

Using Smartphones for Ecological Momentary Assessment of Physical Activity and Eating in Epidemiological Studies



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Methodological Limitations of Epidemiological Instruments

Recall Instruments

- Memory errors and biases
- Not completed in the environment in which the behavior occur
- Difficulty capturing intraindividual variability

Observational Instruments

- Often limited to a single setting
- Do not measure mood or subjective perceptions

Objective Instruments (GPS or accelerometer)

- Difficulty differentiating activity type and travel mode
- Do not measure mood or subjective perceptions

mHealth Technologies

- Mobile phone ownership is common (68% of adults worldwide and 75% of US high school students)
- Adopted across SES groups and in developing countries
- “Apps” can deliver real-time surveys
- Smart phones have built-in accelerometer, GPS, camera, and video technology
- Able to synch with other ambulatory sensors via Bluetooth (e.g., heart rate, asthma inhalers, air pollution, UV)



Methodological Benefits of Ecological Momentary Assessment (EMA)

- **Ecological**
 - Real-world environments & experience
 - Provides ecological validity
- **Momentary**
 - Real-time assessment & focus
 - Avoids recall bias
- **Assessment**
 - Self-report
 - Repeated, intensive, longitudinal
 - **Allows analysis of physiological/psychological/behavioral processes over time**

(Stone & Shiffman, 1994)



Survey



How STRESSED were you feeling just before the beep went off?

1. ☐ Not at all
2. ☐ A little
3. ☐ Quite a bit
4. ☐ Extremely

NEXT

Survey



Were you ALONE just before the beep went off?

1. ☐ Yes
2. ☐ No

NEXT

Survey



What were you DOING right before the beep went off?
(Choose your main activity)

1. ☐ Reading, Computer, or Homework
2. ☐ Watching TV/Movies
3. ☐ Playing video games
4. ☐ Active Play, Sports, or Exercising
5. ☐ Other

NEXT

Survey



Were you with your MOM or DAD just before the beep went off?

1. ☐ Yes
2. ☐ No

NEXT

Survey



WHERE were you just before the beep went off?

