

Moving your Way to a Good Night's Rest

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Exercise Science & Health Promotion

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"...understanding the dynamic interplay of sleep, sedentary, and more active behaviors, and how collectively these behaviors may be harnessed for health promotion and disease prevention."



PHYSICAL ACTIVITY

ENVIRONMENTAL CONTEXT

INTERVENTION

MEASUREMENT

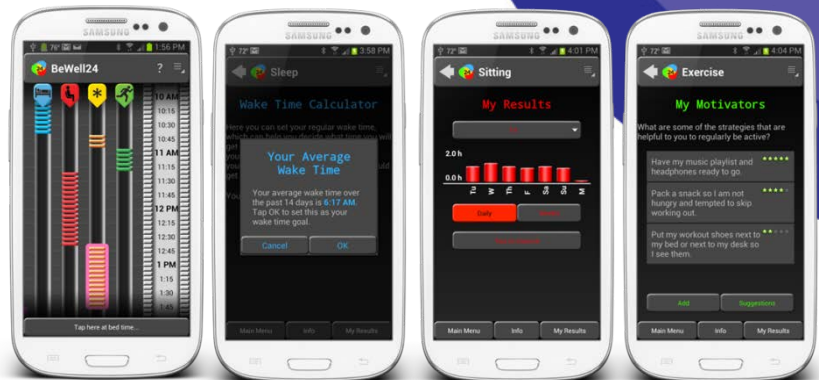


SEDENTARY

Smartphone 'apps' for behavior change across the 24-hour spectrum for cardiometabolic health

Workplace interventions to reduce sitting time and increase light-intensity physical activity

Validation of commercially-available sensors for 24-hour assessment of behaviors.



SLEEP



Background

- Sleep complaints highly prevalent
- Chronic insomnia - 10% of US population
- Long-term pharmacological treatments are not recommended
- Behavioral sleep treatments are more effective but expensive to deliver

Exercise and Sleep:

Summary Findings from RCT's

- Modest improvements in sleep
 - Subjective (sleep quality, sleep-onset latency)
 - Objective (Stage 1, Stage 2, # awakenings)
- National guidelines are sufficient for improvement (more is better!)
- 4 months or longer is better
- Acute vs. chronic effects debate

How much exercise is needed?

- Meeting physical activity guidelines appears sufficient
 - 150min/wk of moderate PA or 75 min/wk of vigorous PA (or some equivalent)
 - Stretching, strength training, and balance exercise (for older adults) are also recommended

How much is too much?

- Some limited evidence that prolonged exercise (>2hrs) leads to sleep disruptions
- Some may be more sensitive than others

Time of Day Effects

- Standard sleep hygiene suggests avoiding exercise 4hrs prior to sleep
- Little evidence
- Exercise 4-8 hrs prior to sleep is optimal
- Evening exercise is not discouraged

Resistance Training

- Limited evidence suggests equal benefits to aerobic activity
- Muscle pain following resistance training not thought to interfere with sleep

Yoga and Tai Chi

- Yoga appears effective, but more controlled studies are needed
- Evidence stronger for Tai Chi

How does exercise improve sleep?

- Reduced depression and anxiety
 - Exercise → depression → sleep
- Restorative effects
 - Body is restored during sleep
- Body temperature changes
 - Greater efficiency in temperature down regulation

How does exercise improve sleep?

- Circadian phase-shifting
 - Exercise as a re-synchronizer
- Inflammatory effects
 - Modest increases in IL-1, IL-6, and TNF- α
- Indirect effects
 - Reduce medications
 - Control weight
 - Improve functional capacity

What about sleep apnea?



Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial

Milo A Puhan, Alex Suarez, Christian Lo Cascio, Alfred Zahn, Markus Heitz, Otto Braendli

Health Outcome	Physical Activity
All-cause mortality	✓
Cardiovascular disease	✓
Stroke	✓
Hypertension	✓
Atherogenic dyslipidemia	✓
Type 2 diabetes	✓
Obesity	✓
Bone health	✓
Physical function/falls	✓
Some cancers	✓
Cognitive function	✓
Depression	✓

