
Accelerometer-derived ‘weekend warrior’ physical activity pattern and brain health

In the format provided by the
authors and unedited

Supplementary Materials

Supplementary Table 1. Baseline characteristics of participants according to accelerometer-derived physical activity pattern.

Supplementary Table 2. Association between physical activity pattern and incident brain disorders in models with different sets of covariates and the fully adjusted model.

Supplementary Table 3. Associations between physical activity pattern and brain disorders using activity threshold of ≥ 150 minutes of MVPA per week (guideline-based).

Supplementary Table 4. Association between physical activity pattern and incident brain disorders, stratified by age and sex.

Supplementary Table 5. Association between physical activity pattern and incident brain disorders, stratified by ethnicity.

Supplementary Table 6. Association of physical activity pattern with brain disorders, with additional adjustment for occupation (n = 75,539).

Supplementary Table 7. Association of physical activity pattern with brain disorders, with additional adjustment for sedentary time (n = 75,629).

Supplementary Table 8. Association of physical activity pattern with brain disorders, with additional adjustment for MVPA volume (n = 75,629).

Supplementary Table 9. Associations between physical activity pattern and brain disorders using activity threshold of ≥ 150 minutes of MVPA per week (guideline-based).

Supplementary Table 10. Association between physical activity pattern and incident brain disorders, excluding individuals who occurred brain disorders within the first 1 or 2 years of follow-up.

Supplementary Table 11. Association of physical activity pattern with brain disorders, using multiple imputations with chained equations (n = 78,889).

Supplementary Table 12. Association of physical activity pattern with brain disorders, with additional adjustment for the wear time and the season of wear (n = 75,629).

Supplementary Table 13. Association of physical activity pattern with brain disorders,

using covariates measured at baseline (n = 75,841).

Supplementary Table 14. Association of physical activity pattern with brain disorders, with additional adjustment for disease which may affect the ability to perform PA (n = 75,629).

Supplementary Table 15. The codes used for brain disorders.

Supplementary Fig. 1. Overview of the study.

Supplementary Fig. 2. Distribution of MVPA on top 2 days vs. remaining 5 days among active individuals using guideline-based activity threshold of 150 minutes or more of MVPA per week.

Supplementary Fig. 3. Flowchart of the study.

Supplementary Fig. 4. Timeline of some covariates collection.

Supplementary Table 1. Baseline characteristics of participants according to accelerometer-derived physical activity pattern.

Baseline characteristics	Physical activity pattern, No. (%) of participants			
	Total (n = 75,629)	Inactive (n = 24,365)	Active regular (n = 21,291)	Active WW (n = 29,973)
Age, mean (SD), years	61.8 (7.9)	62.8 (7.8)	60.8 (7.9)	61.7 (7.7)
Male	33734 (44.6)	8243 (33.8)	10472 (49.2)	15019 (50.1)
Ethnicity, White	73307 (96.9)	23504 (96.5)	20600 (96.8)	29203 (97.4)
BMI, mean (SD)	26.6 (4.4)	27.9 (5.1)	25.7 (4.0)	26.1 (3.9)
Education attainment, college	33720 (44.6)	8691 (35.7)	10675 (50.1)	14354 (47.9)
TDI, mean (SD)	-1.8 (2.8)	-1.9 (2.7)	-1.4 (2.9)	-2.0 (2.7)
Smoking status				
Never	44302 (58.6)	13732 (56.4)	12557 (59.0)	18013 (60.1)
Former	26882 (35.5)	8801 (36.1)	7547 (35.4)	10534 (35.1)
Current	4445 (5.9)	1832 (7.5)	1187 (5.6)	1426 (4.8)
Alcohol intake frequency				
Daily or almost daily	16764 (22.2)	4734 (19.4)	5021 (23.6)	7009 (23.4)
Three or four times a week	20183 (26.7)	5486 (22.5)	5951 (28.0)	8746 (29.2)
Once or twice a week	19211 (25.4)	6229 (25.6)	5252 (24.7)	7730 (25.8)
One to three times a month	8214 (10.9)	3164 (13.0)	2158 (10.1)	2892 (9.6)
Special occasions only	7106 (9.4)	3026 (12.4)	1813 (8.5)	2267 (7.6)
Never	4151 (5.5)	1726 (7.1)	1096 (5.1)	1329 (4.4)
Diet quality, mean (SD)	3.7 (1.5)	3.6 (1.5)	3.8 (1.5)	3.8 (1.5)
Sleep pattern, mean (SD)	3.1 (1.0)	3.0 (1.0)	3.2 (1.0)	3.2 (1.0)
Weekly MVPA volume, mean (SD)	296.6 (244.6)	75.7 (44.7)	463.9 (265.2)	357.4 (190.3)
History of hypertension, yes	16071 (21.2)	6470 (26.6)	3869 (18.2)	5732 (19.1)
History of diabetes, yes	2329 (3.1)	1190 (4.9)	496 (2.3)	643 (2.1)
History of cancer, yes	9905 (13.1)	3602 (14.8)	2534 (11.9)	3769 (12.6)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; BMI, body mass index; TDI, Townsend Deprivation Index; SD, standard deviation.

