

Slower heart rate during fear extinction in people with head injury is associated with worse future post-traumatic stress disorder

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BACKGROUND

- Mild traumatic brain injury (mTBI) is well-established as a risk factor for the development of post-traumatic stress disorder (PTSD), and PTSD is also linked to disturbances in cardiovascular functioning.
- The objective of this study was to examine the cardiovascular response to fear in civilians exposed to trauma with and without head injury (HI) at the time of the trauma and assess future PTSD-related outcomes.
- We hypothesized that decreased HR in those with HI would be a predictor of worse future PTSD.

METHODS

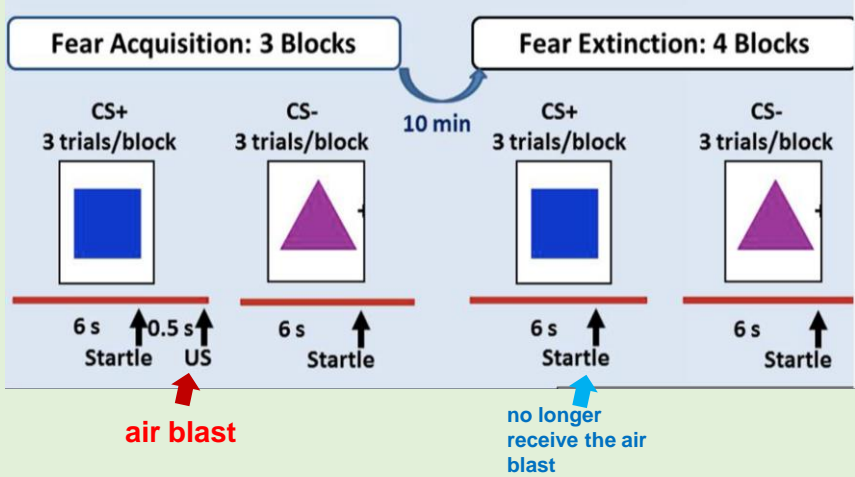
Participants: Participants in this study were recruited from 29 emergency departments (EDs) across the United States following exposure to a traumatic stressor as part of the larger Advancing Understanding of RecOverY afterR traumaA (AURORA) study.

Materials/Measures:

- Participants received an initial evaluation in the ED and assessment of a variety of trauma-related, psychosocial, neurocognitive, and biological factors at multiple follow-up visits up to one-year post-injury (two and eight weeks, three, six and twelve months).
- Participants included in this analysis (N=1089; 61% female) were those who provided HI information in the ED and PTSD symptoms at each time point.
- Participants self-reported HI accompanied with changes in mental status. Injury severity was assessed using the Injury Severity Score (ISS) and the PTSD Checklist for DSM-5 (PCL-5) evaluated PTSD symptoms at every timepoint.

Procedure:

- Two weeks following injury, a subset of participants (N=301, 69% female) completed a deep phenotyping visit, which included a differential fear conditioning paradigm that employs visual conditioned stimuli (CSs).
- During acquisition, the CS+ was paired with an aversive air blast (unconditioned stimulus; US), while a second CS (CS-) was never reinforced. Following acquisition, extinction trials were conducted in which both CSs were presented without the US. BIOPAC was used to measure HR using electrocardiogram (ECG).



