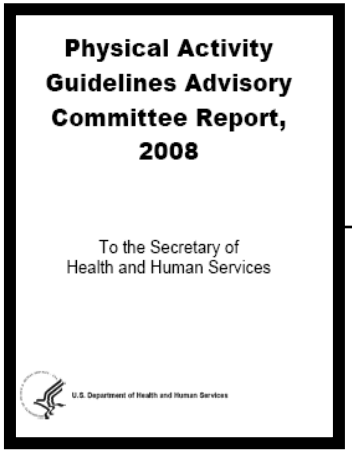
Relationship of Objectively Measured Physical Activity to Physical Performance in Older Women

David M. Buchner, MD MPH
Shahid and Ann Carlson Khan Professor of Applied Health Sciences
University of Illinois at Urbana-Champaign

Michael J. LaMonte PhD MPH
Research Associate Professor, Dept. Epidemiology
University at Buffalo, The State University of New York



Background

- **PAGA 2008** - Strong evidence for functional benefit from regular PA.
- **Recent RCT's** (e.g., LIFE) support causal relationship.
  - RCT's tend to focus on **single dose**, e.g., moderate-to-vigorous PA (MVPA).
- **Cohort studies –** Inverse dose-response between PA and risk of functional decline.
  - Major concern about **confounding** by baseline functional limitations.

Gaps in Knowledge

- **Cohort studies**, like OPACH - important to learn from cross-sectional relationship of PA and physical function to guide how to address confounding by baseline physical function when analyzing PA and functional outcomes.
- Need data using **objective** measures - few studies use objective measures of both PA and physical function.
- Need data on **light-intensity** PA and sedentary time.
- Few data on **how PA varies** in older adults with specific levels of function.

Study Aims

Among older community-living women in OPACH:

1. Describe how **accelerometer-measured** PA varies by physical function level, measured using the SPPB (Short Physical Performance Battery).

2. Determine if the relationship between PA and SPPB **differs by age** group.

3. Describe **how time is divided** among PA intensity categories in relation to SPPB.

Methods - 1

- Analysis **limited to women with:**

  (1) at least 4 days with 10+ hours of accelerometer wear, and

  (2) complete sleep logs of time spent in bed.

- **7 categories of daily PA time** (min/day) based on OPACH study cutpoints:

  - In-bed
  - Sedentary
  - Low light-intensity } Light PA
  - High light-intensity
  - Low MVPA } MVPA
  - High MVPA
  - Awake non-wear time

Methods - 2

- **Physical Function**
  - SPPB (chair stand test, balance tests, and walking speed test)
  - EPESE scoring method … (range 0 -12 – higher scores = better function).
- **Self-reported PA**
  - CHAMPS questionnaire, past 4 weeks recall, scored in MET-minutes/wk.
- **NOTE:** Unlike younger adults in whom accelerometer counts and PA time tend to be moderately correlated, the narrow range over which PA intensity varies in older women produced strong correlations between accelerometer counts and PA minutes … (Pearson r = 0.98 between MPVA counts and minutes)

