Associations of Accelerometer Measures of Physical Activity and Sedentary Behavior with Alzheimer's Disease Related Dementias and Vascular Dementias Classified Using Medicare Claims Data Among Older Black, Hispanic or Latina, and White Women: The Objective Physical Activity and Cardiovascular Health Study

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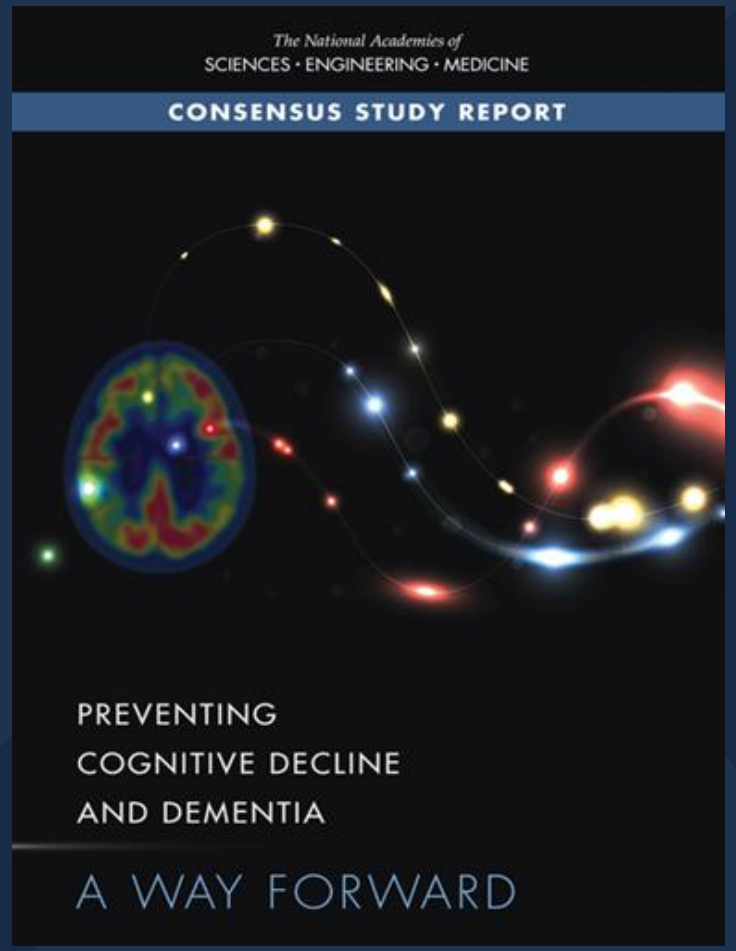
Background

- Alzheimer’s dementia (AD) prevalence is projected to double from 6.9 million in 2024 to 13.8 million by 2060
- Women have nearly double the lifetime risk of AD compared to men (21.1% vs 11.6%)
- Mixed dementia (e.g., from Alzheimer’s and cerebrovascular disease) is common
- Strategies to prevent or delay Alzheimer’s disease related dementias (ADRD) are needed given its extended neuropathological progression

Background

- Physical activity (PA) is listed as 1 of 3 promising interventions for ADRD
- The prospective associations of sedentary behavior (SB) with ADRD are understudied
- Relatively few studies have examined accelerometer measures of PA and SB with vascular dementia specifically
- There have been few accelerometer studies among diverse populations



