ELSA Experience with Accelerometers

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ELSA accelerometer experience

- Wave 6 of ELSA (2012/13)

- 499 invited to do 8 days monitoring
  - ➢ 400 agreed (80%)
    - ▪ 28 technical problems
    - ▪ 38 insufficient wear time
    - ▪ 4 sleep/wake logs lost
  - ➢ 330 completed (66% / 82.5%)

- Kapteyn A, et al., (2018). What they say and what they do: Comparing physical activity across U.S., England, and the Netherlands. *J Epidemiol Community Health, 72*, 471-476.

- Schrempft S et al., (2019) Associations between social isolation, loneliness, and objective physical activity in older men and women. *BMC Public Health, 19*, 74.

ELSA accelerometer experience

- We used the GENEActiv accelerometer
  - Also used in the Whitehall II and Pelotas cohorts

- We plan to use the Axivity accelerometer in new data collection
  - Also used in UK BioBank and the China Kadoorie Biobank
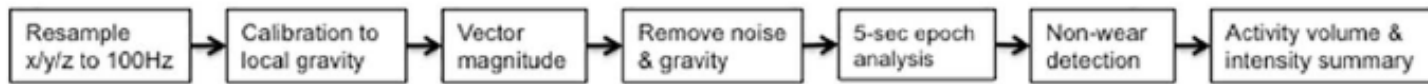 - Open source firmware platform
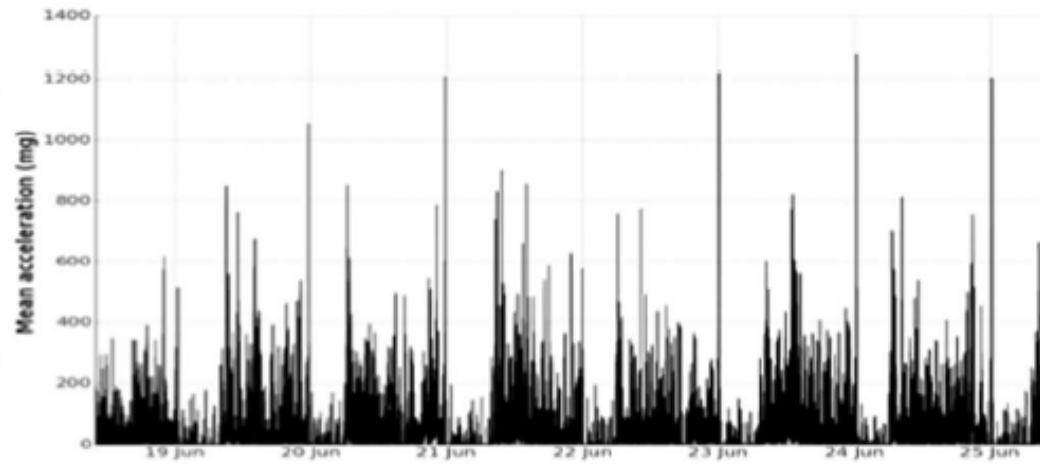
UK Biobank experience

Fig 1. UK Biobank triaxial accelerometer and processing steps to extract physical activity information. Axivity AX3 triaxial accelerometer worn on dominant hand as used in UK Biobank (top left). Time series trace of processed accelerometer values after one week of wear (top right). Overview of process to extract proxy physical activity information from raw accelerometer data (bottom).

ELSA accelerometer experience

- How much wear time needed?
  - ➢ Comparison in UK Biobank between complete 7 days and shorter times suggests that 72 hours needed to be within 10% of complete 7 day measurement

- How to quantify sleep/waking and other activities?
  - ➢ Tailored machine learning model developed

UK Biobank experience

Prediction → Ground truth ↓	Sleep	Sit/stand	Vehicle	Walking	Mixed-activity	Bicycling
Sleep	97%	3%	<1%	<1%	1%	<1%
Sit/stand	3%	89%	1%	3%	3%	<1%
Vehicle	<1%	13%	74%	3%	9%	<1%
Walking	1%	11%	2%	71%	15%	1%
Mixed-activity	1%	20%	2%	19%	57%	1%
Bicycling	1%	1%	1%	12%	14%	71%

Table 1. Percentage of machine-learned behaviours automatically classified from wrist-worn accelerometer data. Confusion matrix after leave-one-out validation on 84,616 labelled minutes of human activity in free-living environments: the CAPTURE-24 study 2014–2015 (n = 132).

Willetts et al., *Scientific Reports*, 2018

ELSA accelerometer plan

- Collect data from 3,500-4,500 participants in wave 10 (2021) using Axivity AX3

- Devices distributed by study nurses or sent in the mail

- Devices to be worn for 7 days then returned by mail

- Data downloaded, cleaned and recalibrated between uses

- Each device to be used 3-4 times every 2 months