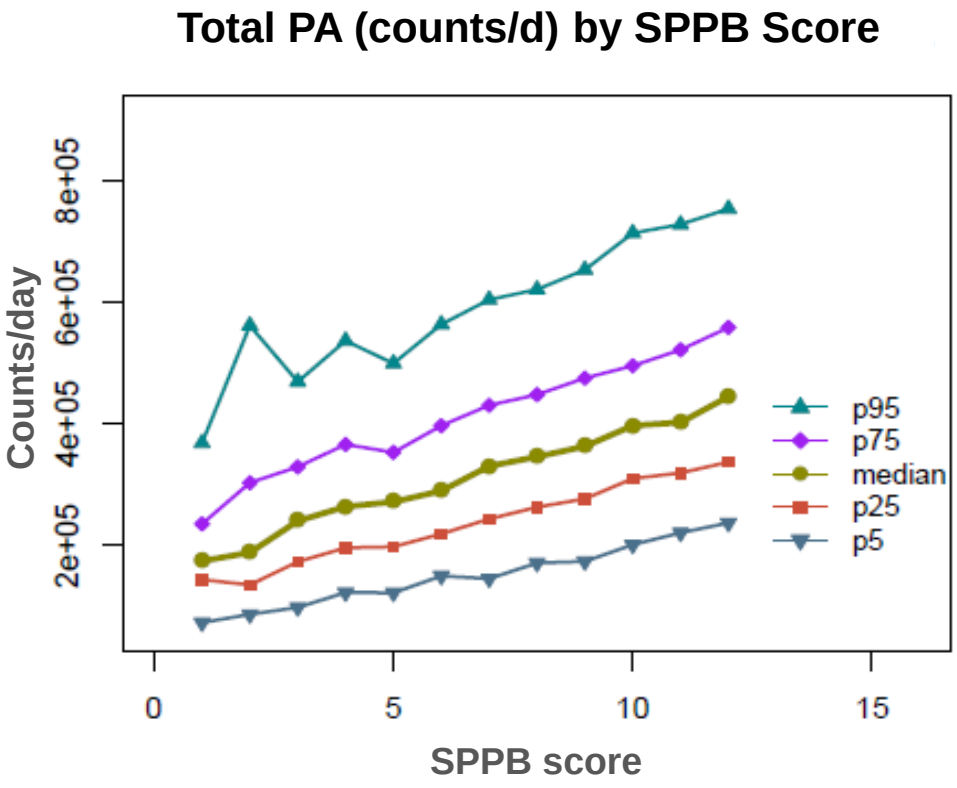
Participant Characteristics by SPPB

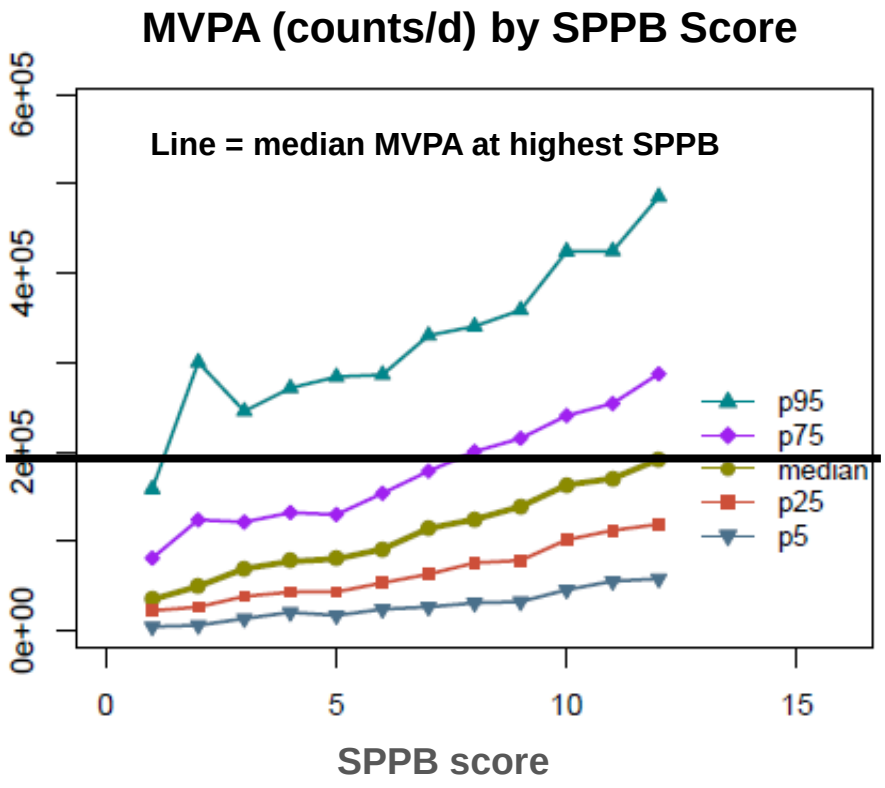
Variable	**SPPB = 1-3 N=231**	**SPPB = 4-6 N=848**	**SPPB = 7-9 N=2061**	**SPPB = 10-12 N=1700**
Age (yrs), mean	83	81	79	77
Ethnicity, % White	61%	54%	47%	48%
Black	30%	33%	38%	29%
Hispanic	9%	13%	15%	24%
BMI ≥25, %	68%	69%	69%	63%
CHAMPS PA (MET-Min/wk), mean	1117	1370	1761	2145
Accelerometer PA Total counts/d, mean	250K	304K	367K	431K

Study Aims

1. **Describe how accelerometer-measured PA varies by physical function level, measured using the SPPB.**
2. Determine if the relationship between PA and SPPB differs by age group.
3. Describe how time is divided among PA intensity categories in relation to SPPB.

