

A novel procedure for integrating three objectively measured dimensions of free-living sedentary time

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BACKGROUND

- Sedentary behaviour (SB) is highly prevalent accounting for between 46 - 72% of the waking day (1-2)
- There has been growing interest in SB over the last 15 - 20 years since it emerged as a risk factor for a number of negative health outcomes (3)
- It remains unclear which components of SB contribute to these negative health outcomes; is it sitting posture, low energy expenditure or a combination of both?
- The most widely accepted definition of SB refers to waking behaviour characterized by an energy expenditure ≤ 1.5 METs while in a sitting or reclining posture (4)
- At present, there is no single field-based device which accurately measures sleep, activity intensity and posture simultaneously

AIM

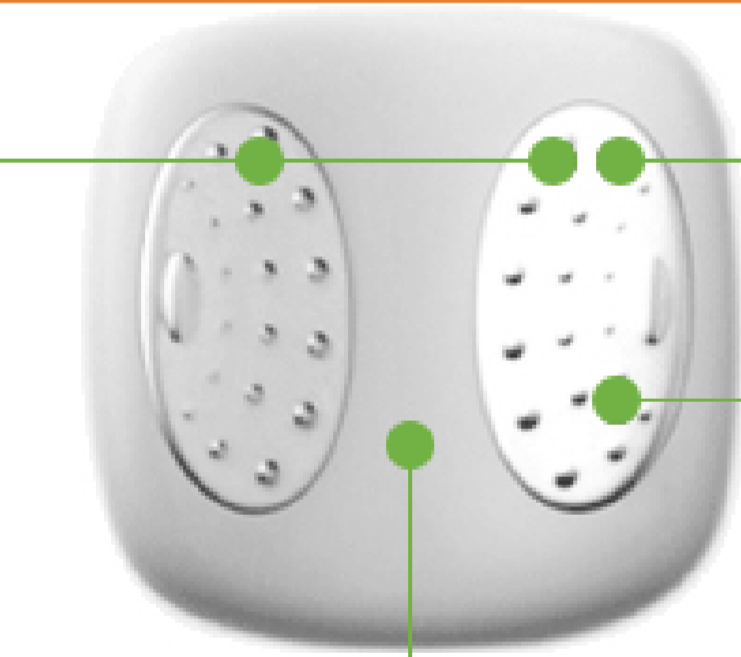
- Develop a novel integrative procedure to combine sleep, activity intensity and posture information from two validated activity monitors to quantify free-living sedentary time based on activity intensity alone, posture alone and activity intensity plus posture

METHODS

- Sixty-three female participants aged 37.1 (SD = 13.6) years with a BMI of 29.6 (SD = 4.7) kg/m² were continuously monitored for 5-7 days with the SenseWear Armband mini [SWA; figure 1] (for sleep and activity intensity) and the activPAL micro [AP; figure 2] (for posture) to track free-living SB
- A set of data merging operations controlled via a simple graphical user interface (GUI) were developed to integrate data from the SWA and AP (see integration procedures) resulting in three operational definitions of SB
- After accounting for sleep time, differences in sedentary time according to sitting/reclining (SED^{AP}), activity intensity ≤ 1.5 METs (SED^{SWA}) and the integration of these dimensions (SED^{INT}) were compared

Galvanic Skin Response

When you sweat, your skin becomes more electrically conductive. This measurement helps to see how active you are.



Skin Temperature

Measures the surface temperature of your body.

Heat Flux

Measures the rate at which heat is dissipating from your body.

3-axis Accelerometer

Measures your motion and steps taken.



