SUPPLEMENTAL MATERIAL

Table S1. Baseline characteristics of the participants in the study by categories based on the 10th, 50th, and 90th percentiles of accelerometer-measured moderate-to-vigorous physical activity distribution (n=39,294).

Variable	Total	<342.72 min/day	342.72 - <675.36 min/day	675.36 - <1139.04 min/day	≥ 1139.04 min/day	*p-value*[‖]
Number	39294	4067	15739	15589	3899	
Sedentary behaviour (min/week)	4994.02 (676.76)	5749.63 (565.47)	5249.43 (525.76)	4749.78 (518.95)	4151.41 (531.41)	<0.001
MVPA (min/week)	716.56 (320.88)	254.84 (69.39)	524.64 (92.66)	868.87 (126.91)	1363.94 (225.11)	<0.001
Total volume of PA (mg)	40.50 (12.52)	23.55 (4.28)	33.74 (4.97)	46.09 (7.23)	63.08 (11.57)	<0.001
Sleep patterns[*] (%)						<0.001
Poor	916 (2.3)	371 (2.4)	297 (1.9)	56 (1.4)	192 (4.7)	
Intermediate	15437 (39.3)	6536 (41.5)	5653 (36.3)	1341 (34.4)	1907 (46.9)	
Healthy	22941 (58.4)	8832 (56.1)	9639 (61.8)	2502 (64.2)	1968 (48.4)	
Age (years)	58.39 (7.13)	61.81 (5.83)	59.35 (6.82)	57.30 (7.18)	55.25 (7.27)	<0.001
Sex = male (%)	19857 (50.5)	2196 (54.0)	8179 (52.0)	7703 (49.4)	1779 (45.6)	<0.001
Obesity[†] = yes (%)	10454 (26.6)	1796 (44.2)	4891 (31.1)	3224 (20.7)	543 (13.9)	<0.001
Education = university/college (%)	23878 (60.8)	2654 (65.3)	9544 (60.6)	9273 (59.5)	2407 (61.7)	0.001
Smoking (%)						<0.001
Never	21230 (54.0)	1962 (48.2)	8452 (53.7)	8643 (55.4)	2173 (55.7)	
Previous	15582 (39.7)	1692 (41.6)	6263 (39.8)	6103 (39.1)	1524 (39.1)	
Current	2482 (6.3)	413 (10.2)	1024 (6.5)	843 (5.4)	202 (5.2)	
Diet score[‡] (%)						<0.001
Poor	9650 (25.0)	795 (20.0)	3739 (24.1)	3996 (26.0)	1120 (29.3)	
Reasonable	2142 (5.5)	295 (7.4)	902 (5.8)	768 (5.0)	177 (4.6)	
Good	26850 (69.5)	2885 (72.6)	10847 (70.0)	10594 (69.0)	2524 (66.1)	
Alcohol use[§] (%)						<0.001
Never	1104 (2.8)	162 (4.0)	451 (2.9)	401 (2.6)	90 (2.3)	
Previous	1054 (2.7)	170 (4.2)	437 (2.8)	353 (2.3)	94 (2.4)	
Occasional	7457 (19.0)	1049 (25.8)	3089 (19.6)	2631 (16.9)	688 (17.6)	
Within guidelines	13264 (33.8)	1187 (29.2)	5425 (34.5)	5375 (34.5)	1277 (32.8)	
Double guidelines	9530 (24.3)	845 (20.8)	3709 (23.6)	3971 (25.5)	1005 (25.8)	
Above double guidelines	6885 (17.5)	654 (16.1)	2628 (16.7)	2858 (18.3)	745 (19.1)	
HbA1c (mmol/mol)	36.21 (6.23)	38.32 (8.22)	36.53 (6.68)	35.58 (5.24)	35.22 (4.77)	<0.001
Pre-existing CVD = yes (%)	13686 (34.8)	2119 (52.1)	5967 (37.9)	4657 (29.9)	943 (24.2)	<0.001
Hypertension medication = yes (%)	12938 (32.9)	1877 (47.8)	2030 (49.9)	5800 (36.9)	4302 (27.6)	<0.001
Mean Arterial	109.06 (10.19)	108.18	109.09	109.23	109.16	<0.001

Pressure (mmHg)		(11.32)	(10.37)	(9.78)	(9.76)	
Diastolic Blood Pressure (mmHg)	87.61 (9.79)	86.47 (10.56)	87.59 (9.91)	87.86 (9.52)	87.82 (9.40)	<0.001
Systolic Blood Pressure (mmHg)	151.96 (16.24)	151.60 (18.02)	152.07 (16.50)	151.98 (15.62)	151.82 (15.70)	0.412