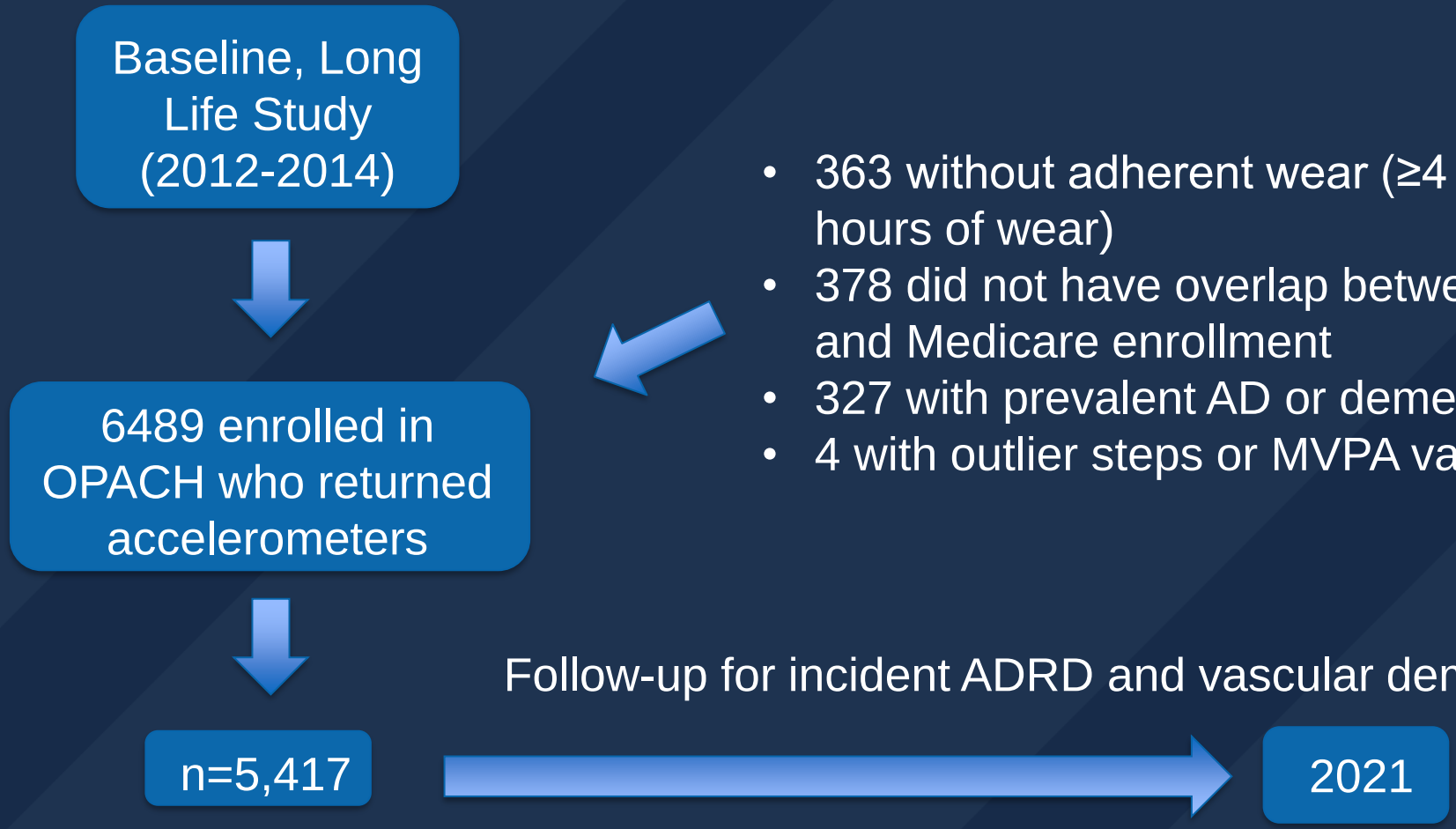
Objectives

- Examine the prospective associations of accelerometer measures of PA and SB with incident ADRD and vascular dementia among older Black, Hispanic or Latina, and White women

- Examine effect modification across age, BMI, physical functioning, Reynolds risk score, and APOE ε4 carrier status

Study Population

- Ambulatory community-living older women in the Objective Physical Activity and Cardiovascular Health (OPACH) study of the Women's Health Initiative (WHI)