1. ☐ Home
2. ☐ School
3. ☐ Car/Van/Truck
4. ☐ Outdoors
5. ☐ Other

NEXT

Survey

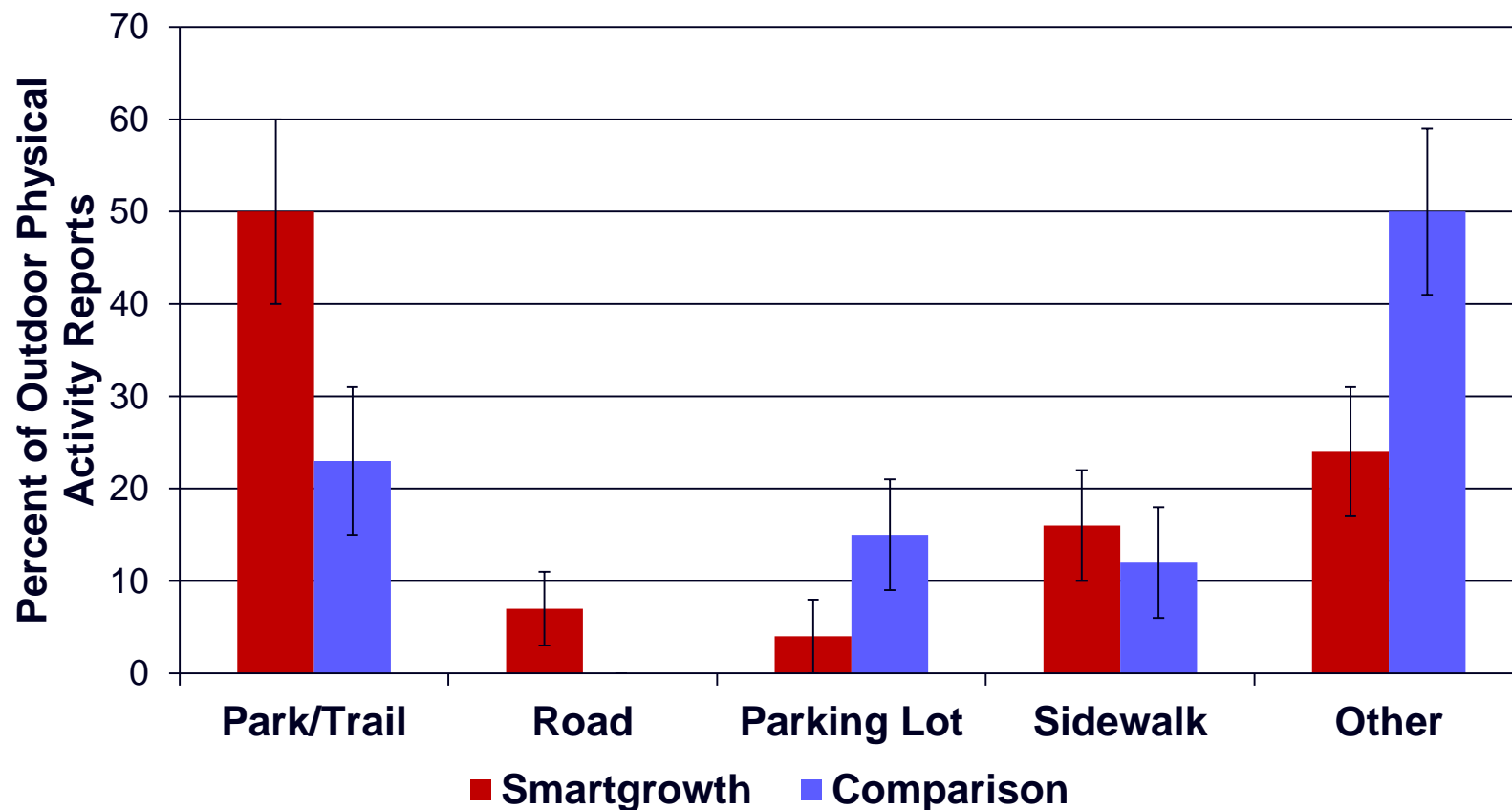


How SAFE do you feel where you are right now?

