



# Posttraumatic Stress Disorder is Associated with Explicit Rather Than Implicit Verbal Memory Performance Deficits in U.S. Military Veterans



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## Background

- Disrupted cognition is commonly reported in veterans with post-traumatic stress disorder (PTSD).
- Verbal learning and memory are well-established domains of impairment in PTSD<sup>1</sup>.
- Verbal memory has two main substrates<sup>2</sup>:
  - Declarative/explicit memory via medial temporal lobes.
  - Procedural/implicit memory via cortical/striatal regions.
- Underlying mechanisms behind PTSD-related verbal memory deficits are poorly understood.
- Little is known about the potential influences of common comorbid conditions such as mild traumatic brain injury (mTBI).

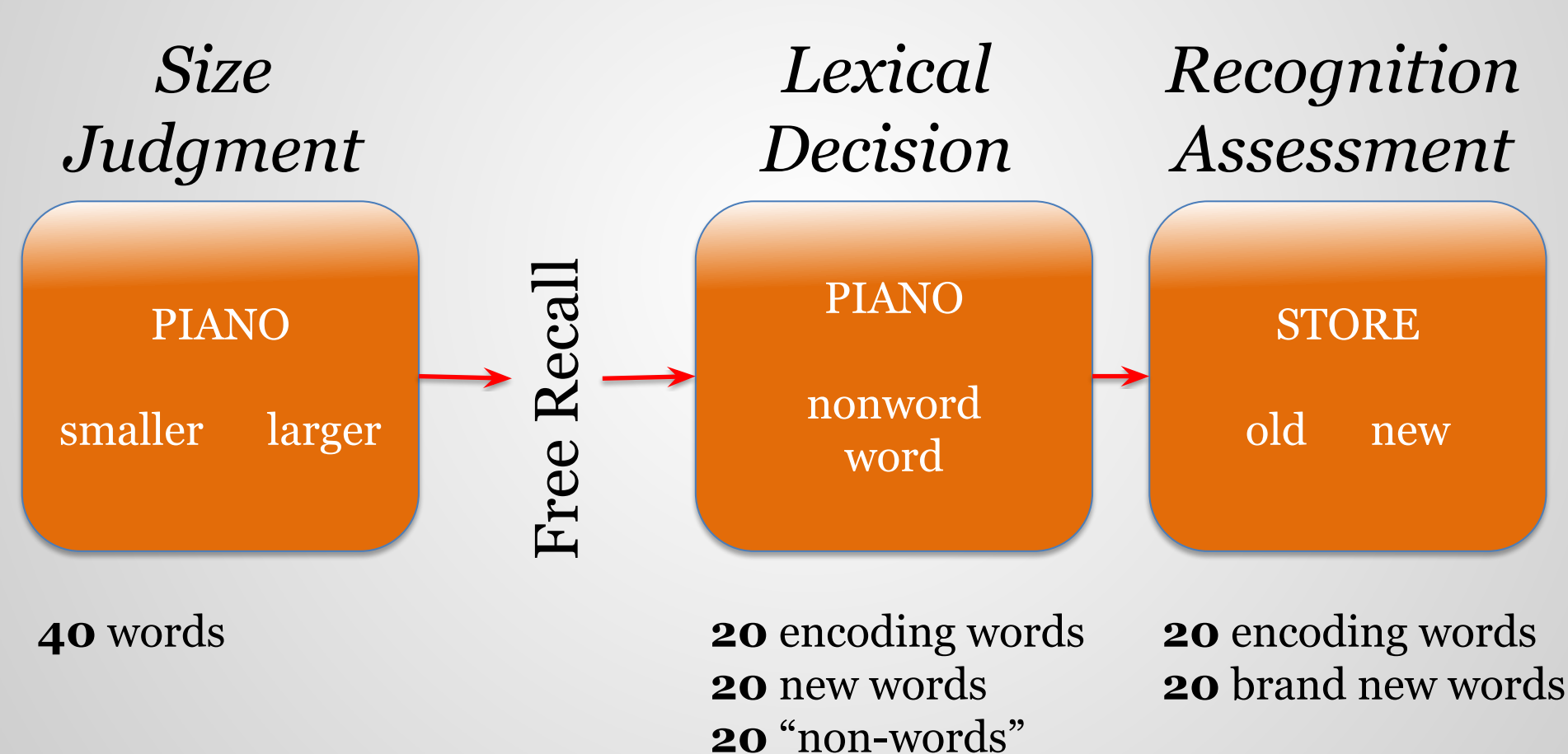
## Objectives

- Measure PTSD-related explicit and implicit verbal memory effects.
- Assess specificity by exploring potential associations with mTBI.
- Confirm laboratory findings using conventional neuropsychological measures of verbal functioning.
- Assess hippocampal subfield volume as a mediator of verbal memory deficits.