Figure 1. SenseWear armband specifications and positioning

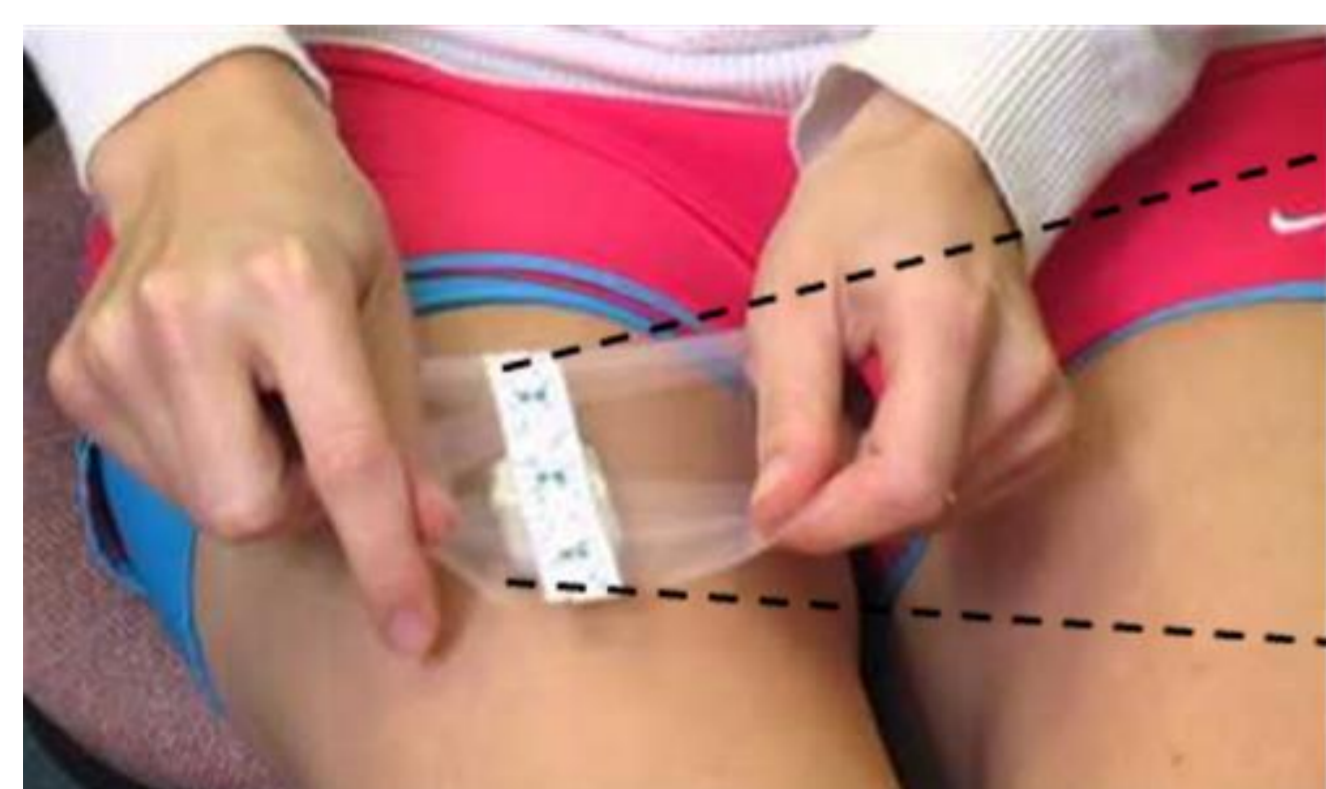


Figure 2. activPAL positioning

- Free-living SB continuously monitored for >22 hours/d, for 5-7 days including ≥ 1 weekend day

