



National Institute of
Diabetes and Digestive
and Kidney Diseases

“Wear Fatigue”: Does device wear compliance wane over a free-living assessment period?

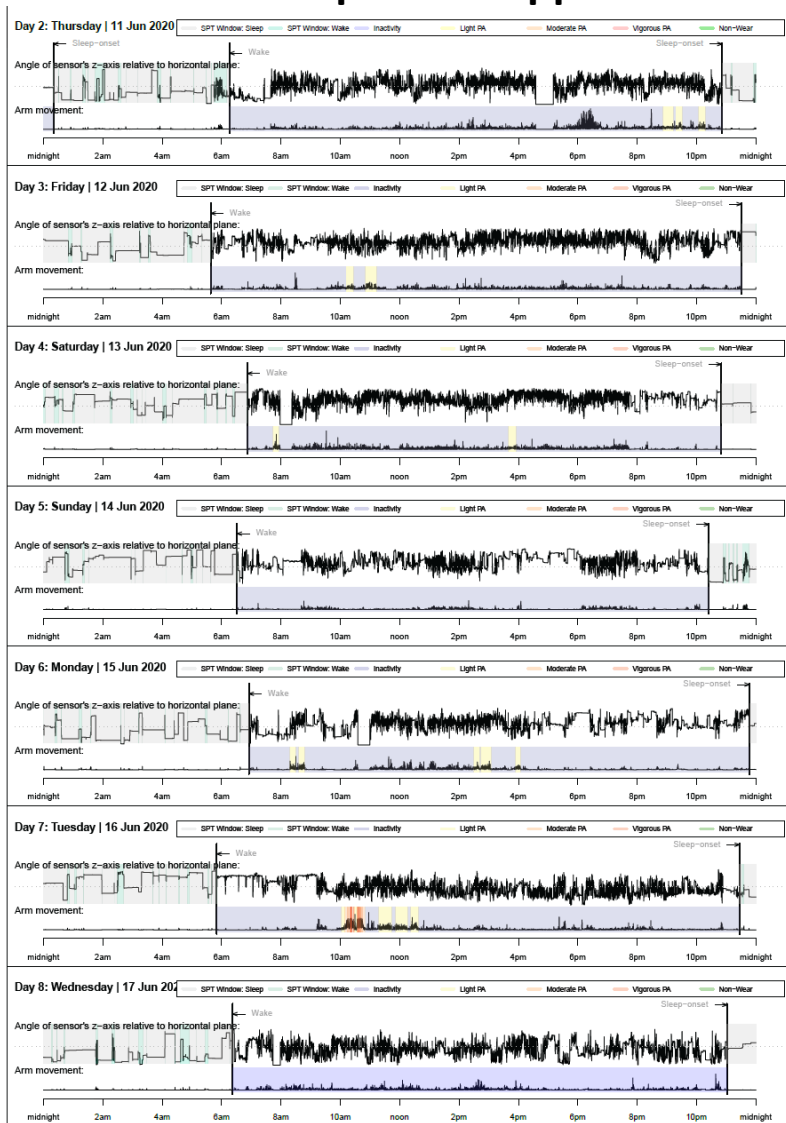


Samuel LaMunion, Robert Brychta, Kong Chen

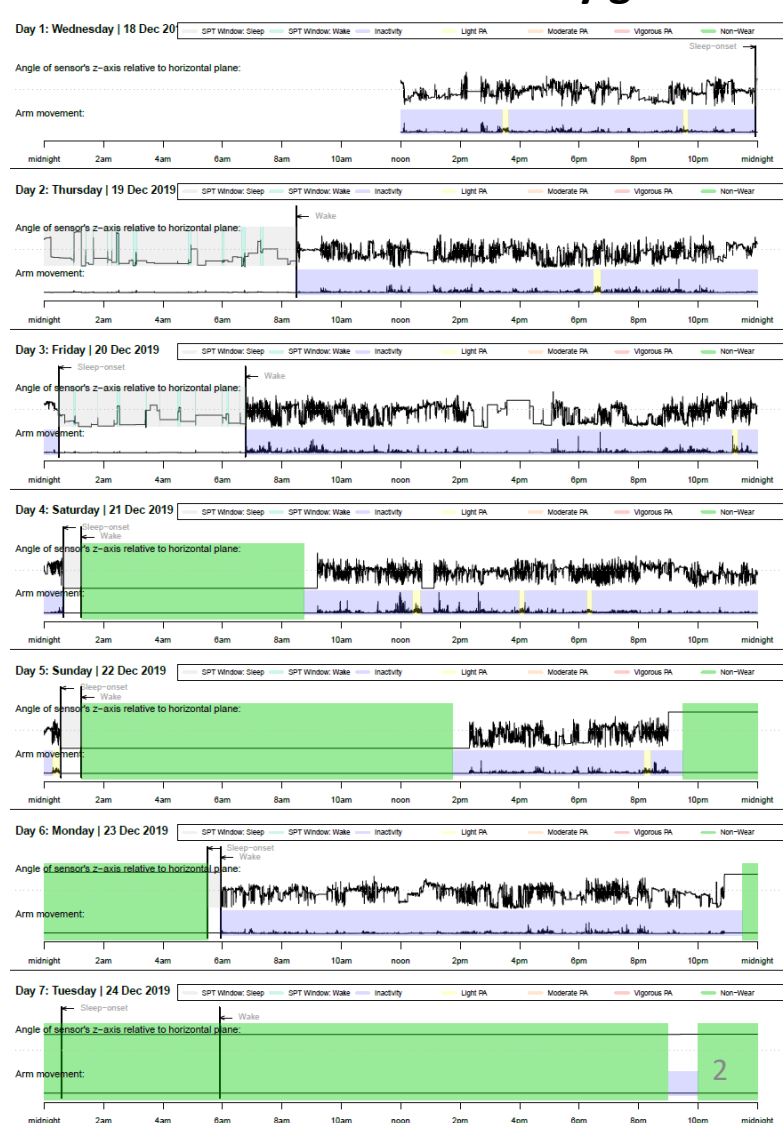
National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Diabetes, Endocrinology, and Obesity Branch, Bethesda, MD

Accelerometer Non-Wear Examples

What we hope will happen...



...versus what we actually get



Wear Compliance

- Dependent on wear protocol (& attachment site)
 - Protocol-based expected non-wear
 - Partial day wear
 - ❖ Waking wear only
 - ❖ Sleep wear only
 - 24hr wear
 - None or minimal non-wear
- Wear compliance estimates from NHANES
 - 2003-2006: ~40-70% compliance (7 days \geq 10hrs wear)¹
 - Waking wear time only, hip-worn device
 - 2011-2012: ~70-80% compliance (7 days \geq 10hrs wear)¹
 - 24hr wear protocol, wrist-worn device



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¹Troiano RP, McClain JJ, Brychta RJ, Chen KY. Evolution of accelerometer methods for physical activity research. Br J Sports Med. 2014 Jul;48(13):1019-23. doi: 10.1136/bjsports-2014-093546.

Wear Fatigue Concept

- Defining “wear fatigue”: the rate and pattern of reduction in daily accelerometer wear time during a ≥ 7 -day wear protocol resulting in less data available for analysis at the end of the assessment period.
- **Research Questions:**
 - 1) Does accelerometer wear time decrease over consecutive days of wear during a 7-day free-living assessment using a 24-hour wear protocol and a wrist-worn device?
 - 2) Non-wear accumulation:
 - Does the rate of reduction vary with age or sex?
 - Is there a temporal pattern or trend in the reduction?



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Data Overview – Participant Characteristics

- All participants with 7 days of recorded data included
 - Partial days removed
- Continuous age categorized into the age group bins shown below
- Participants were asked to wear an ActiGraph GT3X+ on their non-dominant wrist continuously (24h) for 7 consecutive days



Table 1. Summaries of Sample from the 2011-2012 and 2013-2014 NHANES Cycles plus the Youth data from the 2012 NNYFS