1. ☐ Unsafe
2. ☐ Somewhat safe
3. ☐ Very safe

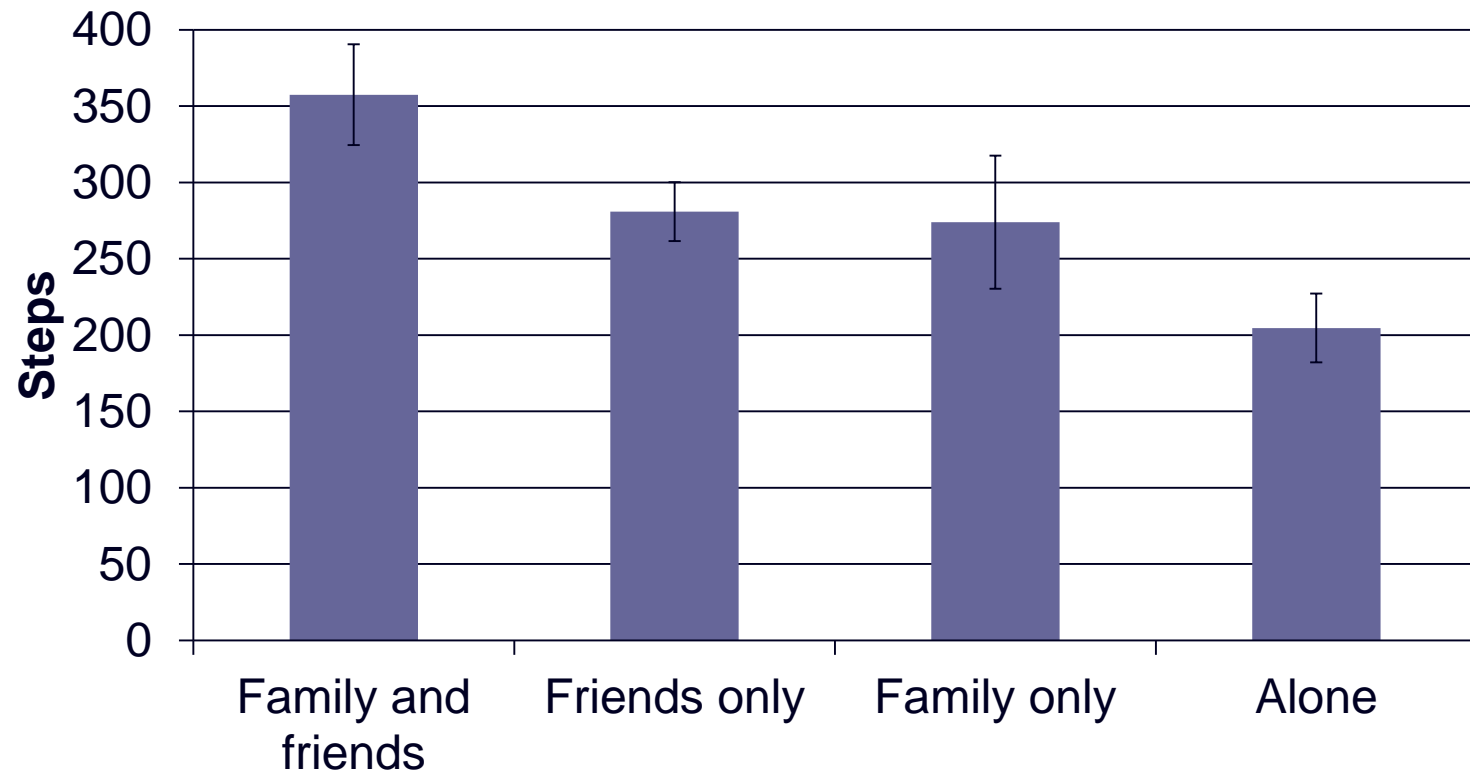
NEXT

Location of Outdoor Physical Activity by Group



Dunton, G. F., Intille, S., Wolch, J., & Pentz, M. Investigating the impact of a smart growth community on the contexts of children's physical activity using Ecological Momentary Assessment, *Health & Place*, 18, 76-84, 2012

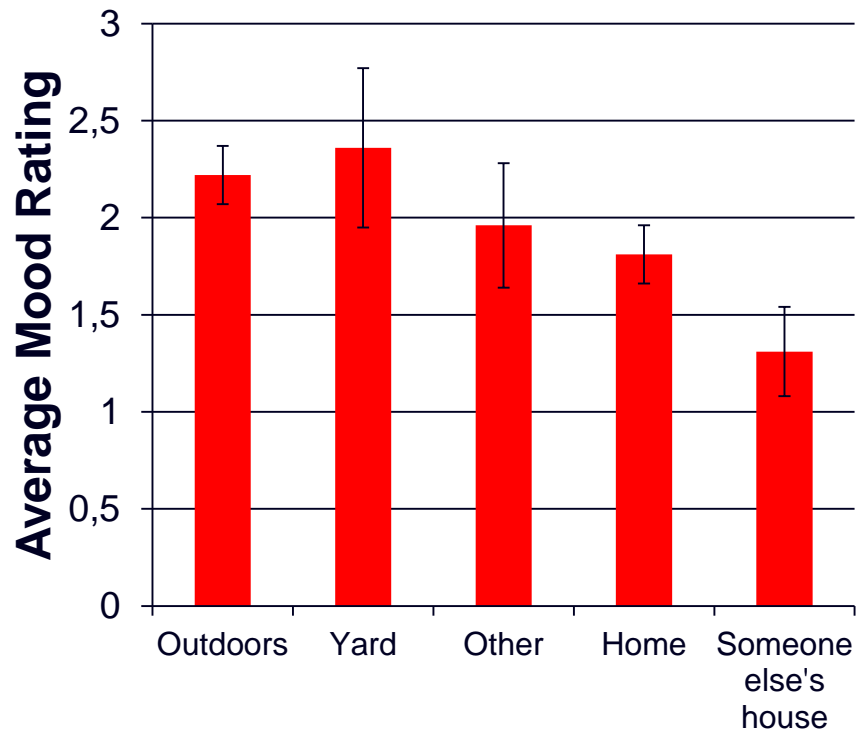
Physical Activity Level by Social Context (30-min. before EMA prompt)