DATA INTEGRATION

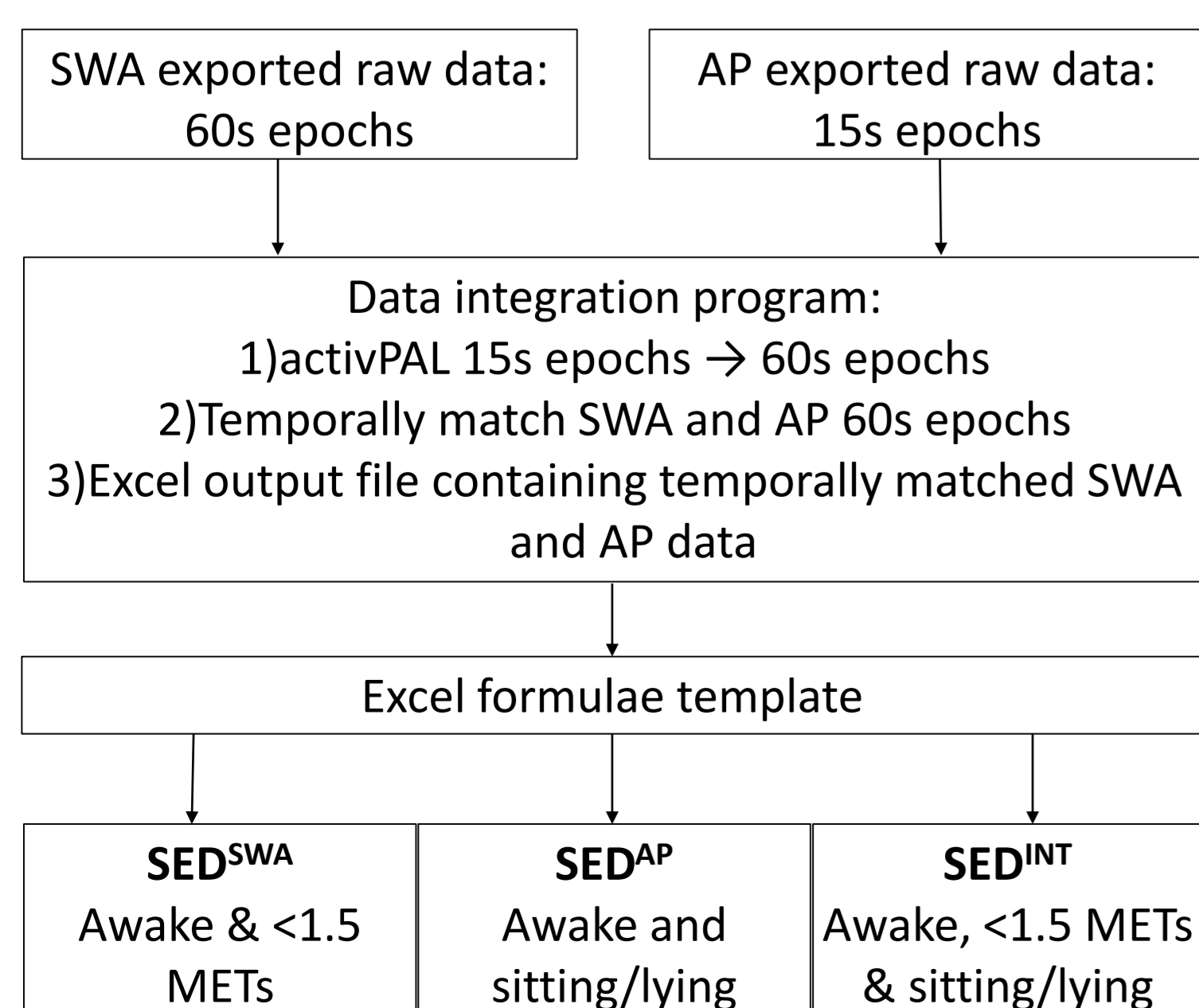


Figure 3. SWA and AP data integration and processing procedure

- AP data cross-checked with SWA data to assess compliance
- GUI temporally matches data from SWA and AP
- GUI produces a single excel output file containing SWA and AP data for full wear period
- Excel formulae template calculates average time spent sedentary and SB accumulation based on the three SB measures

RESULTS

- The three SB measures were positively inter-correlated, see table 1 and figures 4

Table 1. Correlation between the three measures of SB

	SED ^{SWA} (min/d)	SED ^{AP} (min/d)	SED ^{INT} (min/d)
SED ^{SWA} (min/d)	-	.37*	.58**
SED ^{AP} (min/d)	-	-	.91**

n = 63; data are Pearson correlation (r). ** p < .001; * p < .01. SED, sedentary time; SWA, SenseWear Armband; AP, activPAL; INT, integrated data.

