

# Toxic Wounds and Cognition in U.S. Gulf War Veterans from the BBRAIN Repository Network

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## Introduction

- ❖ The Boston, Biorepository and Integrative Network (BBRAIN) for Gulf War Illness (GWI) was created to provide a repository of objective biomarkers and cognitive, demographic and war-related exposures in US Gulf War (GW) veterans.<sup>1</sup>
- ❖ Veterans of the 1991 GW experience a myriad of chronic symptoms including fatigue, pain and cognitive decrements.<sup>2,3</sup>
- ❖ Prior studies have shown cognitive deficits in veterans with GWI compared to healthy GW controls that have correlated with war-related environmental exposures.<sup>4</sup>
- ❖ These prior findings have been in relatively small cohorts of veterans.

## Objectives

- ❖ To validate previous findings of cognitive decrements in veterans with GWI compared to healthy controls in a large study population from the BBRAIN repository.
- ❖ Examine correlations between neurocognitive results and GW-related environmental exposures.

## Methods

- ❖ Participants included 411 GW veterans, who were deployed to the Persian Gulf between August 1990 and July 1991, including 312 with GWI and 99 healthy controls.
- ❖ Cognitive batteries were administered to all participants including the Conners Continuous Performance Test Third Edition (CPT3), Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference, and the California Verbal Learning Test Second Edition (CVLT-II).
- ❖ War related exposures to chemical weapons, anti-nerve gas pills and pesticides were self-reported by study surveys.
- ❖ Exposures were classified into three groups: healthy controls, GWI cases with 0-6 days exposure, and GWI cases with 7 or more days of exposure.

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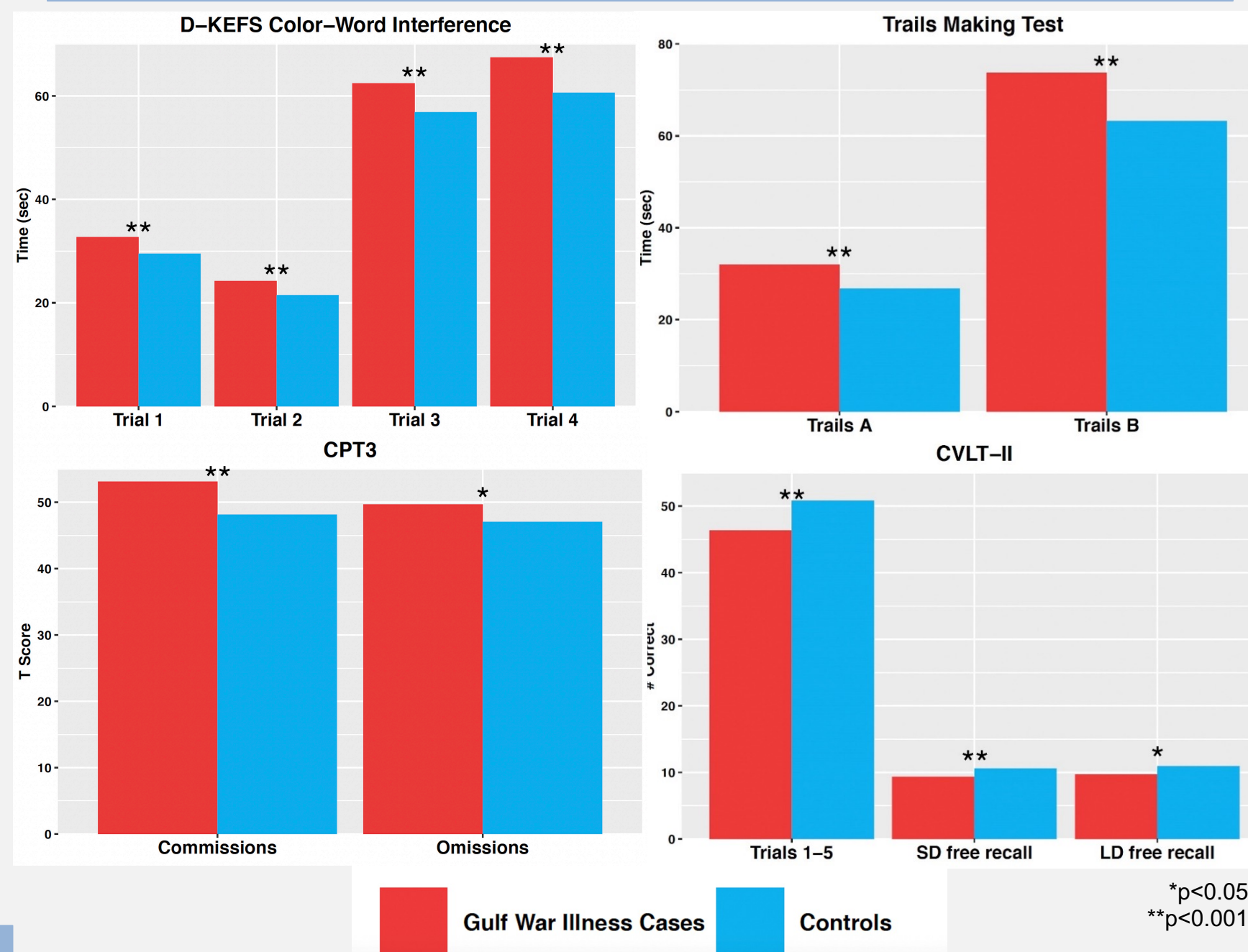
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## Results