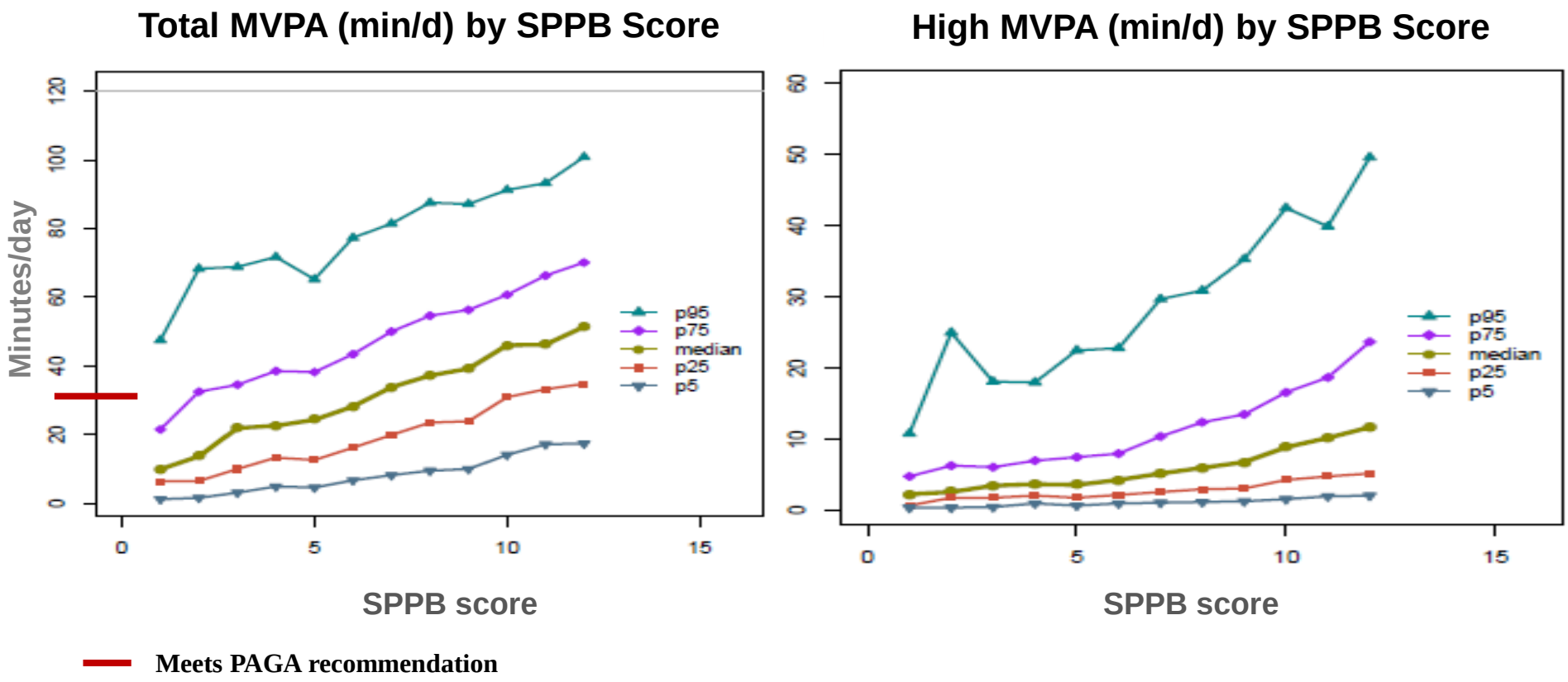
Percentiles of Total PA and MVPA by SPPB