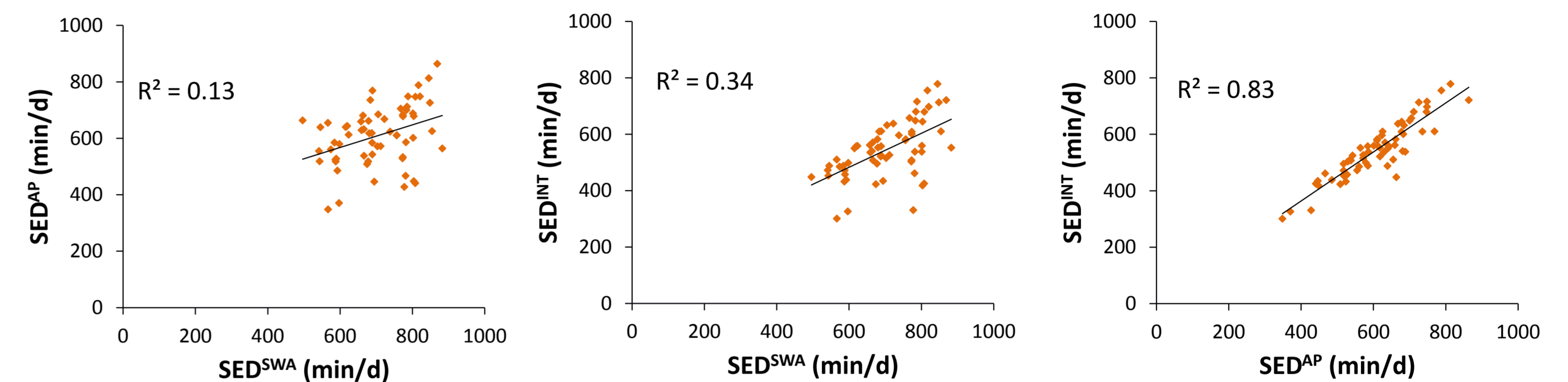


Figure 4. Scatter plots showing the relationship between the three measures of SB

- There was a significant difference between the three measures of sedentary time [F(1.18, 73.15) = 104.70, p < .001], see figure 5
- SED^{SWA} resulted in the most sedentary time (M = 704.6, SD = 96.5 min/d), followed by SED^{AP} (M = 609.8, SD = 105.3 min/d), and SED^{INT} (M = 546.0, SD = 100.3 min/d), or 11.7, 10.2 and 9.1 hours/d, respectively
- Significantly more sedentary time was accumulated on weekdays (M = 715.7, SD = 104.6 min/d) compared to weekend days (M = 681.8, SD = 130.2 min/d) according to SED^{SWA} [t(62) = 2.11, p = .039], however, sedentary time did not differ between weekdays and weekend days according to SED^{AP} [t(62) = 1.63, p = .108] or SED^{INT} [t(62) = 1.16, p = .249]
- As the duration of the sedentary bout categories increases so too did the amount of sedentary time accumulated in that category. The largest difference between methods was in the longest bout category (>40 min), see figure 6