Diet quality was reflected in a diet score based on the frequency of consumption of fruits, vegetables, fish, processed meat, unprocessed red meat, whole grains, and refined grains, with higher scores indicating a healthier diet quality.

The sleep pattern assessment encompassed chronotype, sleep duration, insomnia, snoring, and

excessive daytime sleepiness, utilizing a scoring system ranging from 0 (poorer) to 5 (healthier).

Supplementary Table 2. Association between physical activity pattern and incident brain disorders in models with different sets of covariates and the fully adjusted model.

Brain-related disorder	HR (95% CI)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Dementia					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.91 (0.73,1.13)	0.90 (0.72,1.12)	0.94 (0.75,1.17)	0.92 (0.74,1.15)	0.92 (0.73,1.15)
Active WW	0.74 (0.60,0.90)	0.74 (0.61,0.91)	0.77 (0.63,0.94)	0.75 (0.61,0.92)	0.77 (0.63,0.95)
Stroke					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.82 (0.72,0.94)	0.83 (0.73,0.95)	0.84 (0.73,0.96)	0.87 (0.76,1.00)	0.89 (0.77,1.02)
Active WW	0.79 (0.70,0.90)	0.81 (0.72,0.91)	0.82 (0.73,0.93)	0.84 (0.75,0.95)	0.87 (0.77,0.98)
Parkinson's disease					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.64 (0.48,0.85)	0.62 (0.46,0.82)	0.63 (0.47,0.83)	0.61 (0.46,0.82)	0.58 (0.43,0.78)
Active WW	0.55 (0.43,0.71)	0.54 (0.41,0.70)	0.54 (0.41,0.69)	0.53 (0.41,0.69)	0.51 (0.39,0.66)
Depressive disorder					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.64 (0.56,0.72)	0.64 (0.56,0.73)	0.71 (0.62,0.81)	0.73 (0.64,0.83)	0.77 (0.68,0.88)
Active WW	0.60 (0.53,0.67)	0.62 (0.55,0.70)	0.68 (0.60,0.76)	0.68 (0.60,0.76)	0.74 (0.65,0.84)
Anxiety disorder					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.73 (0.65,0.82)	0.74 (0.66,0.84)	0.78 (0.69,0.88)	0.78 (0.69,0.88)	0.82 (0.72,0.92)
Active WW	0.63 (0.57,0.71)	0.66 (0.59,0.74)	0.69 (0.61,0.77)	0.67 (0.60,0.76)	0.72 (0.65,0.81)
Bipolar disorder					
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	1.06 (0.35,3.22)	0.99 (0.32,3.05)	1.10 (0.36,3.38)	1.28 (0.41,4.02)	1.19 (0.37,3.82)
Active WW	0.61 (0.19,1.95)	0.63 (0.19,2.02)	0.64 (0.20,2.06)	0.72 (0.22,2.38)	0.74 (0.22,2.44)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

Model 1 (basic) was adjusted for age and sex.

Model 2 (socio-demographics) was adjusted for age, sex, ethnicity, TDI, and education level.

Model 3 (lifestyle) was adjusted for age, sex, smoking status, alcohol intake frequency, diet scores, sleep scores.

Model 4 (health conditions) was adjusted for BMI, history of diabetes, history of hypertension, history of cancer.

Model 5 was a fully adjusted model with adjustment for all covariates mentioned above. Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Supplementary Table 3. Associations between physical activity pattern and brain disorders using activity threshold of ≥ 150 minutes of MVPA per week (guideline-based).

Activity pattern	Outcomes, HR (95% CI)					
	Dementia	Stroke	Parkinson's disease	Depressive disorder	Anxiety disorder	Bipolar disorder
Active group defined as $>25^{\text{th}}$ percentile (115.2 minutes/week) of total MVPA volume						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.88 (0.70,1.11)	0.89 (0.77,1.03)	0.54 (0.40,0.73)	0.73 (0.63,0.84)	0.79 (0.70,0.89)	1.30 (0.37,4.59)
Active WW	0.77 (0.62,0.95)	0.84 (0.74,0.96)	0.52 (0.40,0.68)	0.71 (0.62,0.80)	0.71 (0.63,0.80)	0.99 (0.30,3.29)
Active group defined as $>50^{\text{th}}$ percentile (244.8 minutes/week) of total MVPA volume						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.95 (0.75,1.20)	0.97 (0.84,1.11)	0.64 (0.47,0.87)	0.86 (0.75,0.99)	0.85 (0.75,0.96)	1.59 (0.50,5.05)
Active WW	0.84 (0.67,1.05)	0.93 (0.81,1.05)	0.59 (0.44,0.78)	0.84 (0.74,0.96)	0.72 (0.63,0.81)	1.12 (0.33,3.83)
Active group defined as $>75^{\text{th}}$ percentile (417.6 minutes/week) of total MVPA volume						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.94 (0.71,1.25)	0.94 (0.80,1.11)	0.65 (0.44,0.96)	0.83 (0.70,0.99)	0.86 (0.73,1.00)	1.70 (0.46,6.29)
Active WW	0.75 (0.54,1.02)	0.93 (0.78,1.10)	0.56 (0.37,0.84)	0.78 (0.64,0.95)	0.67 (0.56,0.81)	1.39 (0.30,6.42)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer. Inactive was defined as the threshold of MVPA/week (25^{th} , 50^{th} , or 75^{th} percentile of total MVPA volume). Active WW was defined as at or above the MVPA threshold and had $\geq 50\%$ of total MVPA over 1-2 days.