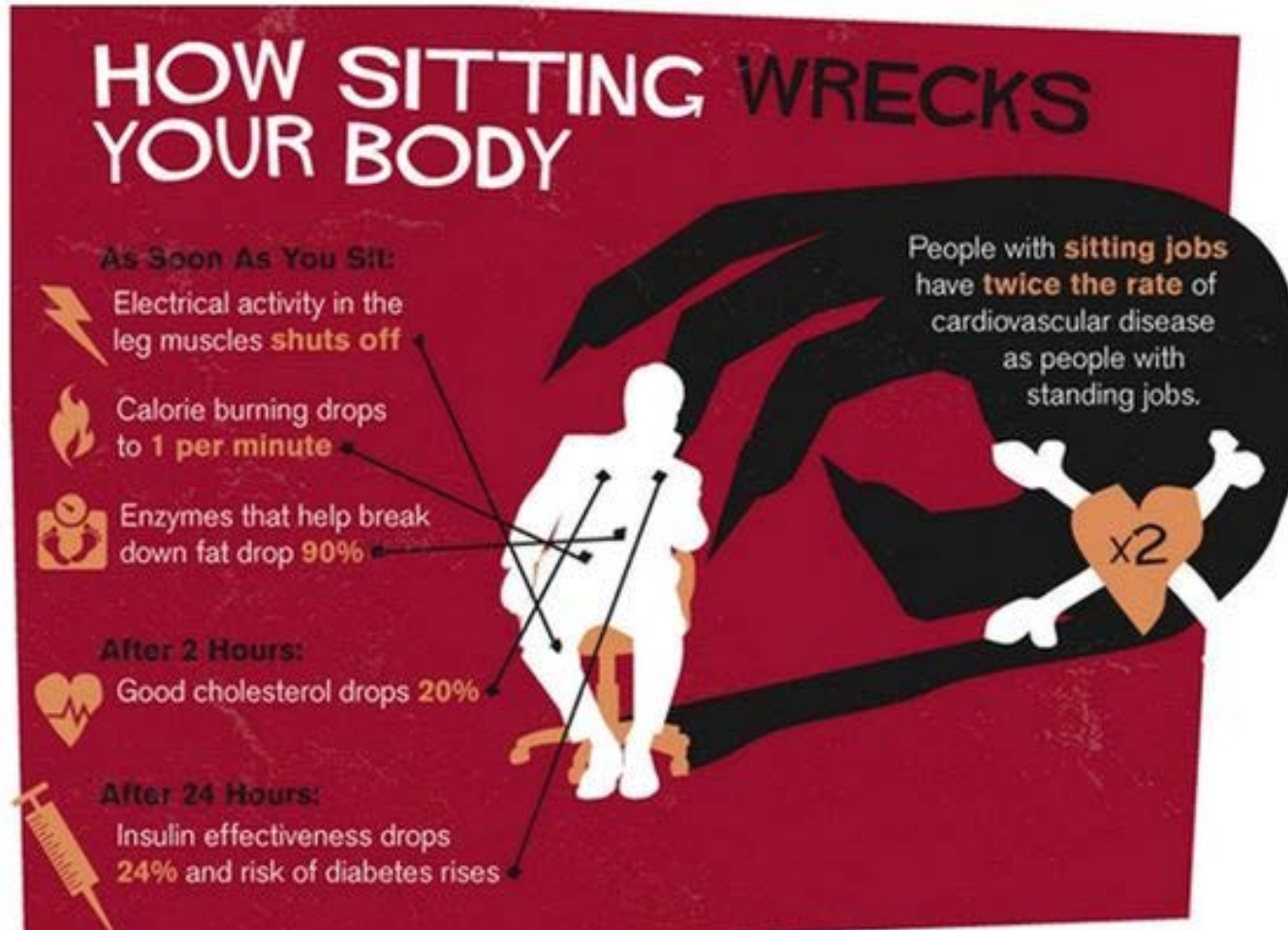
Health Outcome	Physical Activity	Sedentary Behavior
All-cause mortality	✓	✓
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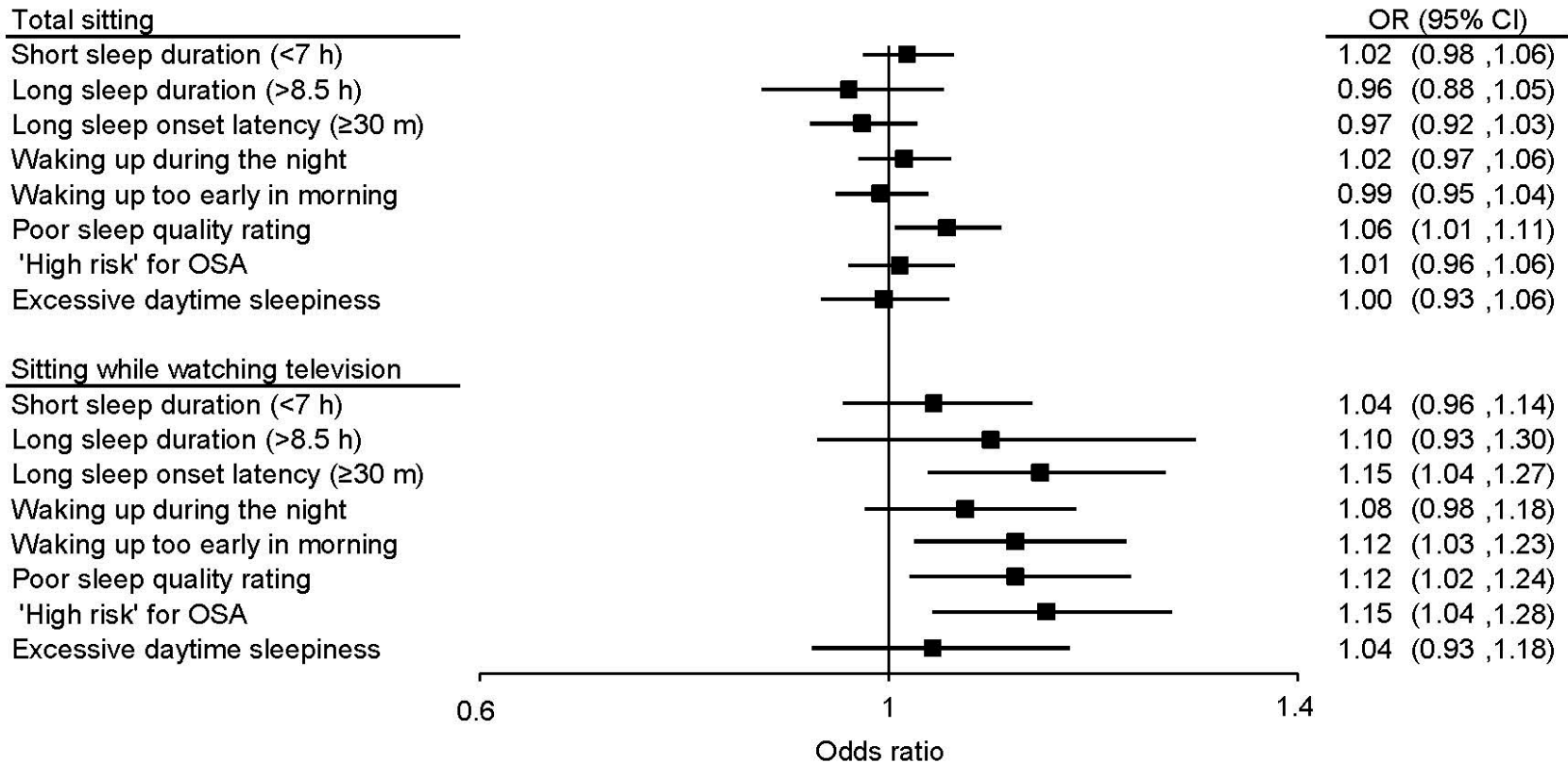
Is sitting the new smoking?



