553)	0.035
Stroke <sup>1</sup> , % (n)	5.1 (153)	2.4 (152)	<0.001
Cancer <sup>1</sup> , % (n)	6.9 (208)	7.7 (496)	0.167
Chronic lung disease <sup>1</sup> , % (n)	7.4 (223)	7.3 (466)	0.777
Clinically relevant depressive	20.3 (565)	13.5 (860)	<0.001
symptoms <sup>1</sup> , % (n)	, ,	,	
Smoking status, % (n)			
Never smoker	36.1 (1085)	37.2 (2387)	< 0.001
Former smoker	44.6 (1341)	48.9 (3141)	-
Current smoker	19.2 (578)	14.0 (897)	_
Level of physical activity, % (n)		(55.)	
High	53.5 (1536)	65.9 (4233)	<0.001
Low	46.5 (1336)	34.1 (2192)	-
	10.5 (1550)	J 1.1 (21J2)	

BMI = body mass index; SD = standard deviation. Note: due to missing data, numbers do not sum to the total and percentages do not sum to 100 for the group of excluded participants for some variables.

Supplementary Table 2. Bayes factors for multiplicative interactions between smoking status and physical activity

		Large effects (RR=3)	M	ledium effects (RR=2)		Small effects (RR=1.5)		
	BF	Interpretation	BF	Interpretation	BF	Interpretation		
Fair/poor self-rated health	0.23	Moderate evidence for H0	0.36	Data were insensitive	0.56	Data were insensitive		
Limiting long-standing illness	0.28	Moderate evidence for H0	0.43	Data were insensitive	0.65	Data were insensitive		
Coronary heart disease	0.48	Data were insensitive	0.68	Data were insensitive	0.88	Data were insensitive		
Stroke	0.62	Data were insensitive	0.84	Data were insensitive	1.02	Data were insensitive		
Cancer	0.30	Moderate evidence for H0	0.45	Data were insensitive	0.65	Data were insensitive		
Chronic lung disease	0.04	Strong evidence for H0	0.06	Strong evidence for H0	0.11	Moderate evidence for H0		
Clinically relevant depressive symptoms	0.29	Moderate evidence for H0	0.43	Data were insensitive	0.65	Data were insensitive		

BF=Bayes factor, H0=null hypothesis, RR=relative risk.

**Supplementary Table 3.** Main effects of smoking status and physical activity and the interaction between smoking status and physical activity for risks of incident health problems over 12-year follow-up: imputed outcome data for participants who dropped out before Wave 8

		Smoking status		Physic	cal activity	Interaction <sup>1</sup>	
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active
Fair/poor self-rated health							
% (n)	48.9 (1168)	58.5 (1839)	69.7 (625)	48.9 (2071)	71.2 (1562)	-	-
RR [95% CI]	1	1.20 [1.09-1.32]	1.42 [1.25-1.63]	1	1.46 [1.33-1.60]		
p		< 0.001	<0.001		< 0.001	-	-
RR <sub>adj</sub> [95% CI]	1	1.15 [1.02-1.30]	1.52 [1.27-1.81]	1	1.23 [1.05-1.44]	0.95 [0.78-1.15]	0.97 [0.74-1.27]
p		0.023	<0.001		0.012	0.567	0.810
Limiting long-standing illness							
% (n)	62.8 (1499)	69.8 (2192)	72.9 (654)	62.1 (2630)	78.2 (1715)	-	-
RR [95% CI]	1	1.11 [1.01-1.22]	1.16 [1.03-1.31]	1	1.26 [1.16-1.37]		
_ <i>p</i>		0.025	0.019		< 0.001	-	-
RR <sub>adj</sub> [95% CI]	1	1.08 [0.96-1.21]	1.18 [1.00-1.39]	1	1.11 [0.96-1.28]	0.98 [0.82-1.17]	1.06 [0.82-1.37]
p		0.195	0.053		0.166	0.786	0.666
Coronary heart disease							
% (n)	14.1 (335)	20.3 (639)	25.3 (227)	14.0 (594)	27.7 (607)	-	-
RR [95% CI]	1	1.45 [1.20-1.75]	1.79 [1.32-2.44]	1	1.97 [1.71-2.27]		
_ <i>p</i>		< 0.001	0.001		< 0.001	-	-
RR <sub>adj</sub> [95% CI]	1	1.21 [0.96-1.53]	2.05 [1.43-2.94]	1	1.37 [1.02-1.82]	1.04 [0.71-1.54]	1.05 [0.69-1.61]
p		0.098	<0.001		0.034	0.829	0.810
Stroke							
% (n)	13.7 (327)	18.4 (579)	23.3 (209)	13.4 (567)	25.0 (547)	-	-
RR [95% CI]	1	1.34 [1.04-1.73]	1.70 [1.30-2.22]	1	1.86 [1.55-2.24]		
p		0.027	0.001		<0.001	-	-
RR <sub>adj</sub> [95% CI]	1	1.20 [0.89-1.63]	2.03 [1.42-2.92]	1	1.42 [1.03-1.97]	0.87 [0.60-1.25]	1.01 [0.67-1.53]
p		0.216	< 0.001		0.035	0.441	0.963

