Neuropsychological Outcomes Vary by Sex in Neurotoxicant Exposed Veterans with Gulf War Illness

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Background

- About a third of veterans of the 1990-91 Gulf War (GW) are still suffering from Gulf War Illness (GWI) thirty years later
- GWI is a multi-symptomatic disorder thought to be caused by war-related exposures that includes chronic fatigue, pain, gastrointestinal problems, *cognitive decrements* and mood problems
- Prior research has shown cognitive deficits in combined samples of male and female GW veterans with GWI
- The Boston, Biorepository, Recruitment and Integrative Network (BBRAIN) stores data on GWI to be used in large analyses

Objective

Use BBRAIN data to compare neuropsychological differences in male and female GW veterans with GWI and by neurotoxicant war-related exposures

Methods

- 297 veterans deployed to the 1990-91 Persian Gulf were enrolled in the BBRAIN study – 247 males and 50 females
- All participants completed a series of neuropsychological tests: Conners Continuous Performance Test Third Edition (CPT3), Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference Test, and the California Verbal Learning Test (CVLT-II)
- War-related exposures were measured by a self-reported survey. We classified 'exposed' as reporting 7+ days of exposure
- GWI case status was defined by the Kansas case status criteria
- Multiple linear regression was used to analyze the association between sex, war-related exposures, and neuropsychological test score outcomes

Male veterans with GWI had poorer performance than female veterans with GWI in verbal memory, learning, response speed and impulsivity. Additionally, these men with war-related neurotoxicant exposures showed worse learning and verbal memory, impulsivity and response speed decrements compared to exposed women veterans.

Table 2. Neuropsychological Outcomes in Female Veterans with GWI compared to Male Veterans with GWI

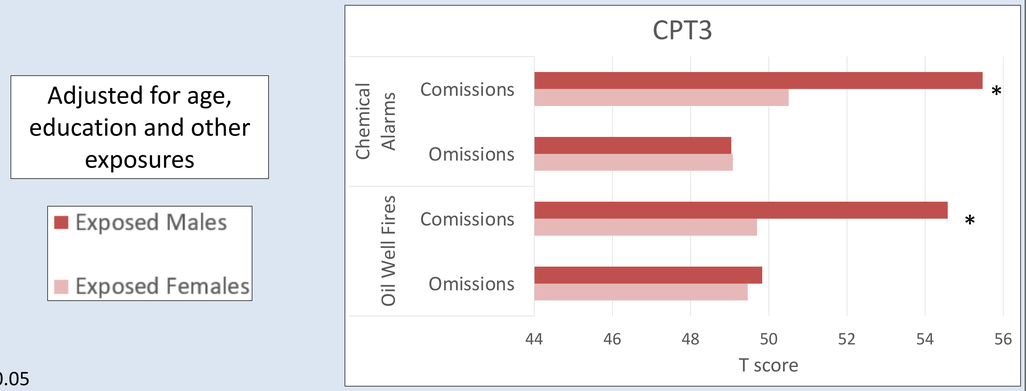
		Female GWI Cases	Male GWI Cases	P-value
CPT3 *(T score)*	***Commissions**	**50.19**	**53.96**	**0.028**
	Omissions	48.84	49.81	0.542
CVLT-II *(# words correct)*	***Trials 1-5**	**49.61**	**45.47**	**0.0081**
	***Short Delay Recall**	**10.32**	**9.11**	**0.016**
	***Long Delay Recall**	**10.71**	**9.42**	**0.0162**
D-KEFS Color-Word Inference *(Time in sec.)*	***Trial 1**	**30.4**	**33.25**	**0.024**
	***Trial 2**	**22.69**	**24.64**	**0.029**
	Trial 3	58.99	63.01	0.111
	Trial 4	66.09	68.05	0.527

Adjusted for age, education and PTSD

*p<0.05

Figures 1&2: Cognitive Outcomes in Exposed Female veterans with GWI compared to Exposed Male veterans with GWI

Adjusted for age, education and other exposures



*p<0.05

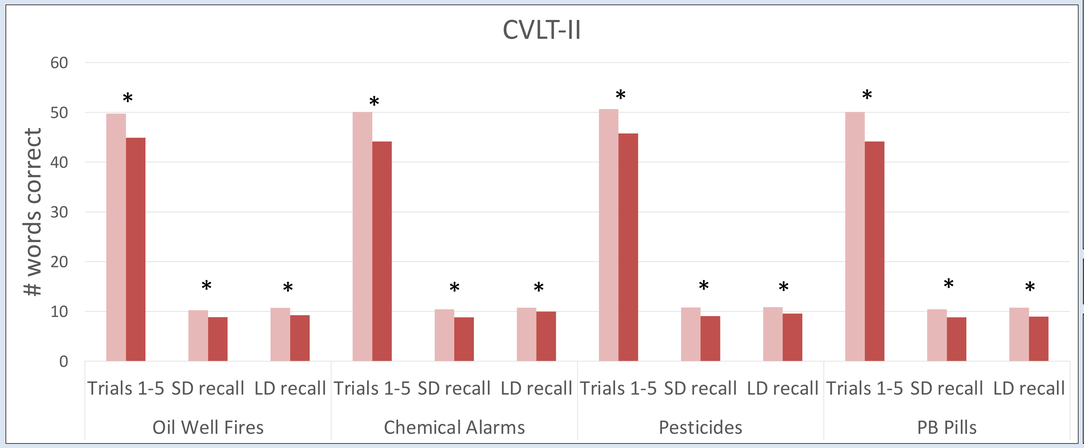


Table 1. Demographics of sample

		Overall *N=297*	Male Cases *N=247*	Female Cases *N=50*
Age *mean(SD)*		52(6)	52(6)	53(5)
PTSD *n(%)*	**Yes**	214(72.1)	177(71.7)	37(76)
	No	83(28)	70(28.3)	13(26)
Race *n(%)*	**White**	228(76.8)	191(77.3)	37(76)
	Black	35(11.8)	26(10.5)	9(18)
	Other	23(7.7)	20(8.1)	3(6)
Highest level of Education *n(%)*	**High School**	23(7.7)	20(8.1)	3(6)
	Some college	138(46.46)	122(49.4)	16(32)
	Bachelor's Degree	68(23)	54(21.9)	14(28)
	Advanced Degree	66(22.2)	49(19.8)	17(34)

Results

- Male cases had significantly lower number of words correct in the CVLT-II learning Trials 1-5, short delay recall and long delay recall compared with female cases
- Male veterans with GWI also performed significantly worse in CPT3 commission scores, and Trials 1 & 2 total time on the D-KEFs Color-Word Inference compared to their female veterans with GWI
- Compared to women veterans with GWI who reported exposure to chemical weapons, pesticides, pyridostigmine bromide (PB) anti-nerve gas pills or smoke from oil well fires, male veterans with the same exposures preformed significantly worse on the CVLT-II trials as well as short and long delay recall
- Male veterans who were exposed to chemical weapons and oil well fires had more CPT3 commission errors than their female counterparts
- Future research should consider male and female veterans separately when examining outcomes from war-related exposures
- These sex differences in cognition should be taken into consideration when treating veterans for GWI

Acknowledgements

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