	NHANES 2011-2012 (N=6609)	NHANES 2013-2014 (N=7540)	NNYFS 2012 (N=1436)	Total (N=15585)
Gender				
Female	3347 (50.6%)	3902 (51.8%)	720 (50.1%)	7969 (51.1%)
Male	3262 (49.4%)	3638 (48.2%)	716 (49.9%)	7616 (48.9%)
Age (y)				
Mean (SD)	37.0 (22.8)	34.9 (23.5)	9.04 (3.66)	33.4 (23.4)
Median [Min, Max]	34.0 [6.00, 80.0]	32.0 [3.00, 80.0]	9.00 [3.00, 15.0]	29.0 [3.00, 80.0]
Age Group				
Adolescents 12-18y	803 (12.2%)	922 (12.2%)	450 (31.3%)	2175 (14.0%)
Adults 18-60y	3281 (49.6%)	3475 (46.1%)	0 (0%)	6756 (43.3%)
Children 3-12y	1084 (16.4%)	1619 (21.5%)	986 (68.7%)	3689 (23.7%)
Older Adults 60-80y	1441 (21.8%)	1524 (20.2%)	0 (0%)	2965 (19.0%)

Rate of Wear fatigue (minutes per day) varies by age group over a 7-day assessment period

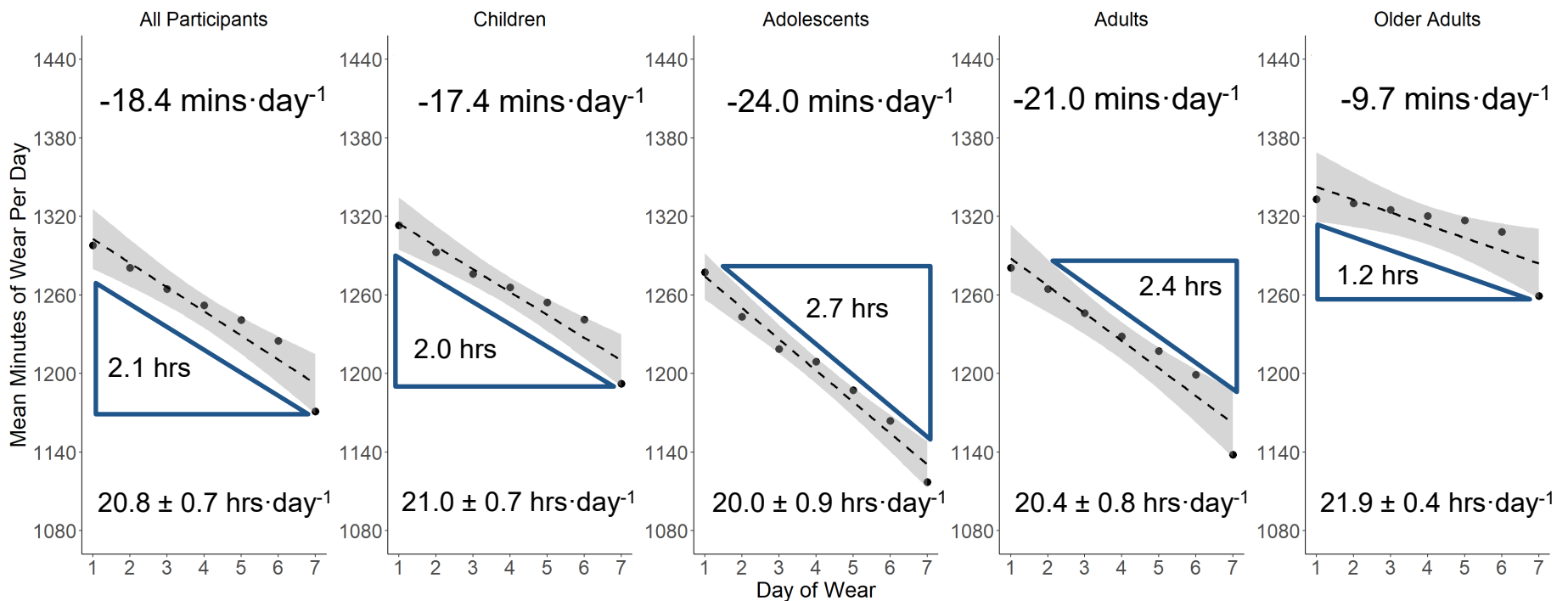


Figure 1a. The rate of wear fatigue trends for mean (shading = 95% CI) minutes of wear time per day for all participants and by age group over the 7-day assessment period.