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.

## Supplementary Table 3. (continued)

	Smoking status			Physi	cal activity	Interaction <sup>1</sup>	
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active
Cancer							
% (n)	18.0 (430)	21.9 (688)	24.6 (221)	17.7 (749)	26.9 (589)	-	-
RR [95% CI]	1	1.22 [1.06-1.40]	1.36 [1.07-1.73]	1	1.52 [1.21-1.90]		
_ <i>p</i>		0.006	0.013		0.002	-	
RR <sub>adj</sub> [95% CI]	1	1.13 [0.93-1.37]	1.57 [1.15-2.16]	1	1.34 [0.98-1.83]	0.96 [0.69-1.32]	0.95 [0.56-1.61]
p		0.207	0.006		0.065	0.792	0.831
Chronic lung disease							
% (n)	6.9 (164)	14.1 (443)	32.5 (292)	9.0 (382)	23.6 (517)	-	-
RR [95% CI]	1	2.05 [1.56-2.72]	4.76 [3.10-7.32]	1	2.61 [1.79-3.81]		
_ <i>p</i>		< 0.001	<0.001		0.001	-	<u>-</u>
RR <sub>adj</sub> [95% CI]	1	2.14 [1.42-3.24]	6.27 [3.88-10.09]	1	2.66 [1.65-4.27]	0.74 [0.49-1.12]	0.63 [0.40-0.99]
p		0.001	<0.001		<0.001	0.157	0.044
Clinically relevant							
depressive symptoms							
% (n)	52.8 (1259)	58.0 (1823)	62.9 (564)	52.4 (2219)	65.1 (1428)	-	-
RR [95% CI]	1	1.10 [0.98-1.24]	1.19 [1.02-1.39]	1	1.24 [1.13-1.36]		
_ <i>p</i>		0.111	0.029		<0.001	-	
RR <sub>adj</sub> [95% CI]	1	1.10 [0.96-1.26]	1.18 [0.98-1.43]	1	1.07 [0.91-1.27]	1.01 [0.84-1.22]	1.09 [0.82-1.43]
p		0.184	0.087		0.396	0.905	0.556

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.

**Supplementary Table 4.** Main effects of smoking status and physical activity and the interaction between smoking status and physical activity for risks of incident health problems over 12-year follow-up: sample restricted to participants with data at Wave 2 and Wave 8

		Smoking status		Physi	cal activity	Interaction <sup>1</sup>	
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active
Fair/poor self-rated health							
% (n)	31.5 (351)	39.0 (494)	45.4 (129)	32.9 (668)	47.9 (306)	-	-
RR [95% CI]	1	1.24 [1.06-1.45]	1.44 [1.14-1.84]	1	1.45 [1.24-1.71]		
р		0.008	0.003		< 0.001	-	-
RR <sub>adj</sub> [95% CI]	1	1.16 [0.96-1.41]	1.53 [1.13-2.05]	1	1.19 [0.90-1.56]	1.06 [0.74-1.52]	1.11 [0.65-1.91]
р		0.134	0.005		0.223	0.734	0.693
Limiting long-standing illness							
% (n)	47.5 (488)	52.6 (599)	50.0 (135)	48.2 (915)	57.1 (307)	-	-
RR [95% CI]	1	1.11 [0.96-1.28]	1.05 [0.83-1.33]	1	1.18 [1.01-1.39]		
p		0.166	0.662		0.040	-	-
RR <sub>adj</sub> [95% CI]	1	1.09 [0.92-1.30]	1.08 [0.82-1.43]	1	1.07 [0.82-1.38]	0.98 [0.69-1.39]	1.18 [0.69-2.02]
р		0.321	0.572		0.626	0.926	0.543
Coronary heart disease							
% (n)	5.7 (73)	7.9 (114)	8.6 (32)	6.1 (138)	9.6 (81)	-	-
RR [95% CI]	1	1.39 [1.03-1.88]	1.52 [0.99-2.35]	1	1.56 [1.17-2.07]		
p		0.033	0.056		0.002	-	-
RR <sub>adj</sub> [95% CI]	1	1.20 [0.82-1.76]	1.72 [0.99-2.98]	1	1.12 [0.66-1.88]	1.37 [0.72-2.63]	0.94 [0.38-2.35]
p		0.359	0.053		0.677	0.339	0.893
Stroke							
% (n)	5.4 (72)	6.5 (100)	8.1 (32)	5.6 (131)	7.9 (73)	-	-
RR [95% CI]	1	1.21 [0.89-1.65]	1.50 [0.98-2.31]	1	1.43 [1.06-1.92]		
p		0.234	0.065		0.019	-	-
RR <sub>adj</sub> [95% CI]	1	1.02 [0.69-1.51]	1.42 [0.78-2.57]	1	1.07 [0.63-1.81]	1.15 [0.58-2.27]	1.59 [0.64-3.92]
p		0.918	0.247		0.812	0.682	0.315