Veterans with GWI had significantly poorer performance on all neuropsychological tests than healthy controls, indicating deficits in sustained attention and verbal memory. Further, these cognitive decrements were associated with environmental exposures during the Gulf War.



After adjusting for age, gender and education, veterans with GWI had significantly higher mean Connors CPT3 omission and commission errors, D-KEFS Color-Word Interference times on all Trials and lower CVLT-II Trials 1-5, short-and-long-delayed recall scores and slower Trail Making Test times on A and B than controls (p<0.05).

Exposures		Controls	<7 days	7+ days
			Exposed Cases	Exposed Cases
Mean				
	CPT 3	Omissions*	49.09	49.71
		Commissions*	45.4	52.67
Heard chemical alarms sounded	CVLT-II	# correct in long-delay free recall*	11.79	9.77
		Trails	Trail A(sec)*	22.94
		Trail B(sec)*	59.65	71.04
Saw Smoke from oil well fires	CVLT-II	# correct in short-delay free recall*	11.2	9.71
		Trails	Trail A(sec)*	23.2
				33.78

\*p<0.05

After adjusting for age, sex, education, and other GW-relevant exposures, cases that were more exposed to chemical weapons compared to controls had significantly more errors on the CPT3, less words recalled during long-delay and short-delay on the CVLT-II and slower times on Trails A and B.

## Results

Demographics	Control (N=99)	Cases (N=312)
	mean(sd)	
Age*	54.7(7.1)	52.0(6.1)
Race	Black	7(7.4%)
	White	37(12.5%)
	Other	6.4(1.1%)
Gender	Male	87(87.9%)
	Female	23(7.8%)
Hispanic/Latino	Yes	2(4.3%)
	No	20(9.2%)
Education*	High school/ GED	44(95.7%)
	More than high school	6(6.1%)
	Bachelor's	24(7.9%)
	Advanced degree	31(31.3%)
	23(23.2%)	71(23.4%)
	39(39.4%)	68(22.4%)

\*p < 0.01

Differences in age and education were found to be statistically different between cases and controls (p<0.01).

## Conclusions

- ❖ These findings validate previous research on cognitive decrements in veterans with GWI compared to healthy controls in a larger sample population.
- ❖ GWI cases with higher exposure to chemical weapons and smoke from oil well fires during the war, showed significantly poorer speed, sustained attention, executive function and verbal recall.

## References

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