Supplementary Table 4. Association between physical activity pattern and incident brain disorders, stratified by age and sex.

Brain disorder	HR (95% CI)			
	Age <65	Age ≥65	Female	Male
Dementia				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.81 (0.37,1.76)	0.84 (0.67,1.07)	0.90 (0.63,1.27)	0.93 (0.69,1.26)
Active WW	0.95 (0.47,1.94)	0.69 (0.55,0.86)	0.82 (0.60,1.12)	0.74 (0.56,0.98)
<i>p-value</i> for interaction	=0.7303		=0.8592	
Stroke				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.88 (0.68,1.13)	0.83 (0.70,0.98)	0.90 (0.73,1.12)	0.87 (0.72,1.04)
Active WW	0.93 (0.74,1.18)	0.80 (0.69,0.92)	0.94 (0.78,1.14)	0.82 (0.69,0.97)
<i>p-value</i> for interaction	=0.6176		=0.5514	
Parkinson's disease				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.72 (0.39,1.35)	0.49 (0.35,0.69)	0.44 (0.25,0.77)	0.66 (0.46,0.93)
Active WW	0.50 (0.26,0.93)	0.48 (0.36,0.64)	0.44 (0.27,0.72)	0.55 (0.40,0.75)
<i>p-value</i> for interaction	=0.6945		=0.7952	
Depressive disorder				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.78 (0.66,0.93)	0.77 (0.63,0.95)	0.78 (0.65,0.92)	0.75 (0.60,0.94)
Active WW	0.78 (0.67,0.92)	0.68 (0.56,0.82)	0.79 (0.68,0.92)	0.66 (0.54,0.81)
<i>p-value</i> for interaction	=0.3685		=0.2657	
Anxiety disorder				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.80 (0.68,0.94)	0.85 (0.71,1.01)	0.85 (0.74,0.99)	0.75 (0.61,0.94)
Active WW	0.68 (0.58,0.80)	0.77 (0.65,0.90)	0.73 (0.64,0.84)	0.71 (0.58,0.87)
<i>p-value</i> for interaction	=0.1374		=0.7898	
Bipolar disorder				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.67 (0.14,3.25)	1.94 (0.36,10.50)	0.59 (0.11,3.14)	3.76 (0.39,36.08)
Active WW	0.42 (0.07,2.46)	1.13 (0.21,6.02)	0.66 (0.15,2.79)	1.34 (0.12,15.45)
<i>p-value</i> for interaction	=0.6661		=0.3849	

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age (except for subgroup of age), sex (except for subgroup of sex), ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer. Wald tests were used to obtain two-sided *p-values*.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥ 150 minutes of MVPA/week and had $\geq 50\%$ of total MVPA over 1-2 days.

Supplementary Table 5. Association between physical activity pattern and incident brain disorders, stratified by ethnicity.

Brain disorder	HR (95% CI)	
	White (n = 73,307)	Other (n = 2,322)
Dementia		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	0.92 (0.73,1.16)	1.02 (0.22,4.63)
Active WW	0.77 (0.62,0.95)	0.96 (0.22,4.29)
<i>p-value</i> for interaction		=0.9554
Stroke		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	0.87 (0.76,1.00)	2.18 (0.88,5.42)
Active WW	0.86 (0.76,0.97)	1.47 (0.57,3.79)
<i>p-value</i> for interaction		=0.3261
Parkinson's disease		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	0.59 (0.44,0.79)	NA
Active WW	0.50 (0.38,0.66)	0.88 (0.12,6.41)
<i>p-value</i> for interaction		=0.8964
Depressive disorder		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	0.78 (0.68,0.89)	0.68 (0.31,1.49)
Active WW	0.74 (0.65,0.83)	0.92 (0.45,1.88)
<i>p-value</i> for interaction		=0.7336
Anxiety disorder		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	0.81 (0.72,0.92)	0.85 (0.44,1.64)
Active WW	0.72 (0.65,0.81)	0.70 (0.36,1.38)
<i>p-value</i> for interaction		=0.9253
Bipolar disorder		
Inactive	1.00 (ref)	1.00 (ref)
Active regular	1.53 (0.46,5.12)	NA
Active WW	0.89 (0.26,3.07)	NA
<i>p-value</i> for interaction		NA

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference; NA, not available.

