


Study of physical activity levels using accelerometers and self- report in community-dwelling older adults: a SAGE study

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Physical activity, disease burden and ageing

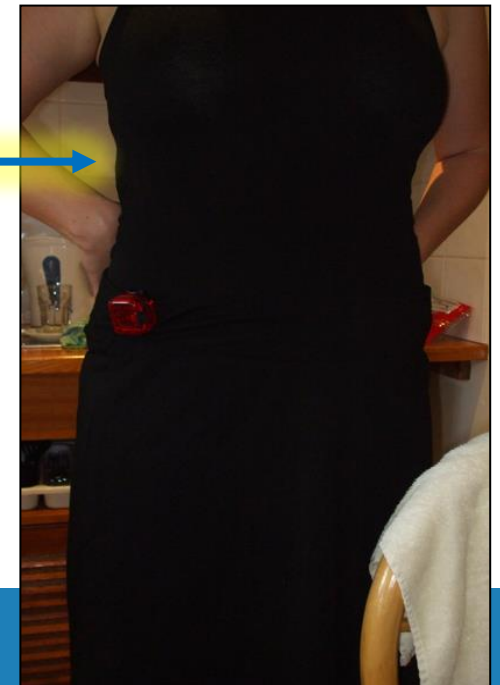
- Globally, physical inactivity is 10th leading risk for morbidity (2010 GBD)
- Physical inactivity typically  with age
- Self-reported physical activity (GPAQ) levels
 - under-report energy expenditure
 - over-estimate activity
- Accelerometry
 - results more strongly associated with health status
 - ? relationship with self-report in lower income countries

Physical Activity Assessment using Accelerometry

- Habitual physical activity is an important contributor to chronic disease risk & frailty, yet it is difficult to measure accurately
- Accelerometers are motion sensors typically worn at the waist or wrist that objectively measure movement of the body by detecting and recording acceleration
- Participants wear a unit for 7 to 21 days and then return it for data downloading

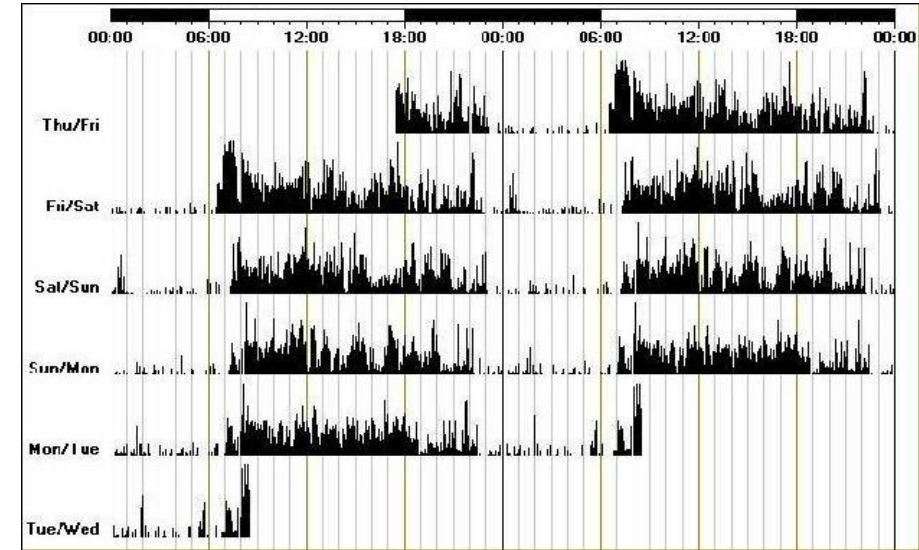


Accelerometer typically worn ~1 cm toward the midline from the hip bone



Activity Data

- Accelerometry provides data on total daily energy expenditure (TDEE) and physical activity level (PAL) in free-living populations
 - Also, time spent in sedentary vs. moderate vs. vigorous activities
- Few studies have used accelerometry to examine activity in older adults
- Few comparisons between accelerometry data and self-report information on activity



Accelerometry data file showing graphical display of activity data

Research Objectives

- To measure physical activity levels using accelerometers in order to:
 - 1) Examine age and sex differences in activity and functioning
 - 2) Investigate links between activity and measures of health and frailty
 - 3) Compare measured activity with self-report data obtained in SAGE using GPAQ (Global Physical Activity Questionnaire)

Methods

- WHO Study on global AGEing and adult health (SAGE) sub-study conducted in May 2010
- SAGE-PA sub-study conducted in Jodhpur, Rajasthan among urban adults
- Accelerometry data collected from 200 adults (72 men, 128 women) aged 49-90 years old

Methods: Accelerometry

- Participants wore ActiGraph GT3X accelerometers at the hip for 7 consecutive days
- Accelerometer worn at all times except when showering, bathing, or swimming, and when sleeping
- After 7-days, an interviewer visited the participant's home, retrieved the accelerometer, and conducted an interview using the SAGE Global Physical Activity Questionnaire
- Activity variables considered include:
 - Physical activity level, Total daily energy expenditure, Average daily activity counts, Average sleep time

