

Implementation of accelerometry in ELSA

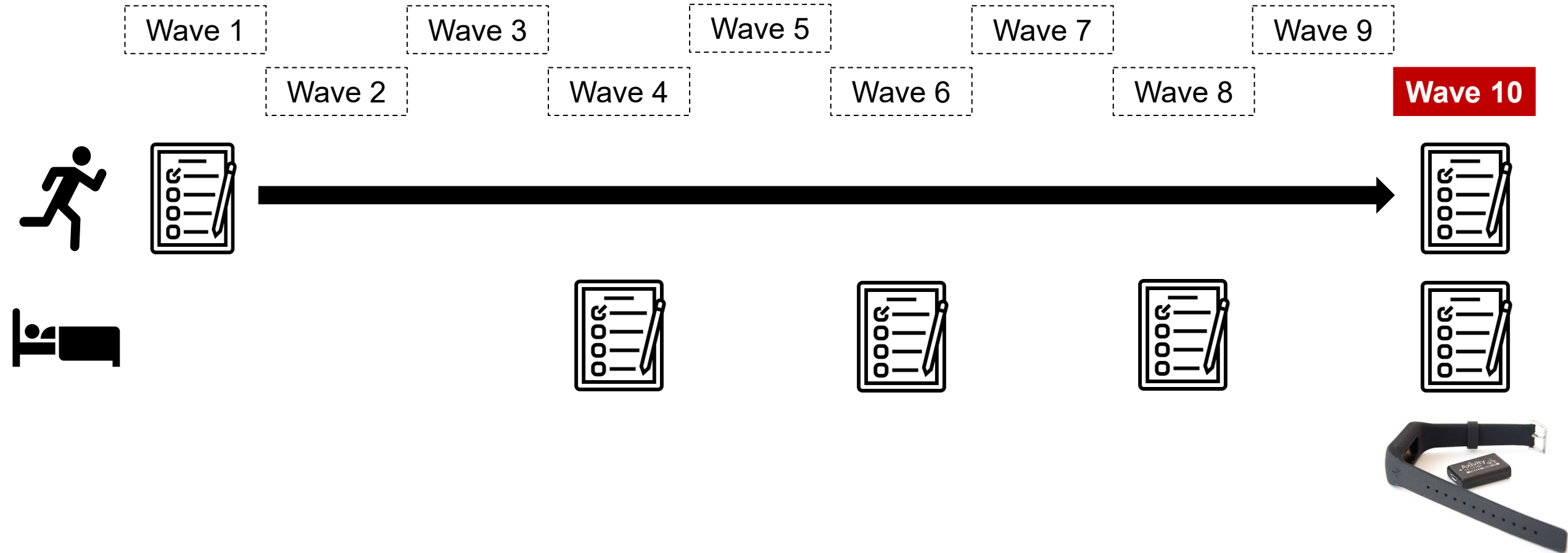
Dr Laura Brocklebank



Background: accelerometry vs. self-report

- Adherence to the moderate-to-vigorous physical activity (MVPA) recommendations is substantially lower (Troiano et al., 2008).
- The maximal risk reduction for the association with all-cause mortality is:
 - Considerably greater in magnitude.
 - Observed at considerably lower levels of MVPA (Wasfy and Lee, 2022).

ELSA timeline



Accelerometer protocol

Parameter	ELSA Wave 10
Axes	3
Frequency	100 Hz
Range	$\pm 8 g$
Wrist	Dominant
Wear protocol	24 hours per day for 8 days
Monitoring period	10 days*

* To allow for postal delays



Axivity AX3

Please start wearing the monitor immediately and record below the date and time you start wearing the monitor.

Date started wearing (dd/mm/yy): / /

Time started wearing (24-hour clock, hh:mm): :

Wrist monitor worn on (left or right):

Please return this postcard with the activity monitor in the pre-paid envelope provided.