Sitting as a novel risk factor

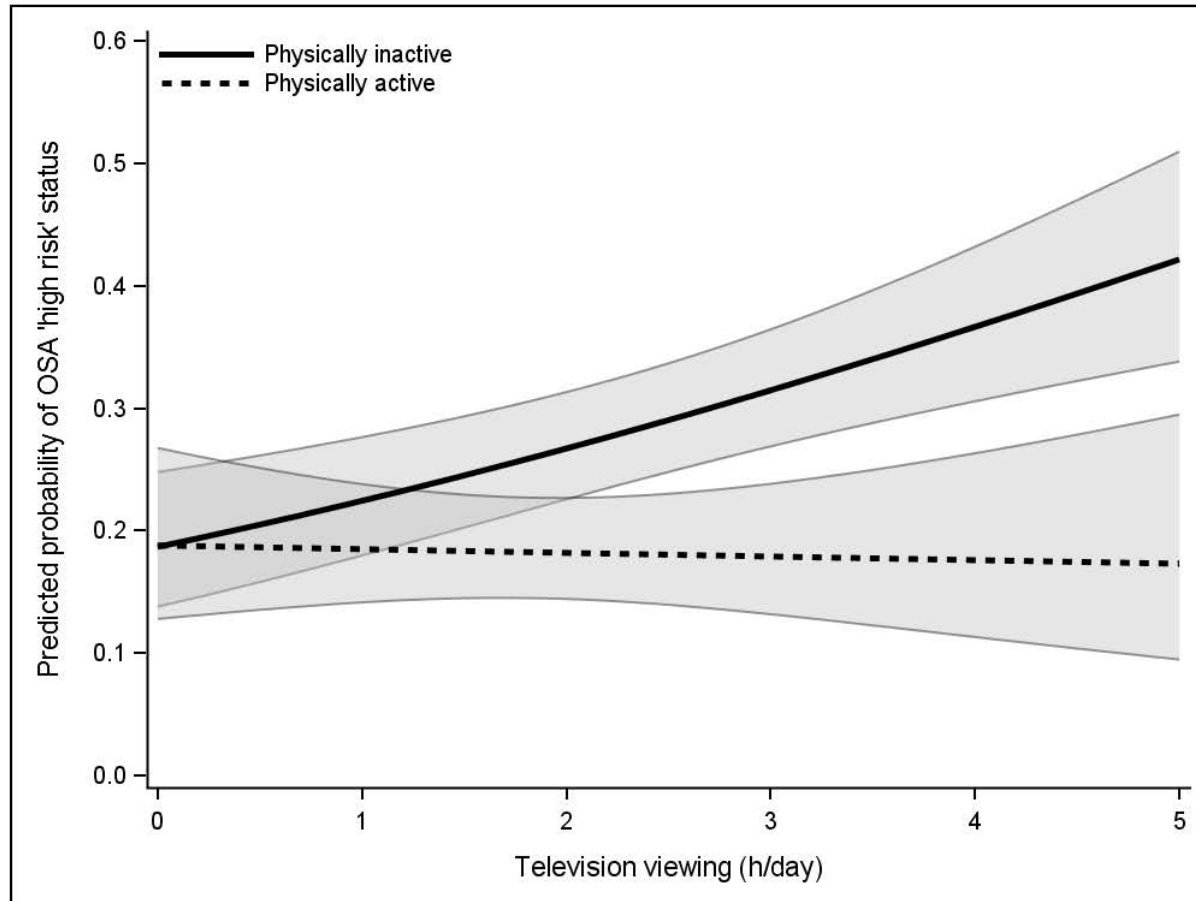


2013 NSF Annual Poll



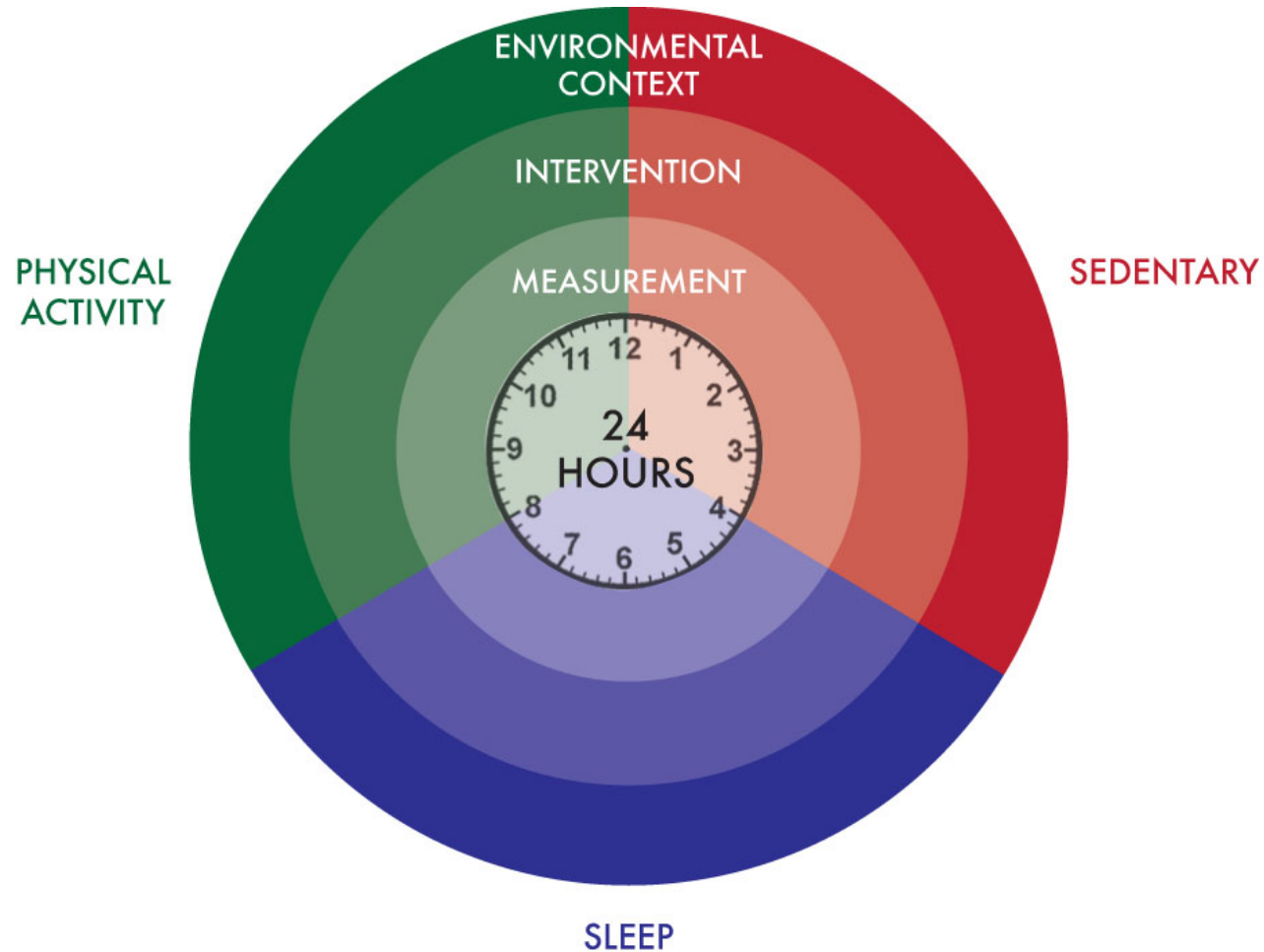
Buman et al., CHEST, in press

Exercise protects against sitting



Buman et al., CHEST, in press

Considering the full 24h spectrum



Isotemporal Substitution Method

- 24h day is distributed between sleep, sedentary, and active behaviors
- Time is finite; increasing one behavior means decreasing another

<u>Target Behavior</u>	<u>Replace with...</u>	<u>Health Outcome</u>
↓Television viewing	↑Brisk walking ↑Desk work ↑Sleep ↑Household chores	??? ??? ??? ???
↓Sleep	↑Running ↑Sitting	??? ???

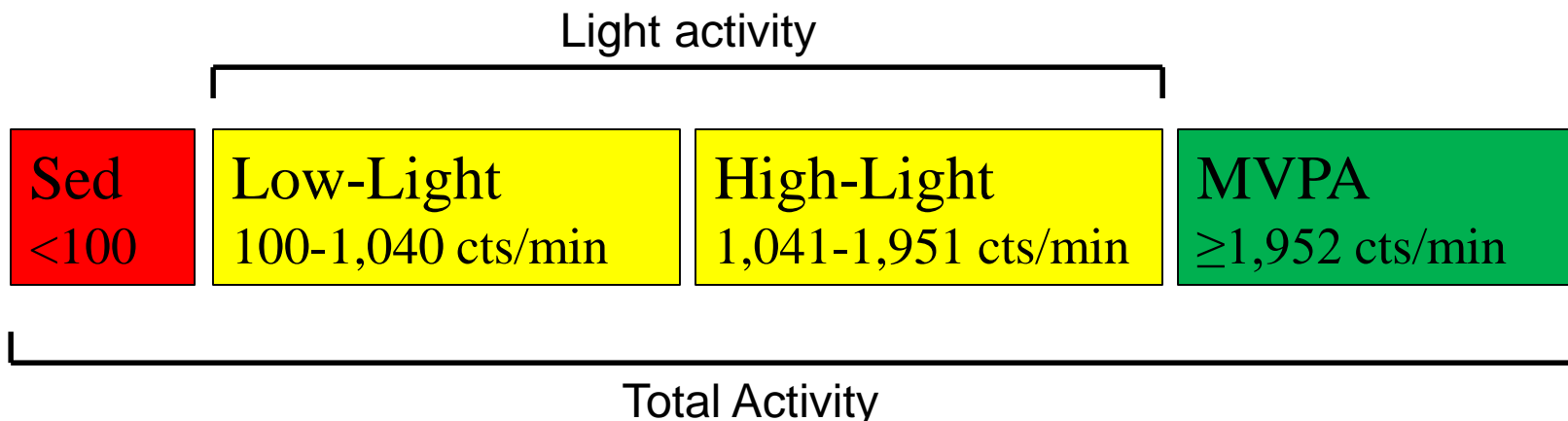


Original Contribution

Objective Light-Intensity Physical Activity Associations With Rated Health in Older Adults