Incident ADRD and Vascular Dementia

- Bynum 1-year standard algorithm for identifying ADRD in Medicare claims data
  - Medicare Provider and Analysis Review: Inpatient and skilled nursing facility
  - Home Health Agency: Any claim
  - Hospice: any claim
  - Hospital Outpatient File (HOF): Claims from Rural Health Clinics, Federally Qualified Health Centers, Critical-Access Hospitals-Payment Option II
  - Carrier File for services from physicians and other care providers: At least 2 Carrier or HOF claims at least 7 days apart

- Two endpoints: ADRD and vascular dementia

- List of ICD-9 and ICD-10 codes:

Accelerometer Measures

Variable	Estimation method
Total physical activity min/day	OPACH Calibration Study vector magnitude cutpoints
Moderate-to-vigorous intensity physical activity min/day	
Light physical activity min/day	
Steps/day	ActiGraph proprietary algorithm
Total sitting time min/day	Convolutional Neural Network Hip Accelerometer Posture (CHAP) algorithm
Mean sitting bout duration min/bout	

- We adjusted for accelerometer wear time using the residuals method

Statistical Analyses

- Multivariable Cox proportional hazards models to estimate hazard ratios and 95% confidence intervals
- Models adjusted for age, race and ethnicity, education, alcohol, smoking, physical function, diabetes, hypertension, and body mass index
- Restricted cubic splines tested linearity of associations
- Stratified analysis and effect modification across age, BMI, physical function, Reynolds Risk Score, race and ethnicity, and APOE ε4 carrier status

Table 1. Baseline (2012-2014) characteristics by step quartiles in OPACH cohort.

		Step (n/day) quartiles[a]		
Characteristics	**Total**	**Q1 (low): <2,161**	**Q4 (high): ≥4,540**	**p**
Age, mean (sd)	78.6 (7)	82.2 (6)	75.1 (6)	<0.001
Race and or ethnicity, n (%)				<0.001
White	2745 (50.7)	815 (60.1)	577 (42.6)	
Black	1778 (32.8)	453 (33.4)	404 (29.8)	
Hispanic	894 (16.5)	87 (6.4)	373 (27.5)	
Highest education level, n (%)				<0.001
High school/GED or less	1083 (20.1)	301 (22.3)	239 (17.7)	
Some college	2098 (39)	562 (41.7)	460 (34.1)	
College graduate	2204 (40.9)	485 (36)	649 (48.1)	
Current smoking, n (%)	140 (2.6)	55 (4.1)	20 (1.5)	<0.001
Alcohol use in past 3 months, n (%)				<0.001
Non-drinker	1825 (33.7)	574 (42.4)	353 (26.1)	
<1 drink/week	1709 (31.5)	410 (30.3)	424 (31.3)	
≥ 1 drink/week	1428 (26.4)	235 (17.3)	491 (36.3)	
Unknown	455 (8.4)	136 (10)	86 (6.4)	
BMI; kg/m^2, mean(sd)	28.12 (5.66)	29.04 (6.27)	26.21 (4.58)	<0.001
Physical functioning, mean (sd)	69.38 (25.7)	49.41 (26.22)	85.96 (15.76)	<0.001
Diabetes	1080 (19.9)	371 (27.4)	164 (12.1)	<0.001
Hypertension	3880 (71.6)	1116 (82.4)	791 (58.4)	<0.001
Reynolds Risk Score	12.3 (10.68)	18.17 (13.55)	7.53 (6.5)	<0.001
APOE ε4 carrier status (≥1 ε4 allele)	269 (19.8)	97 (20.9)	37 (18.5)	0.87

Table 2. Associations of PA with ADRD and Vascular Dementia (VD)