Validity of the Axivity AX3



Axivity AX3

biobank^{uk}

N > 100,000

CHINA KADOORIE
BIOBANK

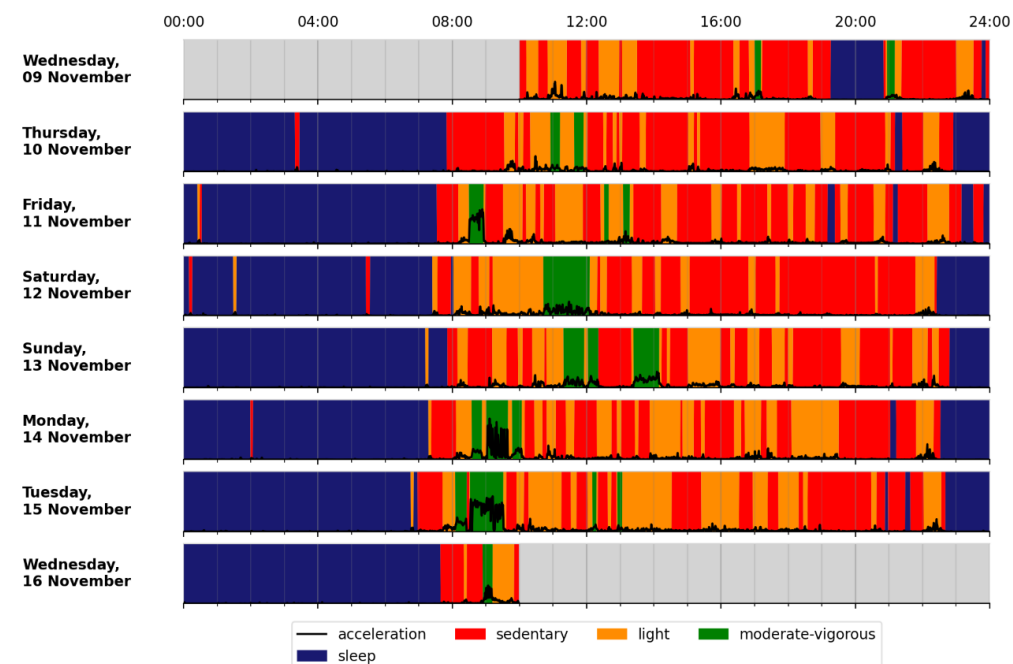
中国慢性病前瞻性研究

N > 20,000



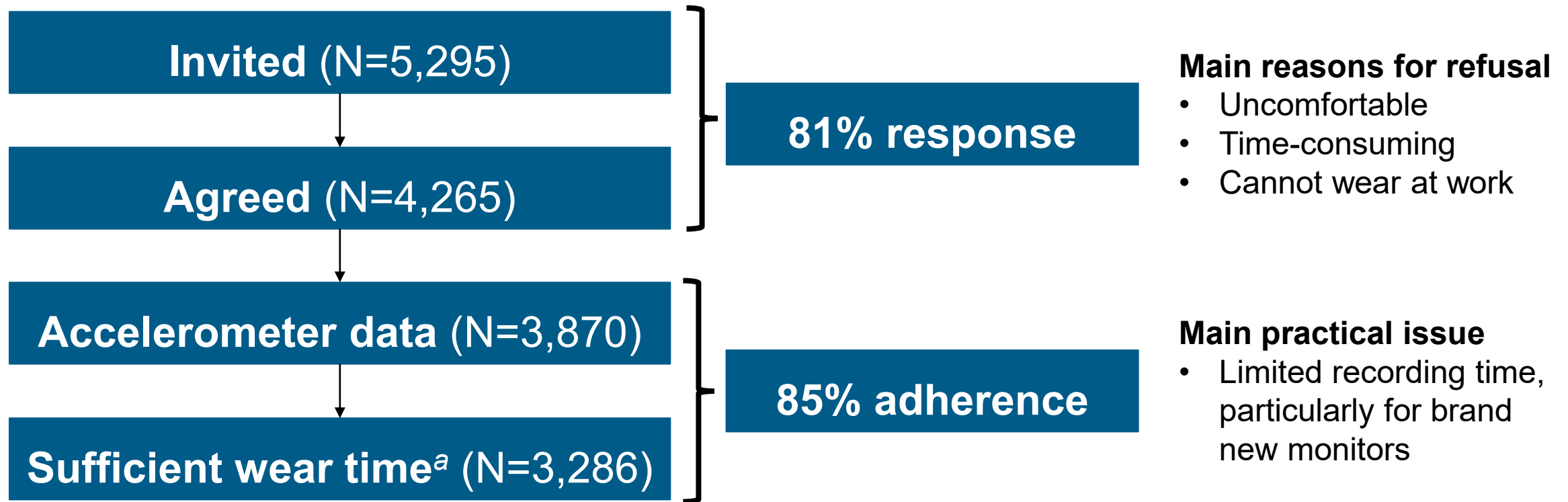
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ACCELEROMETER
ANALYSIS