Matthew P. Buman*, Eric B. Hekler, William L. Haskell, Leslie Pruitt, Terry L. Conway, Kelli L. Cain, James F. Sallis, Brian E. Saelens, Lawrence D. Frank, and Abby C. King

* Correspondence to Dr. Matthew P. Buman, Department of Medicine, Stanford University School of Medicine, Medical School Office Building, 251 Campus Drive, MC 5411, Stanford, CA 94305-5411 (e-mail: mbuman@stanford.edu).

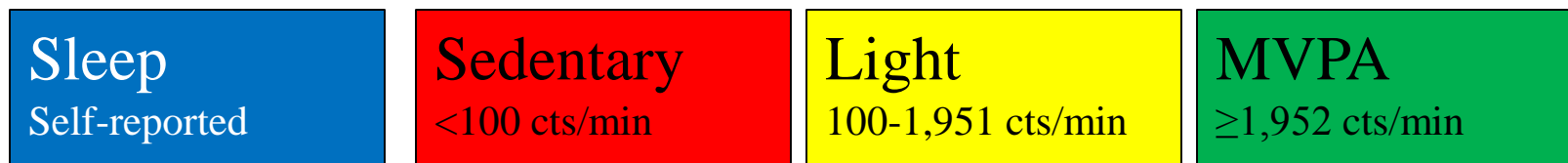


Adding in sleep

Nutritional and Health Examination Survey (NHANES)

(N=2185 adults >20 years of age)