All adjusted for age, sex, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer. Wald tests were used to obtain two-sided *p-values*.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥ 150

minutes of MVPA/week and had $\geq 50\%$ of total MVPA over 1-2 days.

Supplementary Table 6. Association of physical activity pattern with brain disorders, with additional adjustment for occupation (n = 75,539).

Outcomes	No. of cases	Physical activity pattern, HR (95% CI)		
		Inactive	Active regular	Active WW
Dementia	529	1.00 (ref)	0.93 (0.74,1.16)	0.78 (0.63,0.96)
Stroke	1 465	1.00 (ref)	0.90 (0.78,1.03)	0.87 (0.77,0.99)
Parkinson's disease	318	1.00 (ref)	0.57 (0.42,0.76)	0.50 (0.39,0.66)
Depressive disorder	1 505	1.00 (ref)	0.79 (0.69,0.90)	0.75 (0.66,0.85)
Anxiety disorder	1 789	1.00 (ref)	0.82 (0.73,0.93)	0.73 (0.65,0.82)
Bipolar disorder	18	1.00 (ref)	1.30 (0.40,4.18)	0.79 (0.24,2.63)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer, and occupation.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥ 150 minutes of MVPA/week and had $\geq 50\%$ of total MVPA over 1-2 days.

Supplementary Table 7. Association of physical activity pattern with brain disorders, with additional adjustment for sedentary time (n = 75,629).

Outcomes	No. of cases	Physical activity pattern, HR (95% CI)		
		Inactive	Active regular	Active WW
Dementia	530	1.00 (ref)	0.98 (0.78,1.24)	0.81 (0.66,1.00)
Stroke	1 468	1.00 (ref)	0.89 (0.78,1.03)	0.87 (0.77,0.99)
Parkinson's disease	319	1.00 (ref)	0.71 (0.53,0.96)	0.60 (0.45,0.78)
Depressive disorder	1 507	1.00 (ref)	0.77 (0.67,0.88)	0.74 (0.65,0.83)
Anxiety disorder	1 794	1.00 (ref)	0.80 (0.71,0.91)	0.71 (0.64,0.80)
Bipolar disorder	18	1.00 (ref)	0.87 (0.27,2.79)	0.58 (0.17,1.92)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer, and sedentary time.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥ 150 minutes of MVPA/week and had $\geq 50\%$ of total MVPA over 1-2 days.

Markers indicate hazard ratios (HRs), with vertical lines representing 95% CIs.

Supplementary Table 8. Association of physical activity pattern with brain disorders, with additional adjustment for MVPA volume (n = 75,629).

Outcomes	No. of cases	Physical activity pattern, HR (95% CI)		
		Inactive	Active regular	Active WW
Dementia	530	1.00 (ref)	1.13 (0.85,1.51)	0.90 (0.70,1.15)
Stroke	1 468	1.00 (ref)	0.96 (0.81,1.14)	0.92 (0.79,1.06)
Parkinson's disease	319	1.00 (ref)	0.63 (0.43,0.91)	0.54 (0.39,0.74)
Depressive disorder	1 507	1.00 (ref)	0.88 (0.74,1.05)	0.81 (0.70,0.94)
Anxiety disorder	1 794	1.00 (ref)	0.98 (0.84,1.15)	0.83 (0.72,0.95)
Bipolar disorder	18	1.00 (ref)	1.05 (0.24,4.49)	0.67 (0.17,2.58)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer, and total MVPA volume.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Markers indicate hazard ratios (HRs), with vertical lines representing 95% CIs.

Supplementary Table 9. Associations between physical activity pattern and brain disorders using activity threshold of ≥ 150 minutes of MVPA per week (guideline-based).

Activity pattern	Outcomes, HR (95% CI)					
	Dementia	Stroke	Parkinson's disease	Depressive disorder	Anxiety disorder	Bipolar disorder
Weekend warrior defined as $\geq 75\%$ MVPA over 1-2 days						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.85 (0.71,1.03)	0.89 (0.79,1.00)	0.56 (0.44,0.71)	0.77 (0.69,0.86)	0.76 (0.69,0.85)	1.04 (0.38,2.87)
Active WW	0.66 (0.45,0.98)	0.76 (0.61,0.96)	0.38 (0.22,0.67)	0.59 (0.45,0.75)	0.74 (0.60,0.91)	NA
Weekend warrior defined as $\geq 50\%$ MVPA over 1-2 consecutive days						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.90 (0.73,1.11)	0.88 (0.78,1.01)	0.55 (0.42,0.72)	0.78 (0.69,0.88)	0.77 (0.68,0.86)	1.40 (0.48,4.04)
Active WW	0.75 (0.60,0.94)	0.87 (0.76,0.99)	0.52 (0.39,0.69)	0.72 (0.63,0.83)	0.75 (0.67,0.85)	0.38 (0.08,1.90)
Weekend warrior defined as $\geq 50\%$ MVPA over 1-2 weekend days						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.84 (0.70,1.02)	0.87 (0.77,0.97)	0.53 (0.42,0.67)	0.76 (0.68,0.85)	0.76 (0.69,0.85)	0.95 (0.34,2.65)
Active WW	0.70 (0.46,1.06)	0.94 (0.76,1.16)	0.59 (0.36,0.95)	0.68 (0.55,0.84)	0.75 (0.62,0.91)	0.74 (0.09,6.27)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference; NA, not available.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer.