## Methods

- Two cross-sectional cohorts of OEF/OIF veterans from the Minneapolis VAHCS.
- Laboratory verbal memory task.
  - Size judgment task for encoding.
  - Free recall to assess explicit memory.
  - Lexical decisions to assess repetition priming effects on response time (RT).
  - Recognition to confirm memory effects.

### Task Block Example



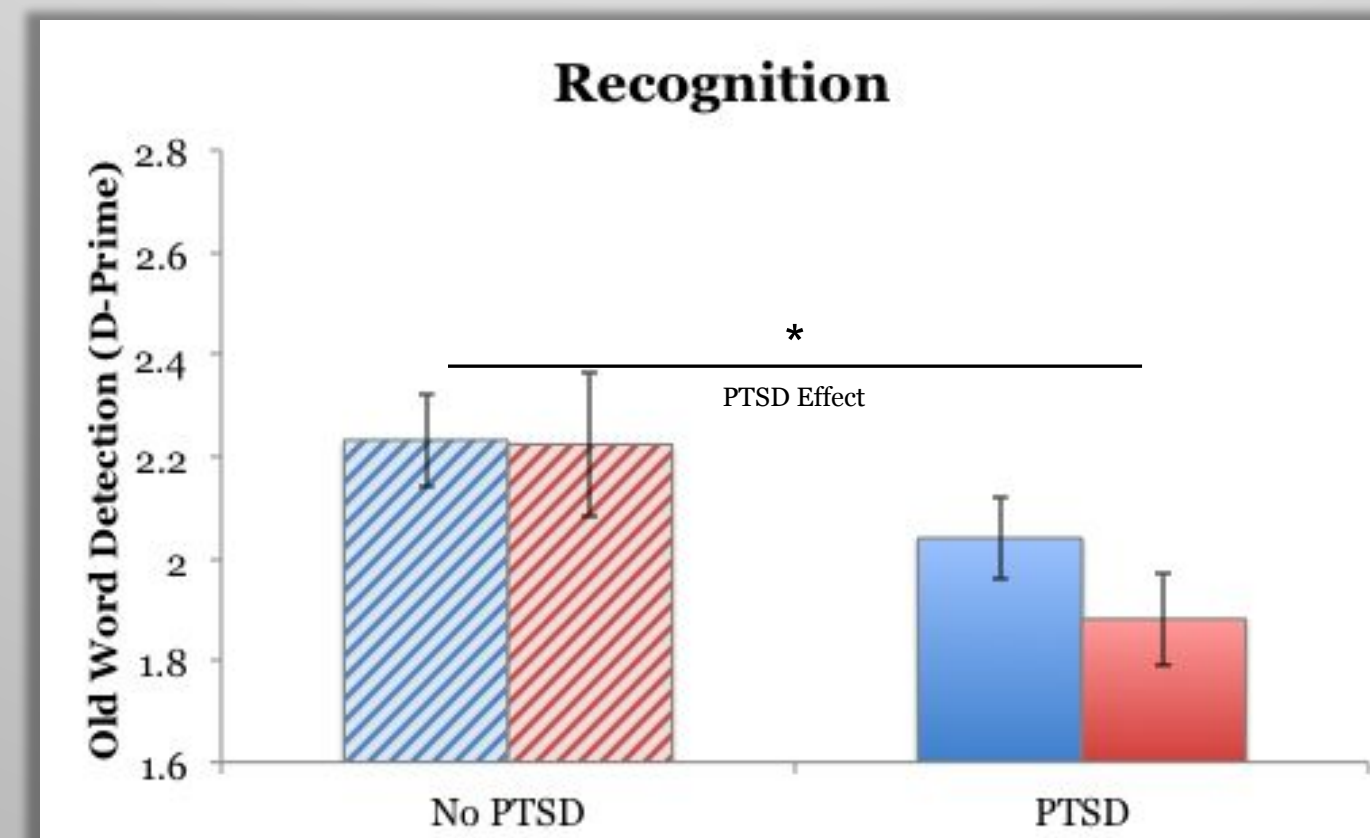
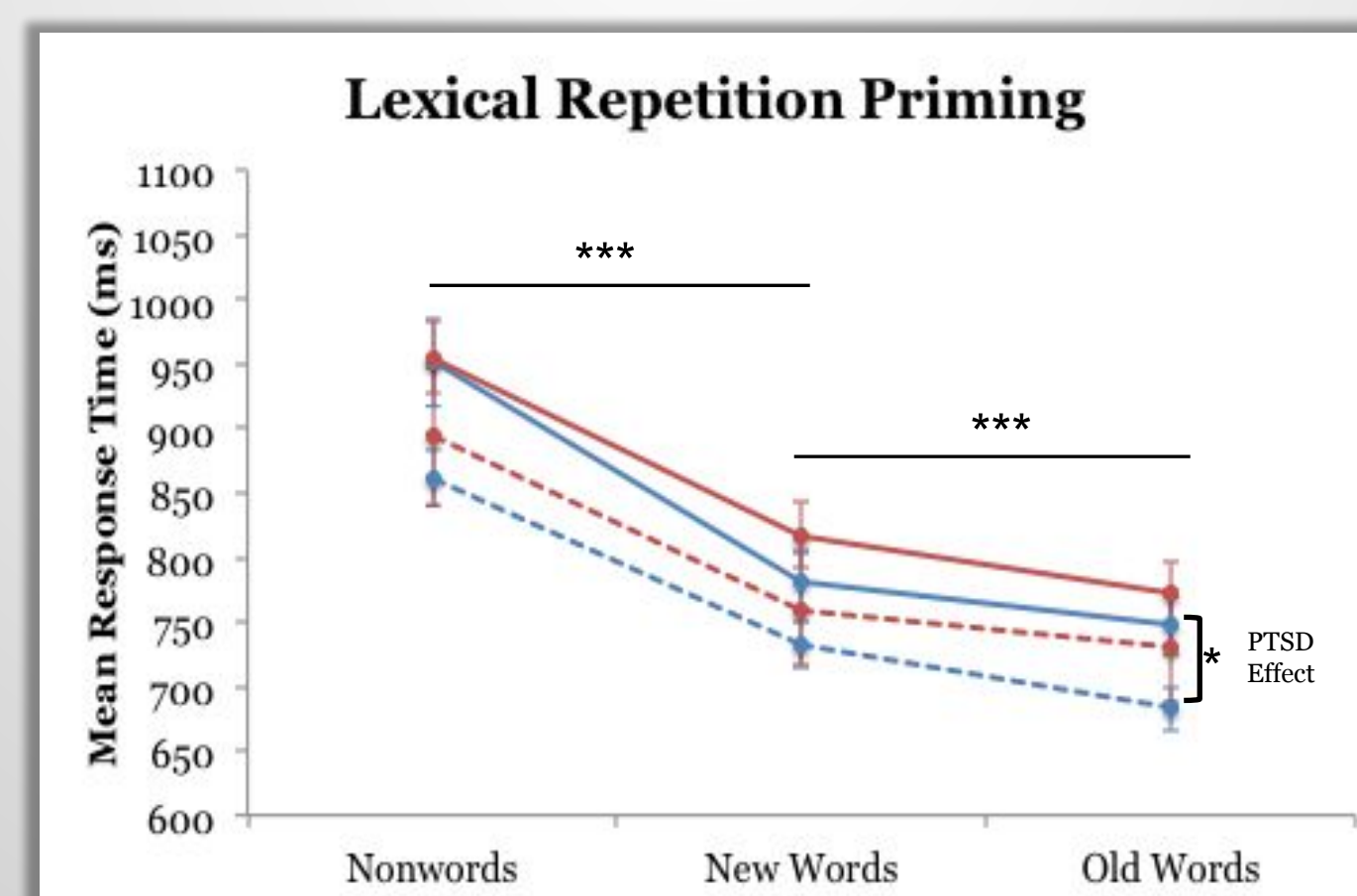
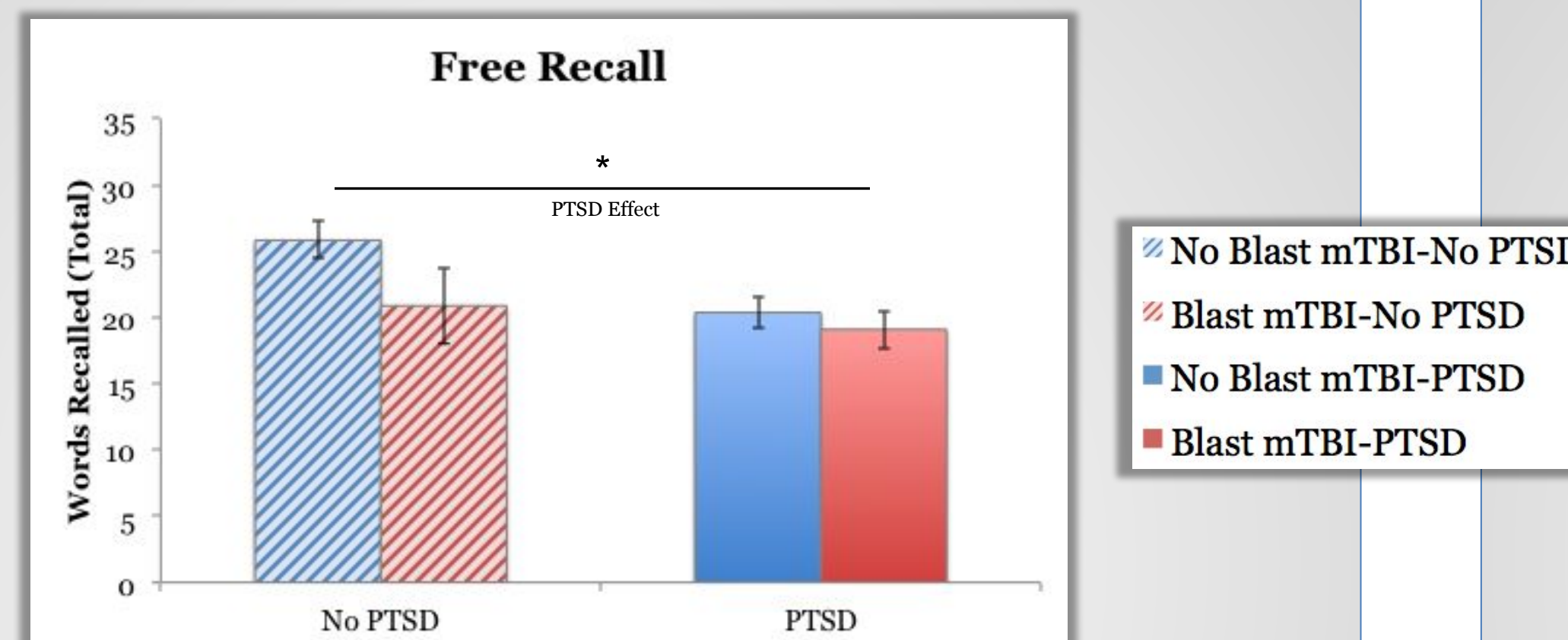
- Neuropsychological assessments.
  - WTAR for overall verbal ability.
  - CVLT-II for verbal memory.
- Structural MRI segmented for hippocampal subfield volumes: presubiculum, CA3, and hippocampal tail.
  - Assessed mediation between PTSD diagnosis and CVLT-II delayed recall.