	Total physical activity (minutes/day)					
	Q1 (<276)	Q2 (276-336)	Q3 (336-397)	Q4 (>397)	HR for 1-SD increment (90)	P-trend[a]
ADRD HR (95% CI)	1.00 (ref)	0.88 (0.75-1.04)	0.94 (0.80-1.11)	0.83 (0.69-1.00)	0.93 (0.87-1.00)	0.04
VD HR (95% CI)	1.00 (ref)	0.82 (0.54-1.23)	1.14 (0.77-1.70)	0.77 (0.48-1.25)	0.97 (0.82-1.15)	0.70
	Moderate-to-vigorous intensity physical activity (minutes/day)					
	Q1 (<27)	Q2 (27-45)	Q3 (45-69)	Q4 (>69)	HR for 1-SD increment (34)	P-trend[a]
ADRD HR (95% CI)	1.00 (ref)	0.78 (0.67-0.91)	0.60 (0.51-0.72)	0.58 (0.48-0.71)	0.80 (0.74-0.86)	<0.001
VD HR (95% CI)	1.00 (ref)	0.77 (0.54-1.12)	0.55 (0.36-0.86)	0.61 (0.38-0.99)	0.79 (0.65-0.97)	0.02
	Steps (n/day)					
	Q1 (<2161)	Q2 (2161-3212)	Q3 (3212-4540)	Q4 (>4540)	HR for 1-SD increment (2051)	P-trend[a]
ADRD HR (95% CI)	1.00 (ref)	0.70 (0.60-0.82)	0.61 (0.51-0.73)	0.53 (0.43-0.65)	0.76 (0.69-0.83)	<0.001
VD HR (95% CI)	1.00 (ref)	0.70 (0.48-1.03)	0.61 (0.39-0.95)	0.57 (0.34-0.97)	0.73 (0.58-0.92)	0.01
	Total sitting time (minutes/day)					
	Q1 (<556)	Q2 (556-625)	Q3 (625-695)	Q4 (>695)	HR for 1-SD increment (102)	P-trend[a]
ADRD HR (95% CI)	1.00 (ref)	1.03 (0.87-1.23)	0.99 (0.83-1.19)	1.15 (0.95-1.38)	1.08 (1.01-1.16)	0.03
VD HR (95% CI)	1.00 (ref)	1.17 (0.75-1.81)	0.94 (0.60-1.49)	0.84 (0.52-1.37)	0.97 (0.81-1.15)	0.72

Abbreviations: ADRD = Alzheimer's Disease Related Dementia

[a] P-values from Cox multivariable linear regression models with accelerometer measure in continuous form.

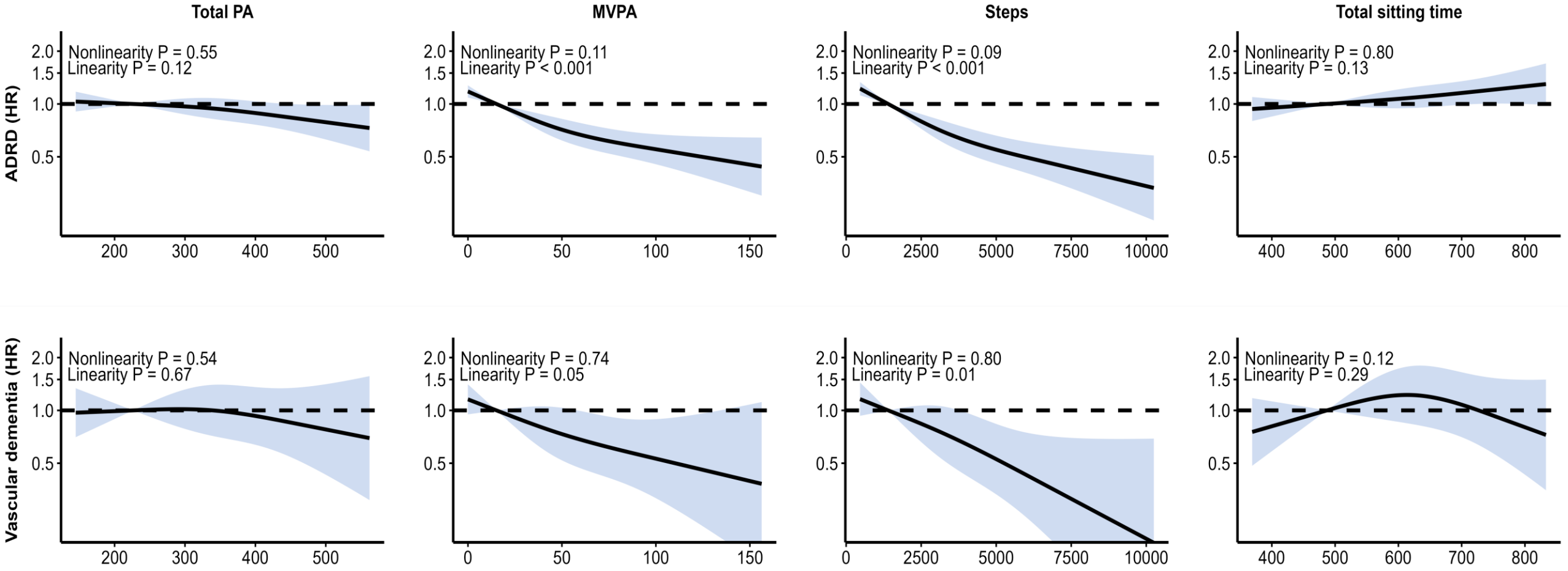
[b] Crude incidence rate per 1000 person-years