Rate of Wear fatigue (minutes per day) varies by age group over a 7-day assessment period

$p < 0.003$

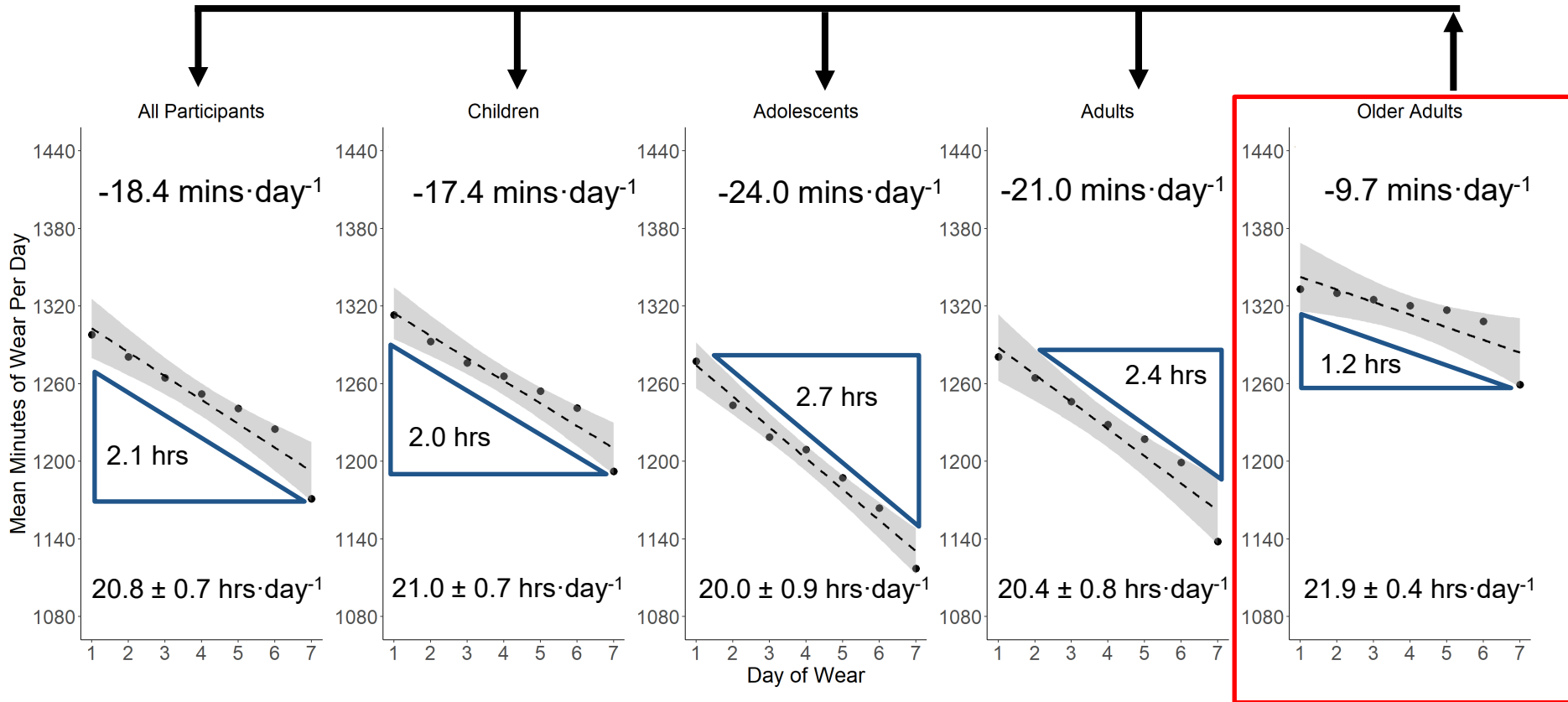


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