## Results

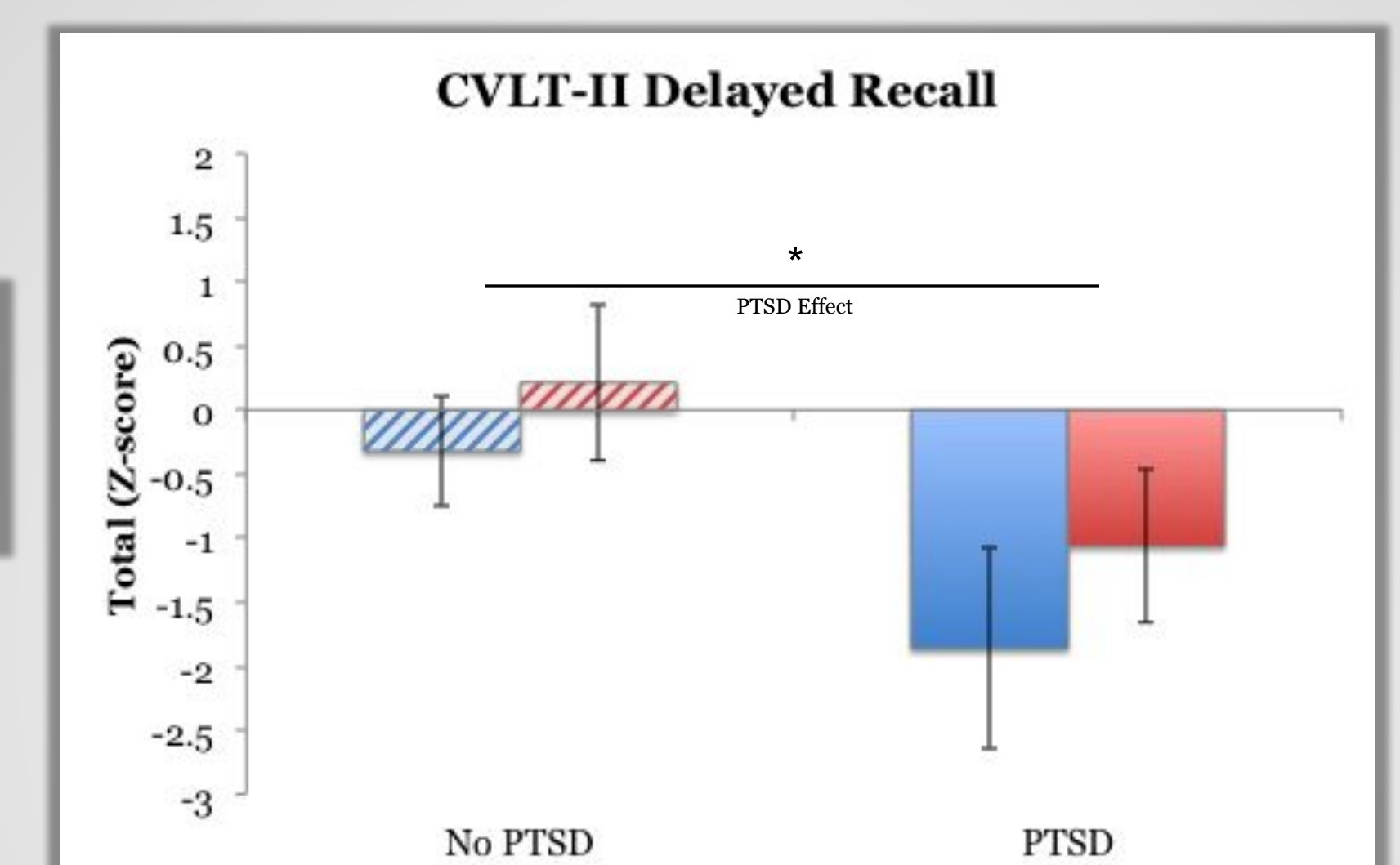