Respondent characteristics

Measures, Mean (SD) or %	Young Older Adults (49-60 years old)		Old Older Adults (>60 years old)	
	Men (N = 33)	Women (N = 80)	Men (N = 38)	Women (N = 47)
Age	55.6** (2.9)	53.6 (3.8)	68.1 (6.1)	69.3 (7.2)
Height (cm)	172.0* (6.3)	159.0 (7.4)	171.8* (6.4)	155.9 (5.1)
Weight (kg)	71.5*** (15.4)	64.9 (14.0)	66.3 (16.3)	60.3 (12.0)
BMI (kg/m ²)	24.1 (5.0)	25.7 (5.3)	22.4*** (5.0)	24.9 (4.9)
Household Size	4.5 (1.7)	4.9 (2.4)	5.1 (2.2)	5.2 (2.2)
Social Cohesion Score	20.6* (4.2)	17.1 (3.7)	18.7** (3.8)	16.6 (3.4)
Work Status				*P < 0.001; **P < 0.01; ***P < 0.05.
Yes	42.4%	58.8%	34.2%	42.6%
No	57.6%	41.3%	65.8%	57.4%

Objective # 1: activity by age & sex

Physical Activity Measures, Mean (SD)	Young Older Adults (49-60 years old)		Old Older Adults (>60 years old)	
	Men (N = 33)	Women (N = 80)	Men (N = 38)	Women (N = 47)
Total Daily Energy Expenditure (TDEE; kcal/day)	1865.4* (289.5)	1529.3 (203.2)	1618.4* (322.5)	1333.5 (166.6)
Physical Activity Level (PAL; TDEE/BMR)	1.17 (0.09)	1.17 (0.07)	1.15 (0.09)	1.14 (0.08)
Activity Counts (Average per day)	194,895.1 (103,847.6)	178,868.7 (77,740.7)	159,329.3 (77,632.8)	141,191.9 (86,966.6)
Activity Energy Expenditure (AEE; kcal/day)	269.4 (152.4)	222.3 (102.7)	212.3*** (153.5)	159.0 (93.2)

*P < 0.001; **P < 0.01; ***P < 0.05.

Objective #1, Key Findings: Age & sex differences

- Overall, low activity levels
 - Lower in women than men
 - Age negatively correlated with AEE in both sexes
- No significant differences in PAL or daily average activity count between men and women
 - PAL = 1.16 for both men and women
- Older men (>60 years) had higher total activity counts and daily average active counts than older women ($P < 0.05$)

Objective #2: Women, PA and anthropometric measures

Measures	Physical Activity Measures			
	Total Daily Energy Expenditure (TDEE; kcal/day)	Physical Activity Level (PAL; TDEE/BMR)	Activity Counts (Average per day)	Activity Energy Expenditure (AEE; kcal/day)
Height (cm)	0.258**	0.071	-0.035	0.106
Weight (kg)	0.844*	0.062	-0.238**	0.228**
BMI (kg/m ²)	0.767*	0.022	-0.248**	0.181***
Household Size	-0.086	-0.042	-0.003	-0.031
Social Cohesion Score	0.130	0.226**	0.210***	0.231**

^aCorrelations are statistically significant at: *P ≤ 0.001; **P ≤ 0.01; ***P ≤ 0.05.

Objective #2, Key Findings: Women, activity & health measures

- Younger women (49-60) had higher PAL and AC than older (>60)
- TDEE, PAL, AC and AEE all negatively correlated with age
- TDEE and AEE positively, AC negatively correlated with BMI
- High social cohesion = higher PAL, AC, AEE

Objective #2: Men, PA and anthropometric measures

Measures	Physical Activity Measures			
	Total Daily Energy Expenditure (TDEE; kcal/day)	Physical Activity Level (PAL; TDEE/BMR)	Activity Counts (Average per day)	Activity Energy Expenditure (AEE; kcal/day)
Height (cm)	0.354**	0.184	0.099	0.265***
Weight (kg)	0.878*	0.142	-0.126	0.357**
BMI (kg/m ²)	0.817*	0.094	-0.162	0.299**
Household Size	-0.080	-0.083	-0.036	-0.055
Social Cohesion Score	-0.046	-0.114	-0.083	-0.066

^aCorrelations are statistically significant at: *P ≤ 0.001; **P ≤ 0.01; ***P ≤ 0.05.

Objective #2, Key Findings: Men, Activity & Health Measures

- TDEE and AEE negatively correlated with age
- TDEE and AEE positively correlated with BMI
- Social cohesion and HH size not significant factors in physical activity measures.

Objective #3, Key Findings: Self-report vs objective measures

- For men, activity levels recorded by the accelerometer were not significantly correlated with self-report measures from GPAQ
- For women, self-report measures of time spent in moderate-intensity activities at work were positively correlated with activity levels from the accelerometer, including TDEE ($r = .19, P < 0.05$), PAL ($P < 0.05$), and daily average activity counts ($P < 0.01$).

Conclusions

- Extremely low physical activity levels measured using accelerometry
- This study suggests that accelerometry provides reliable and robust estimates of physical activity in older adults
- Relationship between self-report and objective measures require more investigation
- This study provides an improved understanding of the biases in self-reported activity, in order to target modifiable risk factors for chronic diseases and frailty with increasing age