Outcomes: Cardiometabolic risk factors

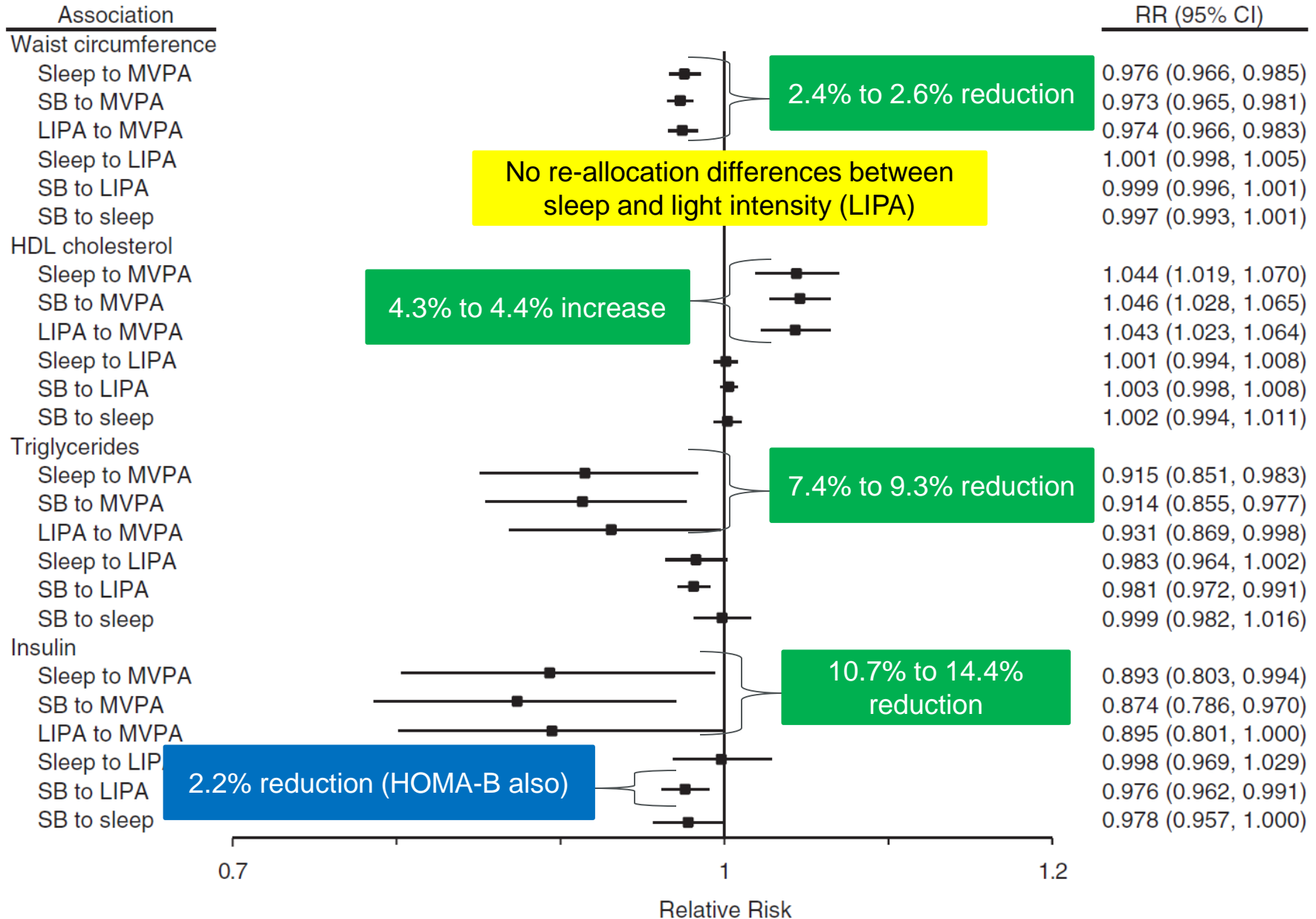


Total Activity

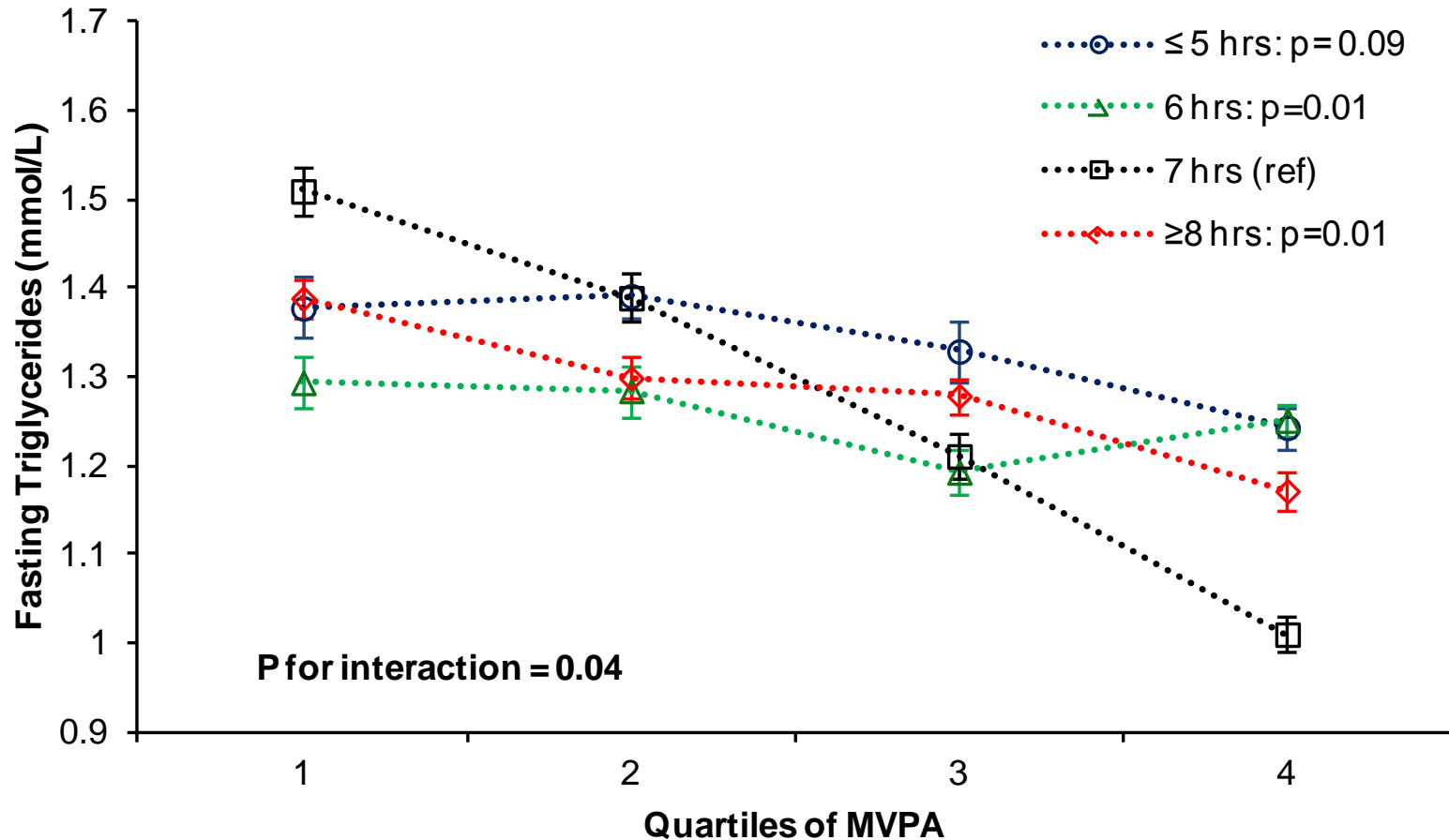
Research Questions

- What is the impact of re-allocating time spent in sleep, sedentary, and active behaviors on cardiometabolic risk biomarkers?
- Are decreased sedentary time or increased active time protective or synergistic in the relationship between sleep duration and cardiometabolic risk?

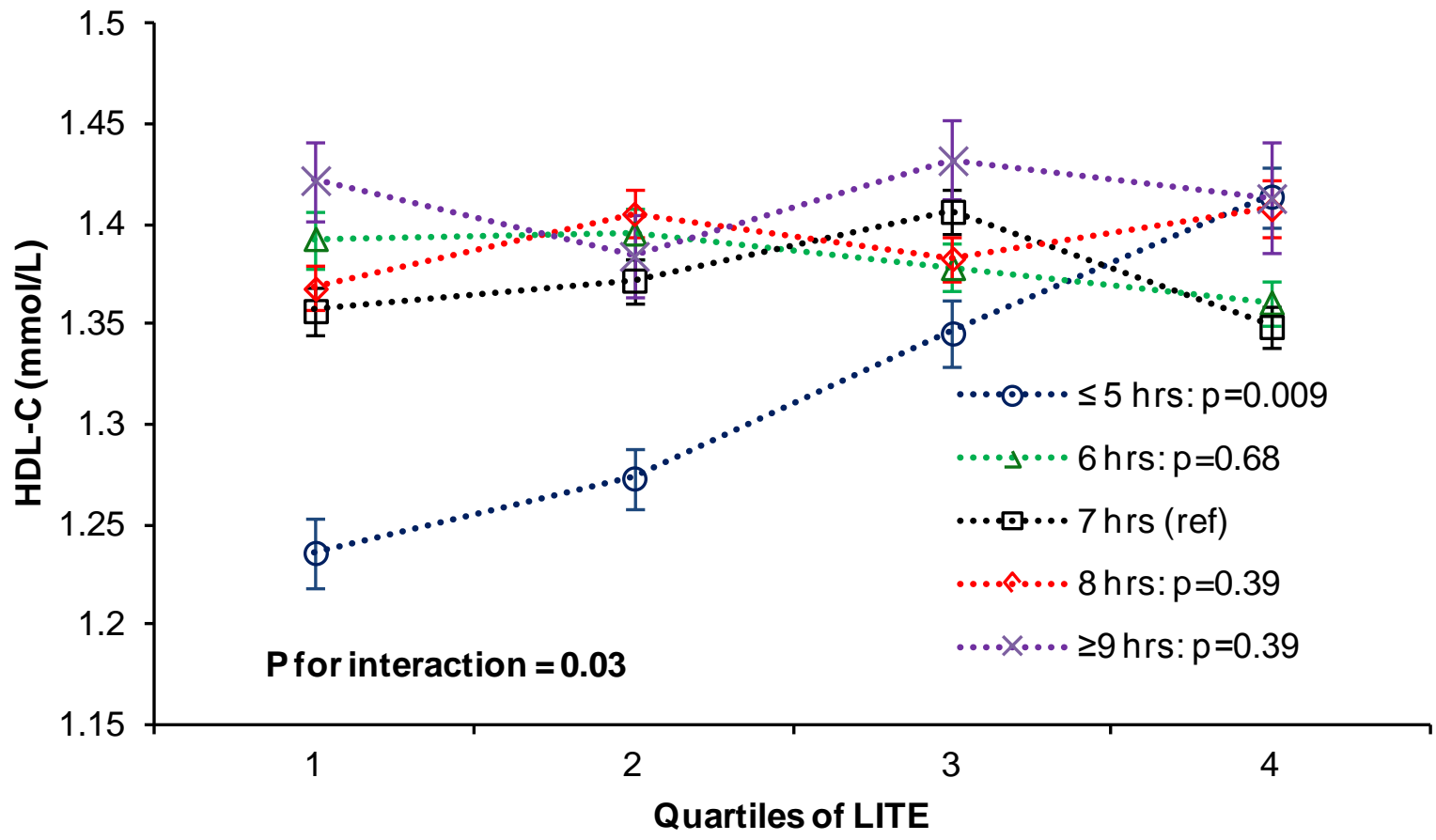
Results (per 30min re-allocation)