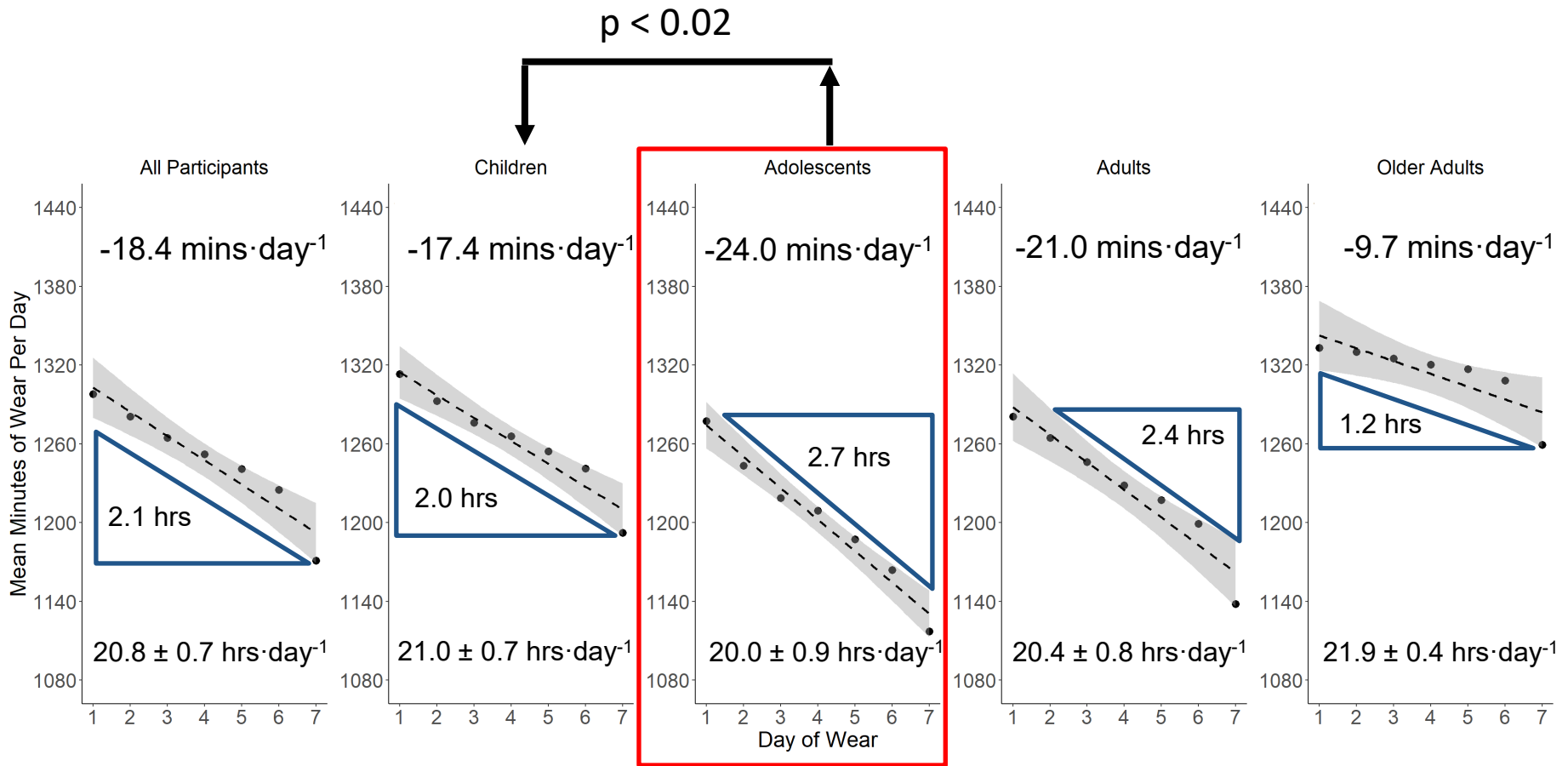


Figure 1a. The rate of wear fatigue trends for mean (shading = 95% CI) minutes of wear time per day for all participants and by age group over the 7-day assessment period.