Supplementary Table 10. Association between physical activity pattern and incident brain disorders, excluding individuals who occurred brain disorders within the first 1 or 2 years of follow-up.

PA patterns	HR (95% CI)					
	Dementia	Stroke	Parkinson's disease	Depressive disorders	Anxiety disorders	Bipolar disorders
Excluding those who occurred outcomes within the first 1 years of follow-up (n = 75,110)						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.92 (0.73,1.17)	0.90 (0.77,1.04)	0.61 (0.45,0.83)	0.80 (0.69,0.92)	0.81 (0.72,0.92)	1.14 (0.32,4.01)
Active WW	0.81 (0.65,1.01)	0.88 (0.77,1.01)	0.53 (0.41,0.70)	0.77 (0.68,0.88)	0.72 (0.64,0.81)	0.85 (0.25,2.93)
Excluding those who occurred outcomes within the first 2 years of follow-up (n = 74,615)						
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Active regular	0.93 (0.73,1.19)	0.92 (0.79,1.08)	0.62 (0.45,0.84)	0.82 (0.70,0.95)	0.83 (0.73,0.96)	1.39 (0.37,5.21)
Active WW	0.81 (0.65,1.01)	0.91 (0.79,1.04)	0.53 (0.40,0.70)	0.76 (0.66,0.88)	0.75 (0.66,0.85)	0.81 (0.21,3.20)

Abbreviation: PA, physical activity; MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval.

All adjusted for age (except for subgroup of age), sex (except for subgroup of sex), ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Supplementary Table 11. Association of physical activity pattern with brain disorders, using multiple imputations with chained equations (n = 78,889).

Outcomes	Physical activity pattern, HR (95% CI)		
	Inactive	Active regular	Active WW
Dementia	1.00 (ref)	0.92 (0.74, 1.15)	0.80 (0.65, 0.98)
Stroke	1.00 (ref)	0.88 (0.77, 1.00)	0.86 (0.77, 0.98)
Parkinson's disease	1.00 (ref)	0.65 (0.49, 0.86)	0.52 (0.40, 0.68)
Depressive disorder	1.00 (ref)	0.78 (0.69, 0.89)	0.73 (0.64, 0.82)
Anxiety disorder	1.00 (ref)	0.83 (0.74, 0.94)	0.74 (0.66, 0.83)
Bipolar disorder	1.00 (ref)	1.04 (0.00, NA)	0.76 (0.00, NA)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference; NA, not available.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, and history of cancer.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Supplementary Table 12. Association of physical activity pattern with brain disorders, with additional adjustment for the wear time and the season of wear (n = 75,629).

Outcomes	Physical activity pattern, HR (95% CI)		
	Inactive	Active regular	Active WW
Dementia	1.00 (ref)	0.91 (0.72,1.14)	0.76 (0.62,0.94)
Stroke	1.00 (ref)	0.89 (0.78,1.02)	0.88 (0.78,1.00)
Parkinson's disease	1.00 (ref)	0.57 (0.43,0.77)	0.51 (0.39,0.66)
Depressive disorder	1.00 (ref)	0.77 (0.67,0.88)	0.74 (0.65,0.84)
Anxiety disorder	1.00 (ref)	0.82 (0.72,0.92)	0.73 (0.65,0.82)
Bipolar disorder	1.00 (ref)	1.17 (0.37,3.74)	0.74 (0.22,2.46)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer, the wear time, and the season of wear.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥ 150 minutes of MVPA/week and had $\geq 50\%$ of total MVPA over 1-2 days.

Supplementary Table 13. Association of physical activity pattern with brain disorders, using covariates measured at baseline (n = 75,841).

Outcomes	Physical activity pattern, HR (95% CI)		
	Inactive	Active regular	Active WW
Dementia	1.00 (ref)	0.94 (0.75,1.17)	0.79 (0.64,0.97)
Stroke	1.00 (ref)	0.88 (0.77,1.02)	0.87 (0.77,0.98)
Parkinson's disease	1.00 (ref)	0.57 (0.43,0.77)	0.51 (0.39,0.66)
Depressive disorder	1.00 (ref)	0.77 (0.67,0.88)	0.73 (0.64,0.82)
Anxiety disorder	1.00 (ref)	0.82 (0.72,0.92)	0.73 (0.66,0.82)
Bipolar disorder	1.00 (ref)	1.17 (0.37,3.73)	0.74 (0.22,2.44)

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; HR, hazard ratio; CI, confidence interval; ref, reference.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, and history of cancer.

Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Supplementary Table 14. Association of physical activity pattern with brain disorders, with additional adjustment for disease which may affect the ability to perform PA (n = 75,629).

Outcomes	Physical activity pattern, HR (95% CI)		
	Inactive	Active regular	Active WW
Dementia	1.00 (ref)	0.93 (0.75,1.17)	0.78 (0.63,0.96)
Stroke	1.00 (ref)	0.90 (0.79,1.04)	0.88 (0.78,1.00)
Parkinson's disease	1.00 (ref)	0.59 (0.44,0.79)	0.51 (0.39,0.67)
Depressive disorder	1.00 (ref)	0.79 (0.69,0.90)	0.75 (0.67,0.85)
Anxiety disorder	1.00 (ref)	0.83 (0.74,0.94)	0.74 (0.66,0.83)
Bipolar disorder	1.00 (ref)	1.26 (0.39,4.08)	0.76 (0.23,2.55)

Abbreviation: PA, physical activity; MVPA, moderate-to-vigorous intensity physical activity; WW, weekend warrior; TDI, Townsend Deprivation Index; BMI, body mass index; HR, hazard ratio; CI, confidence interval; ref, reference; COPD, chronic obstructive pulmonary disease; CKD, chronic kidney disease.

All adjusted for age, sex, ethnicity, TDI, and education level, smoking status, alcohol intake frequency, diet scores, sleep scores, BMI, history of diabetes, history of hypertension, history of cancer, history of myocardial infarction, history of asthma, history of COPD, history of CKD, history of arthritis, and history of motor neuron disease.

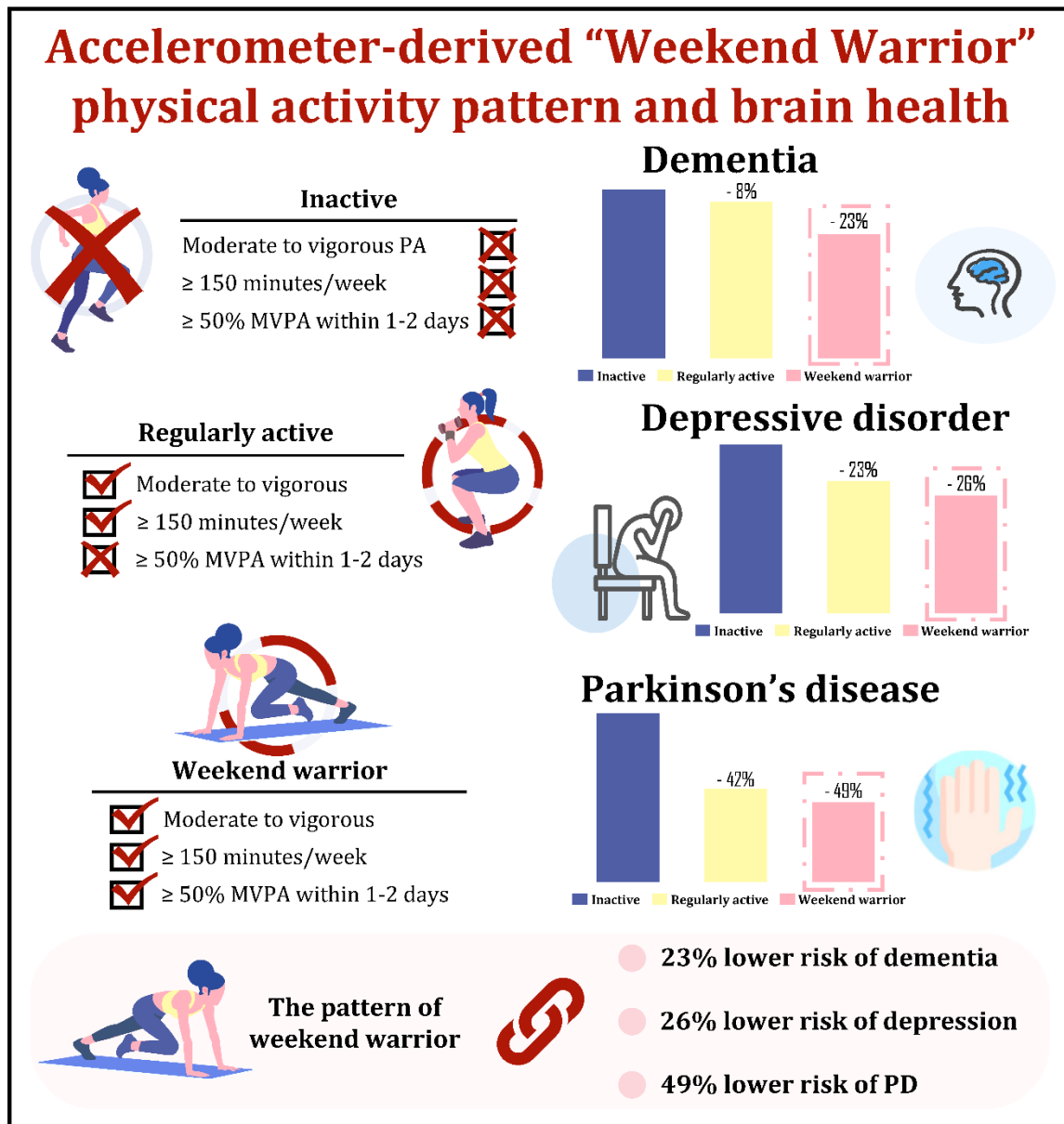
Inactive was defined as <150 minutes of MVPA/week. Active WW was defined as ≥150 minutes of MVPA/week and had ≥50% of total MVPA over 1-2 days.