Legend: p = percentile, e.g. p95 = 95th percentile

Percentiles of Total MVPA and High MVPA by SPPB score

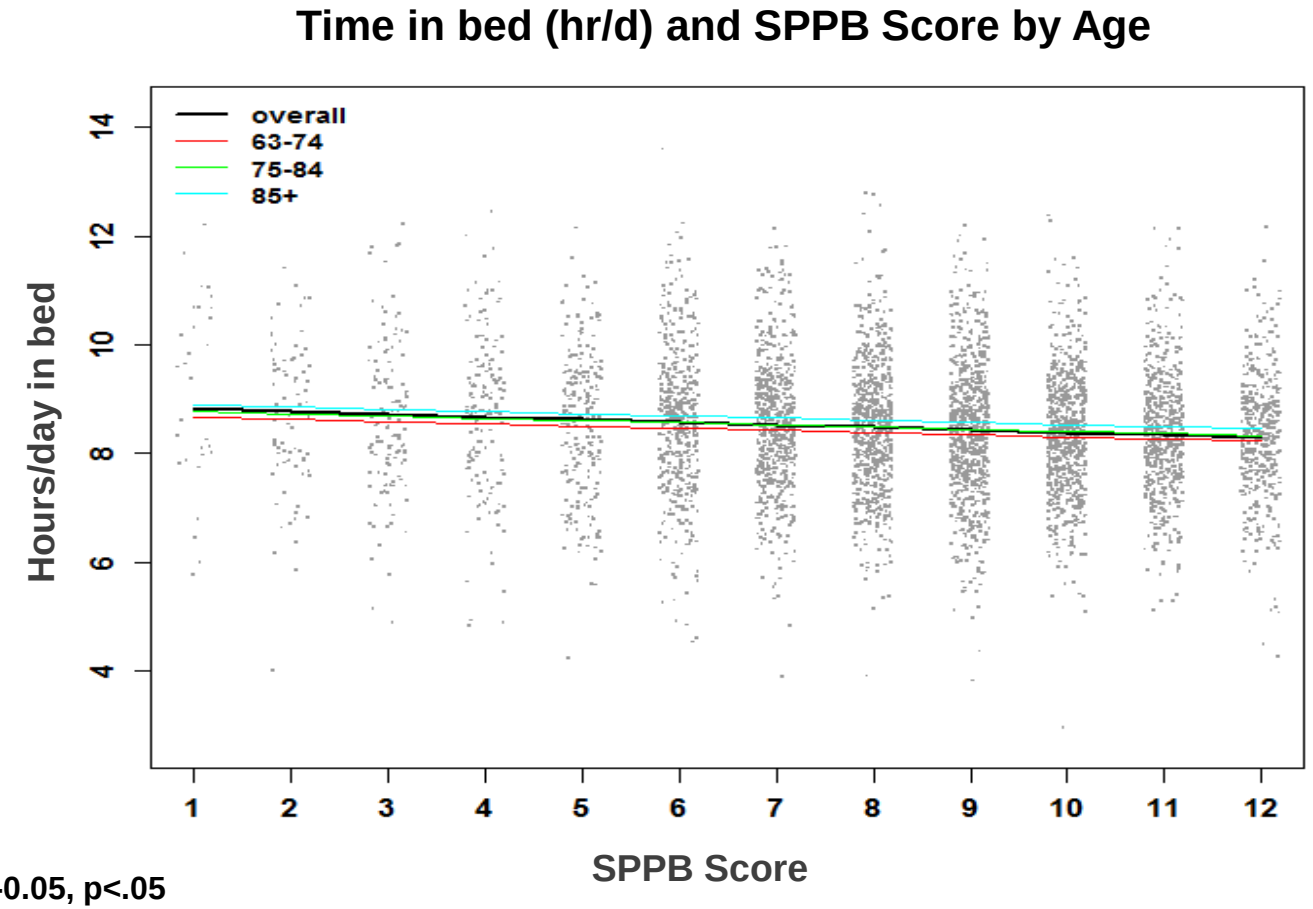


Legend: p = percentile, e.g. p95 = 95th percentile

Study Aims

1. Describe how accelerometer-measured PA varies by physical function level, measured using the SPPB.
2. **Determine if the relationship between PA and SPPB differs by age group.**
3. Describe how time is divided among PA intensity categories in relation to SPPB.