Extracting meaningful health information from large accelerometer datasets



<https://github.com/OxWearables/biobankAccelerometerAnalysis>

ELSA participant flow diagram



^a ≥ 3 days of wear and contribution in each 1-hour period of the 24-hour cycle

Next steps: description paper



RESEARCH ARTICLE

Large Scale Population Assessment of Physical Activity Using Wrist Worn Accelerometers: The UK Biobank Study

Aiden Doherty^{1,2*}, Dan Jackson³, Nils Hammerla³, Thomas Plötz³, Patrick Olivier³, Malcolm H. Granat⁴, Tom White⁵, Vincent T. van Hees⁶, Michael I. Trenell⁶, Christopher G. Owen⁷, Stephen J. Preece⁴, Rob Gillions⁸, Simon Sheard⁸, Tim Peakman⁸, Soren Brage^{5†}, Nicholas J. Wareham^{5†}

Coming soon!

Next steps: data sharing



- [Raw data](#)
- [Time-series data](#) (5-second epochs)
- [Summary data](#)



Coming soon!

Next steps: cross-cohort comparisons



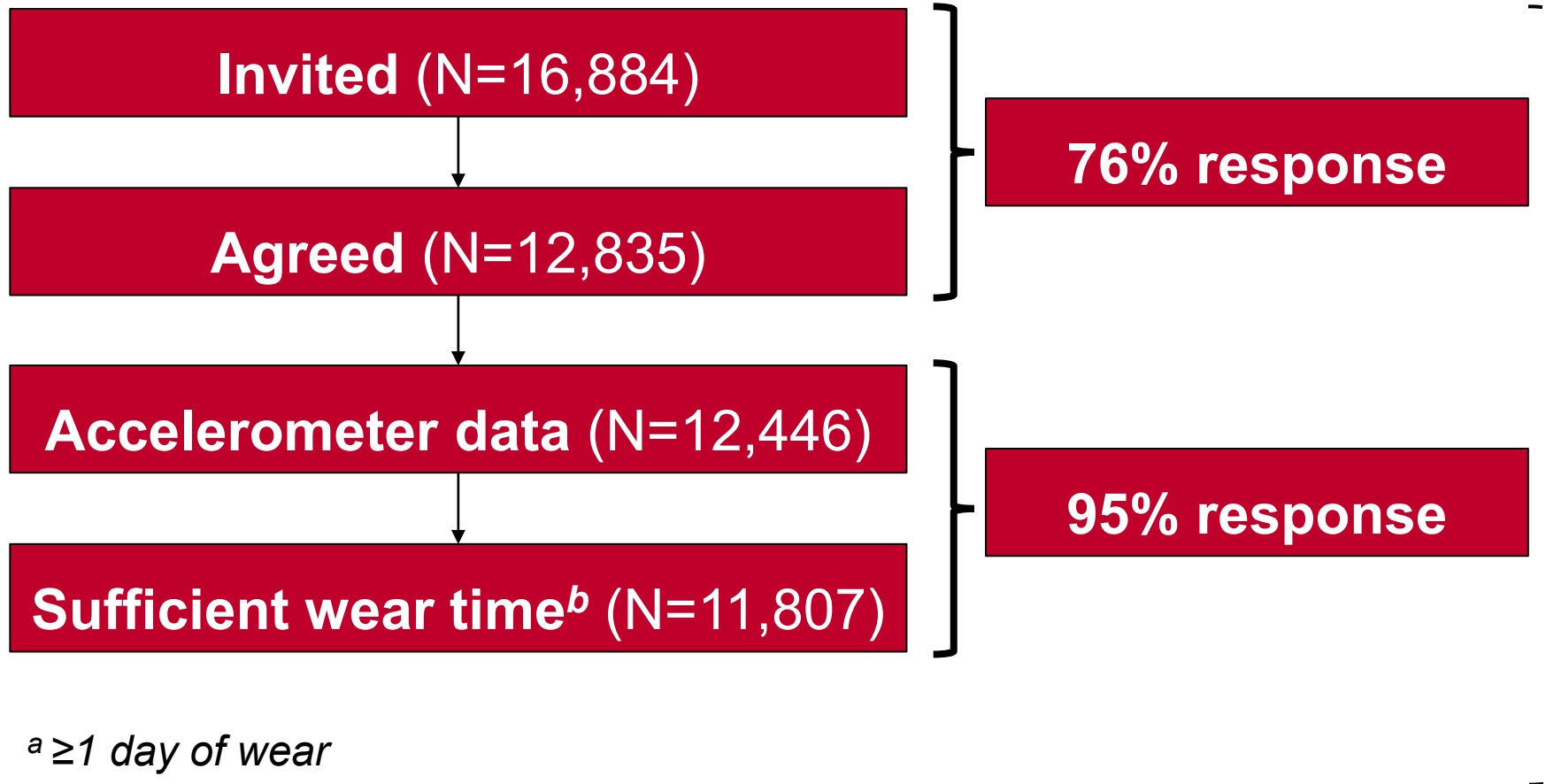
CHARLS – nationally-representative cohort study of the Chinese population aged ≥ 45 years – is also implementing wrist-worn accelerometry for the first time in its latest wave (Wave 5; 2021-23).