Values represent Mean (SD) unless specified otherwise.
MVPA, moderate-to-vigorous physical activity.
* Participants were categorized by how many healthy sleep characteristics (morning chronotype, adequate sleep duration (7-8 hr./d), never or rare insomnia, never or rare snoring, and infrequent daytime sleepiness) they displayed into three groups (healthy: ≥ 4; intermediate: 2-3; poor: ≤ 1)[16,17].
†Obesity was ascertained based on body mass index, BMI (i.e., participants with a BMI ≥30 were considered obese).
‡Dietary intake was collected using a touchscreen questionnaire that collected information on food frequency consumption[18]. Dietary pattern was classified based on the UK's latest-available National Health Service Eatwell Guide and a previously applied scoring procedure that considered consumption of fruits, vegetables, fish, red meats (unprocessed), and processed meats. One point was awarded for each of the following conditions that were met in each participant's diet, with possible scores ranging from 0 to 4 points: total fruit and vegetable intake ≥ 4.5 pieces or servings/day (one serving of vegetables was considered to be 3 tablespoons of vegetables); total fish intake ≥ 2 times/week; red meat (unprocessed) intake ≤ 5 times/week; processed meat intake ≤ 2 times/week. Diets were categorised as poor (0), reasonable (1), and good (2-4)[19].
§Guidelines for alcohol use in the UK recommend no more than 14 units of alcohol per week for both men and women.
‖One-way ANOVA for continuous variables and Chi Square Test for categorical variables

Table S2. STROBE checklist.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study Design	4	Present key elements of study design early in the paper	3,4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3,4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	3,4
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	NA
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	NA
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	NA
		Case-control study—For matched studies, give matching criteria and the number of controls per case	NA

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-5

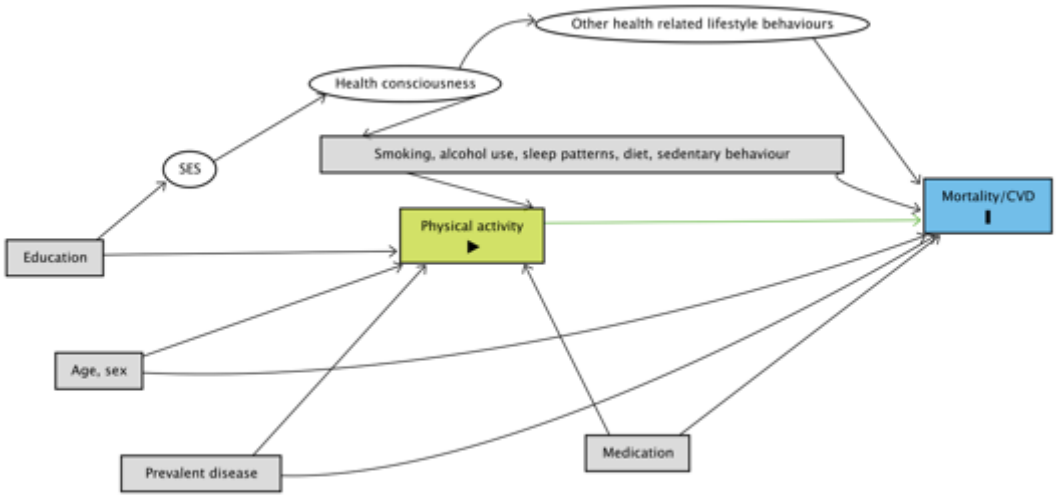
Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-5
Bias	9	Describe any efforts to address potential sources of bias	5,6
Study Size	10	Explain how the study size was arrived at	3,4
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-5
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5,6
		(*b*) Describe any methods used to examine subgroups and interactions	5,6
		(*c*) Explain how missing data were addressed	NA
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	NA
		Case-control study—If applicable, explain how matching of cases and controls was addressed	NA
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	5,6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Supplemental Figure 1; 3,4
		(b) Give reasons for non-participation at each stage	Supplemental Figure 1; 3,4

		(c) Consider use of a flow diagram	Supplemental Figure
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	6,7; Figures 1 and 2
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	6,7; Figures 1 and 2
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	NA
		Cross-sectional study—Report numbers of outcome events or summary measures	NA

Section and Item	**Item No.**	**Recommendation**	**Reported on Page No.**
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Figures 1-4; 5,6
		(*b*) Report category boundaries when continuous variables were categorized	4-6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	6,7; Sup Figures 3-8
Discussion			
Key Results	18	Summarise key results with reference to study objectives	7
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8-9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations,	7-9

		multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	9
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	9

Figure S1. DAG diagram of included covariates in the study.



We used an online software package to generate this figure from Dagitty.net.
SES, social economical status; CVD, cardiovascular disease

Figure S2. Flow diagram of participants in the study.

