Utility of a Rest-Activity Ratio in a Pediatric Brain Injury Rehabilitation Sample: A Pilot Study

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INTRODUCTION

Background:

- Sleep/wake disturbances are common after acquired brain injury (ABI).

- Rehabilitation activities after ABI requires effortful participation.

- Poor sleep can impact daytime engagement and performance in physical, occupational, speech, and therapeutic recreation therapies.

- The rest period used in actigraphy to generate sleep-wake variables can be ambiguous in hospital settings due to increased amount of time spent in bed.

- Obtaining accurate sleep diaries and consistent use of actigraph event markers can be difficult for impaired individuals recovering from ABI.

- A *rest-activity ratio* (Duclos et al., 2013) has been shown to be sensitive to changes in sleep-wake regulation over the course of recovery after ABI among adults.

Objective:

- To examine the utility of this *rest-activity ratio* in differentiating children with and without acquired brain injury (ABI) in an inpatient pediatric rehabilitation setting

METHOD: Measures

- Participants wore an actigraph (Phillips Respironics Actiwatch Spectrum Plus) for 7 days.
  - Raw activity counts across 1-minute epochs were used to derive a *rest-activity ratio*
  - Periods designated as off-wrist were replaced with the mean activity count per minute pertaining to the day or night period as appropriate

$$\text{Rest-activity ratio} = \frac{\Sigma\, b}{\Sigma\, (b+a)}$$

Where b = activity counts from 07:00 to 21:59
a = activity counts from 22:00 to 6:59

- Rehabilitation Therapists were asked to provide an alertness rating using a 5-point Likert scale:

 How would you describe this patient's alertness during the therapy session?
  1 = Sleepy, falling asleep at times.
  2 = Drowsy, fighting to stay awake.
  3 = Relaxed, calm, awake with low energy.
  4 = Awake and alert with moderate energy.
  5 = Highly aroused and extremely energetic.

METHOD: Participants

- Eleven males and five females, ages 8-16 years (M=12.6, SD=2.4) participated in a larger study examining sleep & daytime functioning among children in an inpatient pediatric rehabilitation program

- Eight participants were diagnosed with ABI whereas the other 8 had other non-neurological conditions and served as a control

RESULTS

- Those with ABI had lower average ratios (M=0.73, SD=0.14) compared with controls (M=0.84, SD=0.04), $F_{(1,14)}=4.3$, p=0.058

- Individuals with ratios of 0.85 or higher were rated by their physical therapists as being more alert during therapy, $F_{(1,14)}=4.1$, p=0.061

- While these results were marginally significant, this pilot sample was small, and the effect sizes were large ($\eta^2 = 0.234$ and 0.229, respectively)
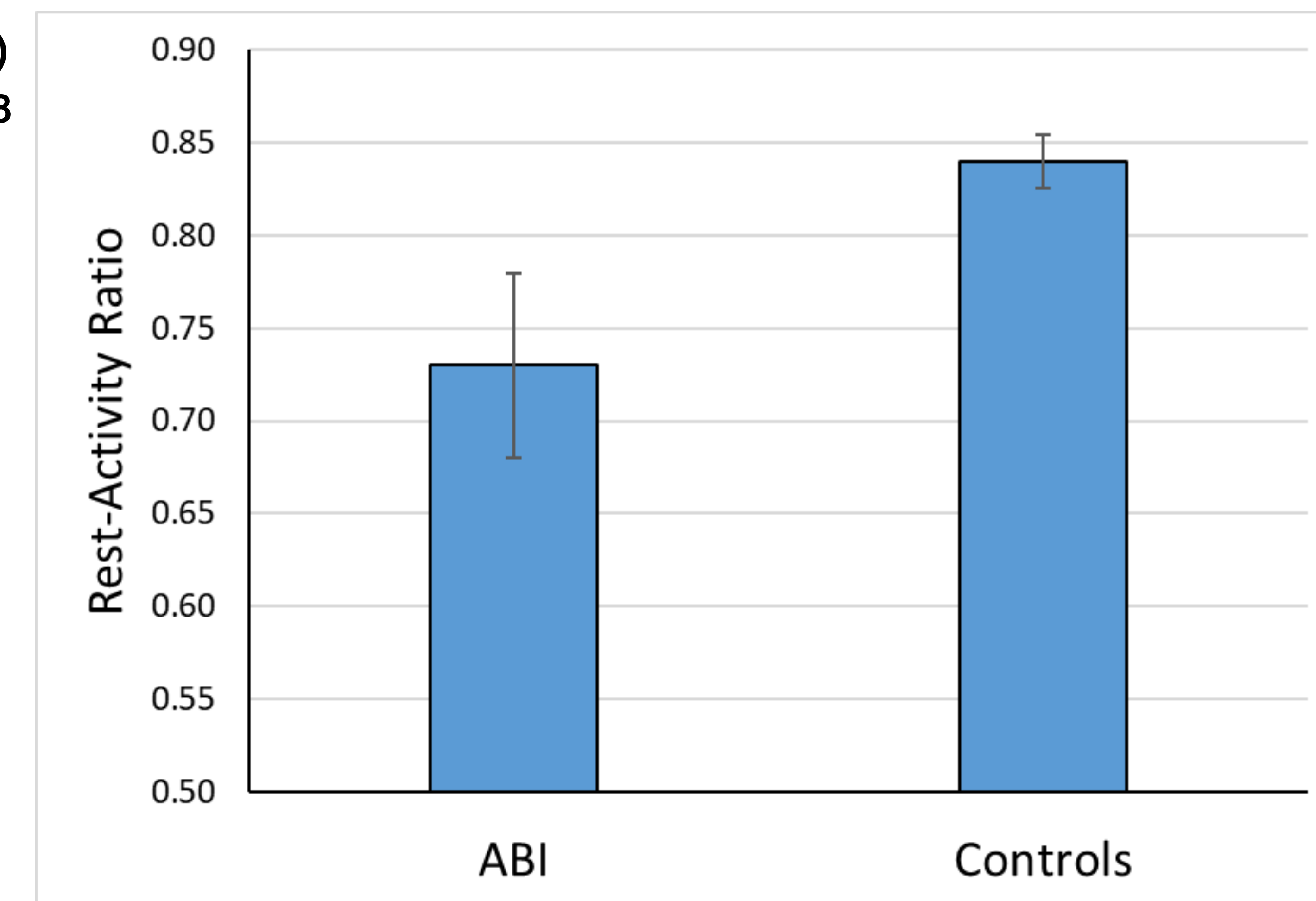
CONCLUSIONS

- The *rest-activity ratio* successfully distinguished those with ABI from those without ABI in a pediatric sample

- This is consistent with the adult research literature showing the ratio to be sensitive to the effects of ABI on sleep-wake regulation.

- Such a *rest-activity ratio* may be a useful metric in the inpatient pediatric rehabilitation setting when sleep diaries may be difficult to obtain and patients may be spending more wakeful hours in bed

- Future studies with larger sample sizes are needed to explore the correlates of this ratio with other aspects of rehabilitation after pediatric brain injury