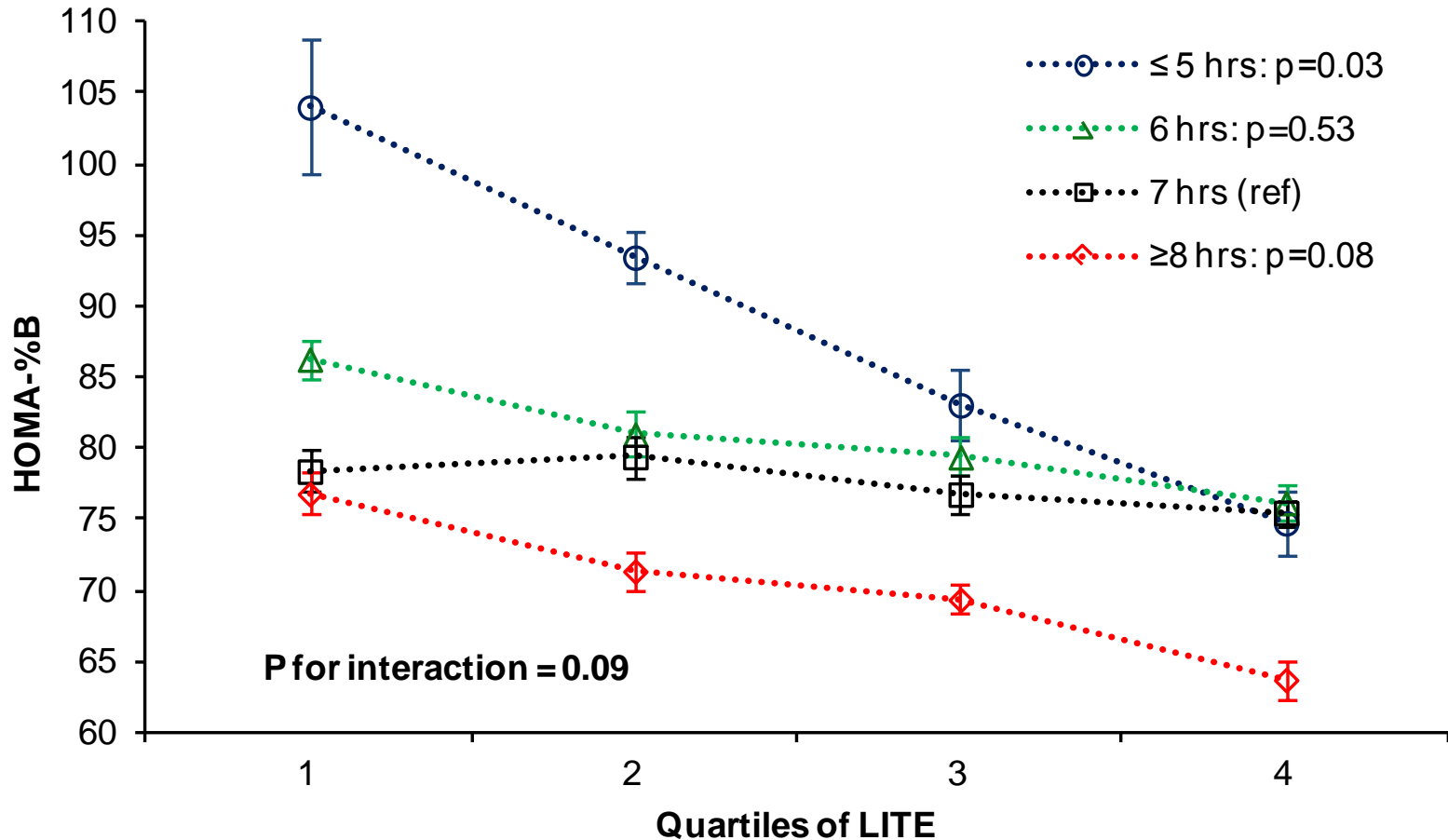
Optimal sleep enhances MVPA effects



Light Intensity “protection” from short sleep



Light Intensity “protection” from short sleep



What does this all mean?

- MVPA may be the most health-enhancing (time dependent) behavior
- Light activity and sleep are also beneficial
- Activities should be re-allocated from sedentary time (but doesn't have to be replaced with MVPA for benefit)

What to do with an extra 30 minutes...



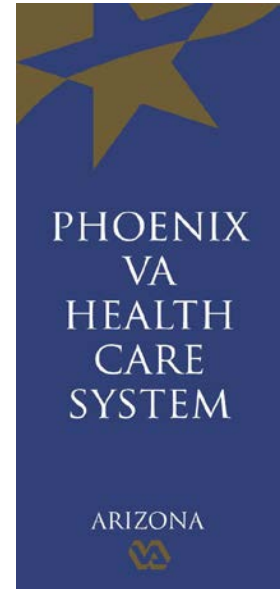


BeWell24

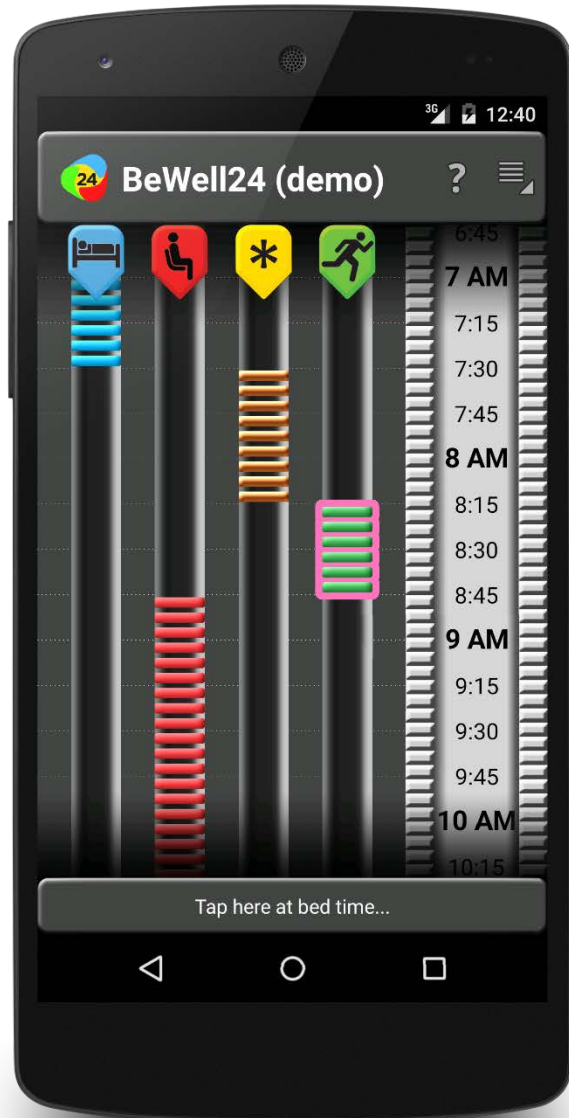
Smartphone “app” that uses evidence-based behavioral strategies to target the full 24h spectrum of health behaviors