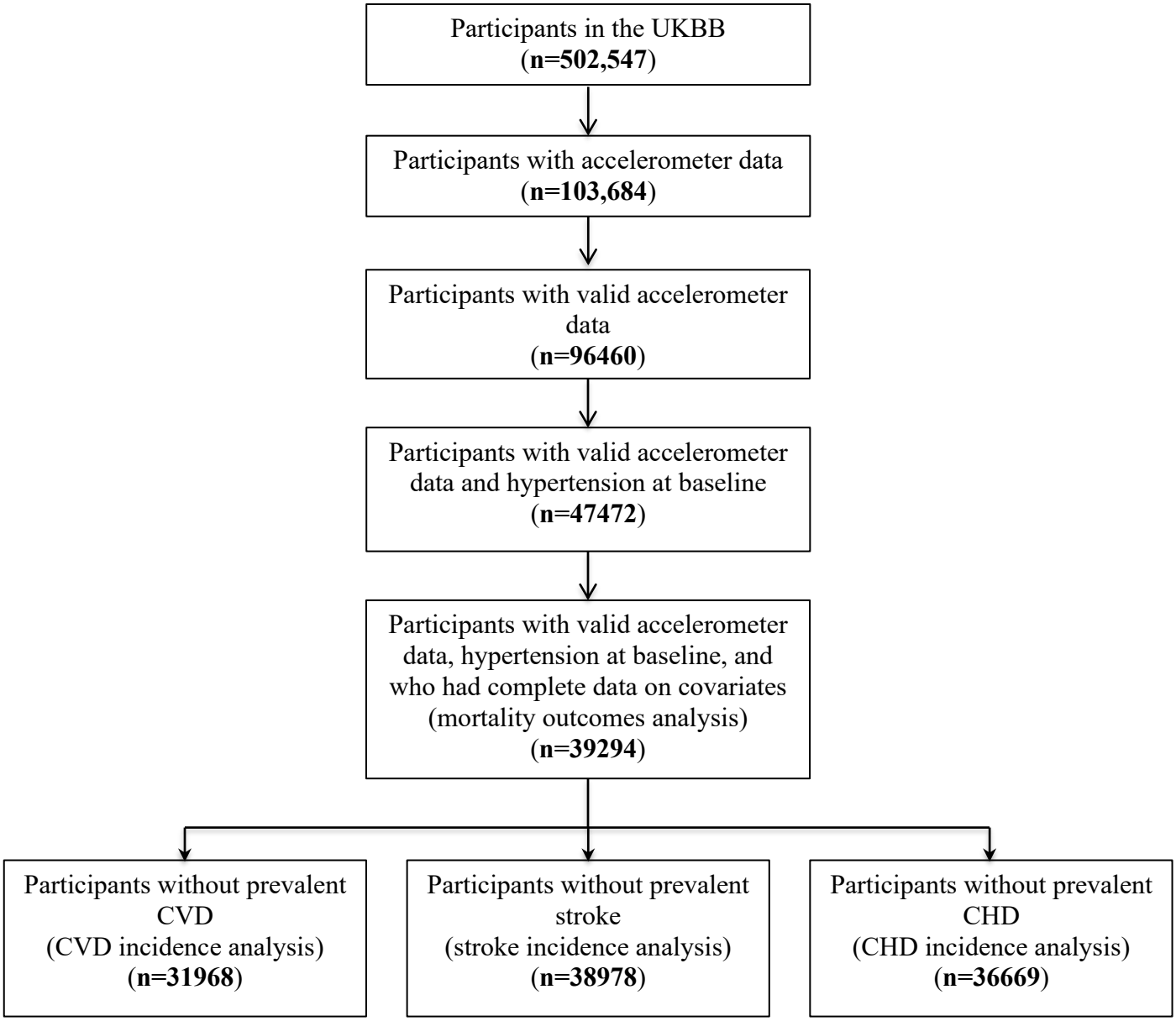
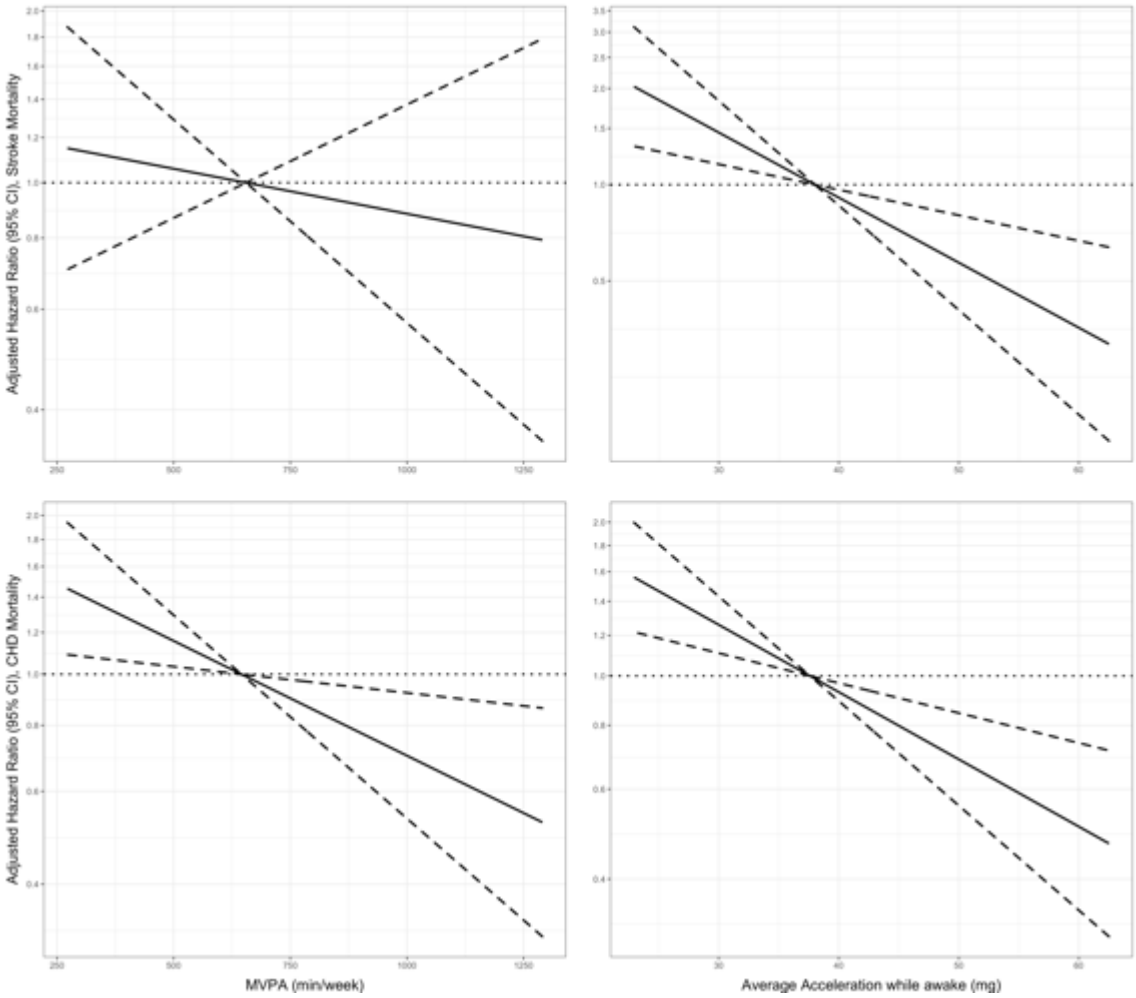