Pattern of Wear fatigue varies by age group over a 7-day assessment period

- Temporal variation
 - Disproportionate nocturnal non-wear
 - Distributed differently based on age group

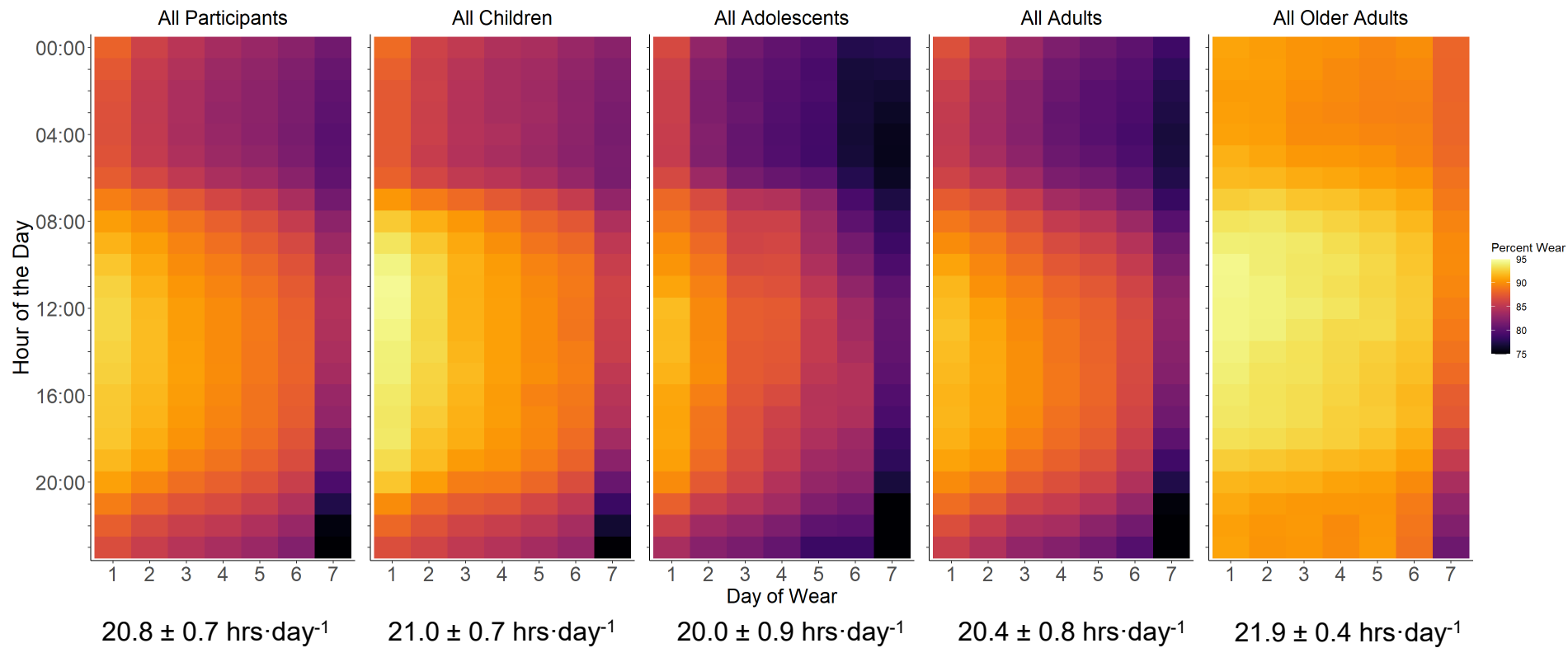


Figure 1b. Pattern of wear fatigue trends for mean (shading = 95% CI) hour-by-hour wear time (%) heatmaps for all participants and by age group over the 7-day assessment period.

Summary

- Wear compliance wanes over time resulting in wear fatigue.
- Wear fatigue is not uniformly distributed across individuals and time.
 - The rate and pattern of wear fatigue varies by age but not sex.
 - Disproportional at night and towards the end of a wear period.



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Discussion

- No data examined with >7 days of wear time (*so far...*)
- Non-wear scoring dependent on the algorithm
 - the NHANES/MIMS scoring algorithm isn't yet available.
- Wear compliance already relatively high (>20hrs/day)
 - Focused more on clinical relevance where sample sizes are small and maximizing useable data captured is a priority.
- Some non-wear is unavoidable
 - What we hope to reduce is the data lost to non-wear by taking the device off and forgetting to put it back on and for overall compliance with the specified wear protocol. Intervention to increase/maintain wear may be needed.