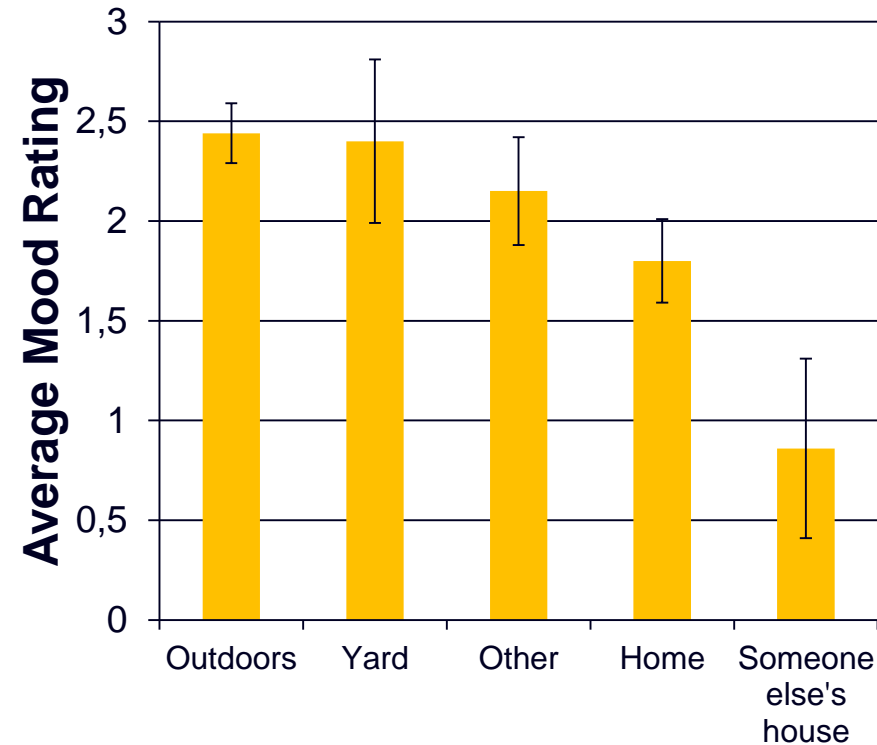
Dunton, G. F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. (2011). Social and physical contextual influences on children's leisure-time physical activity: An Ecological Momentary Assessment study. *Journal of Physical Activity and Health*, 8(Suppl 1), S103-S108.