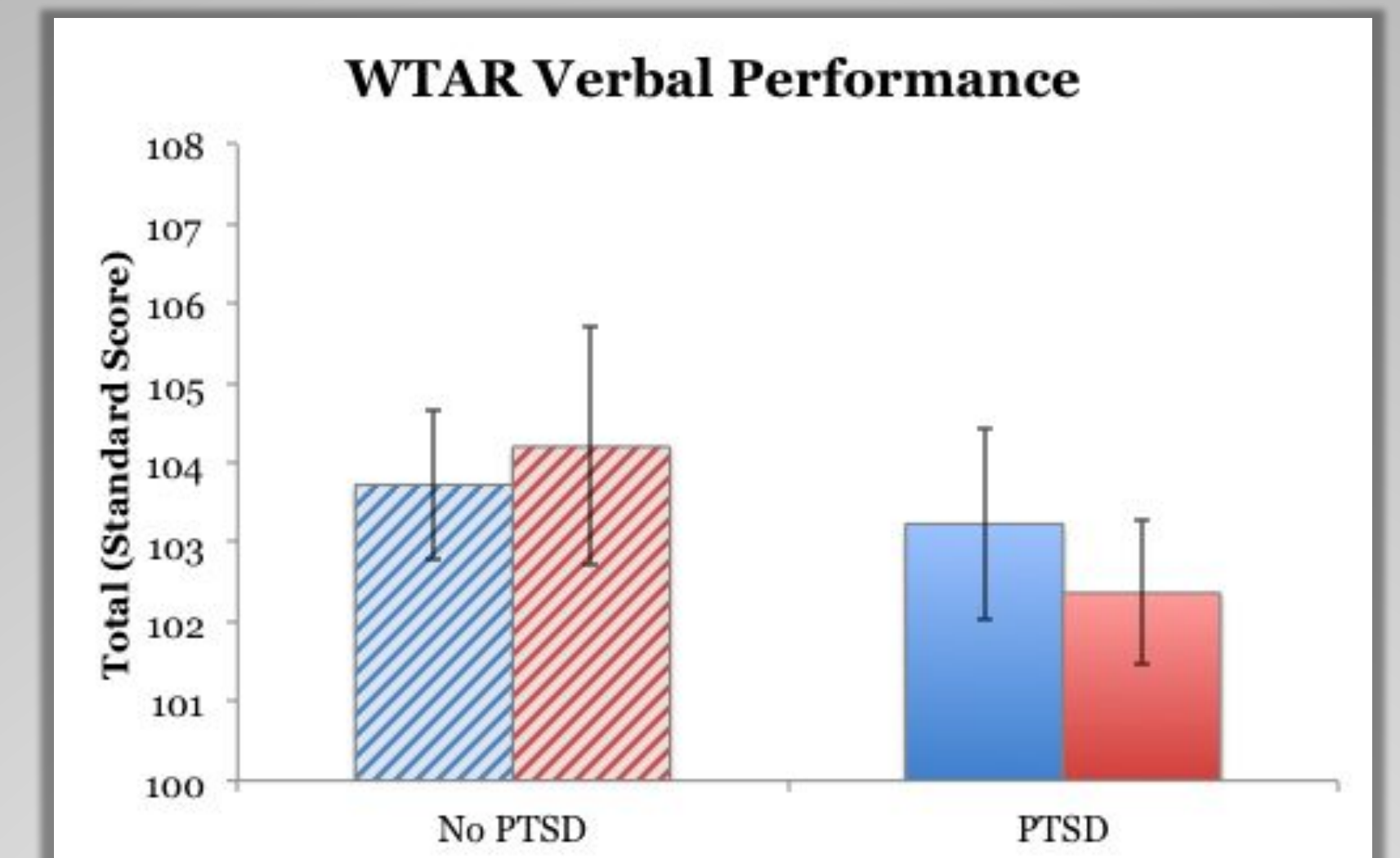
### Sample Characteristics