Returning Veterans are at greater risk

- Often suffer from PTSD, traumatic brain injury
- May struggle with re-integration into civilian life
- At disproportionate risk for metabolic syndrome

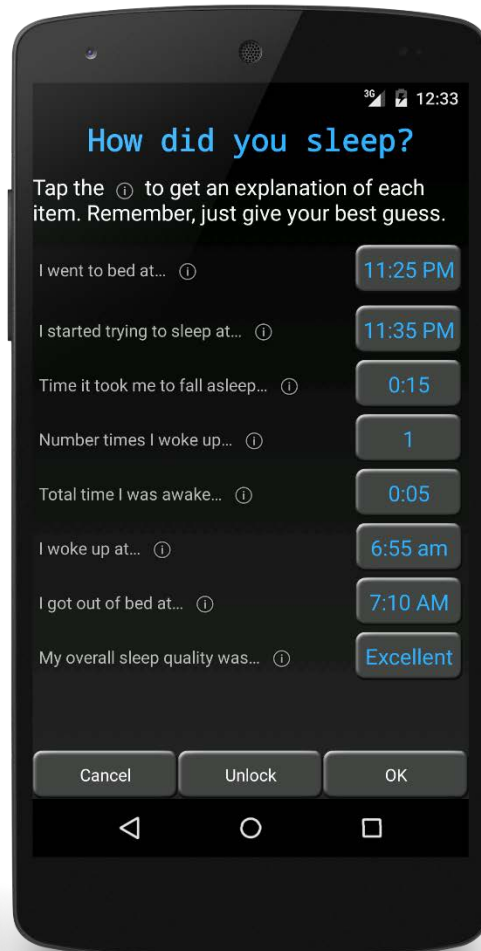
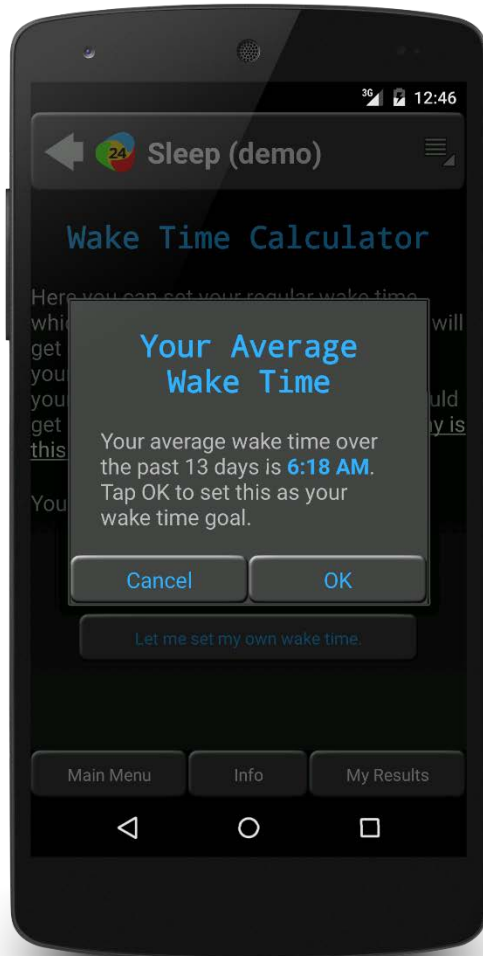


Activity Monitoring



- Users self-report behaviors across the 24h
- Able to report context of behaviors
 - Sleep quality metrics
 - Domains of sitting (e.g., work, TV, transport)
 - Types of exercise
- Ideally 5min in morning and 5min in evening

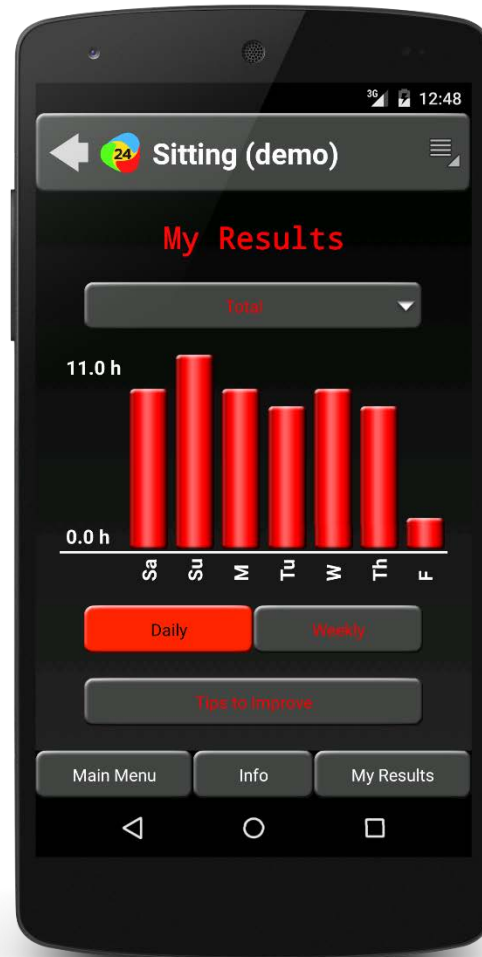
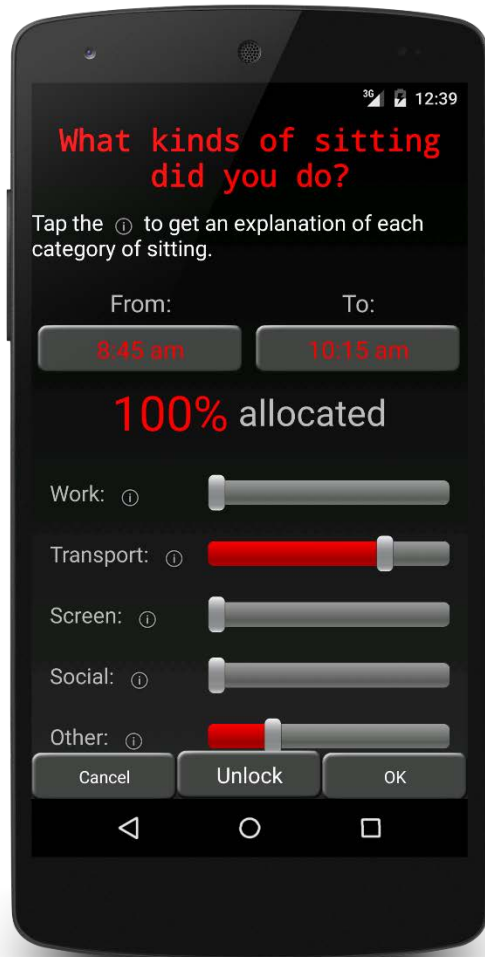
Sleep



- Evidence-based treatment to re-associate bed with restful sleep
- Personalized wake time calculator with feedback
- Basic sleep hygiene tips