Regression of Time in bed and SPPB by Age Groups

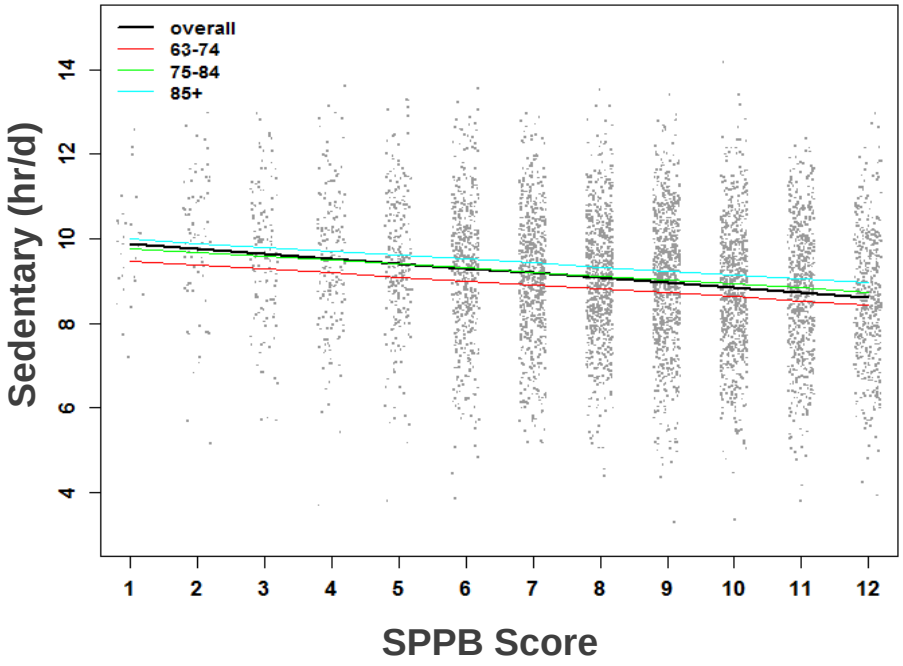


Overall: β = -0.05, p<.05

Age x SPPB Interaction not significant

Regression of Sedentary and Light PA with SPPB by Age Groups

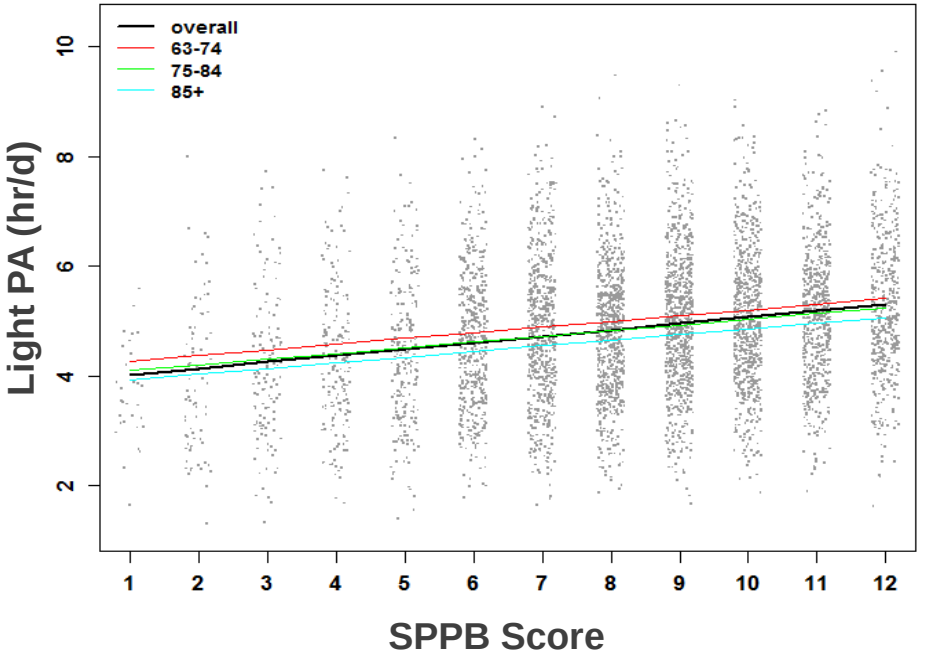
Sedentary (hr/d) and SPPB Score by Age



Overall: β = -0.11, p<.05

Age x SPPB Interaction not significant

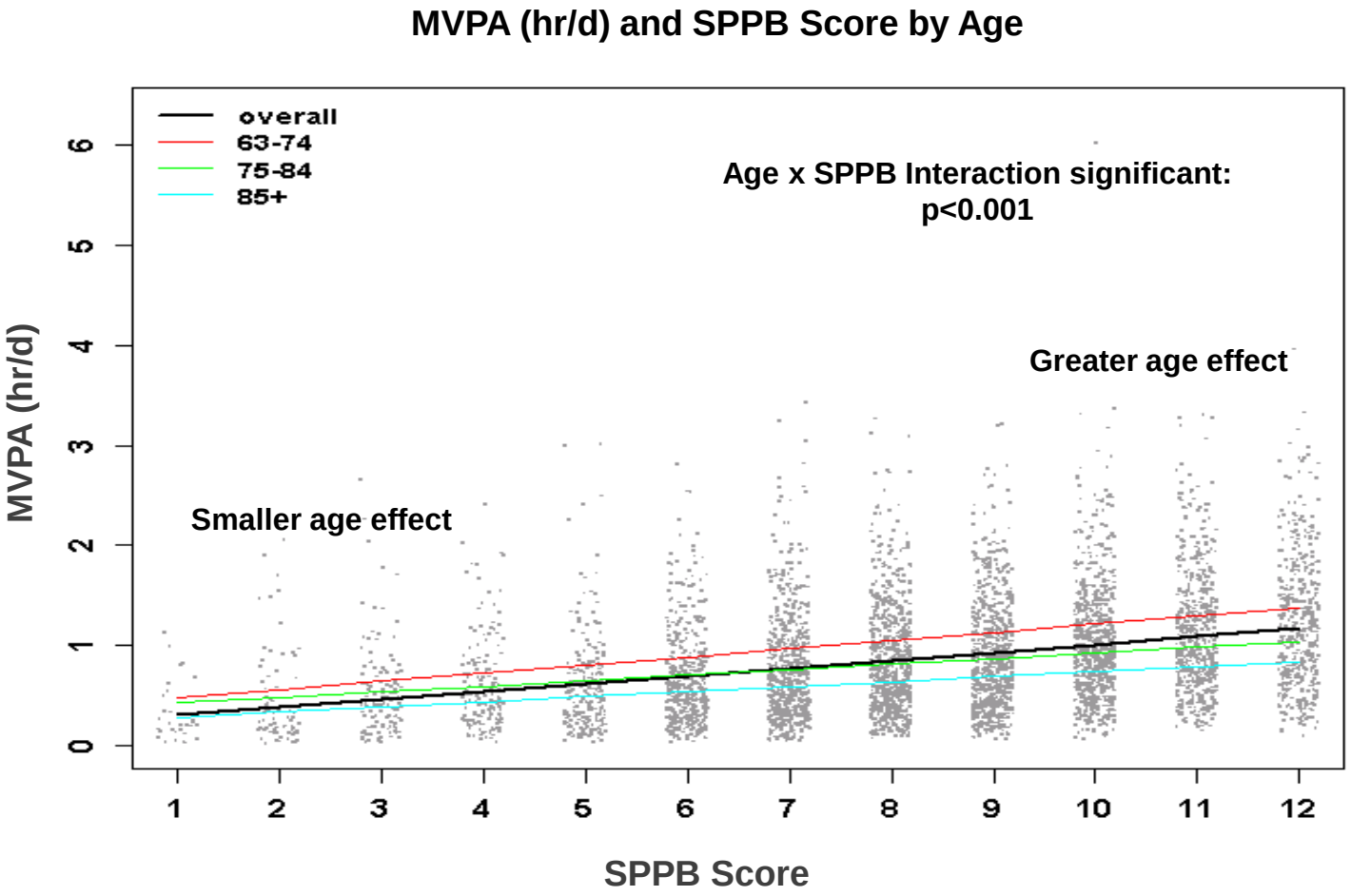
Light PA (hr/d) and SPPB Score by Age



Overall: β = 0.12, p<.05

Age x SPPB Interaction not significant

Regression of MVPA with SPPB by Age Groups



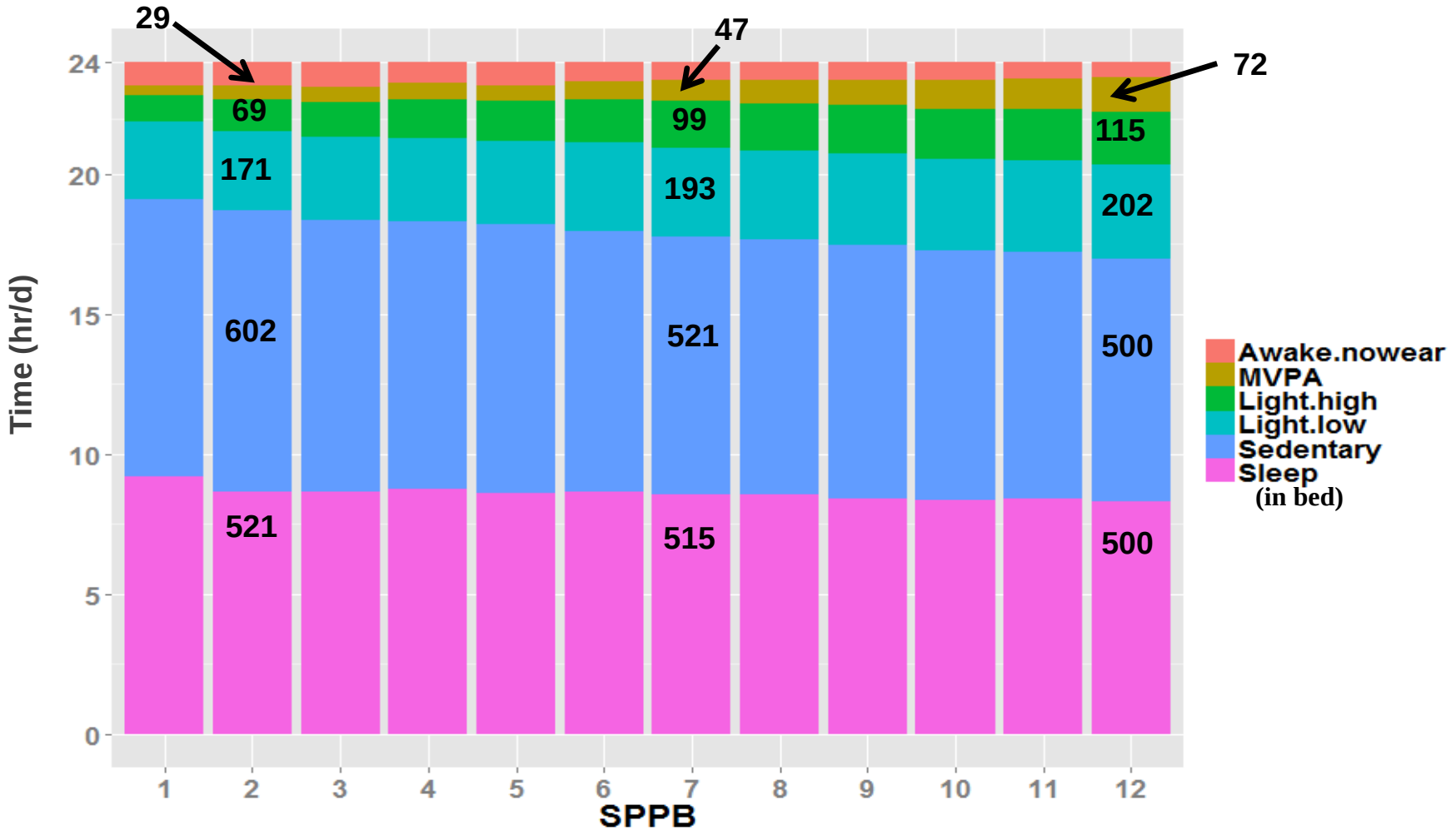
Study Aims

1. Describe how accelerometer-measured PA varies by physical function level, measured using the SPPB.

2. Determine if the relationship between PA and SPPB differs by age group.

