

Supplementary Online Content

Spartano NL, Davis-Plourde KL, Himali JJ, et al. Association of accelerometer-measured light-intensity physical activity with brain volume: the Framingham Heart Study. *JAMA Netw Open*. 2019;2(4):e192745. doi:10.1001/jamanetworkopen.2019.2745

eFigure. Diagram illustrating derivation of analytic sample used for the main analysis

eTable 1. Adjusted means of brain MRI measures, no significant differences between those meeting and not meeting the PA Guidelines

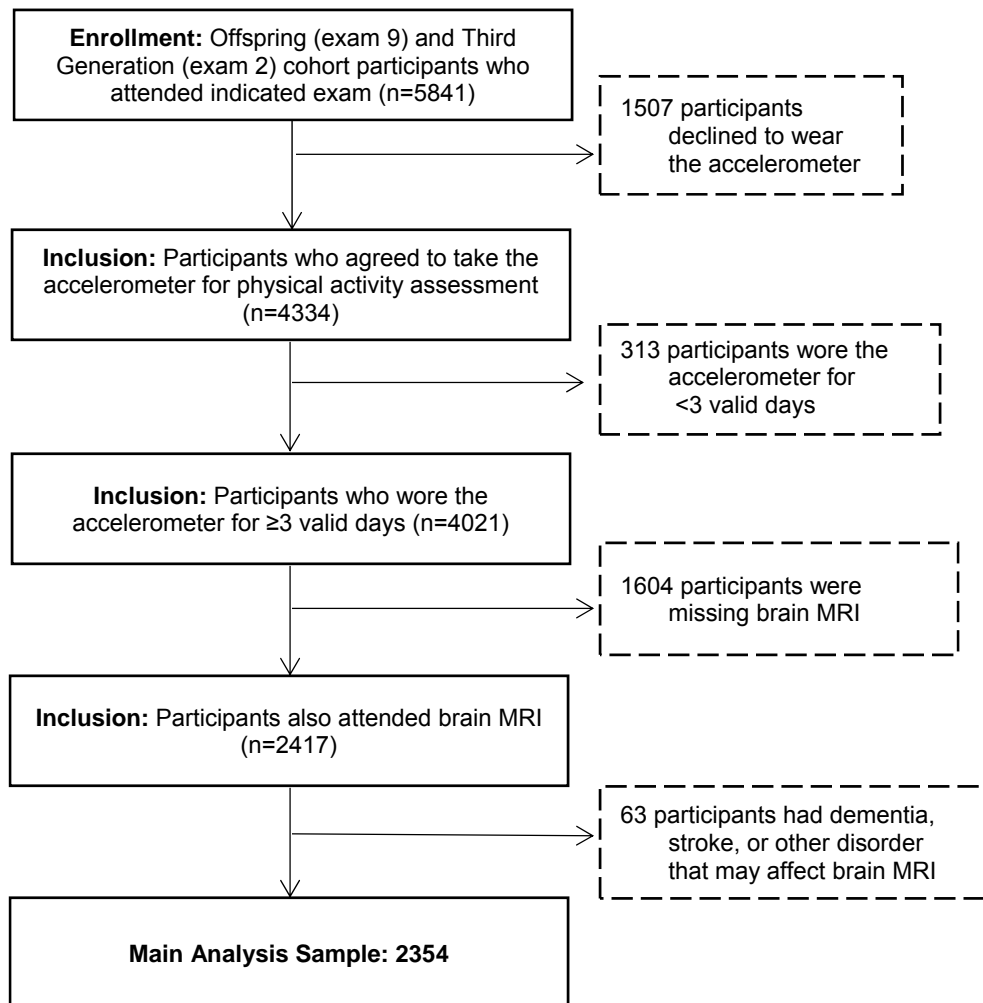
eTable 2. Relations of objectively measured physical activity to brain MRI measures in the full study sample (n=2354), with 2 adjustment models

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eTable 4. Relations of objectively measured physical activity to secondary brain MRI measures in the full study sample (n=2354), with 2 adjustment models

This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. Diagram illustrating derivation of analytic sample used for the main analysis



eTable 1. Adjusted means of brain MRI measures, no significant differences between those meeting and not meeting the PA Guidelines

	NOT meeting PA-guidelines (n=1255)	Meeting PA-guidelines (n=1099)	P for difference
Total Cerebral Brain Volume, % (mean±SE)	87.27± 0.079	87.34 ± 0.086	0.572
Hippocampal Volume, % (mean±SE)	0.54 ± 0.0013	0.54 ± 0.0015	0.194
Lateral Ventricular Volume, % (mean±SE)	1.46 ± 0.027	1.41 ± 0.029	0.299
White Matter Hyperintensities Volume, log% (mean±SE)	-2.86 ± 0.028	-2.90 ± 0.031	0.365
Total white matter volume, % (mean±SE)	40.21 ± 0.061	40.12 ± 0.065	0.291
Total gray matter volume, % (mean±SE)	49.28 ± 0.066	49.29 ± 0.071	0.951
Cortical gray matter volume, % (mean±SE)	37.63 ± 0.051	37.62 ± 0.055	0.883

Abbreviations: Magnetic resonance imaging (MRI); physical activity (PA); standard error (SE); p-value (p).

