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

LaMunion SR, Brychta RJ, Chen KY

Introduction: Accelerometers are often used to objectively measure physical behaviors in free-living environments, typically for ≥7 consecutive days. We hypothesized that over a typical assessment period some participants may be prone to "wear fatigue", defined as the rate of reduction in wear time from the beginning to the end of the study period. To test this hypothesis, we examined accelerometer data from the 2011-2014 National Health and Nutrition Examination Survey (NHANES) cycles and the 2012 NHANES National Youth Fitness Survey Data. **Methods:** Participants were instructed to wear an ActiGraph GT3X+ on their non-dominant wrist for 24 h/day for 7 consecutive days. Publicly available accelerometer wear-time data were scored by the National Center for Health Statistics used in the presented analyses. All participants with 7 complete days of recorded data, regardless of wear status, were included in the analyses (N = 15,585). The first and last partial days were removed. **Results:** Participants recorded 1247.4 ± 288.2 (Mean ± SD) minutes per day of wear time (86.6% ± 20.0%). For all participants, wear fatigue was 21.2 ± 59.7 minutes/day resulting in a significant decrease of 127.0 ± 358.2 minutes ($p < 0.001$) between day 1 (1298.0 ± 257.8 minutes or 90.1% ± 17.9%) and day 7 (1171.0 ± 414.9 minutes or 81.3% ± 28.8%, Figure 1). Wear fatigue varied temporally, with greater rates occurring at night, and by age group, with adolescents having the highest (26.7 ± 65.8 mins/day) and older adults having the lowest rates (12.3 ± 45.7 mins/day, Figure 1). **Conclusion:** Further research is needed to determine if the wear fatigue would be different in longer studies, interventional studies, or in other countries/cultures. To minimize wear fatigue, periodic reminders may be needed to maintain high wear compliance, particularly when sleep monitoring is important or for younger age groups and when the 24h activity cycle is a primary endpoint.
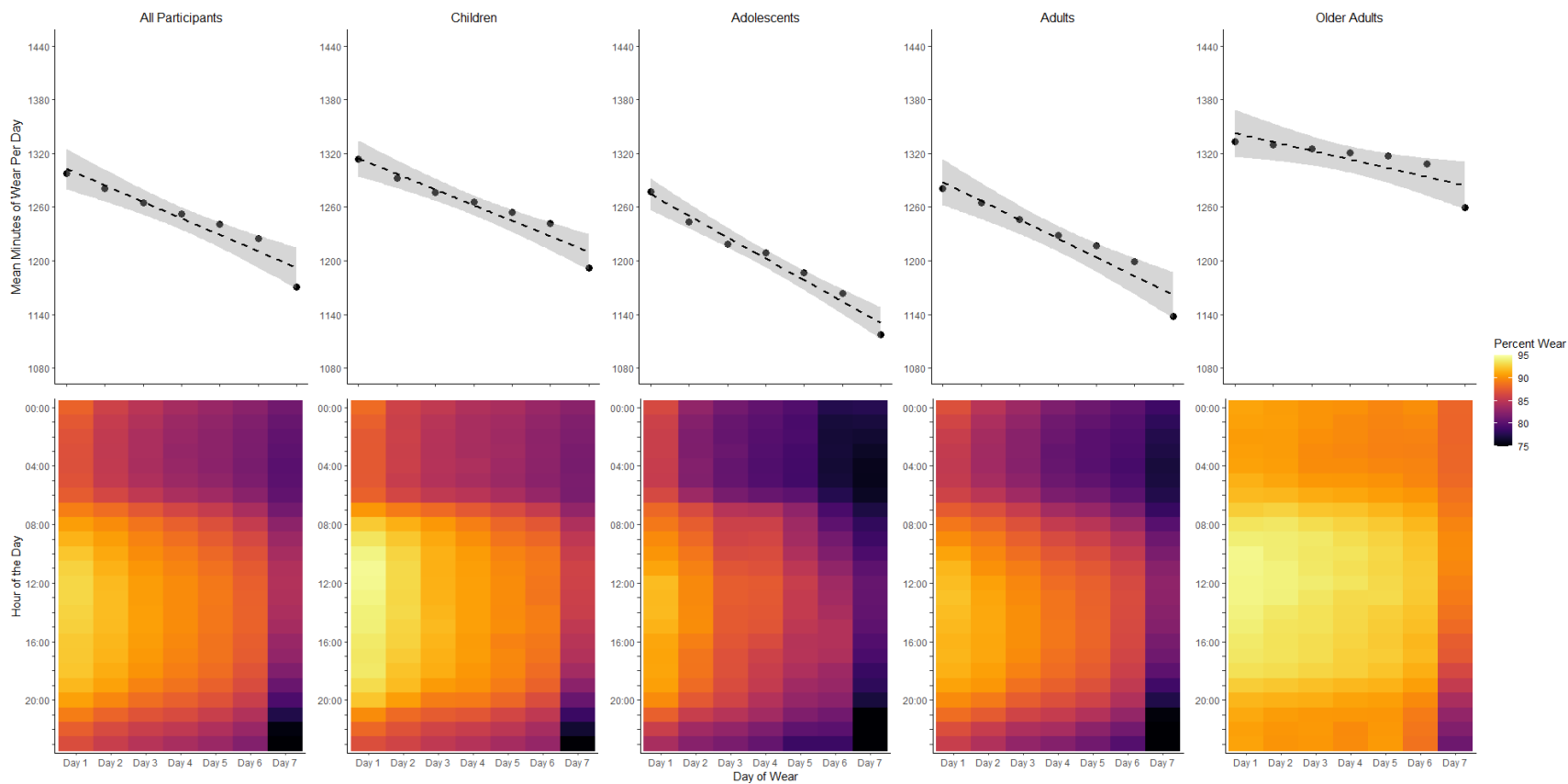
Figure 1. Wear fatigue trends for mean (shading = 95% CI) minutes of wear per day and hour-by-hour wear time (%) heatmaps for all participants and by age group over the 7-day assessment period.