China Health and Retirement Longitudinal Study



CHARLS participant flow diagram



BUT CHARLS is using a different brand of wrist-worn accelerometer to ELSA

Next steps: cross-cohort comparisons

elsa English
Longitudinal
Study of
Ageing

W10
→
2021-23



Axivity AX3

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中国慢性病前瞻性研究

CHARLS
中国健康与养老追踪调查

W5
→
2021-23



Matrix 003

- Newly developed
- Economical (~50% cheaper)
- Triaxial accelerometer + gyroscope + heart rate monitor

Next steps: free-living validation study



Axivity AX3



Matrix 003



Order A



Order B

8 days (and nights)

Functional equivalence → harmonisation

Preliminary analysis (N=72)

n average (mg)

ICC (95% CI): 0.96 (0.87-0.98)

Next steps: free-living validation study

Automated wearable camera



1 (waking) day

Sleep diary

SLEEP DIARY

Camera wear day (day 2, both morning and evening)

Participant ID: _____
Date: _____

Please use the 24-hour clock (hh:mm)

What time did you wake up? (eyes open) _____ : _____ : _____

What time did you physically get out of bed? _____ : _____ : _____

Please circle YES NO

Did you wake up at any point during the night? YES NO

If yes, please specify:

	1 st Time	2 nd Time	3 rd Time	4 th Time
Time you woke up	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____
Time you fell back to sleep	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____

Please use the 24-hour clock (hh:mm)

Please circle YES NO

Did you have a nap today? YES NO

If yes, please detail any naps:

	1 st Time	2 nd Time	3 rd Time	4 th Time
Time you fell asleep	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____
Time you woke up	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____

Please use the 24-hour clock (hh:mm)

Page 1 of 2

2 evenings + 2 mornings around the camera wear day

Please circle YES NO

Did you take off any of the activity monitors? YES NO

If yes, please specify:

	1 st Time	2 nd Time	3 rd Time	4 th Time
Activity AX3				
Time you took it off	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____
Time you put it back on	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____
Matrix 003				
Time you took it off	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____
Time you put it back on	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____	_____ : _____ : _____

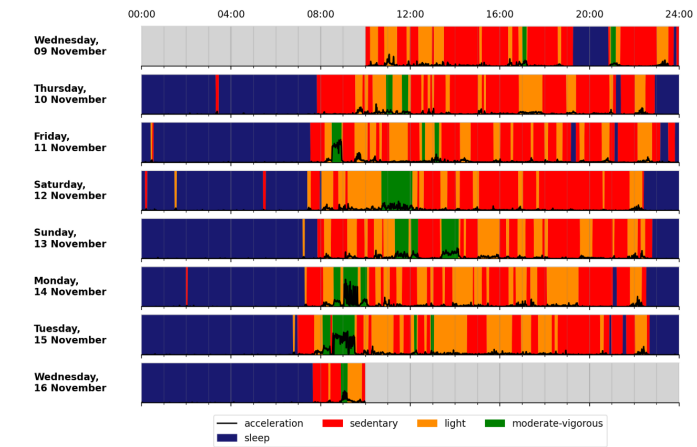
Please use the 24-hour clock (hh:mm)

Please use the 24-hour clock (hh:mm)

What time did you physically get into bed? _____ : _____

Approximately what time did you fall asleep? _____ : _____

Ground truth behaviour labels for training a new machine-learning model(s) for use in ELSA and/or CHARLS



Thank you for listening,
any questions?

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