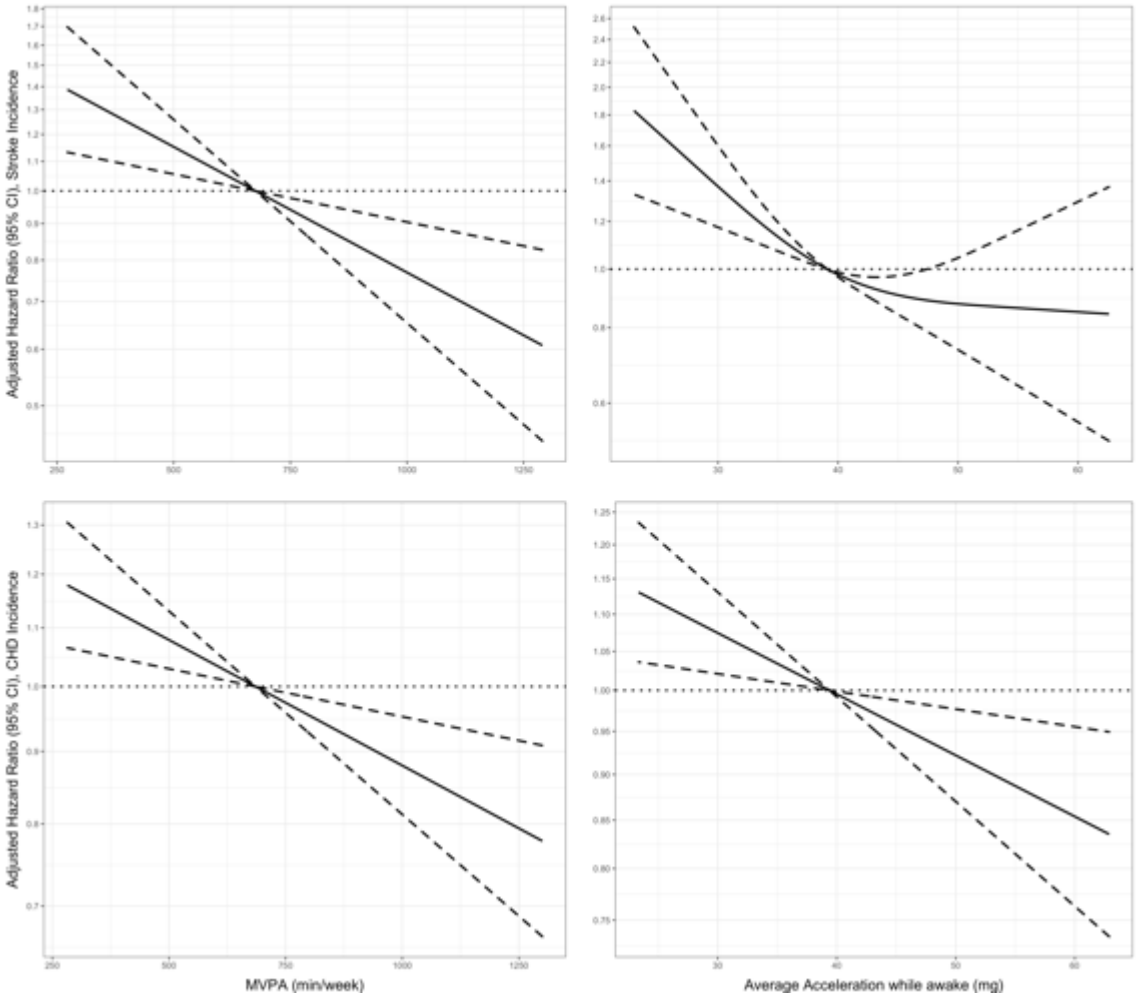