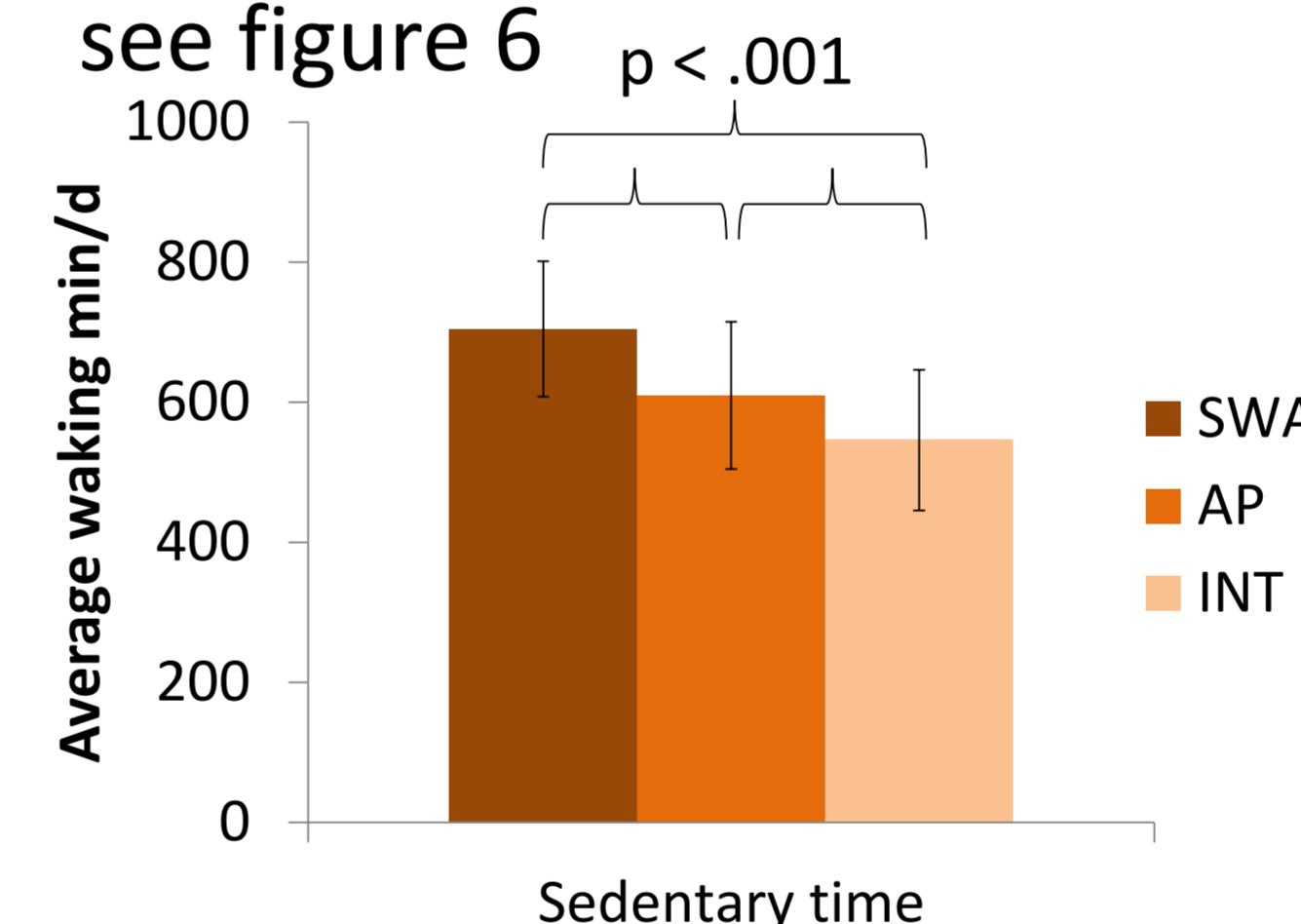


Figure 5. Difference in sedentary time

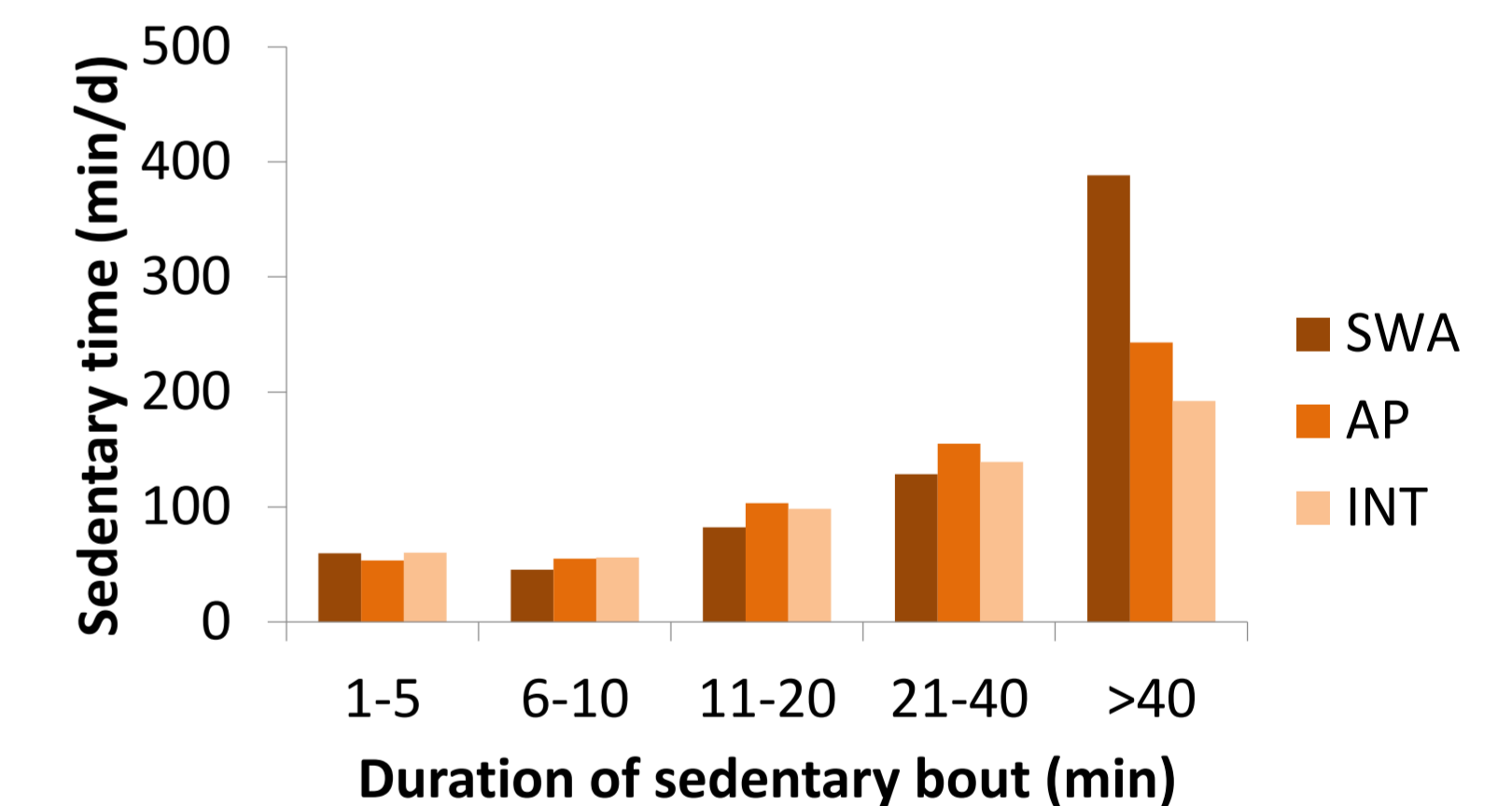


Figure 6. Sedentary time accumulated in different bout categories

CONCLUSIONS

- We combined information from two validated activity monitors to obtain a measure of free-living SB based on posture **and** activity intensity during waking hours
- The positive correlation suggests that both activity intensity and posture are related aspects of the same phenomenon (SB)
- However, sedentary time according to posture and sedentary time according to activity intensity are conceptually different
- The implications of this methodological distinction for understanding the impact of SB on markers of health and obesity are yet to be determined

FUTURE DIRECTION

- The novel data integration and processing procedures presented in this study represent an opportunity to investigate whether different components of SB (posture or activity intensity) are more strongly related to health outcomes than others and should therefore be targeted during interventions

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