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Future Research

- How does wear fatigue impact results comparing groups (ex. age) when considering individual variabilities?
- How will wear fatigue affect the 24hr activity cycle impacting sleep and SB?
- Is it unique to U.S. population and does it vary culturally?



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Thank You!

Thank you to my co-authors:

Dr. Kong Chen

Dr. Rob Brychta

Questions?

Sam LaMunion (samuel.lamunion@nih.gov)

Postdoctoral Intramural Research Training Award Fellow

The National Institutes of Health – Bethesda, MD

National Institute of Diabetes, Digestive, and Kidney Diseases

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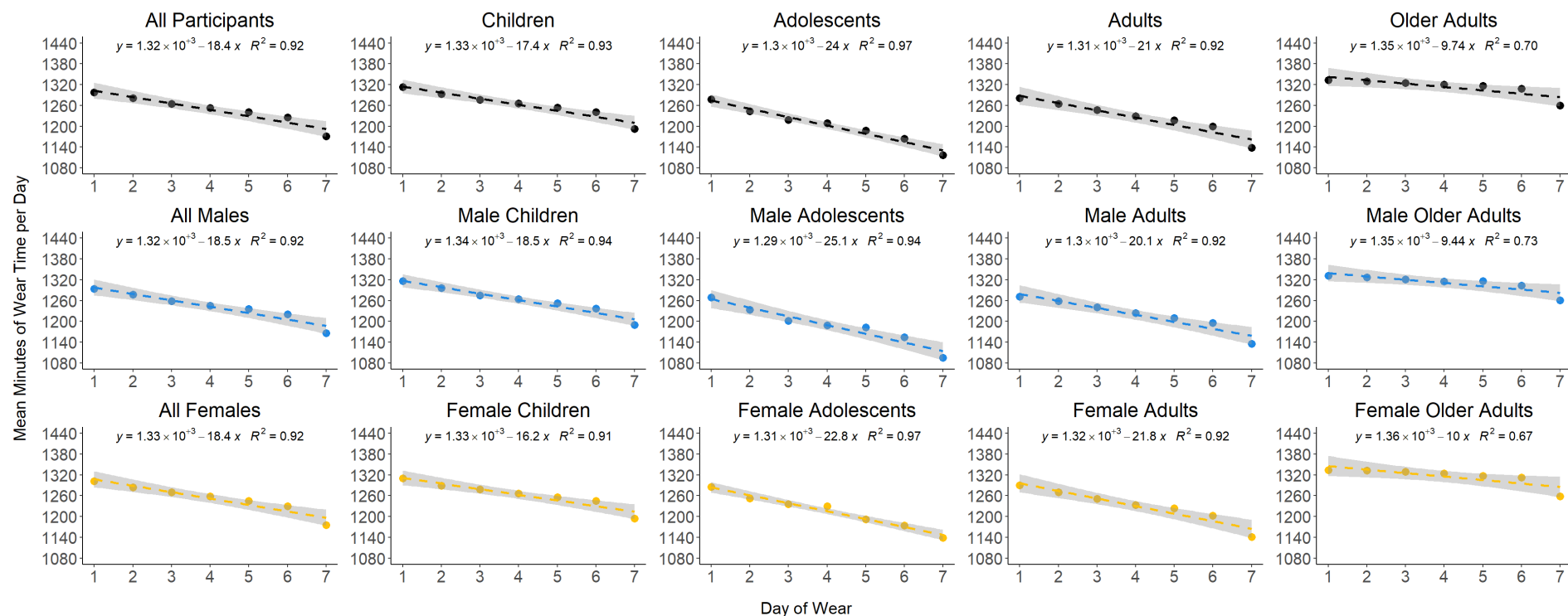
Human Energy and Body Weight Regulation Core

Metabolic Clinical Research Unit



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Rate of Wear Fatigue by Sex and Age



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Wear Fatigue over a 6-day window instead of 7