Variable	Study 1, Laboratory Verbal Memory Task						Study 1 & Study 2, Neuropsychological Assessment					
	No PTSD			PTSD			No mTBI			PTSD		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Total	41			17			41			47		
Female	6			0			3			2		
Minority	6			0			4			2		
Age, years	33.4	8.7		35.1	8.8		32.6	8.7		30.6	6.3	
Education, years	15.0	1.6		15.1	2.0		17	14.5	1.8	23	14.2	1.6
Depressive disorder	2			4			17			14		
Alcohol dependence	2			4			14			15		

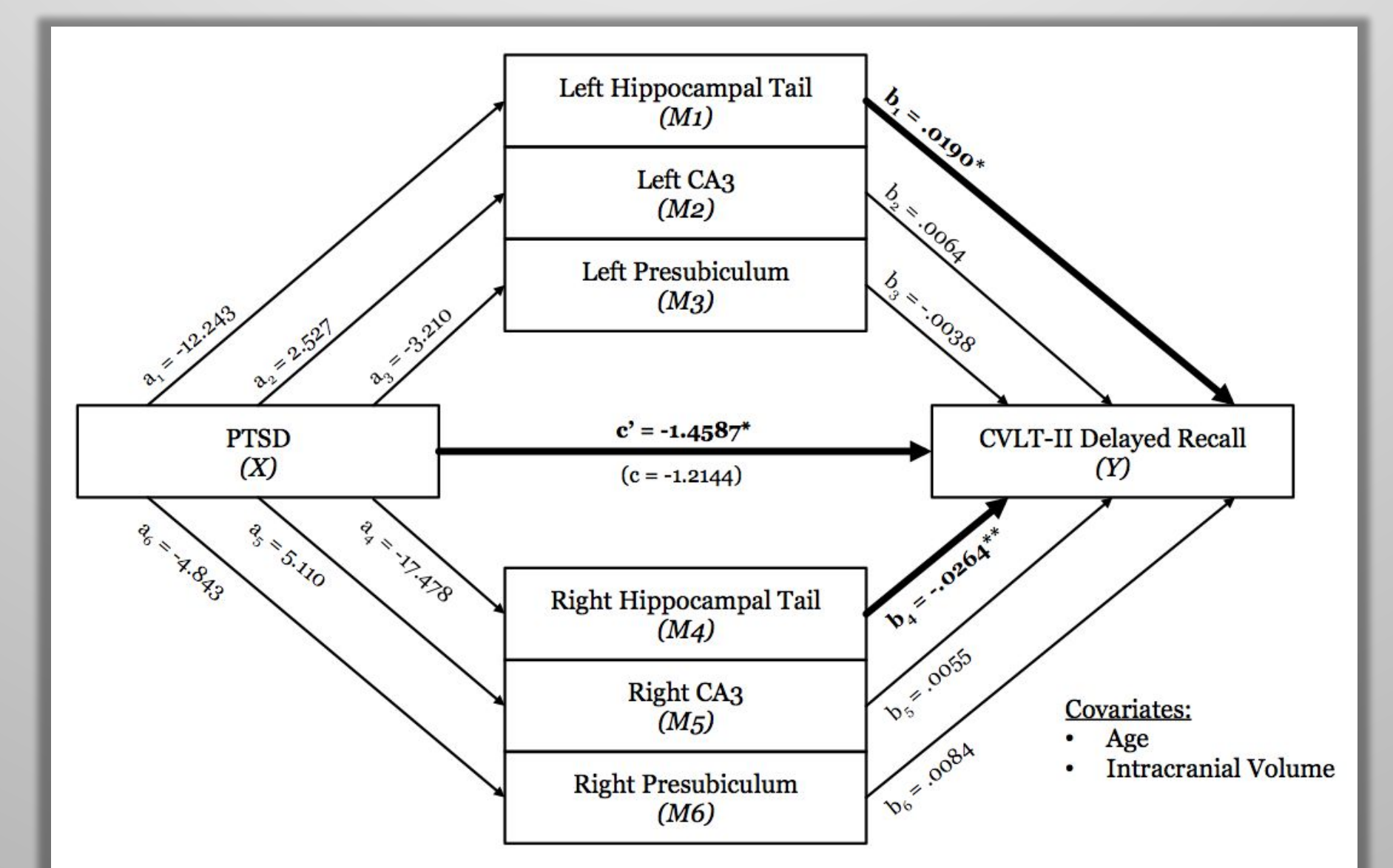
### Laboratory Verbal Memory Task



### Neuropsychological Assessments



### Hippocampal Subfield Volumes: Parallel Mediation Modeling



## Findings

- PTSD associated with fewer words recalled and lower performance during word recognition testing.
- Although veterans with PTSD were slower, repetition priming while making lexical decisions was intact.
- Hippocampal tail volume predicted CVLT-II delayed recall performance, but did not mediate PTSD effects on verbal memory.

## Conclusions

- Verbal memory deficits in PTSD related to explicit/declarative rather than implicit/procedural processes.
- Contrary to predictions, hippocampal subfield volumes did not mediate the effect of PTSD on explicit recall.
- No observed effects of blast-related mTBI, which highlights the importance of considering PTSD when assessing post-deployment cognitive outcomes.

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## Citations

- Scott, J. C., Matt, G. E., Wrocklage, K. M., Crnich, C., Jordan, J., Southwick, S. M., ... & Schweinsburg, B. C. (2015). A quantitative meta-analysis of neurocognitive functioning in posttraumatic stress disorder. *Psychological Bulletin, 141*(1), 105.
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