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.

## **Supplementary Table 4.** (continued)

		Smoking status		Physi	cal activity	Interaction <sup>1</sup>	
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active
Cancer							
% (n)	9.8 (125)	11.6 (173)	11.5 (44)	10.1 (228)	12.9 (114)	-	-
RR [95% CI]	1	1.19 [0.93-1.51]	1.17 [0.82-1.68]	1	1.28 [1.01-1.62]		
p		0.162	0.388		0.044	-	-
RR <sub>adj</sub> [95% CI]	1	1.22 [0.91-1.64]	1.20 [0.74-1.94]	1	1.38 [0.93-2.06]	0.82 [0.49-1.39]	1.07 [0.51-2.25]
p		0.192	0.460		0.111	0.467	0.864
Chronic lung disease							_
% (n)	2.6 (34)	5.0 (75)	14.4 (52)	3.4 (78)	9.4 (83)	-	-
RR [95% CI]	1	1.94 [1.28-2.93]	5.54 [3.54-8.66]	1	2.75 [2.00-3.78]		_
p		0.002	<0.001		<0.001	-	-
RR <sub>adj</sub> [95% CI]	1	2.67 [1.41-5.03]	7.02 [3.49-14.12]	1	4.09 [2.01-8.32]	0.47 [0.20-1.09]	0.45 [0.18-1.13]
p		0.002	<0.001		< 0.001	0.077	0.088
Clinically relevant							_
depressive symptoms							
% (n)	43.7 (283)	44.7 (334)	48.8 (104)	42.9 (480)	49.3 (241)	-	-
RR [95% CI]	1	1.02 [0.84-1.24]	1.12 [0.85-1.47]	1	1.15 [0.95-1.39]		
p		0.832	0.430		0.147	-	-
RR <sub>adj</sub> [95% CI]	1	1.06 [0.84-1.33]	0.98 [0.68-1.41]	1	1.01 [0.74-1.38]	1.02 [0.67-1.55]	1.37 [0.77-2.41]
ρ		0.639	0.917		0.965	0.931	0.284

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.

**Supplementary Table 5.** Main effects of smoking status and physical activity and the interaction between smoking status and physical activity for risks of incident health problems over 12-year follow-up: excluding current smokers with low levels of nicotine dependence (<15 cigarettes/day)