Adjustment model 1: age, age-squared, sex, time from exam to MRI, smoking, cohort, wear time, season of exam, residence in New England versus other, body mass index, hypertension, diabetes mellitus, cardiovascular disease

(not adjusting for light-intensity PA)

eTable 2. Relations of objectively measured physical activity to brain MRI measures in the full study sample (n=2354), with 2 adjustment models

Physical Activity Measure	Categories of Physical Activity	Model	Total Cerebral Brain Volume		Total White Matter Volume		White Matter Hyperintensities Volume		Lateral Ventricular Volume	
			$\beta \pm SE$	p	$\beta \pm SE$	p	$\beta \pm SE$	p	$\beta \pm SE$	p
Total Activity (Steps/d)	0-5000 steps (n=489)	2	0	Ref	0	Ref	0	Ref	0	Ref
		3	0	Ref	0	Ref	0	Ref	0	Ref
	5000-7500 steps (n=684)	2	0.09 ± 0.16	0.599	-0.09 ± 0.12	0.472	0.01 ± 0.06	0.847	-0.12 ± 0.05	0.031
		3	0.09 ± 0.16	0.591	-0.08 ± 0.13	0.511	0.02 ± 0.06	0.741	-0.12 ± 0.06	0.038
	7500-10000 steps (n=581)	2	0.29 ± 0.17	0.096	0.14 ± 0.13	0.288	0.009 ± 0.06	0.880	-0.16 ± 0.06	0.006
		3	0.29 ± 0.17	0.096	0.15 ± 0.13	0.246	0.02 ± 0.06	0.741	-0.16 ± 0.06	0.006
10000+ steps (n=596)	2	0.35 ± 0.18	0.045	0.03 ± 0.13	0.849	-0.03 ± 0.06	0.683	-0.14 ± 0.06	0.015	
	3	0.37 ± 0.18	0.039	0.04 ± 0.14	0.755	-0.01 ± 0.06	0.845	-0.15 ± 0.06	0.015	
Light-intensity PA,* per hour increments		2	0.22 ± 0.07	0.003	0.05 ± 0.06	0.377	0.07 ± 0.03	0.007	-0.05 ± 0.02	0.028
		3	0.21 ± 0.07	0.003	0.05 ± 0.06	0.375	0.07 ± 0.03	0.009	-0.06 ± 0.02	0.014
MVPA,* min/d	0-10 min (n=602)	2	0	Ref	0	Ref	0	Ref	0	Ref
		3	0	Ref	0	Ref	0	Ref	0	Ref
	10-20 min (n=580)	2	0.29 ± 0.16	0.076	0.25 ± 0.13	0.047	-0.08 ± 0.06	0.192	-0.10 ± 0.06	0.066
		3	0.30 ± 0.17	0.071	0.25 ± 0.13	0.052	-0.07 ± 0.06	0.272	-0.10 ± 0.06	0.066
	20-30 min (n=421)	2	0.35 ± 0.18	0.057	0.11 ± 0.14	0.443	-0.07 ± 0.07	0.255	-0.14 ± 0.06	0.029
		3	0.34 ± 0.19	0.072	0.11 ± 0.14	0.456	-0.06 ± 0.07	0.399	-0.13 ± 0.06	0.043
30+ min (n=751)	2	0.14 ± 0.17	0.390	0.01 ± 0.13	0.940	-0.10 ± 0.06	0.084	-0.07 ± 0.06	0.240	
	3	0.15 ± 0.17	0.397	0.01 ± 0.13	0.919	-0.09 ± 0.06	0.160	-0.06 ± 0.06	0.296	

Abbreviations: Magnetic resonance imaging (MRI); moderate to vigorous physical activity (MVPA); minutes (min); day (d) ; beta estimate (β); standard error (SE); p-value (p).

Adjustment Model 2: age, age-squared, sex, time from exam to MRI, smoking status, cohort, wear time, season of exam, residence in New England.

*Light-intensity PA models were additionally adjusted for MVPA categories (≥ 10 min v. < 10 min); and MVPA models were additionally adjusted for light-intensity PA.