Figure S3. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with stroke (n=39294; events=93) and CHD (n=39294; events=251) mortality.



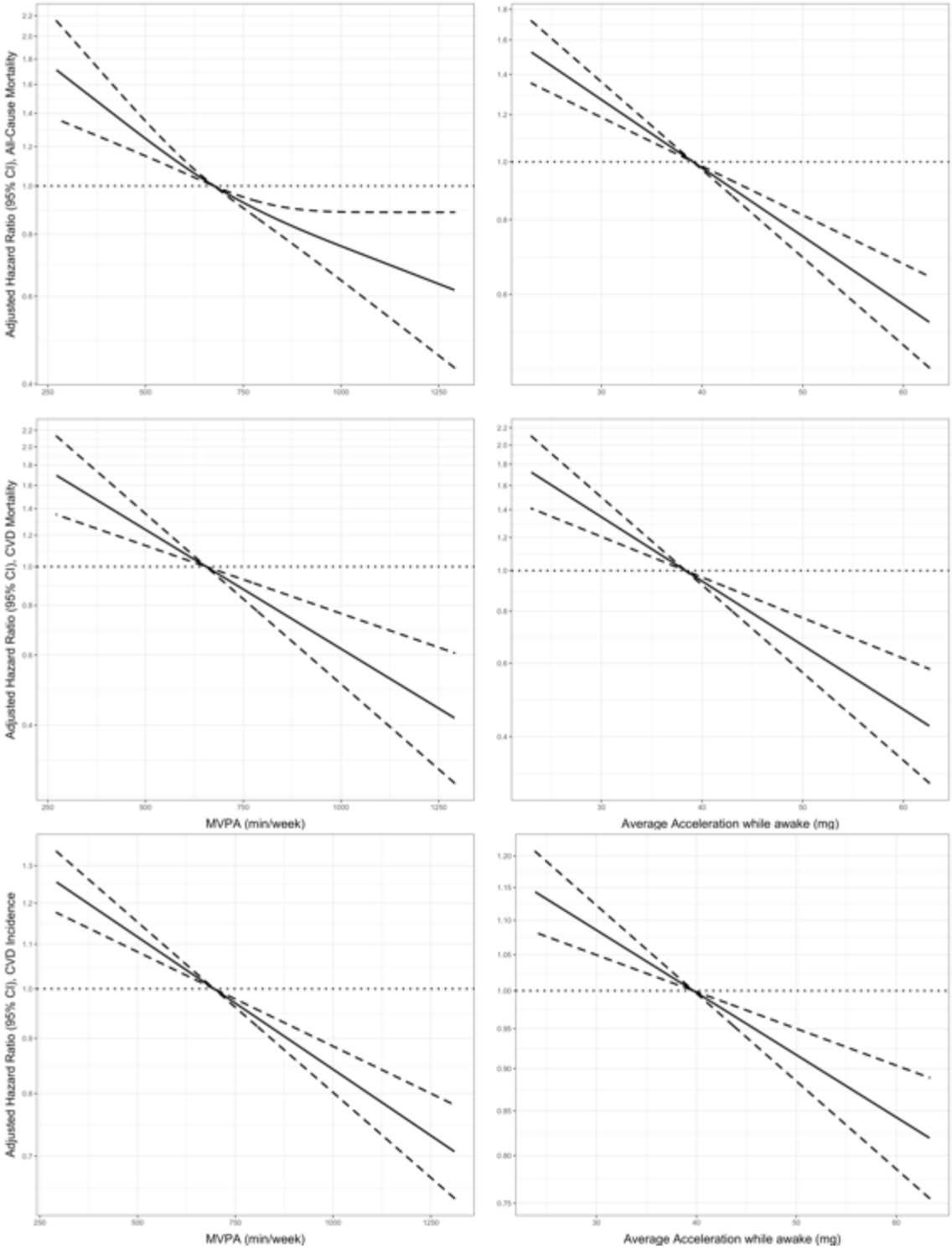
*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, and alcohol use. CVD, cardiovascular disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest (reference category = 675.36 minutes/week of moderate-to-vigorous physical activity; and 39.04 milligravities (mg) for total volume of physical activity). Hazard ratios are in logarithmic scale.

Figure S4. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with incidence of stroke (n=38978; events=527) and CHD (n=36669; events=1493).