		Smoking status		Physi	cal activity	Interaction <sup>1</sup>		
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active	
Fair/poor self-rated health								
% (n)	40.9 (529)	49.0 (744)	63.8 (134)	42.2 (946)	59.3 (461)	-	-	
RR [95% CI]	1	1.20 [1.05-1.37]	1.56 [1.23-1.98]	1	1.41 [1.22-1.61]			
p		0.008	< 0.001		<0.001	-	-	
RR <sub>adj</sub> [95% CI]	1	1.14 [0.97-1.35]	1.75 [1.29-2.36]	1	1.19 [0.94-1.49]	0.99 [0.74-1.34]	0.99 [0.58-1.67]	
р		0.115	< 0.001		0.144	0.953	0.955	
Limiting long-standing illness								
% (n)	57.1 (720)	62.7 (905)	70.8 (148)	58.2 (1282)	69.2 (491)	-	-	
RR [95% CI]	1	1.10 [0.97-1.24]	1.24 [0.99-1.56]	1	1.19 [1.04-1.36]			
p		0.143	0.067		0.012	-	-	
RR <sub>adj</sub> [95% CI]	1	1.07 [0.93-1.24]	1.36 [1.03-1.79]	1	1.07 [0.86-1.32]	0.97 [0.73-1.29]	0.97 [0.58-1.63]	
ρ		0.348	0.032		0.548	0.847	0.908	
Coronary heart disease								
% (n)	8.8 (117)	11.7 (176)	14.9 (34)	9.0 (200)	14.9 (127)	-	-	
RR [95% CI]	1	1.33 [1.04-1.70]	1.70 [1.13-2.55]	1	1.65 [1.30-2.09]			
p		0.023	0.011		<0.001	-	-	
RR <sub>adj</sub> [95% CI]	1	1.13 [0.82-1.55]	1.94 [1.10-3.41]	1	1.20 [0.79-1.83]	1.19 [0.70-2.02]	1.15 [0.49-2.69]	
р		0.459	0.021		0.392	0.533	0.750	
Stroke								
% (n)	8.2 (113)	9.9 (159)	12.6 (30)	7.9 (182)	13.1 (120)	-	-	
RR [95% CI]	1	1.22 [0.95-1.56]	1.53 [1.00-2.35]	1	1.65 [1.29-2.10]			
p		0.129	0.049		<0.001	-	-	
RR <sub>adj</sub> [95% CI]	1	1.12 [0.80-1.57]	1.69 [0.87-3.26]	1	1.41 [0.93-2.13]	0.81 [0.47-1.39]	1.59 [0.65-3.89]	
p		0.498	0.121		0.109	0.437	0.306	

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.

## **Supplementary Table 5.** (continued)

	Smoking status			Physic	cal activity	Interaction <sup>1</sup>	
	Never smoker	Former smoker	Current smoker	High active	Low active	Former smoker x low active	Current smoker x low active
Cancer							
% (n)	13.4 (178)	15.8 (247)	19.8 (48)	13.8 (309)	18.4 (164)	-	-
RR [95% CI]	1	1.18 [0.96-1.45]	1.48 [1.05-2.10]	1	1.33 [1.08-1.63]		
p		0.112	0.027		0.006	-	-
RR <sub>adj</sub> [95% CI]	1	1.11 [0.85-1.43]	1.85 [1.18-2.91]	1	1.29 [0.91-1.82]	1.01 [0.65-1.57]	0.81 [0.39-1.67]
р		0.446	0.008		0.149	0.974	0.565
Chronic lung disease							
% (n)	3.3 (44)	7.8 (120)	26.3 (61)	5.0 (111)	13.0 (114)	-	-
RR [95% CI]	1	2.34 [1.65-3.34]	7.89 [5.22-11.91]	1	2.60 [1.98-3.41]		
p		< 0.001	<0.001		< 0.001	-	-
RR <sub>adj</sub> [95% CI]	1	2.80 [1.64-4.79]	11.40 [6.10-21.31]	1	3.49 [1.87-6.50]	0.57 [0.27-1.17]	0.40 [0.17-0.93]
p		< 0.001	<0.001		< 0.001	0.123	0.033
Clinically relevant							
depressive symptoms							
% (n)	53.5 (418)	56.4 (535)	63.0 (104)	52.4 (668)	62.5 (389)	-	-
RR [95% CI]	1	1.06 [0.90-1.24]	1.18 [0.90-1.55]	1	1.19 [1.02-1.40]		
p		0.512	0.236		0.028	-	-
RR <sub>adj</sub> [95% CI]	1	1.10 [0.90-1.34]	1.18 [0.82-1.70]	1	1.09 [0.84-1.41]	0.95 [0.68-1.34]	1.11 [0.64-1.95]
р		0.370	0.375		0.527	0.783	0.705

CI = confidence interval; RR = relative risk from bivariate models; RR<sub>adj</sub> = relative risk adjusted for age, sex, ethnicity, wealth, alcohol intake, body mass index, and physical activity (for smoking status) or smoking status (for physical activity).

<sup>&</sup>lt;sup>1</sup> Multiplicative interaction between smoking status and physical activity. Results can be interpreted as the difference in RR between high active and low active former/current smokers, relative to the difference in RR between high and low active never smokers. Thus, an interaction term above 1 indicates the disparity between high and low active groups was greater for former/current smokers than never smokers, and an interaction term below 1 indicates the disparity between high and low active groups was smaller for former/current smokers than never smokers.