Adjustment Model 3: Model 2 + body mass index, hypertension, diabetes mellitus, cardiovascular disease

eTable 3. Relations of objectively measured physical activity to total cerebral brain volume in participants aged 40-79 years (n=1922), by decade of age

Multivariable Regression Models in Full Sample, Total Cerebral Brain Volume	Age 40-49 (n=696)		Age 50-59 (n=602)		Age 60-69 (n=385)		Age 70-79 (n=239)	
	$\beta \pm SE$	p	$\beta \pm SE$	p	$\beta \pm SE$	p	$\beta \pm SE$	p
Total Activity (Steps/d) ≥7500 (n=957) v. <7500 (n=962)	0.10 ± 0.19	0.59	0.17 ± 0.20	0.39	0.37 ± 0.30	0.21	0.65 ± 0.45	0.15
Light Activity,* per hour increments	0.11 ± 0.12	0.35	0.36 ± 0.12	0.003	0.12 ± 0.20	0.56	0.27 ± 0.25	0.30
MVPA,* min/d ≥10min (n=1752) v. <10 min (n=602)	-0.14 ± 0.27	0.61	0.31 ± 0.24	0.19	0.47 ± 0.32	0.14	0.51 ± 0.44	0.25

Abbreviations: Magnetic resonance imaging (MRI); moderate to vigorous physical activity (MVPA); minutes (min); day (d); beta estimate (β); standard error (SE); p-value (p). The upper limits for age ranges are exclusive.

Model 2: age, age-squared, sex, time from exam to MRI, smoking status, cohort, wear time, season of exam, residence in New England

*Light Activity models were additionally adjusted for MVPA categories (≥10min v. <10 min); and MVPA models were additionally adjusted for light activity.

eTable 4. Relations of objectively measured physical activity to secondary brain MRI measures in the full study sample (n=2354), with 2 adjustment models

Full Sample (n=2354)	Categories of Physical Activity	Model	Hippocampal Volume		Total Gray Matter Volume		Cortical Gray Matter Volume		
			$\beta \pm SE$	p	$\beta \pm SE$	p	$\beta \pm SE$	p	
Total Activity (Steps/d)	0-5000 steps (n=489)	2	0	Ref	0	Ref	0	Ref	
		3	0	Ref	0	Ref	0	Ref	
	5000-7500 (n=684)	2	0.002 ± 0.003	0.482	0.13 ± 0.13	0.316	0.04 ± 0.10	0.671	
		3	0.003 ± 0.003	0.228	0.09 ± 0.14	0.521	0.02 ± 0.11	0.869	
	7500-10000 (n=581)	2	0.004 ± 0.003	0.142	0.26 ± 0.14	0.071	0.12 ± 0.11	0.277	
		3	0.006 ± 0.003	0.041	0.19 ± 0.14	0.186	0.09 ± 0.11	0.436	
	10000+ (n=596)	2	0.001 ± 0.003	0.680	0.17 ± 0.15	0.231	0.08 ± 0.11	0.482	
		3	0.004 ± 0.003	0.201	0.11 ± 0.15	0.443	0.05 ± 0.12	0.652	
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	Light-intensity PA,*		2	0.001 ± 0.001	0.281	0.05 ± 0.06	0.402	0.02 ± 0.05	0.657
per hour increments		3	0.001 ± 0.001	0.238	0.05 ± 0.06	0.400	0.02 ± 0.05	0.707	
MVPA,* min/d	0-10 min (n=602)	2	0	Ref	0	Ref	0	Ref	
		3	0	Ref	0	Ref	0	Ref	
	10-20 min (n=580)	2	0.003 ± 0.003	0.229	0.09 ± 0.14	0.486	0.02 ± 0.10	0.831	
		3	0.005 ± 0.003	0.098	0.06 ± 0.14	0.659	0.005 ± 0.11	0.960	
	20-30 min (n=421)	2	-0.005 ± 0.003	0.118	0.10 ± 0.15	0.498	-0.02 ± 0.12	0.848	
		3	-0.003 ± 0.003	0.346	0.03 ± 0.15	0.863	-0.06 ± 0.12	0.590	
	30+ min (n=751)	2	-0.002 ± 0.003	0.585	0.05 ± 0.14	0.741	-0.004 ± 0.11	0.972	
		3	0.0009 ± 0.003	0.765	-0.03 ± 0.14	0.829	-0.04 ± 0.11	0.723	

Abbreviations: Magnetic resonance imaging (MRI); moderate to vigorous physical activity (MVPA); minutes (min); day (d) ; beta estimate (β); standard error (SE); p-value (p).

Adjustment Model 2: age, age-squared, sex, time from exam to MRI, smoking status, cohort, wear time, season of exam, residence in New England.

*Light-intensity PA models were additionally adjusted for MVPA categories (≥ 10 min v. < 10 min); and MVPA models were additionally adjusted for light-intensity PA.

Adjustment Model 3: Model 2 + body mass index, hypertension, diabetes mellitus, cardiovascular disease