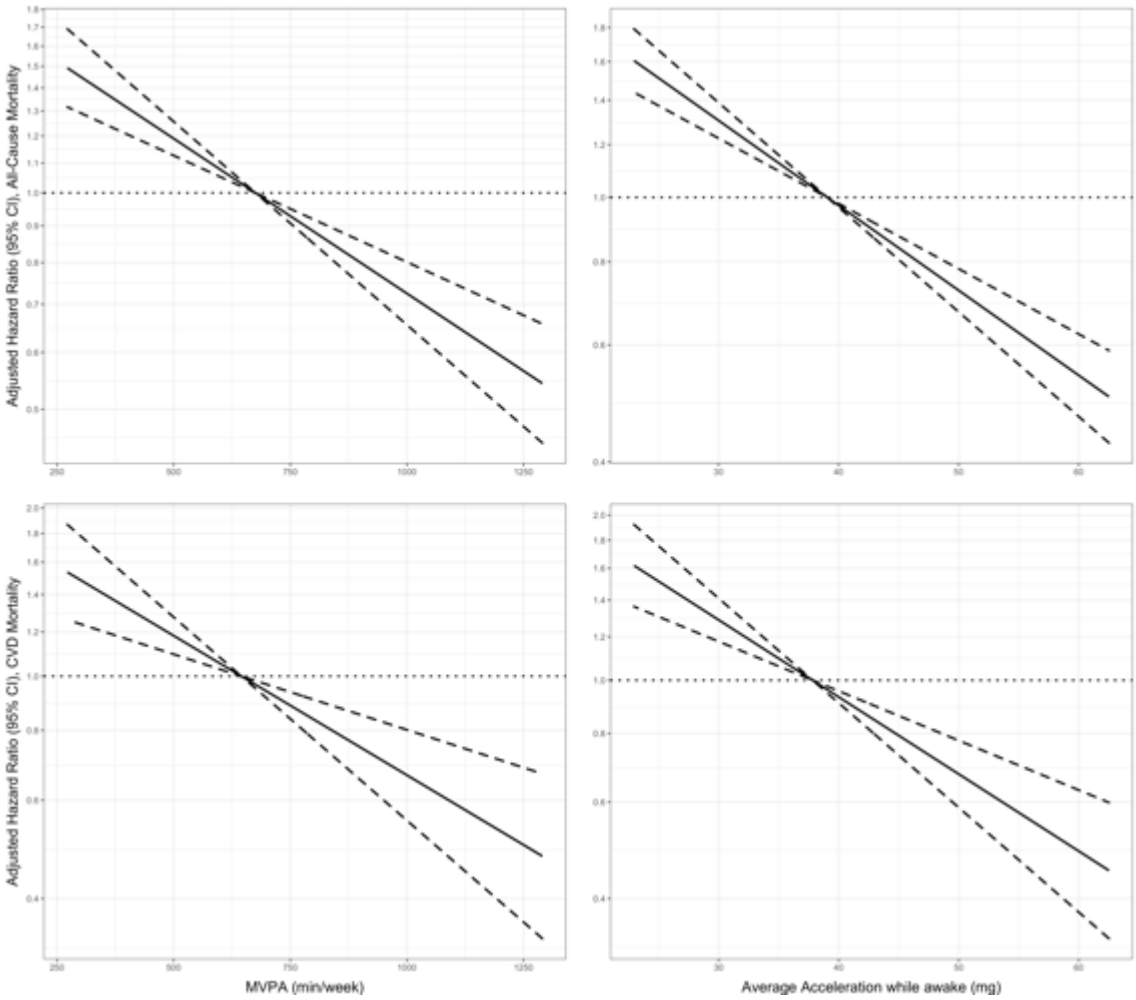
*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, and alcohol use. CHD, coronary heart disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest (reference category = 675.36 and 685.44 minutes/week of moderate-to-vigorous physical activity for stroke and CHD respectively; and 39.09 and 39.38 milligravities (mg) for total volume of physical activity for stroke and CHD respectively). Hazard ratios are in logarithmic scale.

Figure S5. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with all-cause (n=38977; events=12201), CVD mortality (n=38977; events=430), and CVD incidence (n=31768; events=4845) excluding participants that died within the first 2 years of follow-up (317; note, for CVD incidence we also excluded 7209 with previous CVD disease).