Supplementary Table 15. The codes used for brain disorders.

Brain disorders	Field ID	ICD-10 code
Dementia	130836	F00
	130838	F01
	130840	F02
	130842	F03
	131036	G30
Parkinson's disease	131022	G20
Stroke	131056	G45
	131058	G46
	131360	I60
	131362	I61
	131366	I63
	131368	I64
Depressive disorder	130894	F32
	130896	F33
Anxiety disorder	130904	F40
	130906	F41
Bipolar affective disorder	130892	F31

ICD-10, International Classification of Disease, 10th Revision.

Supplementary Fig. 1. Overview of the study.



Abbreviation: PA, physical activity; MVPA, moderate-to-vigorous intensity physical activity; PD, Parkinson's disease.

Supplementary Fig. 2. Distribution of MVPA on top 2 days vs. remaining 5 days among active individuals using guideline-based activity threshold of 150 minutes or more of MVPA per week.

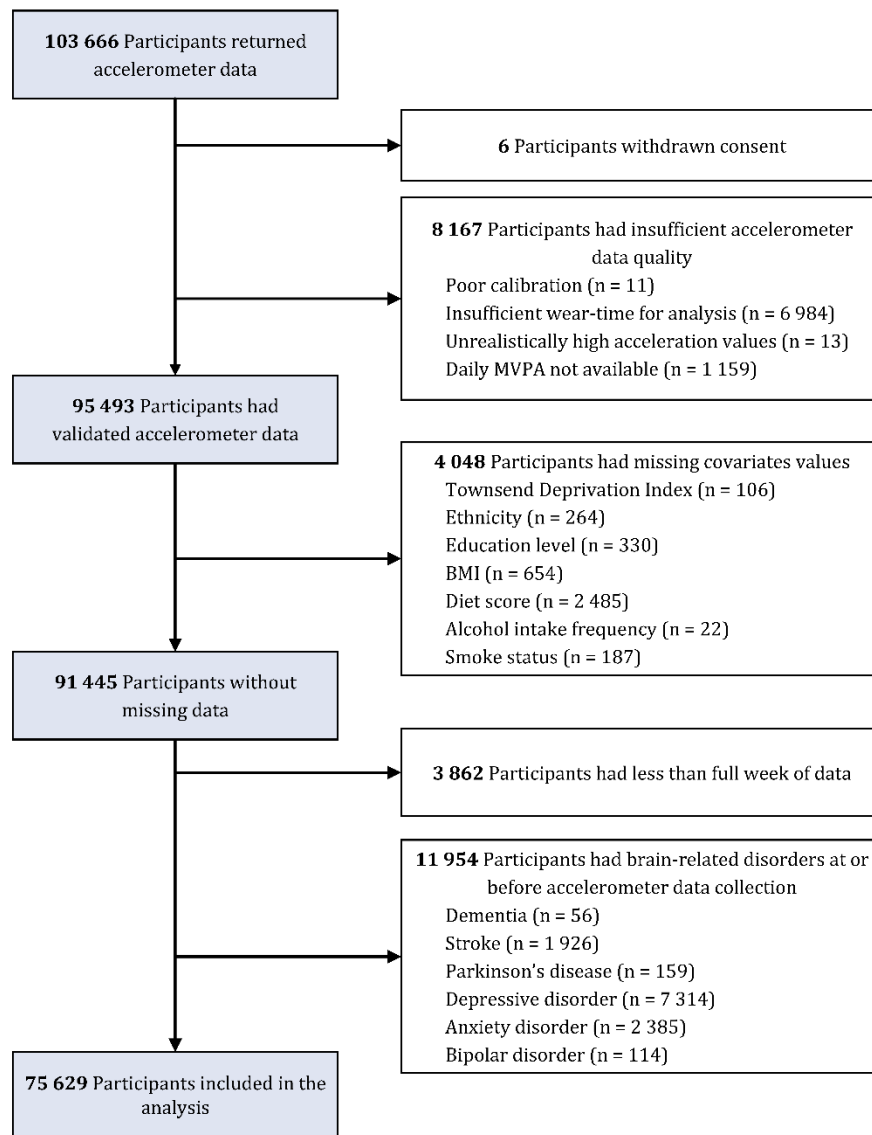


Depicted is the distribution of daily MVPA on the 2 most active days of the week (blue), vs the remaining 5 days (red), among individuals with activity above the guideline-based threshold (i.e., ≥ 150 minutes MVPA over the week, $n = 51,264$).