[c] Data are hazard ratio (95% confidence interval)

[d] Model results were estimated with missing covariate imputed using multiple imputation by chained equations (MICE) from the R *mice* package.

Models adjusted for age, race and ethnicity, education;, smoking status, alcohol use, diabetes, hypertension, RAND-36 physical functioning score, and BMI

Figure 2. Continuous dose-response associations of PA and SB with ADRD and Vascular Dementia.



Abbreviations: MSBD=mean sedentary bout duration
Models adjusted for age, race and ethnicity, education, alcohol consumption, smoking status, diabetes, hypertension, RAND-36 physical functioning, and BMI
Results were trimmed at the 1st and 99th percentiles. The reference was set to the 10th percentile of accelerometer measure.

Table 3. Stratified Analyses and Effect Modification for Steps with ADRD

	n	n events	HR (95% CI) for IQR (2379 steps)	P-interaction
Total Sample	5417	1143	0.72 (0.65-0.80)	
Age				0.14
< 80 Years	2754	384	0.72 (0.62-0.85)	
≥ 80 Years	2663	759	0.72 (0.63-0.83)	
Physical function				0.53
< 75	2447	588	0.64 (0.53-0.77)	
≥ 75	2970	555	0.77 (0.68-0.87)	
Reynolds Risk Score				0.57
<9.12	2652	457	0.77 (0.66-0.91)	
≥9.12	2765	686	0.69 (0.58-0.83)	
***APOE ε4* carrier status**				**0.02**
0 ε4 alleles	1087	292	**0.74 (0.61-0.89)**	
≥ 1 ε4 allele	269	107	**0.81 (0.60-1.09)**	
Race and ethnicity†				0.32
White	2745	681	0.70 (0.61-0.81)	
Black	1778	323	0.69 (0.57-0.85)	
Hispanic/Latina	894	139	0.80 (0.63-1.01)	

† Models for each level of race and ethnicity were not mutually adjusted for race and ethnicity.
Models adjusted for age, race and ethnicity, education, smoking status, alcohol use, multimorbidity, physical functioning, self-rated health, BMI, and hypertension. RAND-36 physical functioning and MVPA were split at the median. Model results were estimated with missing covariate data imputed using multiple imputation by chained equations (MICE) from the R *mice* package.

Discussion & Conclusions

- Among older Black, Hispanic or Latina, and White women, higher amounts of MPVA and steps/day are associated with lower risk of ADRD and vascular dementia
  - Higher total PA is associated with lower ADRD risk
  - Higher total sitting time is associated with higher ADRD risk
  - LPA and MSBD were not associated with ADRD or vascular dementia

- At least moderate intensity PA may be needed for lower ADRD and vascular dementia risks

- Lower amounts of sitting should be encouraged for lower ADRD risk while higher amounts of LPA should be encouraged for general health benefits

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Questions & Further Discussion

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