3. **Describe how time is divided among PA intensity categories in relation to SPPB.**

Minutes per day spent in each PA category by SPPB score



Quantifying overall association of PA and SPPB

- Accelerometer variables have skewed distributions (as shown by percentiles).
- In an age-adjusted regression of log(total counts/day) with SPPB, log of total accelerometer counts explains **9.1% of the variance** in SPPB.
- CHAMPS total PA (MET-min/d) explains 4.2% of variance in SPPB.

Study Limitations

- **Cross-sectional** analysis.
- Analysis of factors affecting association of PA and SPPB limited to **age**.
- ≈800 participants **excluded** from analysis for non-wear time or missing data.
- PA classification using **accelerometer cutpoints** often criticized for misclassification error, though no consensus about best approach.
- Unequal **numbers of women in SPPB** categories with smaller sample sizes in categories 1, 2, and 3 (N=281).

Conclusions

In older community-living women in OPACH:

- **PA levels varied** considerably in every SPPB category:
  - Some women in every category attained relatively high levels of PA.
  - PA explained only ~10% of variance in SPPB after age adjustment.
- Larger **differences by age** groups seen for relationship of SPPB with MVPA.
- At lower physical function levels, time in MPVA and high-light PA appears to **shift into sedentary time**, rather than into low-light PA or in-bed time.
- **PA may not be a sufficient proxy** of physical function status when studying older adults.