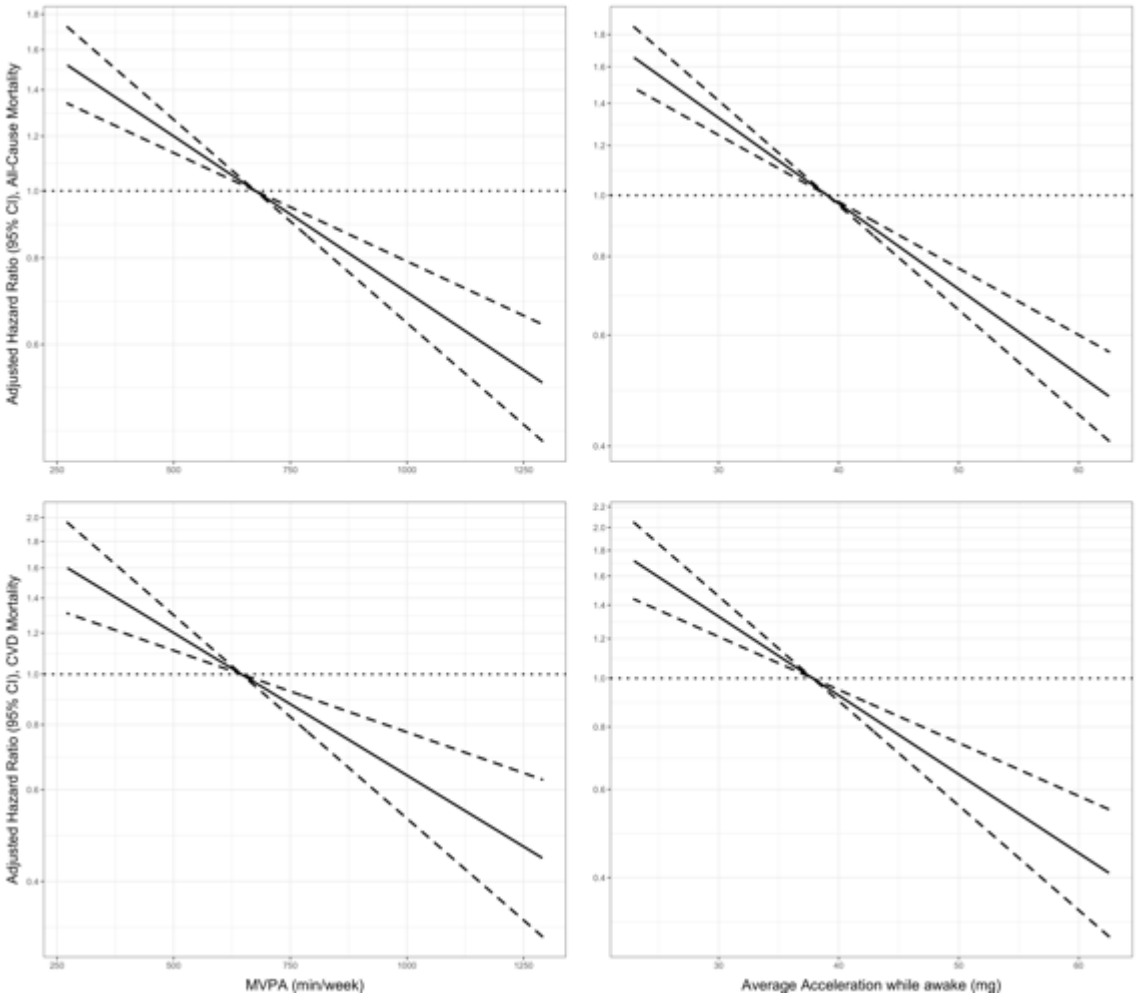
*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, and alcohol use. CVD, cardiovascular disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest (reference category = 675.36 and 695.52 minutes/week of moderate-to-vigorous physical activity for mortality outcomes and CVD incidence respectively; and 39.10 and 39.70 milligravities (mg) for total volume of physical activity for mortality outcomes and CVD incidence respectively). Hazard ratios are in logarithmic scale.

Figure S6. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with all-cause and CVD mortality with additional adjustment for diet.