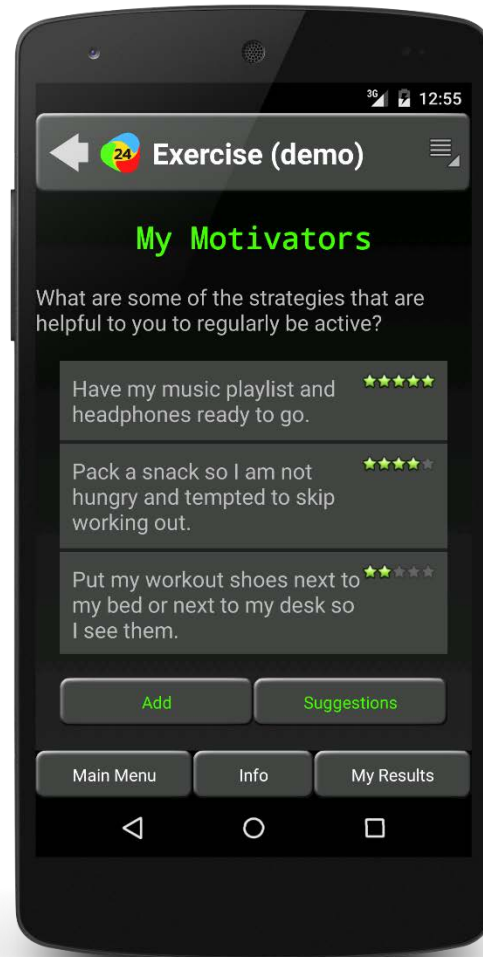
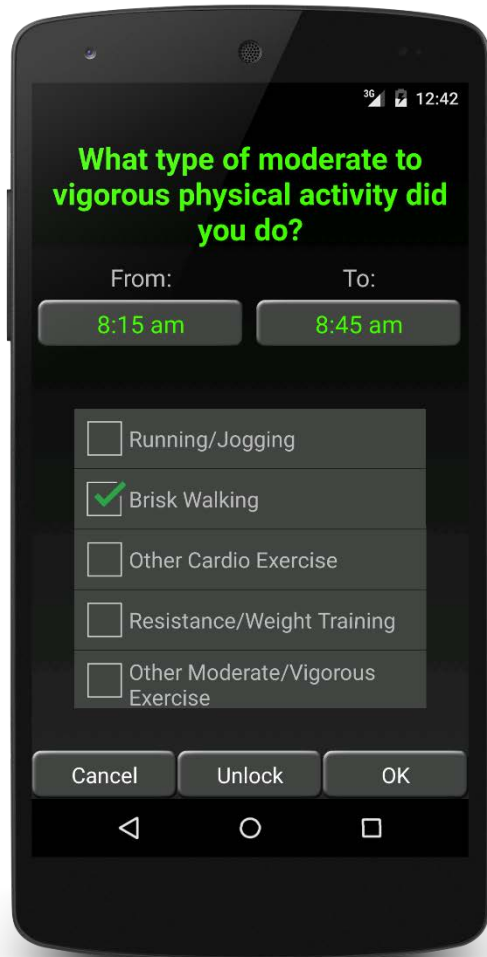
Sedentary



- Focus on reducing time spent sitting by swapping sitting with other activities
- Gives context-specific (i.e., work, TV) feedback and tips

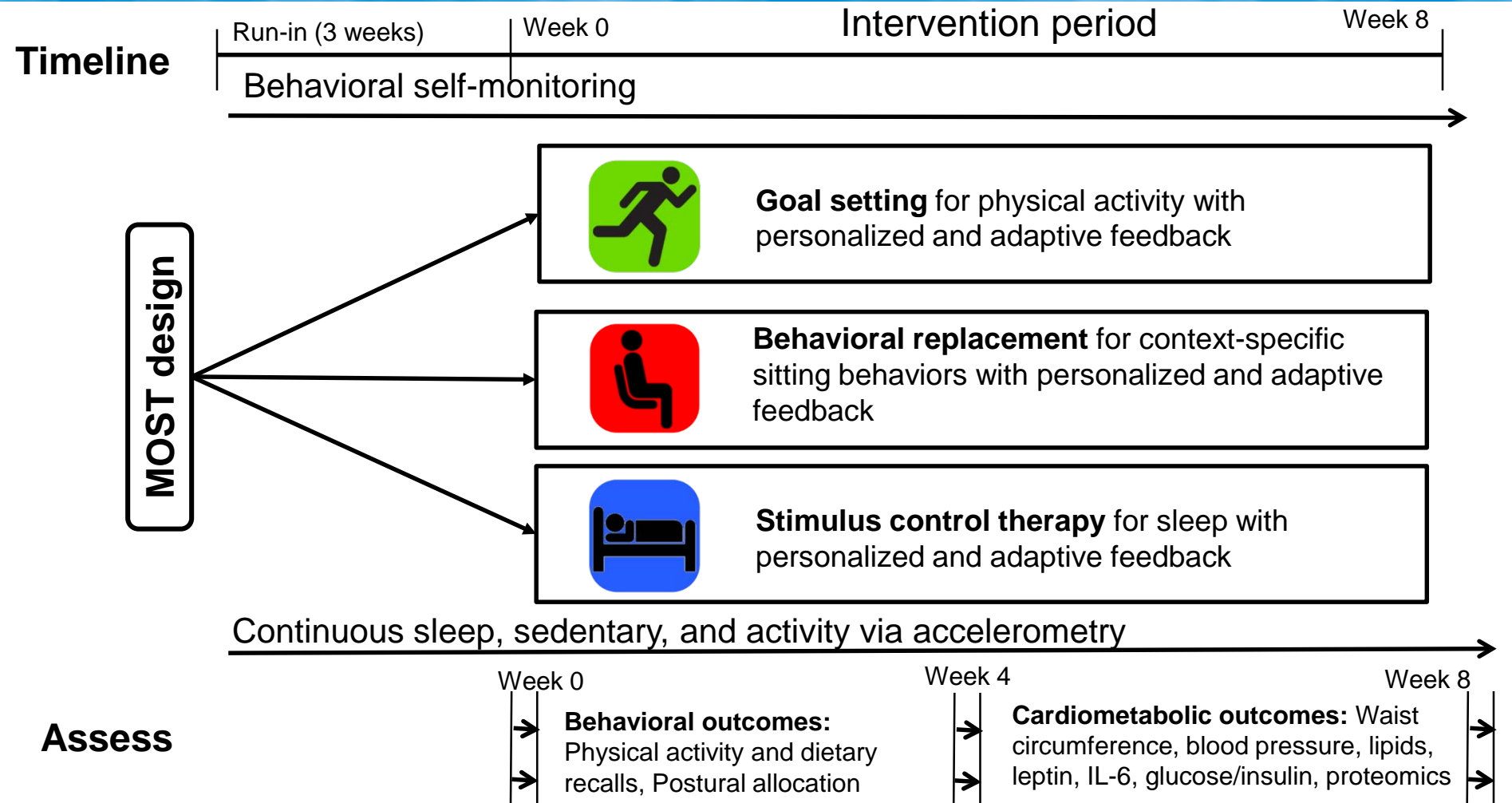


Physical activity



- Based on Fit-Minded strategies
- Provides automated goal suggestions based on previous behavior
- Provides user-generated tips for motivation

BeWell24 Pilot study



Preliminary results



7% increase in
sleep efficiency



12% of 47 min/day
in sitting



105% or 11 min/day of
moderate-vigorous physical activity



12.3% reduction in
fasting glucose



Thank you!

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