A, Active individuals not meeting criteria for weekend warrior activity (regular) are shown. B, Individuals meeting criteria for weekend warrior activity (i.e., $\geq 50\%$ of total MVPA achieved in 1-2 days) are shown.

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity.

Supplementary Fig. 3. Flowchart of the study.



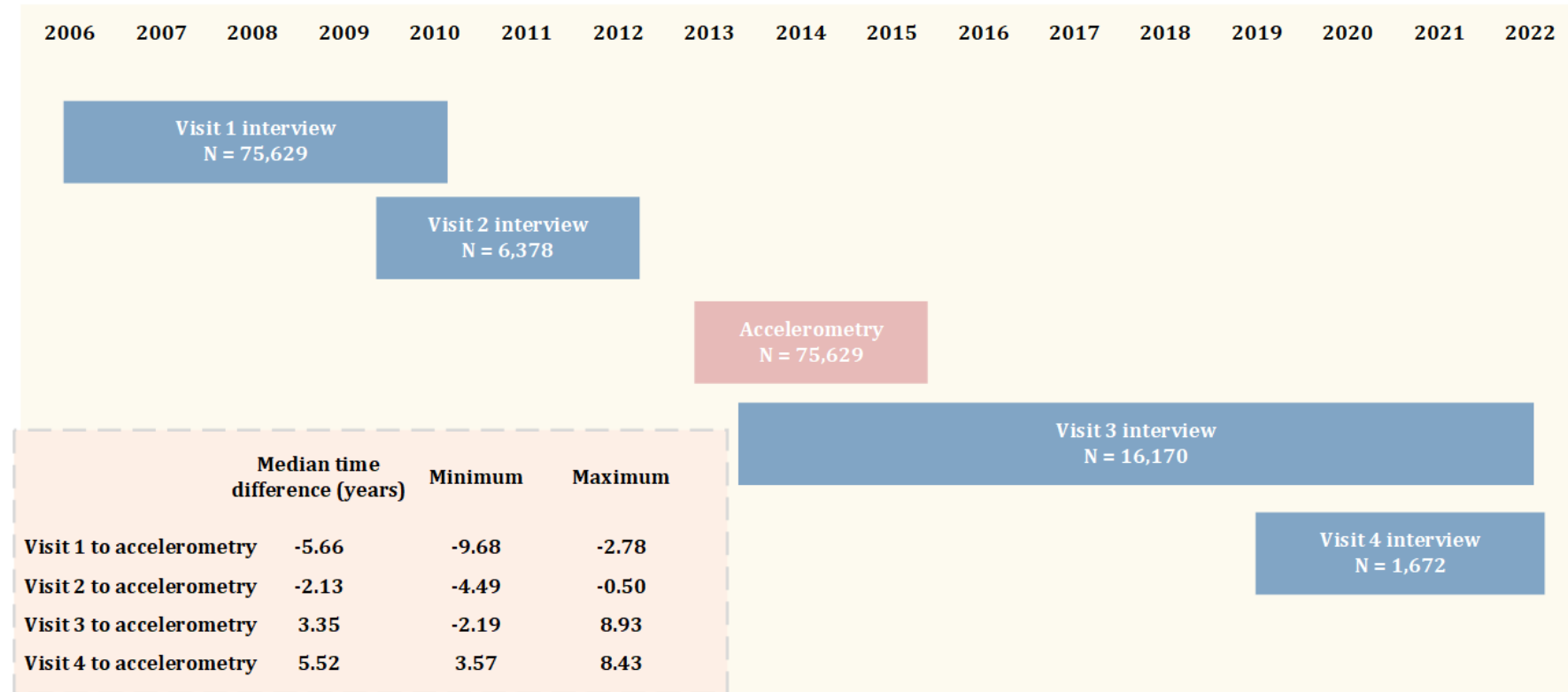
Note:

1. The exclusion criterion of “insufficient wear time for analysis” was based on the Field ID 90015 in the UK Biobank, which is the minimal wear time criterion [Doherty A, et al., *PLOS ONE* 2017].

2. The exclusion criterion of “less than full week of data” was based on the Field ID 90004 in the UK Biobank, which ensured that the participants included had values corresponding to a full week so that we could compare the weekend warrior and regular activity patterns.

Abbreviation: MVPA, moderate-to-vigorous intensity physical activity; BMI, body mass index.

Supplementary Fig. 4. Timeline of some covariates collection.



The covariates with repeated measurements including education level, BMI, smoking status, alcohol frequency, diet scores, and sleep scores were obtained from touchscreen questionnaires at the time-point closest to the baseline of this study.