

**Appendix A-12a. Vaccines (Individual Types): Association with Symptoms and Multisymptom Illness in Studies of Gulf War Veterans**

Study	Veterans Studied	Vaccine/Shot Assessed	Health Outcome	Association of Health Outcomes with Individual Types of Vaccines		
				Crude (no adjustments)	Adjusted only for military, demographic variables	Adjusted for other deployment exposures
Boyd 2003	978 GWV in GW Registry	Botulism Meningococcus <b>Anthrax</b> Plague Typhoid IgG	High symptom vs. low symptom groups		OR = 1.8, p = 0.02* OR = 1.6, p = 0.10 <b>OR = 1.7, p = 0.03*</b> OR = 1.3, ns OR = 1.4, ns OR = 1.2, ns	
Goss Gilroy 1998	3,113 Canadian GWV	Non-routine immunizations (anthrax, plague)	Cognitive symptoms Chronic fatigue symptoms Fibromyalgia symptoms		OR (CI) = 1.3 (1.1-1.5)* OR (CI) = 1.9 (1.5-2.5)* ns	
Gray 1999	527 U.S. Navy Seabees	<b>Anthrax</b>  IgG  Botulism	23 individual symptoms	12 of 23 symptoms sign.; ORs 2.0-4.5  11 of 23 symptoms sign.; ORs 2.1-8.1  16 of 23 symptoms sign.; ORs 2.7-5.2		
Gray 2002	3,831 U.S. Navy Seabees	Meningococcus Botulism <b>Anthrax</b> Plague IgG Typhoid	GWI (study-defined)	OR (CI) = 3.6 (2.5-5.2)* OR (CI) = 4.9 (3.5-7.0)* <b>OR (CI) = 3.7 (2.6-5.4)*</b> OR (CI) = 3.2 (2.2-4.8)* OR (CI) = 1.9 (1.4-2.5)* OR (CI) = 2.3 (1.5-3.6)*	OR (CI) = 1.3 (1.0-1.6)* ns ns ns ns ns	

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Hotopp 2000	923 U.K. GWV with vaccine records	Received predeployment Anthrax	CMI		OR (CI) = 1.3 (0.8-2.0)	
		Plague			OR (CI) = 1.2 (0.6-2.2)	
		Pertussis			OR (CI) = 1.0 (0.5-1.7)	
		Tetanus			OR (CI) = 0.9 (0.6-1.3)	
		Cholera			OR (CI) = 0.9 (0.6-1.2)	
		Hepatitis A			OR (CI) = 1.3 (0.8-2.1)	
		Hepatitis B			OR (CI) = 0.8 (0.5-1.3)	
		Polio			OR (CI) = 0.7 (0.5-1.2)	
		Yellow fever			OR (CI) = 1.3 (0.9-1.9)	
		Typhoid			OR (CI) = 1.0 (0.7-1.4)	
Received during deployment CMI						
		Anthrax			OR (CI) = 1.3 (0.9-2.0)	
		Plague			OR (CI) = 0.9 (0.6-1.4)	
		Pertussis			OR (CI) = 1.3 (0.9-2.0)	
		Tetanus			OR (CI) = 2.7 (1.0-7.2)*	
		Cholera			OR (CI) = 2.9 (1.0-7.9)*	
		Hepatitis A			OR (CI) = 1.3 (0.5-3.2)	
		Hepatitis B			OR (CI) = 0.7 (0.3-1.4)	
		Polio			OR (CI) = 1.2 (0.3-4.3)	
		Yellow fever			OR (CI) = 0.8 (0.2-3.7)	
		Typhoid			OR (CI) = 0.7 (0.3-2.0)	
Kang 2002	10,423 U.S. GWV	Botulism vaccine	GW-unique neurological symptom complex	OR (CI) = 3.5 (2.7-4.7)*†		
Mahan 2004	11,441 U.S. GWV	Anthrax vaccine (verified by DOD records)	10 severe symptoms		5 of 10 symptoms sign.; ORs = 1.5-1.6	

This study was widely criticized and most results were retracted - so why is it included?

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Schumm 2005	650 Ohio GWV reservists	Anthrax	GWI (Kansas definition)	sign.*		
Unwin 1999	2,735 U.K. GWV	Anthrax Plague Pertussis Any biological vaccine Hepatitis A Hepatitis B Yellow fever Typhoid Poliomyelitis Cholera Tetanus Any routine vaccine	CMI		OR (CI) = 1.5 (1.3-1.7)* OR (CI) = 1.3 (1.1-1.6)* OR (CI) = 1.1 (0.9-1.4) OR (CI) = 1.5 (1.3-1.7)* OR (CI) = 1.1 (0.8-1.5) OR (CI) = 1.0 (0.8-1.3) OR (CI) = 1.3 (1.1-1.7)* OR (CI) = 1.0 (0.8-1.3) OR (CI) = 1.2 (1.0-1.5) OR (CI) = 1.1 (0.9-1.4) OR (CI) = 1.3 (1.1-1.5)* OR (CI) = 1.2 (1.1-1.4)*	
Wolfe 2002	945 U.S. Army GWV	Anthrax	CMI - Mild-moderate CMI - Severe CMI - Mild, mod, severe	OR (CI) = 1.5 (1.1-2.1)* OR (CI) = 1.9 (1.4-2.6)*		OR (CI) = 1.5 (1.1-2.0)*

GW = Gulf War; GWV = Gulf War veterans; CMI = chronic multisymptom illness;<sup>464</sup> OR = odds ratio; CI = 95% confidence interval; sign. = statistically significant; ns = not significant;  
 \* statistically significant; †calculated from reported data