RESULTS

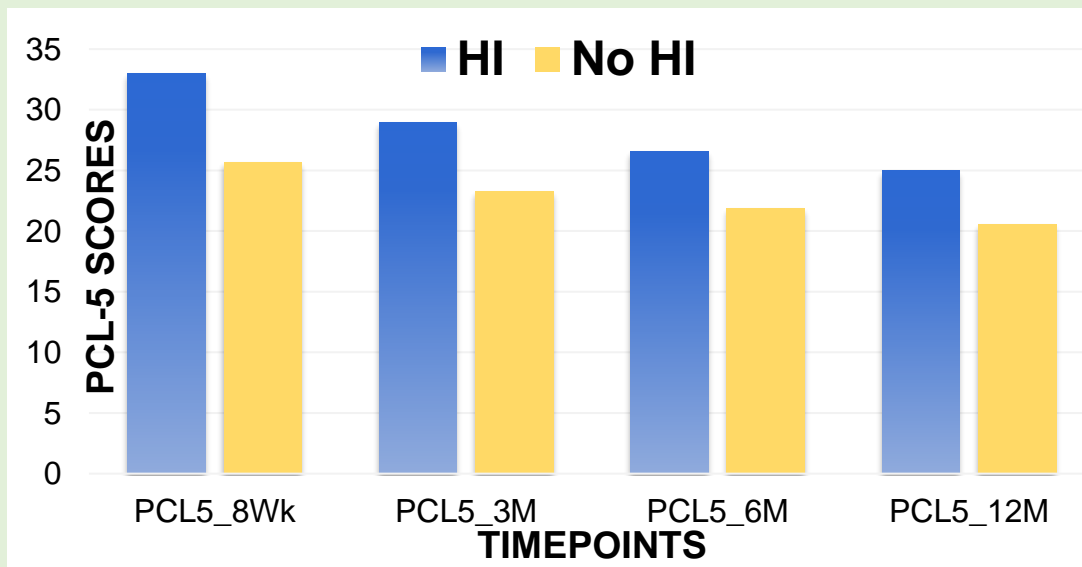
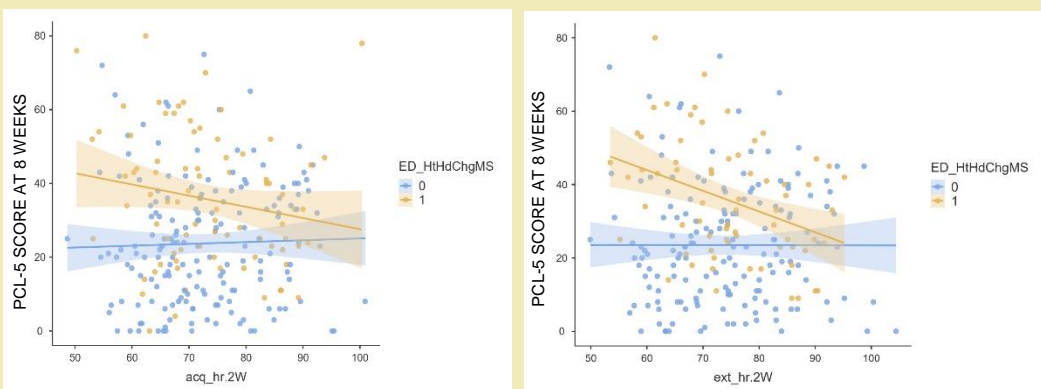
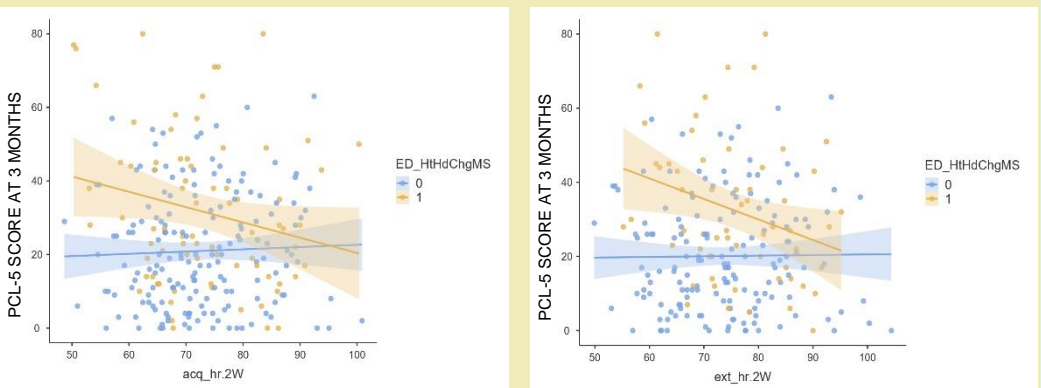


Figure 1: A two-way repeated measures ANOVA revealed main effects of both time, i.e., 8 weeks, 3, 6, and 12 months post-trauma ($F(3,3261)=84.55$, $p<.001$) and HI ($F(1,1087)=20.65$, $p<.001$) but no interaction, indicating that while PCL-5 scores declined for both groups over time, PTSD symptoms were significantly higher in the HI group compared to those without HI, at every timepoint.

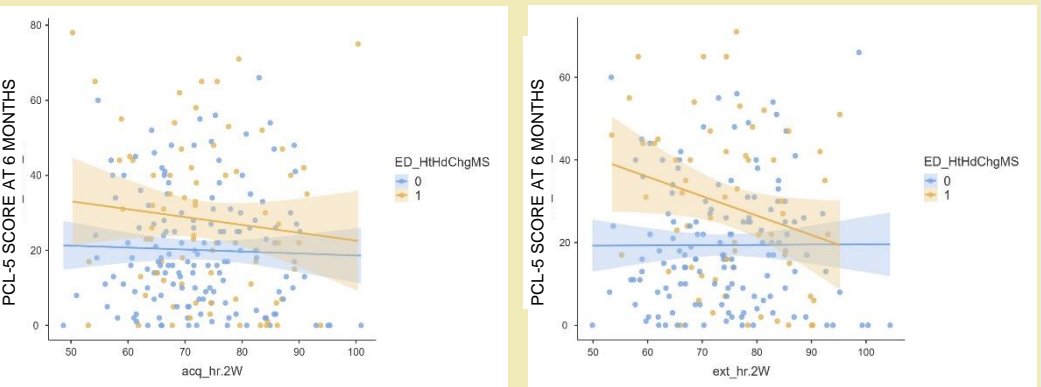
RESULTS



Plot 1: Fear Acquisition: PTSD symptoms were not associated with HR. Fear Extinction: higher PTSD symptoms were associated with reduced HR at 8 weeks following trauma exposure only in individuals with HI ($r(68)=-0.37$, $p=0.02$).



Plot 2: Fear Acquisition: PTSD symptoms were not associated with HR. Fear Extinction: higher PTSD symptoms were associated with reduced HR at 3 months following trauma exposure only in individuals with HI ($r(60)=-0.29$, $p=.03$).



Plot 3: Fear Acquisition: PTSD symptoms were not associated with HR. Fear Extinction: higher PTSD symptoms were associated with reduced HR at 6 months following trauma exposure only in individuals with HI ($r(60)=-0.25$, $p=.05$).

CONCLUSIONS

Results indicated that slower HR during fear extinction in the early aftermath of trauma may predict worse PTSD outcomes in individuals who sustained HI during the traumatic event.

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