Mood During Physical Activity by Physical Context

Positive Affect

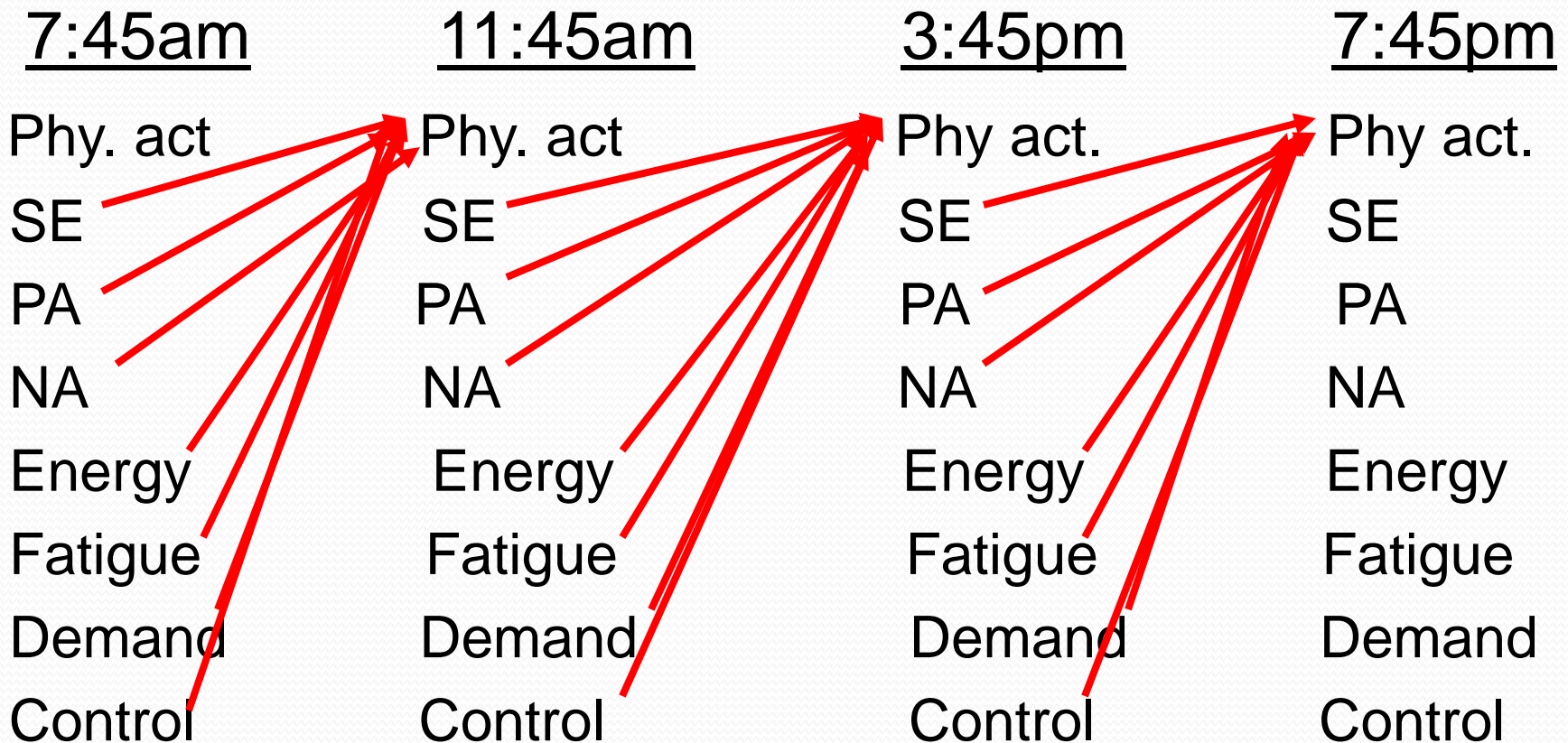


Enjoyment



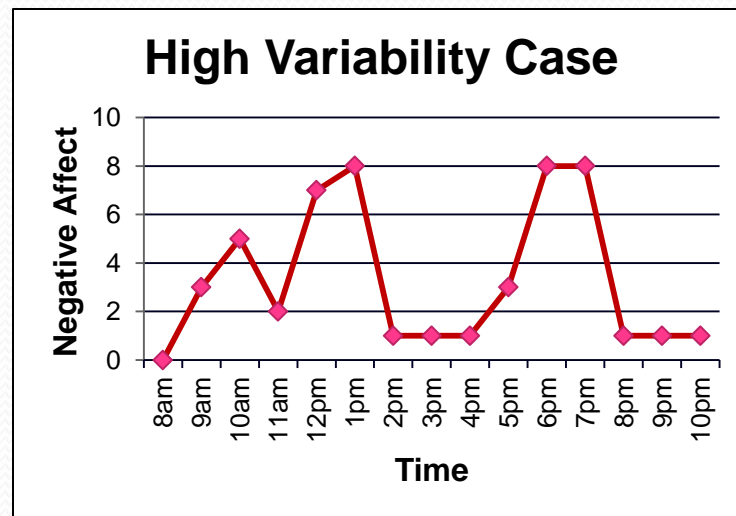
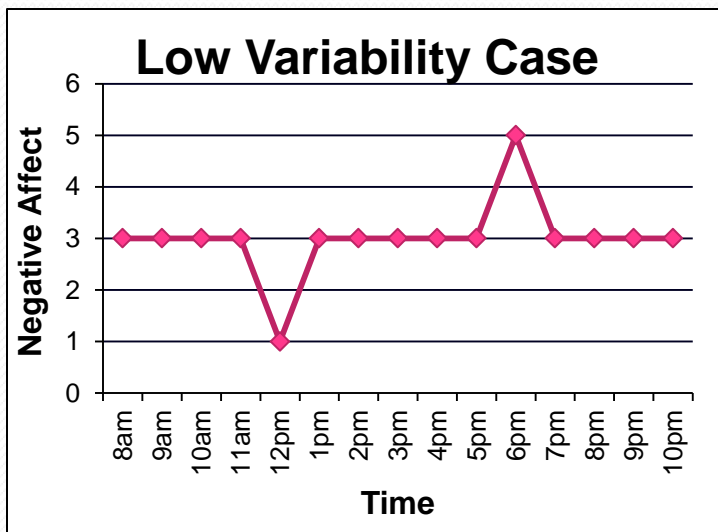
Dunton, G. F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. (2011). Social and physical contextual influences on children's leisure-time physical activity: An Ecological Momentary Assessment study. *Journal of Physical Activity and Health*, 8(Suppl 1), S103-S108.