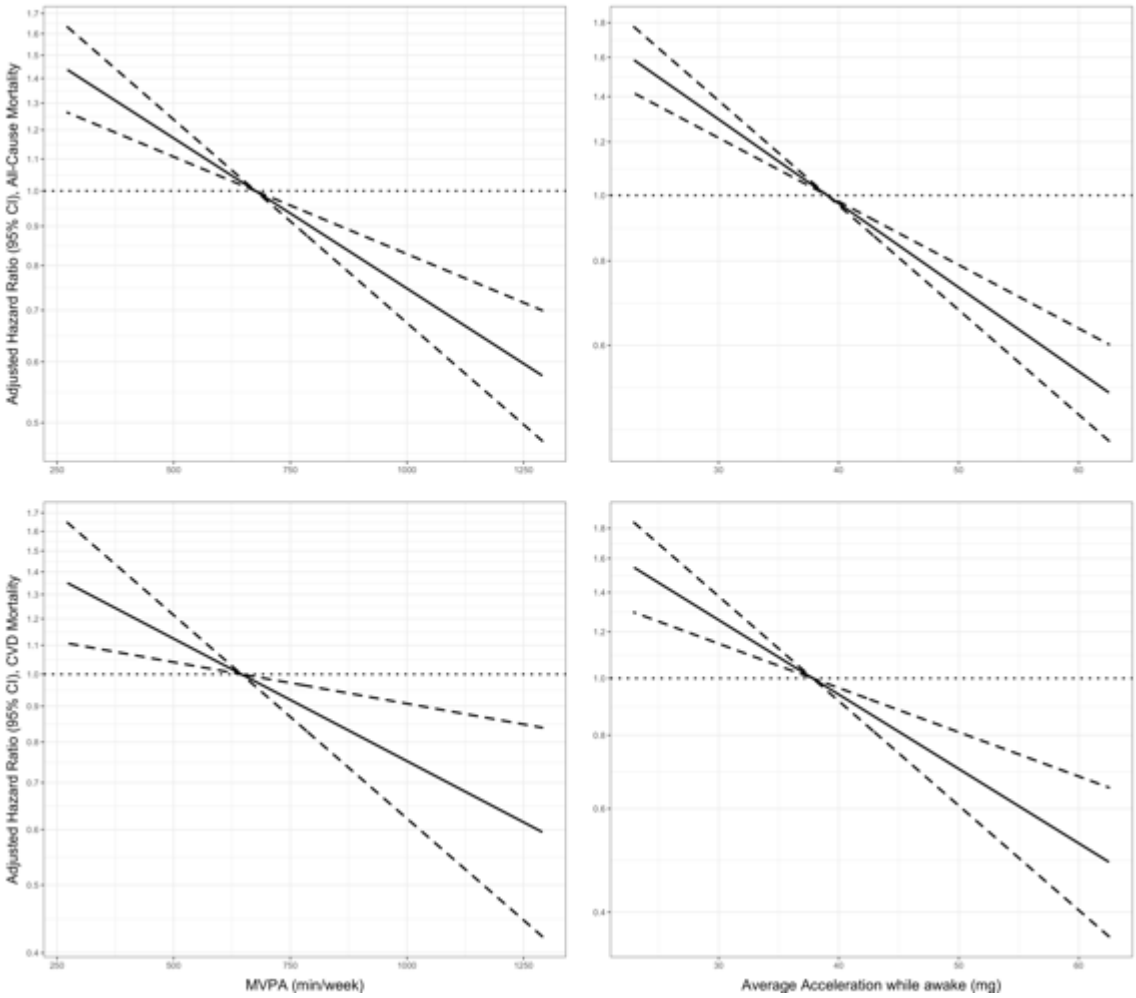
*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, alcohol use, and diet. CVD, cardiovascular disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest. Hazard ratios are in logarithmic scale.

Figure S7. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with all-cause and CVD mortality with additional adjustment for blood pressure.



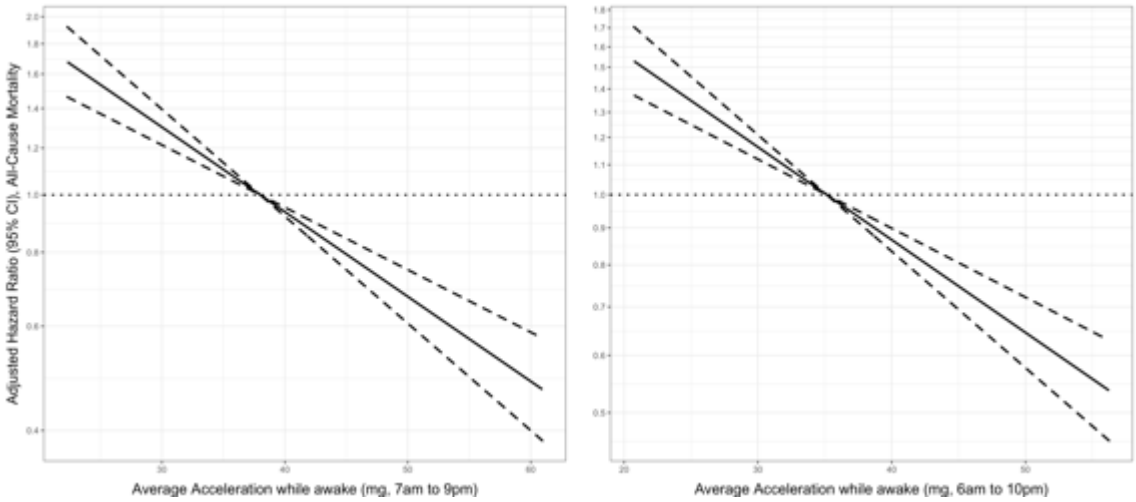
*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, alcohol use, and mean arterial pressure. CVD, cardiovascular disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest. Hazard ratios are in logarithmic scale.

Figure S8. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between accelerometer-measured moderate-to-vigorous physical activity and total volume of physical activity with all-cause and CVD mortality with additional adjustment for pre-existing CVD and Hb1Ac.



*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, alcohol use, and pre-existing CVD and Hb1Ac. CVD, cardiovascular disease. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest. Hazard ratios are in logarithmic scale.

Figure S9. Dose–response association (Adjusted* hazard ratios and associated 95% confidence interval band) between total volume of physical activity while awake (7am to pm and 6am to 10pm) with all-cause mortality.



*Adjusted for age, sex, education, sedentary behaviour (only models for moderate-to-vigorous physical activity), sleep pattern, obesity, smoking, and alcohol use. Dose-response associations were assessed with restricted cubic splines with knots at 10th, 50th, and 90th centiles of the distribution of the exposure of interest. Hazard ratios are in logarithmic scale.