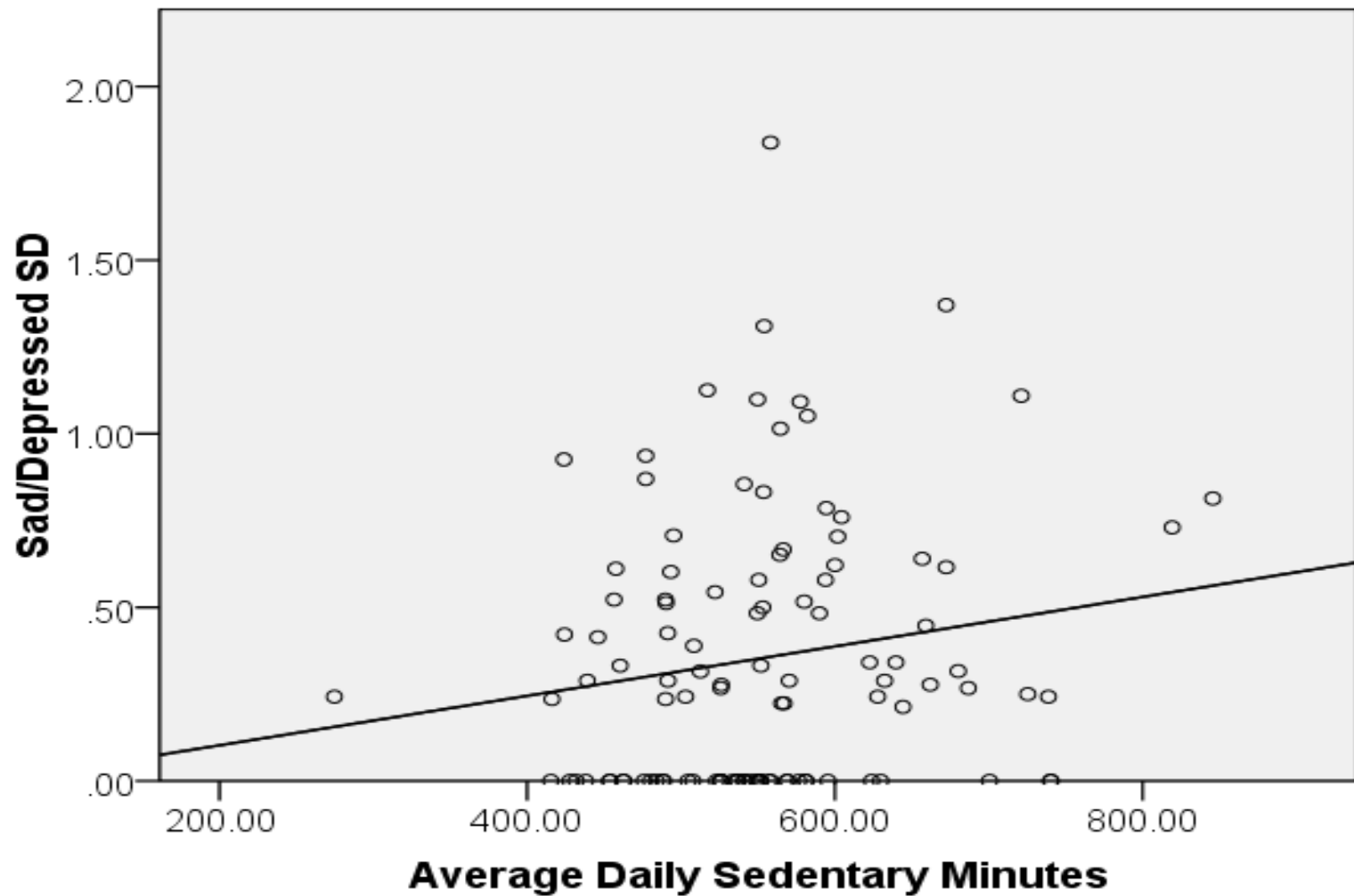
Lagged Effects Models



Dunton, G. F., Atienza, A., Castro, C. M., & King, A. C. (2009). Using ecological momentary assessment to examine antecedents and correlates of physical activity bouts in adults age 50+ years: A pilot study. *Annals of Behavioral Medicine*, 38, 249-255.

- Is mood variability (i.e., instability, fluctuation) related to levels of physical and sedentary activity?





Location Model of Within-Person Mean ($\beta = 0.001$, $t = 1.46$, $p > .05$)

Scale Model of Within-Person Variability ($\tau = 0.002$, $t = 6.32$, $p < .001$)

Context-sensitive EMA with Instrumented asthma inhaler



- Bluetooth-enabled communication to smartphone
- EMA survey prompted 3-4 minutes after each asthma inhaler use



Current Activity By Type of EMA Prompt



	Random EMA	Rescue CS-EMA	Chi- Square
Using Technology	47.8%	7.1%	8.38**
Sports/Exercise	19.5%	50.0%	6.59*
Eating/Drinking	12.4%	14.3%	0.41
Reading/Homework	7.1%	0.0%	1.06
Going Somewhere	5.3%	7.1%	0.08
Sleeping	8.8%	14.3%	0.43

**p < .10, *p < .05

Challenges and Limitations

- Missing data
- Reactance
- Participant burden
- Costs



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